A CRUDE RESPONSE

Alyeska Corporation's Failure to Respond and Coast Guard Oversight of the *EXXON VALDEZ* Oil Spill

by

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Research and Internship Report

Submitted to

Marine Resource Management Program
College of Oceanography
Oregon State University
Corvallis, Oregon 97331

1991

in partial fulfillment of
the requirements for the
degree of

Master of Science

Internship: U.S. Coast Guard, Federal On-Scene Coordinator

This report funded in part by Oregon Sea Grant

ACKNOWLEDGEMENTS

I would like to express my appreciation for the help I have received from many sources. These include the secretaries and other support staff of the College of Oceanography, and the Research Assistants of the college. Special thanks go out to Kathryn Boeckman Howd, the "Camp Counselor" for the Marine Resource Management program, and to Donna Obert of the secretarial staff.

I would also like to thank everyone for putting up with my sense of humor during my stay at OSU.

My most heartfelt appreciation is extended to my wife and lifemate, Tamsen, without whose help I would never have attempted this program, much less successfully completed it.

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INTRODUCTION

"I think the necessity of being *ready* increases. -Look to it."

Abraham Lincoln. The whole of a letter to Governor Andrew Curtin of Pennsylvania, 8 April, 1861.

Public opinion concerning possible pollution of Prince William Sound, and general opposition to the construction of the Trans-Alaska Pipeline, resulted in a the need for then-Vice President Spiro Agnew to cast a tie-breaking vote in Congress to allow to construction of the pipeline to proceed, notwithstanding the National Environmental Policy Act. The above quote of Abraham Lincoln roughly defines the message from the state and federal governments to Alyeska Pipeline Service Corporation in regards to its requirement to respond to a spill of oil that has been transported through the Trans-Alaska pipeline. However, in spite of the need for the ability to respond to an oil spill, Alyeska Corporation did not effectively respond to the *EXXON VALDEZ* oil spill. Events leading up to the spill were thus reviewed, in order to determine if there was any common thread that could be found that would aid in explaining the failure of response. Additionally, experiences of the author in working on the spill were examined in light of the findings of this research.

PART I: THE FAILURE OF ALYESKA RESPONSE

At four minutes past midnight, on March 24th, 1989, the motor tankship *EXXON VALDEZ* went aground on Bligh Reef, in Prince William Sound, Alaska, and spilled over 10 million gallons of crude oil in less than five hours. At the time of the spill, there were no fewer than six contingency plans in place, ranging from the National Contingency Plan to site specific plans for Prince William Sound. The initial responses to be taken were detailed in both the local Coast Guard Marine Safety Office plan for the Port of Valdez and the Alyeska Pipeline Service Company's Contingency Plan for Prince William Sound.

The Alyeska Pipeline Service Company's oil spill contingency plan for Prince William Sound is an industry plan that is required under state law. The plan includes general provisions for Alyeska's oil spill response capability for the Port of Valdez and Prince William Sound. The Alyeska plan was developed specifically to ensure rapid and effective response to spills from vessels in trade with Alyeska's Valdez oil terminal, and it states that Alyeska "will direct cleanup operations of spills" from tankers carrying Trans-Alaska Pipeline System (TAPS) oil through Prince William Sound in such a manner that federal intervention will be unnecessary.[1]

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[1] Right-of-Way Lease for the Trans-Alaska Pipeline between the State of Alaska and Amarada Hess Corp., ARCO Pipeline Co., Exxon Pipeline Co., Mobil Alaska Pipeline Co, Phillips Petroleum Co., Sohio Pipe Line Co., and Union Alaska Pipeline Co., Art. 24 and Stip 2.14.4. Also required as per 33CFR154.310.

The Alyeska plan covered specific responses, detailing reconnaissance, exclusion booming sites, oil transfer operations, spill trajectory, and response times (specifying a five-hour objective for initial spill response). The spill plan outlined three scenarios, including one for an 8.4-million-gallon (200,000 barrels) spill in Prince William Sound, a spill similar to the magnitude of the actual *EXXON VALDEZ* spill. This 8.4 million gallon scenario estimated that approximately 50% of the spilled oil would be recovered, 15% would evaporate, 15% would be recovered from shore, 15% would be naturally dispersed, and the final 5% would remain in the environment. The use of dispersants is described in the Alyeska scenario as an additional control measure, but one that requires advance planning, pre-approval, and a mobilization time of 18 to 72 hours from the site in Arizona where dispersants and the means of application were stockpiled.

In addition, the scenario in the plan for the 8.4 million gallon spill states that the nearest available tanker will be directed to the scene so that the remaining unspilled oil may be transferred. The plan estimates an arrival time of approximately 12 hours, based upon tanker traffic of one arrival per day.

However, as Robert Burns pointed out, "the best laid schemes o' mice and men gang aft a-gley (often go askew)."[2] This is an understated description of what occurred when Alyeska attempted to undertake the response to the *EXXON VALDEZ* oil spill.

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[2] "To A Mouse." Robert Burns.

The U.S. Coast Guard Captain of the Port, Port of Valdez, in response to a radioed report of the grounding and spill from the *EXXON VALDEZ*, notified Alyeska officials of the oil spill at 12:30 a.m. on the day of the spill, about 30 minutes after it happened. Alyeska then began to alert its own personnel, including the key people in Valdez and others in Anchorage. This phase of the planned response action was done in a timely manner.

After notification, the response personnel began to assemble the needed equipment. Although the contingency plan required a barge to be loaded at all times with a variety of spill equipment, the only barge available had been damaged during an earlier wind storm and was unloaded pending repair by a certified welder. The repair had been put off until such a time as a tanker might need the same service, as a means of cutting expenses. There was no back-up barge.

The previously stored aboard the barge had been stored in a warehouse located at the Valdez oil terminal, with open-water skimmers and open-water boom being stored under containment boom, due to space limitations in the warehouse and the more frequent requirement for containment boom. Fenders necessary for lightering operations (offloading of product from tankers to other vessels is referred to as lightering) were stored outside, where they were later found covered by snow.

Because the response equipment was not ready, lightering gear did not arrive at the *EXXON VALDEZ* until noon of March 24, and a barge loaded with skimmers and boom did not

arrive until about 2:30 p.m. of that day. The 2.5 hour preparation time stated in the Alyeska contingency plan was exceeded by at least 12 hours. This was further complicated by the absence of information in the plan stating where equipment was to be stored.

Once upon the scene, the equipment available was neither state-of-the-art, nor sufficient for a spill of that magnitude, despite the inclusion in the plan of a scenario for a spill of that size. Lightering equipment was not available on twelve-hour notice, as required in the plan. Actual lightering of the *EXXON VALDEZ* did not begin until 7:36 a.m. of the day following the grounding and spill, more than 31 hours after the grounding had occurred. However, problems with lightering soon developed, and lightering was stopped at 8:10 p.m. because of suspected damage to the stripping system, which pumps from the top of the oil contained within cargo and ballast tanks. Lightering operations were started again at 11:14 p.m., and continued with interruptions to bring alongside empty ships, until the unloading of the remaining load of approximately 40 million gallons was completed.

A Critique of the Response Plan

The historic average for the recovery of oil from major spills has been in the 10 to 15% range, with the remaining 85 to 90% undergoing natural processes that eventually remove the oil from the environment.[3] In their spill response plan, Alyeska Corp. announced plans to recover

[3] U.S. Congress, Office of Technology Assessment. Coping With An Oiled Sea: An Analysis of Oil Spill Response Technologies. U.S. Government Printing Office, March 1990.

50% of the spilled oil, three to five times the amount previous oil spill recovery experience indicated could be recovered. Additionally, this high-efficiency recovery was to take place in a subarctic environment known for the severity of its storms and was complicated by the increase in viscosity of the oil due to the low temperatures found in Prince William Sound year round. This projected recovery would have required a large capacity for the storage and transportation of recovered oil. This type of storage and transport capacity has been identified as the bottleneck in affecting an optimal response[4], but the Alyeska plan had never been updated to include such advances made in oil spill management strategy.

Two dredges, the *YAQUINA* and the *ESSAYONS*, owned by the U.S. Army Corps of Engineers, were pressed into service as skimmers, using the dredging heads in an inverted position and storing the recovered oil/water mixture in their dredge-spoil holds. Although this ingenious improvisation worked quite well for the recovery of oil, it necessitated high levels of manpower for the emptying and cleaning of these holds, again underlining the need for an effective storage and transportation device for recovered oil. In addition, the dredges required the assistance of support vessels to deploy boom. As an additional improvisation for unavailable appropriate equipment, vacuum trucks, of the type used for street sweeping, were also used for the collection and storage of oil. These trucks were deployed aboard barges, but also proved to be a bottleneck as their emptying process at shore was not a simple matter. The importance of transportation and storage equipment in oil spill recovery is so great that the algorithm developed

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[4] Psaraftis, H.N. and Ziogas, B.O. 1985. A Tactical Decision Algorithm for the Optimal Dispatching of Oil Spill Cleanup Equipment. Journal of The Institute of Management Sciences. Vol.31, NO.12, December 1985.

by Psaraftis and Ziogas recommends a "do-nothing" approach as being more cost-effective, although politically unacceptable, if adequate storage and transportation equipment is not available, as in this case.

Since a "do-nothing" approach is neither politically acceptable nor legal, the approach next recommended by Psaraftis and Ziogas is the use of dispersants. The use of dispersants in this case would have protected the shoreline, which was severely affected by the oil, but it would have spread emulsified oil throughout the water column in Prince William Sound. Most dispersants are composed of a surfactant and a solvent, and all surfactants are toxic at high concentrations, and some of the solvents used in dispersants are of even greater toxicity. Consequently the use of dispersants can have deleterious environmental effects[5], making appropriate early containment and recovery of even more importance in spill management.

The use of dispersants had been pre-approved for various areas of Prince William Sound, and 4,000 gallons had been stockpiled at the marine terminal. However, neither the means of application nor a sufficient amount of dispersant for a spill of the magnitude of the *EXXON VALDEZ* spill were available, despite plan scenarios. At an application factor of 1:20 (one gallon of dispersant for every twenty gallons of spilled oil), approximately 500,000 gallons of dispersant were needed, and nowhere near the 410,000 gallons needed for the 200,000 barrel spill outlined in the spill response plan was available in Alaska or within the time frame for application. The

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[5] Using Oil Spill Dispersants on the Sea. Committee on Effectiveness of Oil Spill Dispersants; Marine Board, Commission of Engineering and Technical Systems, National Research Council. National Academy Press, Washington, D.C. 1989.

plan stated that the needed dispersant was to be shipped from a warehouse in Arizona within 18 to 72 hours. When the spill actually happened, EXXON Corporation was not able to accomplish this. American Petroleum Institute (API) proposals recommend the preplacement of 22,000 gallons at five regional centers, each of which would be able to respond to a spill of less than half-a-million gallons.

Alyeska Corporation and Oil Spill Contingency Planning

Since the Alyeska Corporation was the key organization in Prince William Sound Oil Spill contingency planning, its role is described below.

Federal regulations and the grant of right-of-way for the Trans-Alaska Pipeline System (TAPS) required that an organization be in existence and ready to respond to a spill of oil associated with TAPS. Alyeska was created by a consortium of EXXON, ARCO, and British Petroleum to provide the services required to operate TAPS. Spill drills were conducted before the marine terminal became operational, with the first drill occurring on February 10, 1977. However, an observer from the Alaska Department of Environmental Conservation found this first drill to be flawed, in that the estimated response time was unrealistically short and an inadequate amount of boom was proposed for containment of the spill.[6]

[6] Townsend, R., and Burr Heneman. 1989. The EXXON VALDEZ Oil Spill: A Management Analysis. Center for Marine Conservation, Washington, D.C.

After the Valdez marine terminal opened Alyeska held annual oil spill drills, and a growing pattern of weakness was noticed in these response drills. This finally resulted in the Environmental Protection Agency notifying the U.S. Coast Guard that "Alyeska is not prepared to efficiently respond to a major spill event."[7]

There have been a total of 440 actual spills of oil at the Valdez oil terminal since the marine terminal opened in 1977 (an oil spill consists of any amount that produces a "noticeable sheen" upon the water, as defined in 33 CFR 1321 (b)(4)).[8] Most of these were of quite minor quantities and were either adequately cleaned up or naturally dissipated. There were, however, some events that required response that was later found to be less than adequate.[9]

When the Alyeska Valdez marine terminal opened in 1977 it was staffed with full-time oil response personnel. These teams functioned in the manner of a fire department, with spill response being their only duty. Time was fully occupied with training, drills, and maintenance of equipment. Initially, these crews consisted of teams of twelve, but by 1980 the teams were down to seven or eight per crew.

In 1980 the spill response crews were given additional duties, to the extent that the majority of their time was spent in non-response type activities, such as laying culverts and

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[7] Ibid.

[8] Ibid.

[9] Ibid.

cleaning tanks. The teams were finally abolished, and the members were absorbed into the general workforce of the terminal.

The Theory of the Decline

The failure of Alyeska Corporation to respond to the *EXXON VALDEZ* oil spill was the consequence of many factors. However, in this paper the failure will be interpreted through an examination of Alyeska's response to budget reduction and as a result of internal and external influences.

Bureaucratic Response to Financial Constraint

Bernhard Schwab[10] describes a bureaucracy as "any organization that provides goods or services that are not subject to the direct discipline of free and competitive markets." Because bureaucracies are thus not directly influenced by the market, these systems of organization may react differently to financial constraints than organizations which face the direct discipline of these markets. Alyeska fits such a definition.

In the early 1980s, relatively severe reductions in oil prices and the abrupt termination

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[10] Schwab, B. 1985. Bureaucracies and Austerity: Why the Savings Are So Difficult to Achieve. Journal of General Management, Vol.11, No.1, Autumn, 1985.

of what appeared to be periods of endless growth and prosperity forced Alyeska officials to reassess the financial position of the corporation.[11] Private businesses often react to financial constraint by cutting overhead, and through attempts to increase demand. Examples of reductions in overhead include travel and expense accounts, a careful review of administrative and staff budgets including their personnel allocations, possible freezes or reductions in new developments and investments, and a general streamlining of the organization.

In bureaucratic organizations as discussed by Schwab, however, the process works differently. Revenues do not come from customers, but come primarily from "above", through a budget process. It is in this manner that the bureaucracy is not directly affected by the open market. The money-granting agency is often somewhat removed - both culturally and organizationally - from the subordinated bureaucracy to which it provides funds.

In negotiating for budget, the primary loyalty of almost any administrator tends to be with the operating unit he represents. In addition, many bureaucrats view accomplishing business as the successful throughput of standardized forms, or in this case, paper documentation of required effort and organization for accomplishing the oil spill plan.

Bureaucracies, which are typically funded on a pay-as-you-go basis and are not allowed to run a deficit, rarely have the possibility to build up financial reserves in good years to carry them over bad ones. Given this lack of financial flexibility, and the fact that they are labor

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[11] Townsend and Heneman. Op. Cit.

intensive, with wages and salaries making up the major portion of their budget, any curtailments in funding are likely to result in immediate layoffs. These are inevitably painful to the organization.

A threatened bureaucracy may attempt to avoid confrontations in the budgeting process, as it is easier to defend budgets through threatened cutbacks in service, and the cut in service is likely to occur where it is most visible and painful to the outside world[12]. Thus, the reduction in activity by Alyeska required by the reduction in finances in the 1980s was expressed as a reduction of services, the very thing for which Alyeska Corporation was founded. Most of the individuals were retained, and the letter of the law was met, but the intent of the law - effective spill response - was not. What remained was a bureaucratic structure necessary to ensure that the proper forms were filled out to comply with requirements of the federal government. A spill response system still existed, but only on paper.

Power and Organizational Life Cycles

Current theories of organizational development often include the idea that development is not in a smooth continuous process, but rather a series of stable periods broken by times of rapid change. The analogy that comes to mind is the description of war as long periods of

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[12] Schwab, B. 1985. Bureaucracies and Austerity: Why the Savings Are So Difficult to Achieve. Journal of General Management, Vol.11, No.1, Autumn, 1985.

boredom punctuated by brief moments of terror. During the periods of terror, the organization responds, and is either destroyed or manages to adapt and change in a manner permitting it to survive the immediate crisis situation.

In the life cycle of organizations, many different power structures develop. These structures have been described in terms of the external and internal relationships of those in position to influence the structure and activity of the organization.[13] Of the various power structures described by Mintzberg, the following were selected as being applicable to the Alyeska situation:

> External influences: passive; no outsider sought to exercise direct power; a large number of dispersed external influences existed which tended to produce a passive external coalition.
>
> Internal influences: bureaucratic; formal standards dominated.

Conflicting and non-dominated external influences, by pulling parts of the internal coalition in different directions with no particular direction dominating, encouraged the breakdown of more legitimate forms of influence, such as authority and certified expertise. These external influences existed in the form of the Alaska Department of Environmental

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[13] Mintzberg, H. 1984. Power and Organizational Life Cycles. The Academy of Management Review, Vol.9, No.2. April, 1984.

Conservation (ADEC), and the oil industry funding of Alyeska through a per barrel shipped fee. ADEC, also a bureaucracy, provided state oversight, and promoted the retention of an effective, dedicated organization but was itself limited in power by funding and the fact that any action it took in regard to Alyeska's spill response effectiveness might be seen by the people of Alaska as a constraint on the Alaskan oil industry that would have negative effects on the Alaska "permanent fund", derived from TAPS (tax) revenues. Influence from the oil industry came from its attempts to minimize operational expenses through reduction of personnel costs.

Passive external influences coupled with a bureaucratic internal coalition results in what Mintzberg describes as a closed system of power configuration.[14] Because of the utilitarian nature of the organization, its tendency towards a strong organization ideology - characterized by belief in the pursuit of mission per se - is discouraged, as are high levels of technical expertise. Since a strong internal ideology will serve to knit the internal structure into a cohesive group, the lack of such an ideology allows the group to become susceptible to outside pressure. It can be seen that the group able to apply the most external influence will be those who control the purse strings.

As the closed system goes through organizational changes, it usually remains a closed system.[15] Because the closed system contains no natural means of succession, other than for the established leaders to name their successors, political action emerges as the typical method

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[14] Ibid.

[15] Ibid.

of displacing an ineffective leadership. If the system exists as a meritocracy, upon loss of appreciation of merit it will change into a closed system. The ultimate result, in the case of Alyeska, is an unending loop, with response to financial constraint, yet with little change in the ability to respond to oil spills.

A healthy society is one that sustains a steady level of replacement of old, spent organizations by young, energetic ones. In the case of Alyeska, there was no replacement of the former oil spill response organization, nor was there any pressure to encourage the development of the existing organization through internal renewal. The sum of the forces acting upon Alyeska did not foster actual ability to respond to oil spills.

Formalization and the Life Cycle

There are two outcomes of formalization within organizations: administrative efficiency and influence.[16] As formalization contributes to administrative efficiency, it also bestows upon the administrator power and influence. While formalization is likely to contribute to effectiveness early in the life cycle, later in the life cycle it may contribute to organizational ineffectiveness and decline.

[16] Walsh, J.P., and R.D. Dewar. 1987. Formalization and the Organizational Life Cycle. Journal of Management Studies, Vol.24, No.3, May, 1987.

Formalization has been described as distinguishing "how far communications and procedures in an organization are written down and filed."[17] A high degree of formalization implies not only a preponderance of rules defining jobs and specifying what is to be done, but also the enforcement of those rules. It is the standardization of the decision-making process in organizations on the basis of a detailed system of formalized procedures. It is generally considered to be an expression of bureaucratization, whether reference is to the popular notion of bureaucratic red tape or to Weber's theoretical analysis of bureaucracy.

An analysis of formalization, then, should speak to the twin roles of formalization as: first, contributing to efficient and effective administration, and second, servicing power and authority relationships. After its early years, formalization for Alyeska Corp. became simply a matter of conducting yearly drills, which had prior announcement, and the verification of the existence of a response network. Actual response abilities became secondary or tertiary interests as other, "higher priority", duties were assigned to the personnel originally dedicated to oil spill response. In this manner, the unofficial policy of ignoring the response requirement of the plan became reified.

Reification is defined as that process which results in something abstract coming to be regarded as a material thing. As used in this context, an expectation is either written or repeated verbally a sufficient number of times that it is remembered and understood over time by a relatively large number of people. The commands and desires of Alyeska Corporation, as

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[17] Ibid.

expressed in response to critiques of spill responses became reified and formalized.

The early formulation of standards and procedures, such as those in the original oil spill response plan, induces efficiency, orders chaos, and promotes effectiveness by providing a system of assigning authority. Over time, however, additional rules and standards achieve far more order, and these additional rules contribute to influence, rather than administrative effectiveness. These are the rules and procedures that are instituted to reflect the personal preference of the adminstrative manager. Effectiveness begins to suffer since these rules and standards prompt action grounded not in creative response to environmental stimuli but rather in deference to tradition. An example of this was the formalized, pre-announced oil spill drills which became neither demonstrations of proficiency nor occasions to learn and improve performance.

Conclusions

After many years of operation without the actual need for an efficient and effective response organization to function within Alyeska, it became tradition to overlook the need for such functional capability. A popular phrase for such a decline is "use it or lose it." The response organization was not used in either actual spills nor in effective drills, and there was no internal cohesiveness in the form of a standard to which the employees ascribed to prevent its loss. Through a process of divided politics, loyalty to the purse holder rather than the service, and formalization of the decline, the organizational effectiveness was lost. Thus, when the need

arose for a massive response effort the ability to respond effectively was not there.

PART II: THE COAST GUARD RESPONSE

Federal Authority for Coast Guard Response

The federal legislation establishing federal oil spill response authority (33 CFR 1321 [Federal Water Pollution Control Act, Section 311]) states that:

(c)(1): "Whenever any oil or a hazardous substance is discharged, or there is a substantial threat of such discharge, into or upon the navigable waters of the United States, adjoining shorelines, or into or upon the waters of the contiguous zone, or in connection with activities under the Outer Continental Shelf Lands Act or the Deepwater Port Act of 1974, or which may affect natural resources belonging to, or under the exclusive management authority of the United States the President is authorized to act to remove or arrange for the removal of such oil or substance at any time, unless he determines such removal will be done properly by the owner or operator of the vessel, onshore facility, or offshore facility from which the discharge occurs."

"... the President shall prepare and publish a National Contingency Plan for removal of oil and hazardous substances, pursuant to this subsection. Such National Contingency Plan shall provide for efficient, coordinated, and effective action to minimize damage from oil and hazardous substance discharges, including containment, dispersal, and removal of oil and hazardous substances..."

"Except where an owner or operator can prove that a discharge was caused solely by (A) an act of God, (B) an act of war, (C) negligence on the part of the United States Government,

or (D) an act or omission of a third party without regard to whether any such act or omission was or was not negligent, or any combination of the foregoing clauses, such owner or operator of any vessel from which oil or a hazardous substance is discharged in violation subsection (b)(3) of this section shall be liable to the United States Government for the actual costs incurred under subsection (c) of this section for removal of such oil or substance by the United Stated Government..."

In accordance with the above referenced public law, the United States Coast Guard responded to the *EXXON VALDEZ* oil spill and aided with the offloading of the remainder of the oil left in the tanks of the ship. This initial assistance was provided by the Coast Guard Pacific Area Strike Team, later aided by the Atlantic Area Strike Team. These are the response teams that were organized in accordance with the Federal Water Pollution Control Act, and serve as the secondary response to spills, with the primary response being provided by local Coast Guard bases. It was the local Coast Guard, at Valdez, Alaska, that initiated the Federal response by notifying Alyeska Corp. of the spill within 30 minutes after the grounding of the tanker.

Coast Guard Oversight Versus Direction

The magnitude of the *EXXON VALDEZ* spill was such that the combined resources of both the Atlantic and Pacific Area Teams could not provide the oversight personnel needed for the management of this spill. Consequently, the Coast Guard provided additional personnel, from both the regular and reserve forces. Further, the size and possible consequences of this spill far

exceeded the amount of money made available for Federal oil spill response by Section 311(k) of the FWPCA, a revolving account originally established at a level of $35,000,000. Because of the disparity between the fund level set by Congress and the amount required, and the level of effort expended by the EXXON Corporation, the President of the United States decided that the Coast Guard would not direct spill response efforts, but would only provide oversight. Thus, by Presidential direction, the Secretary of the Department of Transportation, Samuel Skinner, was named as coordinator of all federal agencies involved in the clean-up, and the Commandant of the Coast Guard, Admiral Paul Yost, was directed by the President to "assume the personal oversight of developments." In addition, the Secretary of Defense was directed to make available Department of Defense personnel and equipment as necessary to aid in logistics and clean-up activities.

Pursuant to the National Contingency Plan, the Coast Guard put into place a response team/network, consisting of the Federal Coordinating Director, the Federal On-Scene Coordinator (FOSC), two FOSC representatives, and three Incident Command Posts (ICP's), as illustrated in Figure 1. The various zones, also known as areas of operations, were divided into four geographic regions as shown in Figure 2. This command and oversight system, in a basic tree formation, was linked through phone lines, utilizing facsimile machines, computer communications, and common voice phone calls for communication. Activities were coordinated each day through the use of teleconferences, whereby all FOSC representatives, the ICP's, and Coast Guard Headquarters in Washington, D.C., were linked.

My Presence

During my period of active duty, immediately after being commissioned as an ensign, I served in the Coast Guard Office of Research and Development as a project officer in the Environmental Technology Branch. This office was concerned with the testing and development of the means and machinery for responding to discharges of oil and other hazardous wastes to the environment. In particular, I worked with the development of hazardous chemical personnel protection and response techniques for the amelioration of such discharges. These duties brought me into continuing contact with the Coast Guard Strike Teams, units whose duties were to respond to discharges that impacted upon Coast Guard responsibility areas. These activities thus resulted in personal experience of a level that the Coast Guard decided would be of use in activities associated with the *EXXON VALDEZ* oil spill.

I volunteered for assignment to the spill as a reservist in May of 1989, and received orders to go to Alaska in June. Volunteers were placed in a pool, and were selected for duty assignments based on experience and military grade. Although the anticipated duty assignment was given in the orders, personnel were assigned on an as-needed basis upon arrival.

I served two periods of active duty, first in the summer of 1989, from 26 June to 26 July, 1989, and then the next summer, from 13 June to 05 August. Travel arrangements were made by the Coast Guard, and the first year I reported to the Federal On Scene Coordinator (FOSC) in Valdez, Alaska. The FOSC office had not been appraised of my orders, but immediately set

out to find a "home" for me. While the administrative staff was selecting my duty assignment, my indoctrination in Coast Guard responsibilities and procedures for oversight of EXXON Corp. spill response started.

Coast Guard Organization and My Assignment

Although the response to the *EXXON VALDEZ* spill had been in operation since a few hours after the spill was reported, and I arrived on the scene approximately three months later, Coast Guard organization had not yet been impressed upon every portion of spill response and management. Anecdotally, as a comment on Coast Guard organization and federal preparedness, I was not able to arrange for an advance payment of per diem allowances, as I had been assured I would be, and upon arrival in Valdez I was told that the financial officer's safe at the Coast Guard Marine Safety Office (MSO) was broken and not openable, and the MSO would not be able to advance me any money either. However, previous experience with the government and bureaucracies had prepared me for the mishap, and I had brought sufficient personal cash and credit cards to permit me to function in my Coast Guard capacity.

My indoctrination to the workings of the Coast Guard in the spill response commenced with a quick walk-through of both Coast Guard and EXXON office spaces, followed by attendance at a Coast Guard planning meeting and then a joint Coast Guard/EXXON press conference. The tour of office spaces enabled me to meet the people involved, and to renew old acquaintances, an important process in activating a dormant organization. This quick walk-

through, although it took several hours, later proved to be quite beneficial, as I was able to call upon the various people I met for services and their ability to expedite matters.

After working hours, during which it had been decided that I would be sent to the Incident Command Post (ICP) in Seward, I found transportation to Coast Guard officers' quarters, a large house outside of town, where I would spend the night. A very loose form of informal but important indoctrination continued at the lodgings, which went on into the early hours of the morning. I arose the next day at 0600 and found transportation back to town and was dropped off at the airport for a flight to Seward.

This flight followed the traffic lanes for tankers out past Bligh's Reef, and then turned to the west towards Seward. The view of Prince William Sound from a mile of altitude was impressive, and the conditions were perfect for such viewing. Although I had expected to see sheets of oil covering portions of the sound, I could not discern any oil upon the water during the flight, demonstrating the difficulty in obtaining information on large spills from quick overflights. As the flight neared its termination in Seward, and passed up Resurrection Bay, I saw what I first thought to be oil/mousse, but this was merely the sediment load in the water due to a river of melt-water from Exit Glacier. This mistake upon my part I found to be repeated by a number of people throughout my period of duty.

My Area of Responsibility:

After arrival in Seward I reported to the Incident Command Post, and was returned to the airport for an indoctrination/ familiarization flight to learn about the extent of our area of responsibility (AOR). This trip, and most flying, was done by helicopter, which was made available by EXXON and for which only a few hours of notice were needed for a flight to be arranged. Also available were float planes, which were necessary for rendezvousing with vessels in our AOR. Although work could not have been accomplished without the use of aircraft, their availability later proved to be at the heart of one of my greatest problems.

The area of responsibility for which the Seward ICP was accountable included Kenai Fjords National Park, whose rangers often accompanied us on our flights. In addition to being the land managers for the park area, they were able to provide "bear security" in that they carried firearms and had been trained in the proper manner of dealing with these potentially very dangerous animals, which are numerous in this region of Alaska.

Most days, however, were taken up by a "normal" routine of attending meetings to coordinate efforts between the various agencies, and directing movement and logistics of the Coast Guard monitors. Daily work hours were from 0700 to 1800, illustrating the extent of effort required of personnel involved in a major oil spill management.

Coast Guard Monitors:

Since the spill clean-up was not federalized, the Coast Guard supplied monitors, people who ensured that clean-up went according to plan, and that the various constraints and parameters established by the Federal On Scene Coordinator (FOSC) and the land managers were not exceeded. These Coast Guard monitors were also required to ensure that all the needed permits and safety regulations were on hand and followed.

General guidelines set by FOSC for the monitors to follow were listed in the *EXXON VALDEZ* Oil Spill Field Shoreline Treatment Manual, a manual prepared and desktop published after the commencement of federal oversight. These included observation of proper safety procedures; compliance with approved treatment methods; compliance with approved work plans; compliance with special instructions regarding seal haulouts, seabird rookeries, eagle nest avoidance, collection of live and dead animals, possession of animal parts from protected species; restriction of human activity to affected area; removal of all trash and wastes daily; avoidance of interactions between humans and wildlife; and reporting of all dead animals.

The ICP Seward Daily Routine

The "Multi-Agency Coordinating Group"

When the beaches of Resurrection Bay, where Seward is located, were first impacted by the spill, the National Park Service (NPS) established the Seward Multi-Agency Coordinating Group (MAC). This committee was established under the Federal Emergency Management Plan, and was designed to coordinate the activities of all groups responding. I was required to attend

a meeting of the MAC almost every day. As the lead agency for the spill, the Coast Guard passed on suggestions from this group, but did not chair the committee. The committee chair was the local head of the National Park Service, the land manager for the majority of the shoreline within the Seward AOR. Other members of the Seward MAC included the U.S. Fish and Wildlife Service, Alaska Department of Parks and Recreation, Alaska Department of Fish and Game, Alaska Department of Environmental Conservation, the National Oceanic and Atmospheric Administration, the City of Seward, Chugach Alaska Native Corporation, and EXXON. Those recommendations considered appropriate were forwarded to EXXON Corporation through the Coast Guard. The multi-agency complexity of this MAC was typical of the Federal response organization throughout the other cleanup zones as well.

"Hired Guns"

The presence of potentially dangerous wildlife made it necessary to have resource protection officers on active clean-up sites. These officers, known as "shooters" or "hired guns" served to protect the workers from bears. Both the brown and black bears are indigenous to the Kenai Peninsula and abundant. Although black bears are smaller than the brown (grizzly) bear, both are sufficiently dangerous to require the presence of these shooters. It was jokingly suggested that it was easy to tell the difference between a black bear, whose color range is from black to brown to an almost white blonde, and a brown bear. The method suggested was to climb a tree. If the bear climbed the tree after you to eat you, it was a black bear, and if it knocked the tree over to eat you, it was a brown bear. Brown bears are more likely to attack, but often do not follow the attack with a kill; black bears are less likely to attack, but are more

prone to kill the individual attacked. Although we sighted bears several times during operations, there were no attacks or injuries of people by bears, and no weapons were discharged within the Seward AOR to kill or drive bears away.

The requirement for a hired gun to be on scene did, however, prove to be the cause of the first of the major problems I encountered after assuming duties as Assistant Officer in Charge. A dead seal washed up during a high tide onto one of the most severely impacted sites in our area, Morning Cove, in the Pye Islands, which was knee-deep in mousse upon my first visit. This dead seal proved to be an irresistible source of food to one of the local black bears, and the presence of the bear prevented a clean-up team from operating at that site. The seal lay near the high tide line and it came under the jurisdiction of either the U.S. Fish and Wildlife Service, if it was below the high tidal line and thus upon federal land, or the Alaska Department of Environmental Conservation, if it lay above the high tide line and was upon state land. Since it lay near this line demarking different authorities, the dead seal proved to be an item of contention as to which agency had the responsibility of providing the shooter to protect the beach crew. After three days were wasted with each party insisting that the other had the duty to provide the RPO, with a clean-up crew sitting just offshore, I finally, in a manner worthy of Solomon, instructed both parties to divide the cost of the shooter equally, and to expedite the transportation of an RPO to the site forthwith. It was a simple management decision, one that should have been made three days prior, yet was necessary for an arbitrator to make it in order to get clean-up operations restarted.

This example demonstrates how passive external influences, the reification of the need to conserve finances, when coupled with a bureaucratic internal establishment can lead to non-compliance with the conditions for which the bureaucracy is founded.

"High Tide"

The initial treatment of one beach necessitated the use of large plastic boxes, known as fish boxes because of their use by commercial fisherman, for containing the trash generated during the clean-up. Once the beach had been cleaned, the filled boxes were left on the beach, just above the high tide line, for later retrieval. This seemingly simple act almost resulted in a complete stoppage of the clean-up process, as a National Park Service employee pointed out that the boxes were thus left upon federal land, and use of this land required an Environmental Impact Statement, as per federal law. Knowing that the time required for the preparation of such a report would take in excess of the summer window of operations, it was jointly decided to ignore this aspect of federal law so that the clean-up operations would not be hindered. In other words, the spirit of the law was obeyed, if not the letter of the law, but again an arbitrator's intervention was required to prevent operations from halting. Again, the reification the necessity to obey regulations in the face of need to the contrary served to reduce the effectiveness of an organization's response. It was as if a "Stay Off the Grass" sign had slowed reaction to an assault occurring on a lawn.

Work Orders for Beach Cleanup

Work orders were written for each beach or segment of beach that required remediative action. These documents listed the particular items of work that were to be accomplished, and restrictions of any sort, including avoidance of anadromous fish streams and eagle nests. Federal law, as interpreted for this case, required only signatures of the FOSC (or his designee), the EXXON representative, and the land manager. However, copies of all work orders were given to ADEC (Alaska Department of Environmental Conservation), and the signature of an ADEC representative was required before work began on any segment.

Treatment

Most of the impacted shoreline of the Seward AOR had been identified by the time of my arrival, and initiation of treatment and finalization of the treatment process to be utilized was in progress. Treatment had been divided into two types, either that which was purely manual, called "Type A," and that which used machinery, known as "Type B." The decision making process is illustrated in Figure 3.

Suggestions from the public

Although suggestions from the MAC and from the general public were willingly accepted, a major function of the Coast Guard presence was to reassure the public that their concerns were noted. As is often the case, ideas and information were passed from the general public to various agencies for action, and most of these, although made in good faith, were either unworkable or

wrong. However, such input cannot be simply refused, but must be willingly accepted and be seen to be investigated. It is politically and morally wrong for public agencies to do otherwise.

Receipt of such information from the public, especially reports of possible windrows of oil, which when investigated were found to be of natural origin and not from the *EXXON VALDEZ* spill, was assigned to me as the assistant officer in charge of the ICP. I made notes on the information, discarded that which was obviously of no use, and passed on the remainder for discussion at the daily MAC meeting. Some unworkable suggestions were best handled by recommending that the individual making the suggestion do the work required, or by other ways of handing the suggestion back to its origin. Some suggestions, however, required that the individual be informed of certain laws and regulations which prevented the action recommended.

The GEOREF system:

Because of the amount of shoreline impacted by the oil spilled from the *EXXON VALDEZ*, a reference system was set up, by which areas surveyed could be entered into a computerized data base. The general system for the response was a two or three letter code followed by a two or three number designation. In the case of the Seward area, the letters were assigned according to the name of the area, such as the Pye Islands, and then the numbers were taken assigned by general geographic feature. Morning Cove, in the Pye Islands, for instance, was given the identification code of PY-008. This geographic reference system allowed features to be tracked and identified with a minimum of reference to maps, once one was familiar with the AOR. The use of this system , along with reporting of impact, is illustrated in Figure 4.

Signatories to work orders:

The major hindrance to an efficient response to the spill, at least in the Seward AOR, was the requirement for all concerned land managers to sign work orders that went to EXXON Corporation for action. These work orders needed signatures from ADEC, EXXON, the State Historical Preservation Officer, and the FOSC. At the beginning of my first summer in Seward, the ADEC representative would not sign work orders, even if only to acknowledge that ADEC had been informed of recommended work. Many of the state agency people involved seemed reluctant to affix their signature to any official document. This was reported to the FOSC who informed ADEC that any further reluctance to sign work orders would result in that agency being "cut out of the loop." This ended the failure to gain signatures from the agency, and prevented further delays in permitting EXXON to perform specific cleanup work.

The State Historical Preservation Officer (SHPO), was present for all shoreline impact surveys. This was to ensure that no archeological site would be raided or otherwise harmed during the response to the oil spill. One fortuitous outcome of the required presence of the SHPO was the extent of the resulting archeological survey, which was much greater than any heretofore accomplished. Many cultural sites, previously unknown, were identified. Some sites were so rich in artifacts that clean-up required the on scene presence of a SHPO representative to review all material removed from the site, to ensure that no artifacts were removed, either purposefully or accidentally. One interesting sidelight of the effects of the spill upon future radio-isotope dating of archeological sites in the area effected by the oil spill is that the presence of crude oil, since it is of such an age that there is no C^{14} present, will give a much greater

apparent age if the C^{14} method is used on it later.

One site in the Seward AOR was found to be extremely rich in artifacts, but many of these were of such a nature so as not to be noticed until their presence was pointed out by the SHPO. At this site, the cobbled beach was littered with pieces of slate, and there was a dead tree with a hole in it above the high tide line. However, slate is not native to this area of Alaska, and therefore had been brought in by human means. Many of the pieces of slate, when felt, were found to be extremely smooth, and apparently had been used in some manufacturing process employed by the native Alaskans, such as rolling sinew to make bow strings. The tree, a "culturally modified tree," had a hole carved into it wherein sap would collect, which the native Alaskans used as a waterproofing agent. Closer examination of the area revealed there to be many projectile points and hammer-stones; the area had apparently been used as a rendezvous and embarking point for nearby islands where marine mammals and sea birds were hunted.

The scientific and cultural value of such artifacts has been acknowledged through state and federal law. Unauthorized collecting of such artifacts are prohibited, with penalties of up to $100,000 for each count. Thus, as well as being clean-up oversight monitors, Coast Guard personnel were acting in their capacity as federal law enforcement officials in protecting these artifacts. The location of these archeological sites were afforded the same security as classified information to prevent their destruction. The necessity to provide protection to archeological sites illustrates the widespread indirect and unanticipated effects of a major oil spill when it impacts shorelines.

My Second Summer

During my second summer working on the spill I arrived in Anchorage, where FOSC was then located, and again found that the position I had been promised was already filled. As I had the summer before, I started "looking for a home," and was again ordered to Seward, but this time as Officer in Charge of the Incident Command Post. I delayed my departure to the ICP for a day in order to attend Hazardous Waste Operations Emergency Operations (HAZWOPER), an eight-hour course on responding to spills of hazardous materials, a category which includes crude oil (see Figure 5).

The following day I proceeded by bus to Seward, inclement weather prohibiting flying. There had been many changes since I had been there the previous summer. Instead of having a long term contract with a hotel, four two-bedroom apartments had been leased to provide berthing. These apartments were within walking distance of the ICP, and the kitchens made living much easier. No longer was it necessary to take every meal at a restaurant. Major oil spill clean-up activities are of long duration, and have many effects both on the personnel involved and on the local community and its economy.

Asphalt on Yalik Beach

After reporting to the ICP, the departing Officer in Charge and I made visits to the local offices associated with the oil spill, and I renewed acquaintances with the people with whom I

had worked the previous year. The next day started with a flight by helicopter to reacquaint myself with the oiled areas of the AOR. The first stop was at the extreme western limit of the AOR, Yalik Beach. This beach had been impacted by oil the previous year, and the "Type A," or rock-wiping, clean-up which had been used did not totally remove the oil. Over the winter, the oil had hardened, as the lighter fractions evaporated, and combined with sand and other sediment, had formed an asphalt which had "paved" the beach. This "paved" area was the largest extent of asphalt formed from the *EXXON VALDEZ* spill, and generated a great deal of interest from FOSC and the local media.

Treatment

The remediation employed on Yalik Beach utilized two small earthmovers, commonly referred to as "Bobcats." These two machines were fitted with front loaders, and the asphalt was scraped up and loaded into large fiberglass material "supersacks", which were then loaded onto the landing craft ubiquitous to the fishing industry of the Kenai Peninsula. This oiled material was eventually transported roughly 1500 miles to the hazardous materials dump in Arlington, Oregon, a striking illustration of long-distance impact of oil spill clean-up activities.

Bioremediation of Yalik Beach

Following the removal of the asphalt, the beach was combed by one of the Bobcats fitted with a large tine, and bioremediation was employed. This consisted of the scattering of Customblen (see Figure 6), at a rate of 2 pound per hundred square feet. Customblen is a

fertilizer commonly used on lawns, and is encapsulated in a coating made from vegetable oil reacted with cyclic diene. This material supplied the phosphorus, in the form of calcium phosphate and ammonium phosphate, and the nitrogen, in the form of ammonium nitrate, necessary to promote growth of micro-organisms. The coating allowed a slow release of the phosphates and nitrogen, which were considered to be the missing portions of the "Redfield Ratio," (which defines the relative ratios of carbon, nitrogen, and phosphorus in organic matter) with the carbon coming from the spilled oil.

Inipol, an oliophilic compound containing nitrates and phosphates, was not used in the Seward AOR, nor was Corexit 9580, a similar agent, although Material Safety Data Sheets (Figures 7 and 8) were disseminated to all personnel involved with these materials. Neither of these two other agents were permitted to be used by the National Parks Service, but their lack did not seriously slow operations.

Other Reports of Oil

One of the most serious problems encountered was communication between the various government agencies. Much of the communication of grievances between agencies appeared to be done at the higher levels, and problems thus were not alleviated in a timely manner at the lowest level possible. This in turn lead to a magnification of these problems, which further alienated the agencies and caused delays. One example of this is given in the following anecdote.

During one of the MAC meetings, the NPS passed on a report from two of their employees that apparently an area previously assessed had been heavily oiled. As the Coast Guard representative, and aware of several misunderstandings and difficulties from the previous year, I arranged for surface transportation to the area, which was approximately three hours away by boat, since the shoreline of the area precluded the use of aircraft. After the request for surface transportation was made, EXXON refused to accommodate it on the grounds that the site had been surveyed earlier that spring. I then communicated the situation to my superior, who contacted EXXON, and a surface craft was immediately made available. This craft, a fifty-five passenger offshore supply vessel, was used to transport the five of us (two NPS rangers, one ADEC representative, the NOAA SSC, and myself) to the reported site. A thorough investigation by the this team resulted in the finding of approximately one pint of oil, which was hardly the "heavily oiled" situation that had been reported by the National Park Service employees. This, and several other steps taken to promote good relationships between EXXON, the Coast Guard, and the National Park Service were later found to have been taken in vain, as the following incident will illustrate.

The Taroka Arm Clean-up

What happened:

A few weeks after the incident related above, a Coast Guardsman, newly arrived in Alaska, was assigned monitoring duties in the Seward area. While the unit to which he was assigned was transiting to the work area, they passed a small clean-up site in the Kenai Fjords

National Park. The civilian manager of clean-up operations decided to stop and clean this site, and the crew consequently landed and accomplished the work. However, the inexperienced Coast Guard monitor failed to notice a proviso of the Kenai Fjords National Park (KFNP) work permit which stated that a KFNP representative was required to be on the site during the clean-up.

Immediate actions:

When the park manager was notified of this oversight, the Seward ICP was notified, and travel by helicopter was arranged for the next day. The ICP Supervisor (myself), the NOAA scientific spill coordinator, a representative of ADEC, and a Park Ranger flew to the site the day following the clean-up. Examination of the area found some oil that had been missed, and it was agreed that an additional hour of work would have sufficed to accomplish a complete cleaning of the area, but that the amount remaining would not justify transporting the crew back to the site. All parties concurred in the opinion that clean-up was adequate. When the team was flying back to Seward, the NPS representative was dropped off at a remote site, as he had been in town for a dental problem.

Repercussions:

Problems arose when the NPS representative who had been left at his field site, did not communicate his findings to his superiors at the NPS office in Seward. Apparently, word of the oversight in having a NPS representative was communicated from the Seward NPS office to the main office in Anchorage, but the after clean-up site visit by the NPS representative and the team findings were not communicated. The NPS representative in Anchorage then wrote a letter to

the FOSC complaining of Coast Guard negligence in this matter. Word of this was in turn communicated to the Seward ICP, and a third trip to the site, also by helicopter, was arranged. This time, however, it was requested that two volunteers, in addition to the NPS ranger, be transported to the remote site after visiting the clean-up site.

Transportation, both by air and by water, was at the expense of EXXON, and was carried out under the direction of the Joint Transportation Operation Center (JTOC). The operational parameters listed in the JTOC Summer Operations Manual prohibited flight for reasons of other than safety or spill response, unless under special exemption, and since the two extra personnel were not employees of the NPS, it was my decision not to transport these two individuals at the expense of EXXON. The acting supervisor of KFNP did not agree with this decision and thereafter declined to conduct business with the Coast Guard. Although this did not help the situation, my decision was supported by my superiors, who stated that it would have been inappropriate for EXXON to foot the bill for flying people not associated with the oil spill to a remote camping site. In the long run, the relationship with NPS was actually improved by this decision, as many of their small complaints could then be ignored. Although this was a political decision, and made far above my level, it aided the streamlining of operations through the removal of a source of often ungrounded complaints. In this manner, the process of formalization that had occurred, wherein agency displeasure was communicated only at the top echelon, was done away with. While formalization does enhance business procedures on a day-to-day basis, it can be detrimental when applied in certain situations.

Shortly after this, the Seward ICP was slated to be closed, as work orders had been written, and signed by all appropriate agencies, for all beach segments within my AOR. Additionally, personnel could be overseen and directed from the Homer ICP. Since this coincided with the end of my six weeks of active duty orders, I started closing the office, transferring all documents to the federal historian and equipment to the personnel from FOSC assigned to the task of accounting for this equipment.

Conclusions and Recommendations

Because this was the largest response by the Coast Guard to any event since World War II, the following conclusions and recommendations apply only to the small area to which I was assigned.

The largest problem dealt with concerned the clean-up of Taroka Arm that was done without NPS oversight. This was a failure on my part, as I had evidently not sufficiently impressed the Coast Guard monitor of the necessity for ensuring that all conditions and constraints of work were noticed and complied with. The resulting problem could have been ameliorated through better horizontal communication between the agencies after-the-fact, rather than reliance upon agency heads to rectify the situation. However, since both agencies involved were bureaucracies, wherein vertical communication is stressed and communication outside of the agency is formalized, it is not surprising that the situation developed as it did. Additionally, the situation may have been defused through utilization of the "solve at the lowest possible level"

theorem of management, and had it not been used as a political gamepiece in power struggles between agencies. Better communication by all parties involved, and official communication of all site visits, would have circumvented this and many other problems that interfered with the major objective of oil spill clean-up by creating delays.

In general, all of the problems I observed were the result of the attention to minor details and operating procedures with attention diverted from the desired end results. The stumbling that occurred was most often the result of not keeping in mind that conditions were not normal, and that adaptation and not normal operating procedures were the best for the situation. Battles between agencies over turf, which can be of great importance during periods of reduced finance, merely served to slow response in this case. Most obstacles encountered were stumbling blocks only because eyes had been taken off of the common goal of reducing the impact of the spill.

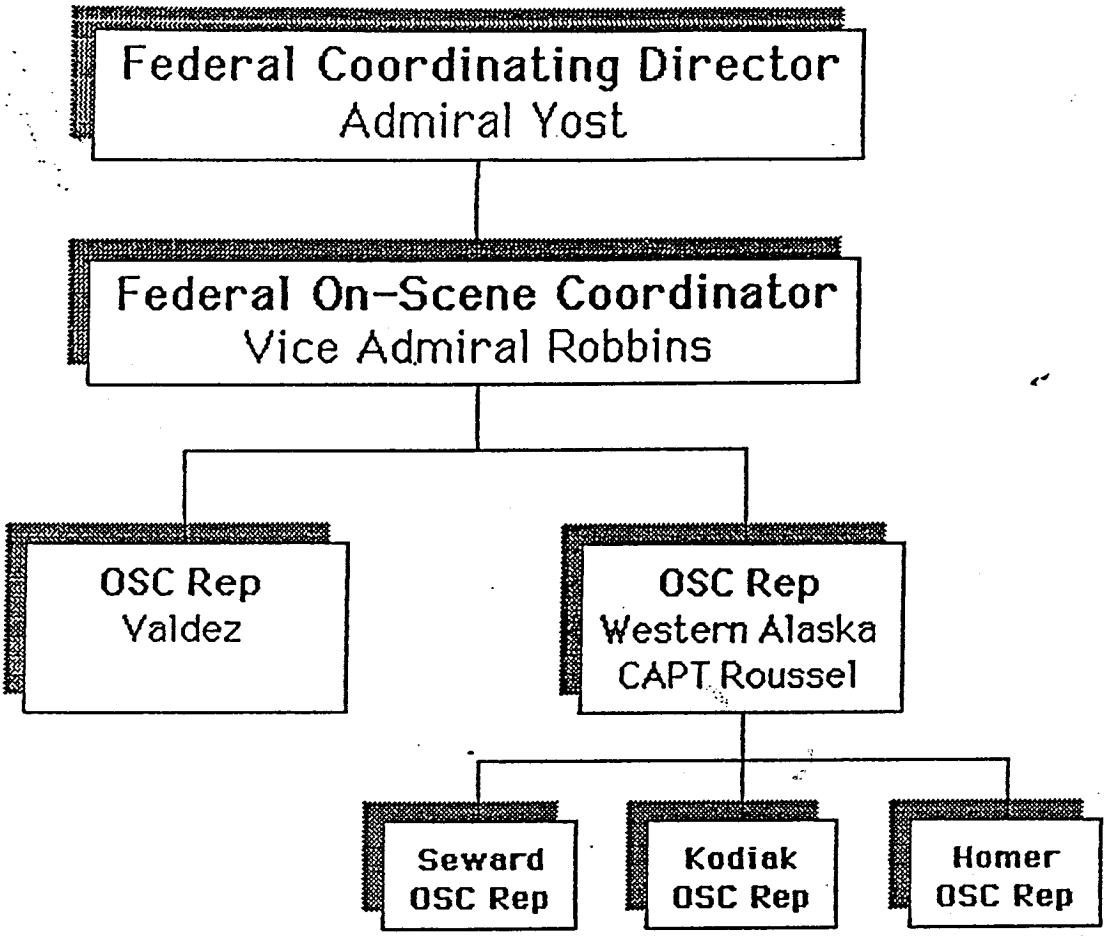


Figure 1. Coast Guard (Federal Oversight) Response Organization

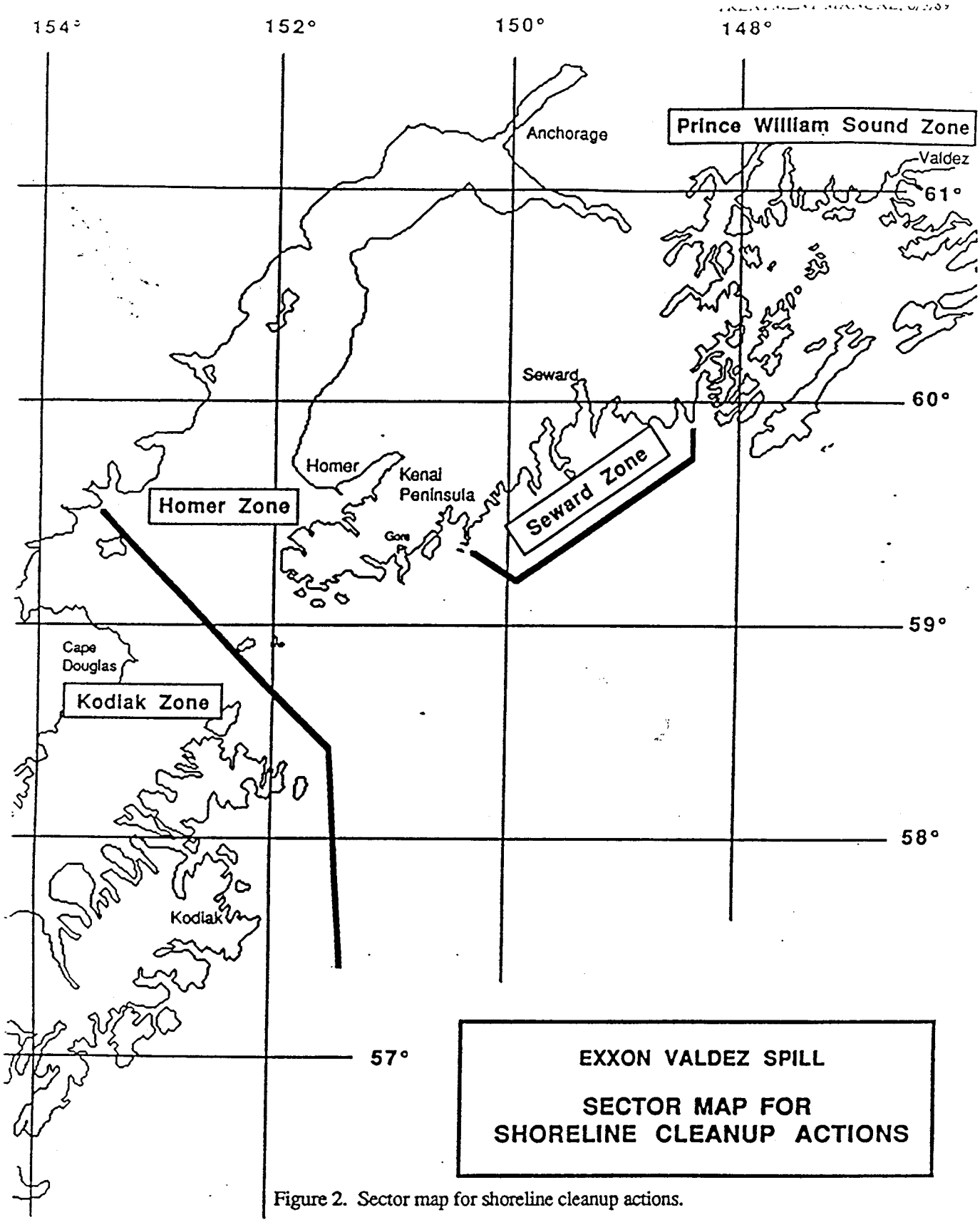


Figure 2. Sector map for shoreline cleanup actions.

Figure 2. Areas of Operations (AO).

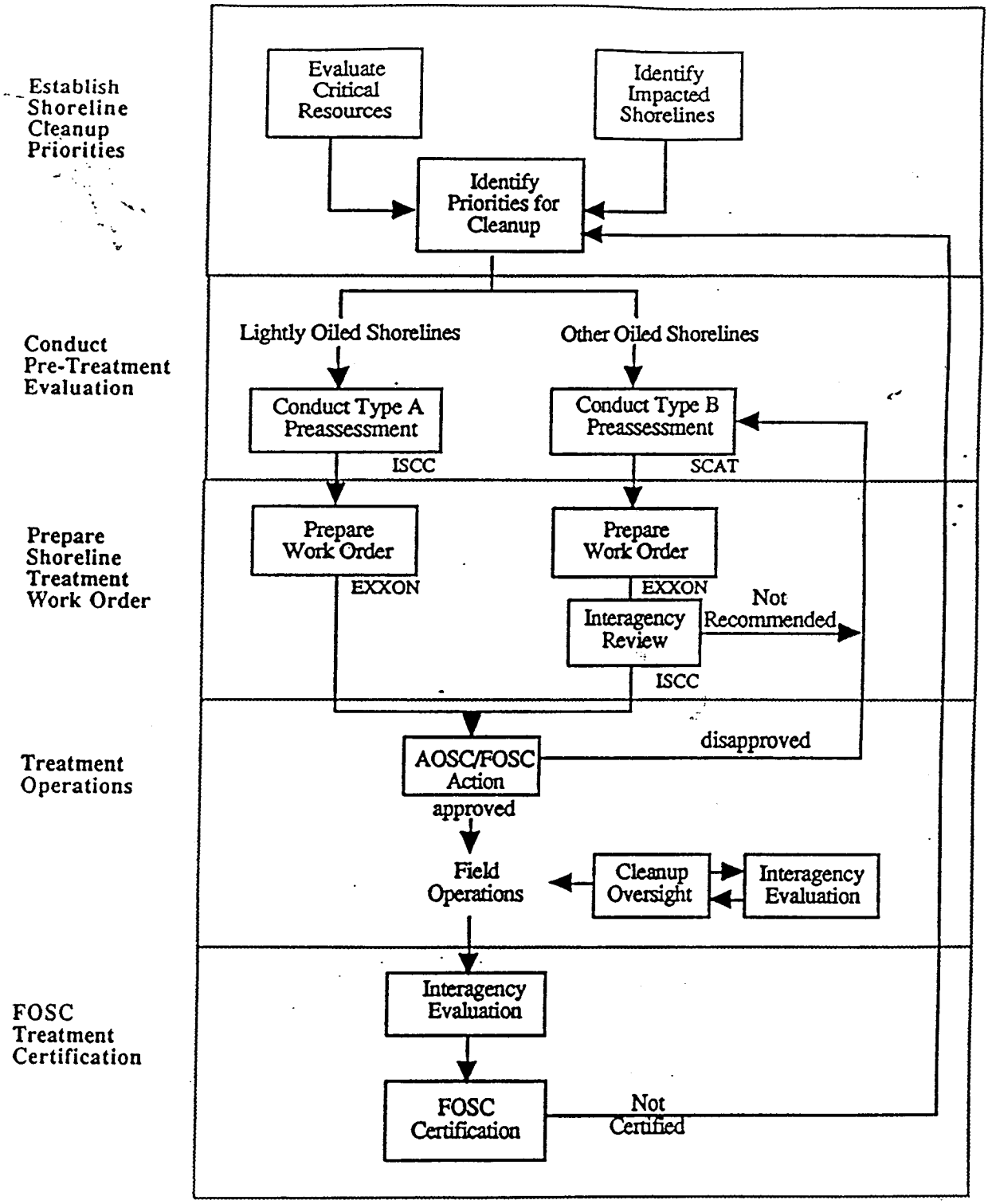
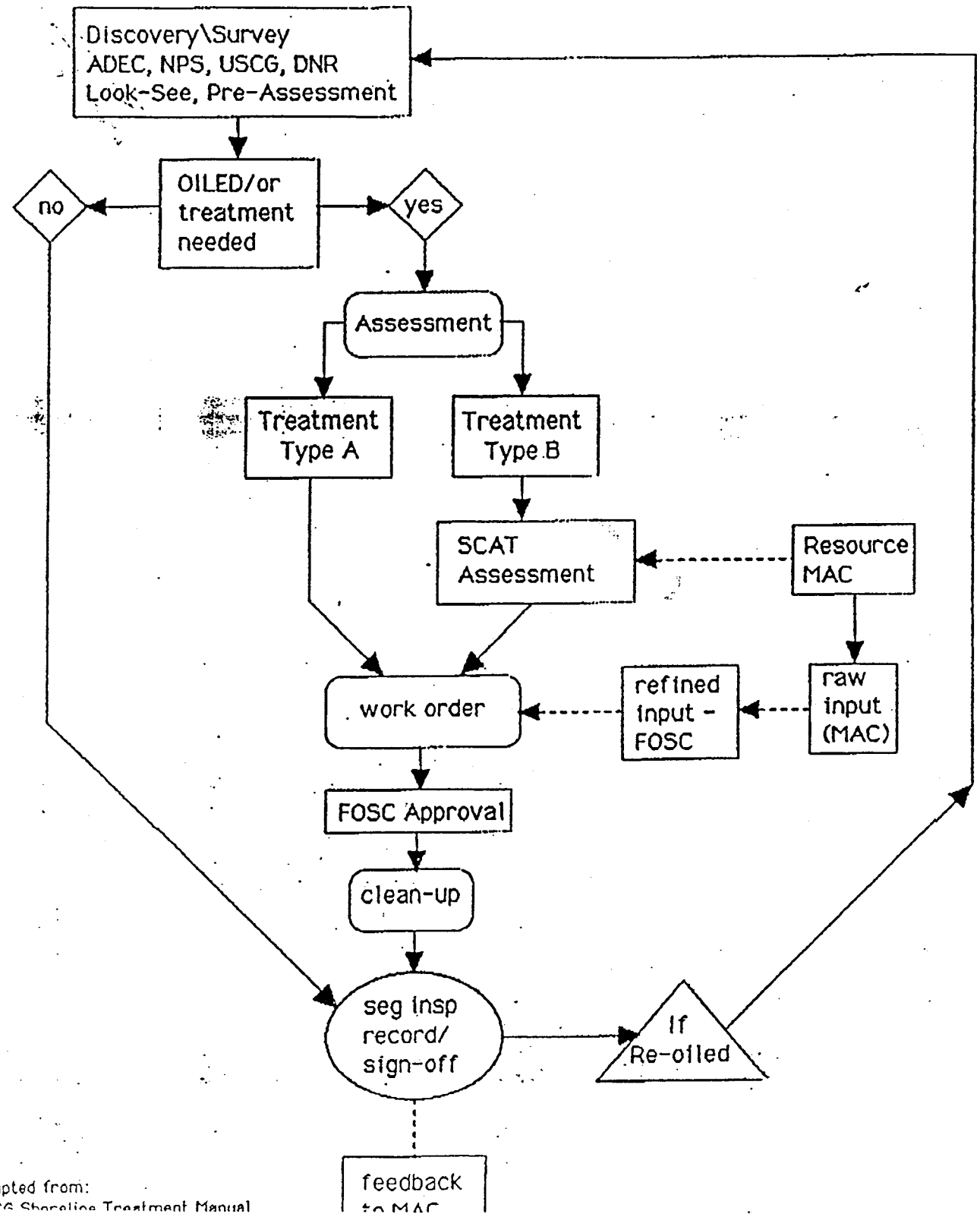


Figure 3. Shoreline treatment operations flow chart.

Figure 3. Clean-up Decision Process Flow Charts.

Seward Cleanup Decision 27 Jun 1989



dapted from:
CG Shoreline Treatment Manual

(version 5/24/89)

LIST OF KEY CODES USED ON SHORELINE CLEANUP EVALUATION FORMS

LOCATION PREFIX'S

A - Naked Is.
PI - Peak Is.
ST - Storey Is.
EL - Eleanor Is.
IN - Ingot Is.
BL - Block Is.
EN - Entrance Is.
SP - Sphinx Is.
DI - Disk Is.
KN - Knight Is.
SM - Smith Is.
SE - Seal Is.
AP - Applegate Rocks
AI - Applegate Is.
GR - Green Is.
LG - Little Green Is.
AB - Agnes (Bass) Is.
LS - Little Smith Is.
L - Lone Is.
M - Montague Is.
A - Aguliak Is.
S - Squirrel Is.
N - New Year Is.
M - Mummy Is.
S - Squire Is.
C - Crafton Is.
P - Point Nowell
J - Junction Is.
C - Chenega Is.
P - Pleiades Is.
B - Bainbridge Is.
F - Flemming Is.
E - Evans Is.
E - Elrington Is.
L - Latouche Is.
D - Danger Is.
E - Eshamy Bay
P - Perry Is.
M - Main Is.

KODIAK

SB - South Spirodon Bay
CK - Cape Kuliuk
SB - South Spirodon Bay
BB - Big Bay
SS - Shuyak Strait
HB - Hallo Bay
KB - Katmai Bay
PB - Puale Bay
FB - Foul Bay
BI - Ban Is.

HOMER

TB - Tonsina Bay
PD - Port Dick
RB - Rocky Bay
WB - Windy Bay
BC - Bootleggers Cove
EI - Elizabeth Is.
CI - East Chugach Is.
CB - Chugach Bay
GP - Gore Point

SEWARD

NI - Nuka Is.
YP - Yalik Point
QB - Quartz Bay
MB - Malina Bay
MT - Matushka Is.
AI - Agnes Cove

* GEOLOGICAL SEDIMENT TYP

Boulder (>256mm)	B
Cobble (64-256)	C
Pebble (4-64)	P
Granule (4-64)	G
Sand (0.06-2)	S
Mud (less 0.06)	M
Rock	R

** DEGREE OF OILING

Heavy	HV
Moderate	MD
Light	LT
No Oil	NO
Unobserved	UN

AREA OF BEACH IMPACT

Supratidal (+SHWL)	SU
HWL to SHWL	SP
Upper 1/3 ITZ	H
Middle 1/3 ITZ	M
Lower 1/3 ITZ	L

ADEC IMPACT SURVEY

Heavy	HVY
Moderate	MOD
Light	LT
No Oil	NO

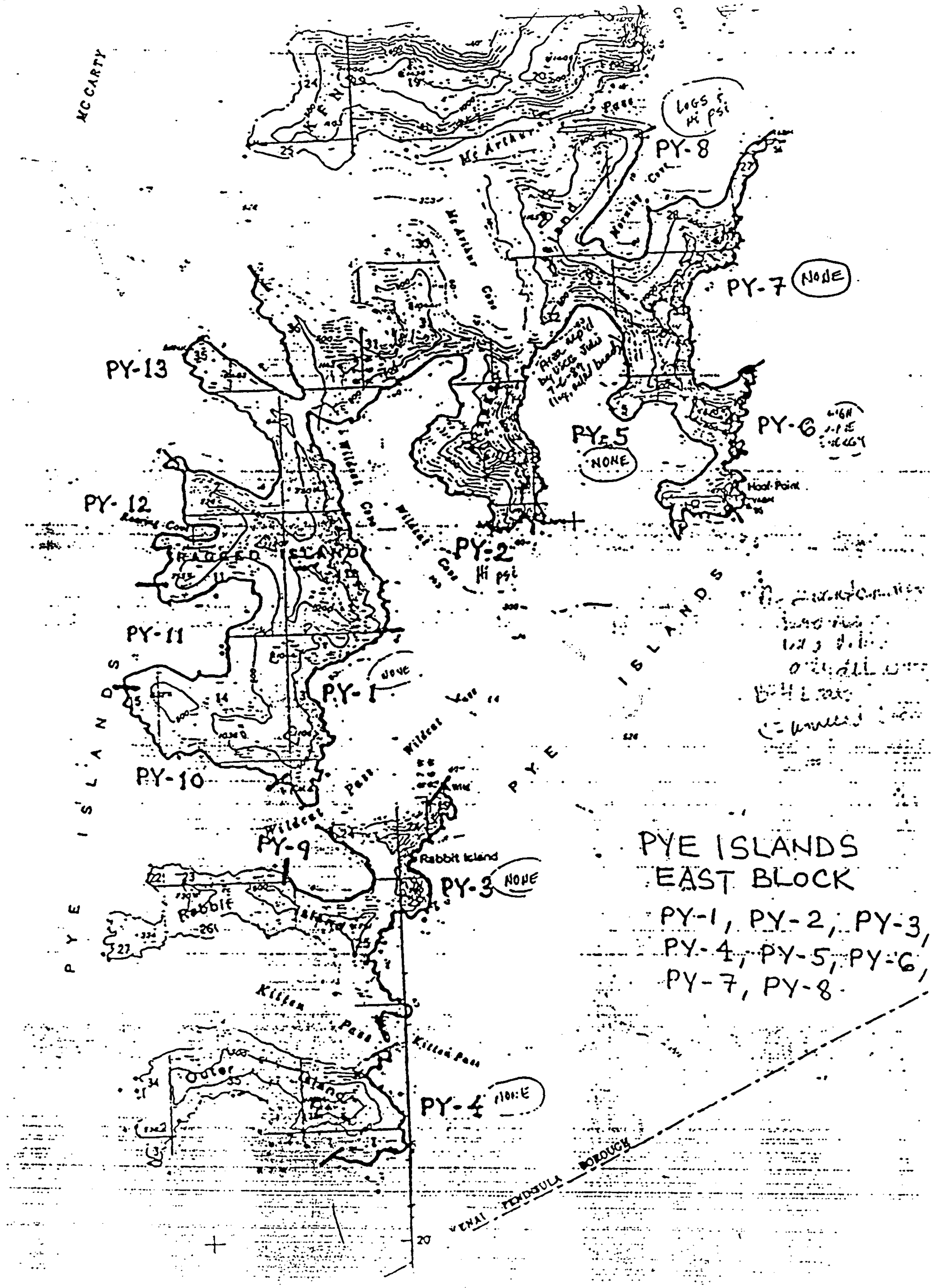
SHORELINE TYPE

Beach	BEA
Cove	COV
High Angle	HANG
Low Angle	LANG
Vertical	VER
Headland	HLD
Spit	SPI

Comments:

Multiple entry is acceptable, use decreasing order of type found.
(e.e. C/G/S where C is most predominant type and S is the least one.)
Heavy (>6m wide and/or >1.0 cm thick)
Moderate (3-6m wide and/or 0.2-1.0 cm thick)
Light (0.1 -3m wide and/or <0.2 cm thick
No oil (free of vissible oil)

Figure 4. Geographic Reference (GEOREF) System.



PYE ISLANDS
EAST BLOCK
PY-1, PY-2, PY-3,
PY-4, PY-5, PY-6,
PY-7, PY-8
PY-1
NONE
PY-2
Hi psi
PY-3
NONE
PY-4
NONE
PY-5
NONE
PY-6
PY-7
NONE
PY-8
LOGS & Hi psi
PY-9
PY-10
PY-11
PY-12
PY-13
McCARTY
McArthur Pass
McArthur Cove
Wildcat Cove
Wildcat Pass
Rabbit Island
Ragged Island
Outer Island
Kitten Pass
Hoof Point
PYE ISLANDS
KENAI PENINSULA BOROUGH

A DIVISION OF EXXON CORPORATION
(PRODUCTION DEPARTMENT)

DATE ISSUED: 05/15/88

MATERIAL SAFETY DATA SHEET

EXXON COMPANY, U.S.A. P. O. BOX 2180 HOUSTON, TEXAS 77252-2180

A. IDENTIFICATION AND EMERGENCY INFORMATION

PRODUCT NAME
Crude Oil

CHEMICAL NAME
Crude Oil

CAS NUMBER
8002-05-9

APPEARANCE AND ODOR
Dark liquid
Strong hydrocarbon solvent odor

EMERGENCY TELEPHONE NUMBER
(713) 656-3424

B. COMPONENTS AND HAZARD INFORMATION

COMPONENTS	CAS NO. OF COMPONENTS	APPROXIMATE CONCENTRATION
Crude Oil - a naturally occurring combination of hydrocarbons with gases, sulfur and nitrogen compounds	8002-05-9	100%

See Section E for health and hazard information

EXPOSURE LIMIT FOR TOTAL PRODUCT
Not established for total product

C. PRIMARY ROUTES OF ENTRY AND EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT
If hot product is splashed into eyes, flush with clear water and contact physician immediately. If splashed into the eyes, flush with clear water for 15 minutes or until irritation subsides. If irritation persists, call a physician.

SKIN CONTACT
Immediately contact a physician for treatment of thermal burns. In case of skin contact with product under other conditions, wash thoroughly with soap and water. Removal of product from skin may be aided by use of waterless handcleaner.

INHALATION
If overcome by vapor, remove from exposure and call a physician immediately. If breathing is irregular or has stopped, start resuscitation, administer oxygen, if available.

INGESTION
If ingested, DO NOT induce vomiting; call a physician immediately.

Figure 5. Crude Oil Material Safety Data Sheet.

9. FIRE AND EXPLOSION HAZARD INFORMATION

FLASH POINT (MINIMUM)
Less than 16°C (60°F) to greater than 93°C (200°F) PMCC

AUTOIGNITION TEMPERATURE
Not Determined

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) - HAZARD IDENTIFICATION

Health	Flammability	Reactivity	BASIS
1	3	0	Not Determined

HANDLING PRECAUTIONS
Keep product away from heat sparks, pilot lights, static electricity, and open flame.

FLAMMABLE OR EXPLOSIVE LIMITS (APPROXIMATE PERCENT BY VOLUME IN AIR)
Estimated Values: Lower Flammable Limit: 0.6% Upper Flammable Limit 15%

HOT CRUDE FLASH WARNING
Studies have shown that relatively low flash point substances, such as low boiling hydrocarbons, may accumulate in the vapor space of crude tanks and bulk transport compartments. Such vapors may exhibit flammability characteristics of a significantly lower flash product than would be indicated by the flash test. As a precaution, keep ignition sources away from vents and openings, including prevention of accumulation of pyrophoric iron sulfide.

EXTINGUISHING MEDIA AND FIRE FIGHTING PROCEDURES
Foam, water spray (fog), dry chemical, carbon dioxide and vaporizing liquid type extinguishing agents may all be suitable for extinguishing fires involving this type of product, depending on size or potential size of fire and circumstances related to the situation. Plan fire protection and response strategy through consultation with local fire protection authorities or appropriate specialists.

The following procedures for this type of product are based on the recommendations in the National Fire Protection Association's "Fire Protection Guide on Hazardous Materials", Eighth Edition (1984):

Use water spray, dry chemical, foam, or carbon dioxide. Water or foam may cause forthing. Use water to keep fire-exposed containers cool. Water spray may be used to flush spills away from exposures. Minimize breathing gases, vapor, fumes or decomposition products. Use supplied-air breathing equipment for enclosed or confined spaces or as otherwise needed.

DECOMPOSITION PRODUCTS UNDER FIRE CONDITIONS
Fumes, smoke, carbon monoxide, aldehydes and other decomposition products, in the case of incomplete combustion.

MPTY" CONTAINER WARNING
"Empty" containers retain residue (liquid and/or vapor) and can be dangerous. DO NOT RESSURIZE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND OR EXPOSE SUCH CONTAINERS TO HEAT, AME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION; THEY MAY EXPLODE AND USE INJURY OR DEATH. Do not attempt to clean since residue is difficult to remove. mpty" drums should be completely drained, properly bunged and promptly returned to a rum reconditioner. All other containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations. For work on tanks refer to Occupational Safety and Health Administration regulations, ANSI Z49.1, and other overnmental and industrial references pertaining to cleaning repairing, welding, or other contemplated operations.

E. HEALTH AND HAZARD INFORMATION

ARIABILITY AMONG INDIVIDUALS
Health studies have shown that many petroleum hydrocarbons pose potential human health risks which may vary from person to person. As a precaution, exposure to liquids, vapors, mists or fumes should be minimized.

FFECTS OF OVEREXPOSURE (SIGNS AND SYMPTOMS OF EXPOSURE)
High vapor concentrations are irritating to the eyes and the respiratory tract, may cause headaches and dizziness, are anesthetic, may cause unconsciousness, and may have other central nervous system effects including death. CAUTION: Product sometimes shipped hot; protect against burns.

URE OF HAZARD AND TOXICITY INFORMATION
kin contact with hot product may cause thermal burns. Prolonged or repeated contact ith this product at warm or ambient temperatures tends to remove skin oils, possibly eading to irritation and dermatitis.

ye contact with hot product may cause thermal burns. Contact with this product at arm or ambient temperatures may cause eye irritation but will not damage eye tissue.

his product may contain benzene, CAS #71-43-2, as a natural constituent. Benzene can ause anemia and other blood diseases, including leukemia (cancer of the blood-forming ystem), after prolonged or repeated exposures at high concentrations (e.g., 50-500 pm). It has also caused fetal defects in tests on laboratory animals.

SHA Regulation 29 CFR1910.1028 establishes an action level for benzene of 0.5 ppm as n 8-hour time weighted average, and permissible exposure limits of 1 ppm as an 8-hour ime weighted average, and a short-term exposure limit of 5 ppm as averaged over any 5 minute period.

he American Conference of Government Industrial Hygienists (ACGIH) has adopted a hreshold limit value for benzene of 10 ppm in air (30 mg/m^3) as a time weighted verage for an 8-hour workday with 25 ppm (75 mg/m^3) STEL.

[illegible] has been shown to cause skin cancer in animal tests. In such lifetime skin painting tests the substance was applied to the shaved backs of mice at regular intervals without cleanup between applications. In view of these findings, there may be a potential risk of skin cancer in humans from prolonged and repeated skin contact with this product in the absence of good personal hygiene.

Limited studies on oils that are very active carcinogens have shown that washing the the animals' skin with soap and water between applications greatly reduces tumor formation. These studies demonstrate the effectiveness of cleansing the skin after contact.

Potential risks to humans can be minimized by observing good work practices and personal hygiene procedures generally recommended for petroleum products. See Section I for recommended protection and precautions.

RE-EXISTING MEDICAL CONDITIONS WHICH MAY BE AGGRAVATED BY EXPOSURE
Benzene - Individuals with liver disease may be more susceptible to toxic effects.

Petroleum Solvents/Petroleum Hydrocarbons - Skin contact may aggravate an existing dermatitis.

F. PHYSICAL DATA

HE FOLLOWING DATA ARE APPROXIMATE OR TYPICAL VALUES AND SHOULD NOT BE USED FOR PRECISE DESIGN PURPOSES

BOILING POINT
Gas to 550°C (1000°F +)

SPECIFIC GRAVITY (H_2O = 1)
Greater than or equal to 0.7

MOLECULAR WEIGHT
Not Available

pH
Essentially Neutral

POUR, CONGEALING OR MELTING POINT
Not Available

VISCOSITY
Not Available

VAPOR PRESSURE
Not Available

VAPOR DENSITY (AIR = 1)
Not Available

PERCENT VOLATILE BY VOLUME
Up to 50%

EVAPORATION RATE @ ATM. AND 25°C (77°F) (n-BUTYL ACETATE = 1)
Not Available

SOLUBILITY IN WATER
Negligible

G. REACTIVITY

This product is stable. Hazardous polymerization will not occur. Avoid contact with strong oxidants such as liquid chlorine, concentrated oxygen, sodium hypochlorite or calcium hypochlorite. Hot product in contact with water can cause foaming or sudden evolution of steam which could cause pressure build-up and possibly rupture a tank or vessel.

Hydrogen sulfide from the product can react with the iron in Crude storage tank to form ferrous sulfide which is pyrophoric.

H. ENVIRONMENTAL INFORMATION

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Shut off and eliminate all ignition sources. Keep people away. Recover free liquid. Add sand, earth or other suitable absorbent to spill area. Minimize breathing vapors. Minimize skin contact. Ventilate confined spaces. Hot product may solidify when cooled. Keep product out of sewers and watercourses by diking or impounding. Advise authorities if product has entered or may enter sewers or watercourses.

Assure conformity with applicable governmental regulations. Continue to observe precautions for volatile, flammable vapors from absorbed material.

EPA HAZARD CLASSIFICATION CODE:

ACUTE HAZARD	CHRONIC HAZARD	FIRE HAZARD	PRESSURE HAZARD	REACTIVE HAZARD	NOT APPLICABLE
XXX	XXX	XXX			

I. PROTECTION AND PRECAUTIONS

VENTILATION

Provide ventilation sufficient to prevent exceeding recommended exposure limit or build-up of explosive concentrations of vapor in air. Use explosion-proof equipment

RESPIRATORY PROTECTION

Use supplied-air respiratory protection in confined or enclosed spaces, if needed.

PROTECTIVE GLOVES

Protect against hot liquid. Use chemical-resistant gloves to avoid skin contact.

EYE PROTECTION

Use splash goggles or fact shield when eye contact may occur.

OTHER PROTECTIVE EQUIPMENT
Use chemical-resistant apron or other impervious clothing, if needed, to protect against hot liquid and to avoid skin contact.

WORK PRACTICES / ENGINEERING CONTROLS
Use explosion-proof equipment. No smoking or open lights.

PERSONAL HYGIENE
Minimize breathing vapor, mist or fumes. Avoid prolonged or repeated contact with skin. Remove contaminated clothing; launder or dry-clean reuse. Remove contaminated shoes and thoroughly clean before reuse; discard if oil-soaked. Cleanse skin thoroughly after contact, before breaks and meals, and at end of work period. Product is readily removed from skin by waterless hand cleaners, followed by washing thoroughly with soap and water.

J. TRANSPORTATION INFORMATION

TRANSPORTATION INCIDENT INFORMATION
For further information relative to spills resulting from transportation incidents, refer to latest Department of Transportation Emergency Response Guidebook for Hazardous Materials Incidents, DOT P 5800.3.

DOT IDENTIFICATION NUMBER
UN 1267

DOT CLASSIFICATION
Not regulated if flash point is ≥200°F
Flammable Liquid (flash point <100°F)
Combustible Liquid (flash point 100 to <200°F)

DOT SHIPPING NAME
Crude Oil Petroleum

The information and recommendations contained herein are, to the best of Exxon's knowledge and belief, accurate and reliable as of the date issued. Exxon does not warrant or guarantee their accuracy or reliability, and Exxon shall not be liable for any loss or damage arising out of use thereof.

The information and recommendations are offered for the user's consideration and examination, and it is the user's responsibility to satisfy itself that they are suitable and complete for its particular use.

The Environmental Information included under Section H hereof as well as the National Fire Protection Association (NFPA) ratings have been included by Exxon Company, U.S.A. in order to provide additional health and hazard classification information. The ratings recommended are based upon the criteria supplied by the developers of these rating system, together with Exxon's interpretation of the available data.

FOR ADDITIONAL INFORMATION ON HEALTH EFFECTS CONTACT:

Director of Industrial Hygiene
Exxon Company, U.S.A.
P. O. Box 2180 - Room 3157
Houston, Texas 77252-2180
(713) 656-2443

... – Safety Data Sheet
May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200. Standard must be consulted for specific requirements.

U.S. Department of Labor
Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072

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IDENTITY (As Used on Label and List)
Customblen(TM) 20-8-0

Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.

Section I

Manufacturer's Name Sierra Chemical Company	Emergency Telephone Number (408)263-8083
Address (Number, Street, City, State, and ZIP Code) 1001 Yosemite Drive	Telephone Number for Information (408)263-8080
Milpitas, CA 95035	Date Prepared 7-20-89
	Signature of Preparer (Optional) Mark Bourne

Section II — Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity; Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
This product is classified as an OXIDIZER for shipping purposes. Each prill is a mixture of: ammonium nitrate (NH_4NO_3); calcium phosphate ($CaSO_4$); and ammonium phosphates ($NH_4H_2PO_4$ and $(NH_4)_2HPO_4$). Each prill has a controlled release coating made from vegetable oil (linseed oil or soybean oil) reacted with cyclic diene.				

Section III — Physical/Chemical Characteristics

Boiling Point Decomposes on heating.	Not Known	Specific Gravity (H_2O = 1)	1.2
Vapor Pressure (mm Hg.)	Not Known	Melting Point	Not Known
Vapor Density (AIR = 1)	non-volitale	Evaporation Rate (Butyl Acetate = 1)	non-volitale
Solubility in Water 80-85%			
Appearance and Odor No odor. Prills are spherical in shape and mixed light and dark tan.			

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used) Decomposes on heating	Flammable Limits Non-flammable	LEL Non-flammable	UEL Non-flammable
Extinguishing Media			
Special Fire Fighting Procedures Flood with water to cool containers.			
Unusual Fire and Explosion Hazards Decomposes on heating to nitrogen oxides.			

Reproduce locally

Figure 6. Customblen (TM) Material Safety Data Sheet.

		X	decomposition to nitrogen oxides.

Incompatibility (Materials to Avoid): Reducing agents.

Hazardous Decomposition or Byproducts: Nitrogen oxides.

Hazardous Polymerization	May Occur		Conditions to Avoid: None
	Will Not Occur	X	

Section VI — Health Hazard Data

Route(s) of Entry: Inhalation? No Skin? No Ingestion? Yes

Health Hazards (Acute and Chronic): Rat oral LD50 greater than 20gm/kg

Carcinogenicity: NTP? None IARC Monographs? None OSHA Regulated? No

Signs and Symptoms of Exposure: Ingestion can lead to gastro-intestinal disturbances.

Medical Conditions Generally Aggravated by Exposure: Ingestion could aggravate gastro-intestinal problems.

Emergency and First Aid Procedures: Ingestion: delay absorption of nitrates by giving water, milk or activated charcol and then remove by forced vomiting or gastric lavage.

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken In Case Material is Released or Spilled: Sweep up.

Waste Disposal Method: Apply to field as fertilizer, or transport to an approved hazardous waste disposal facility.

Precautions to Be Taken in Handling and Storing: Protect from heat and moisture.

Other Precautions: None

Section VIII — Control Measures

Respiratory Protection (Specify Type): None required

Ventilation: None required	Local Exhaust	Special	None
	Mechanical (General)	Other	None
Protective Gloves: None		Eye Protection: None	

Other Protective Clothing or Equipment: None

Hygienic Practices: Adequate personal hygiene.

EXXON COMPANY, USA
A DIVISION OF EXXON CORPORATION

DATE ISSUED: 07/28/89
SUPERSEDES DATE: ••••••••••

MATERIAL SAFETY DATA SHEET

EXXON COMPANY, U.S.A. P.O. BOX 2180 HOUSTON, TX 77252-2180

A. IDENTIFICATION AND EMERGENCY INFORMATION

PRODUCT NAME
INIPOL EAP 22

PRODUCT CODE
134681 - 84681

CHEMICAL NAME
Biodegradation accelerating agent

CAS NUMBER
Complex Mixture
CAS Number not applicable

PRODUCT APPEARANCE AND ODOR
Clear liquid

MEDICAL EMERGENCY TELEPHONE NUMBER
(713) 656-3424

MANUFACTURED BY CECA COMPANY

B. COMPONENTS AND HAZARD INFORMATION

COMPONENTS	CAS NO. OF COMPONENTS	APPROXIMATE CONCENTRATION
This formulation contains the following hazardous component:		
2-Butoxyethanol (ethylene glycol monobutyl ether)	111-76-2	

See Section E for Health and Hazard Information.

See Section H for additional Environmental Information.

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM (HMIS)

Health	Flammability	Reactivity	BASIS
3	1	0	Recommended by Exxon

EXPOSURE LIMIT FOR TOTAL PRODUCT
25 ppm (120 mg/m3) for
2-Butoxyethanol (skin)

BASIS
Recommended by the American Conference of Governmental Industrial Hygienists (ACGIH)
OSHA Regulation 29 CFR 1910.1000

C. PRIMARY ROUTES OF ENTRY AND EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT
If splashed into the eyes, flush with clear water for 15 minutes or until irritation subsides. If irritation persists, call a physician.

SKIN
In case of skin contact, remove any contaminated clothing and wash skin thoroughly with soap and water.

INHALATION
If overcome by vapor, remove from exposure and call a physician immediately. If breathing is irregular or has stopped, start resuscitation, administer oxygen, if available.

343-0277[illegible]

Figure 7. Inipol (TM) Material Safety Data Sheet.

INGESTION
If ingested, DO NOT induce vomiting; call a physician immediately.

D. FIRE AND EXPLOSION HAZARD INFORMATION

FLASH POINT (MINIMUM)
Greater than 100°C

AUTOIGNITION TEMPERATURE
Not determined

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) - HAZARD IDENTIFICATION

Health	Flammability	Reactivity	BASIS
3	1	0	Recommended by Exxon

HANDLING PRECAUTIONS
Use product with caution around heat, sparks, pilot lights, static electricity, and open flame.

FLAMMABLE OR EXPLOSIVE LIMITS (APPROXIMATE PERCENT BY VOLUME IN AIR)
Estimated values: Lower Flammable Limit 0.8% Upper Flammable Limit 7%

EXTINGUISHING MEDIA AND FIRE FIGHTING PROCEDURES
Foam, water spray (fog), dry chemical, carbon dioxide and vaporizing liquid type extinguishing agents may all be suitable for extinguishing fires involving this type of product, depending on size or potential size of fire and circumstances related to the situation. Plan fire protection and response strategy through consultation with local fire protection authorities or appropriate specialists.

The following procedures for this type of product are based on the recommendations in the National Fire Protection Association's "Fire Protection Guide on Hazardous Materials", Eighth Edition (1984):

Use water spray, dry chemical, foam or carbon dioxide to extinguish the fire. Use water to keep fire-exposed containers cool. If a leak or spill has not ignited, use water spray to disperse the vapors and to provide protection for men attempting to stop a leak. Water spray may be used to flush spills away from exposures. Minimize breathing of gases, vapor, fumes or decomposition products. Use supplied-air breathing equipment for enclosed or confined spaces or as otherwise needed.

DECOMPOSITION PRODUCTS UNDER FIRE CONDITIONS
Fumes, smoke, carbon monoxide, aldehydes and other decomposition products, in the case of incomplete combustion.

"EMPTY" CONTAINER WARNING
"Empty" containers retain residue (liquid and/or vapor) and can be dangerous. DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION; THEY MAY EXPLODE AND CAUSE INJURY OR DEATH. Do not attempt to clean since residue is difficult to remove. "Empty" drums should be completely drained, properly bunged and promptly returned to a drum reconditioner. All other containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations. For work on tanks refer to Occupational Safety and Health Administration regulations, ANSI Z49.1, and other governmental and industrial references pertaining to cleaning, repairing, welding, or other contemplated operations.

E. HEALTH AND HAZARD INFORMATION

VARIABILITY AMONG INDIVIDUALS
Health studies have shown that many petroleum hydrocarbons and synthetic lubricants pose potential human health risks which may vary from person to person. As a precaution, exposure to liquids, vapors, mists or fumes should be minimized.

EFFECTS OF OVEREXPOSURE (Signs and symptoms of exposure)
Inhalation of high vapor concentrations may have results ranging from dizziness, headache, and respiratory irritation to unconsciousness and possibly death.

NATURE OF HAZARD AND TOXICITY INFORMATION
Prolonged or repeated skin contact may cause skin irritation.

Product contacting the eyes may cause eye irritation.

Inhalation of high vapor concentrations may cause upper respiratory tract irritation.

USE CAUTION WHEN HANDLING THIS MATERIAL.

Components of this product (2-butoxyethanol) may be absorbed through the skin and could produce blood and kidney damage. Symptoms of overexposure include paleness and red discoloration of the urine.

PRE-EXISTING MEDICAL CONDITIONS WHICH MAY BE AGGRAVATED BY EXPOSURE
Petroleum Solvents/Petroleum Hydrocarbons - Skin contact may aggravate an existing dermatitis.

Glycol Ethers - Persons with a history of blood and/or kidney disease should avoid exposure to this product.

F. PHYSICAL DATA

The following data are approximate or typical values and should not be used for precise design purposes.

BOILING RANGE
Not determined

SPECIFIC GRAVITY (15.6 C/15.6 C)
0.936 at 25°C

MOLECULAR WEIGHT
Approximately 190

pH
5.0-8.5

POUR, CONGEALING OR MELTING POINT
11°C

VISCOSITY
280 cSt @ 20°C

VAPOR PRESSURE
10 mm Hg @ 20°C

VAPOR DENSITY (AIR = 1)
Not determined

PERCENT VOLATILE BY VOLUME
Not determined

EVAPORATION RATE @ 1 ATM. AND 25 C (77 F)
(n-BUTYL ACETATE = 1)
Not determined

SOLUBILITY IN WATER @ 1 ATM. AND 25 C (77 F)
100%

G. REACTIVITY

This product is stable and will not react violently with water. Hazardous polymerization will not occur. Avoid contact with strong oxidants such as liquid chlorine, concentrated oxygen, sodium hypochlorite or calcium hypochlorite.

H. ENVIRONMENTAL INFORMATION

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Shut off and eliminate all ignition sources. Keep people away. Recover free product. Add sand, earth or other suitable absorbent to spill area. Minimize breathing vapors. Minimize skin contact. Ventilate confined spaces. Open all windows and doors. Keep product out of sewers and watercourses by diking or impounding. Advise authorities if product has entered or may enter sewers, watercourses, or extensive land areas.
Assure conformity with applicable governmental regulations.

THE FOLLOWING INFORMATION MAY BE USEFUL IN COMPLYING WITH VARIOUS STATE AND FEDERAL LAWS AND

REGULATIONS UNDER VARIOUS ENVIRONMENTAL STATUTES:

REPORTABLE QUANTITY (RQ), EPA REGULATION 40 CFR 302 (CERCLA Section 102)
No RQ for product or any constituent greater than 1% or 0.1% (carcinogen).

THRESHOLD PLANNING QUANTITY (TPQ), EPA REGULATION 40 CFR 355 (SARA Sections 301-304)
No TPQ for product or any constituent greater than 1% or 0.1% (carcinogen).

TOXIC CHEMICAL RELEASE REPORTING, EPA REGULATION 40 CFR 372 (SARA Section 313)
No toxic chemical is present greater than 1% or 0.1% (carcinogen).

HAZARDOUS CHEMICAL REPORTING, EPA REGULATION 40 CFR 370 (SARA Sections 311-312)

	Acute Hazard	Chronic Hazard	Fire Hazard	Pressure Hazard	Reactive Hazard	Not Applicable
EPA HAZARD CLASSIFICATION CODE:	XXX	XXX				

I. PROTECTION AND PRECAUTIONS

VENTILATION
Use only with ventilation sufficient to prevent exceeding recommended exposure limit or buildup of explosive concentrations of vapor in air. No smoking, flame or other ignition sources.

RESPIRATORY PROTECTION
Use supplied-air respiratory protection in confined or enclosed spaces, if needed.

Use approved organic vapor respirator for concentrations of 2-butoxyethanol in excess of 25 ppm.

PROTECTIVE GLOVES
Use chemical-resistant gloves to avoid prolonged and repeated skin contact.

EYE PROTECTION
Use splash goggles or face shield when eye contact may occur.

OTHER PROTECTIVE EQUIPMENT
Use chemical-resistant apron or slicker suit and chemically resistant boots to avoid contaminating regular clothing, which could result in prolonged or repeated skin contact.

WORK PRACTICES / ENGINEERING CONTROLS
Keep containers closed when not in use. Do not store near heat, sparks, flame or strong oxidants. To prevent fire or explosion risk from static accumulation and discharge, effective ground product transfer system in accordance with the National Fire Protection Association standard for petroleum products.

In order to prevent fire or explosion hazards, use appropriate equipment.

Information on electrical equipment appropriate for use with this product may be found in the latest edition of the National Electrical Code (NFPA-70). This document is available from the National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269.

PERSONAL HYGIENE
Minimize breathing vapor or mist. Avoid prolonged or repeated contact with skin. Remove contaminated clothing; launder or dry-clean before re-use. Remove contaminated shoes and thoroughly clean and dry before re-use. Cleanse skin thoroughly after contact, before breaks and meals, and at end of work period. Product is readily removed from skin by waterless hand cleaners followed by washing thoroughly with soap and water.

J. TRANSPORTATION AND OSHA RELATED LABEL INFORMATION

TRANSPORTATION INCIDENT INFORMATION
For further information relative to spills resulting from transportation incidents, refer to latest Department of Transportation Emergency Response Guidebook for Hazardous Materials Incidents, DOT P 5800.3.

DOT IDENTIFICATION NUMBER
Not applicable

OSHA REQUIRED LABEL INFORMATION

In compliance with hazard and right-to-know requirements, the following OSHA Hazard Warnings should be found on a label, bill of lading or invoice accompanying this shipment.

WARNING!

MATERIAL MAY BE ABSORBED THROUGH THE SKIN

PROLONGED AND REPEATED EXPOSURE MAY CAUSE
EYE AND SKIN IRRITATION AND MAY CAUSE
BLOOD AND KIDNEY DAMAGE

Note: Product label will contain additional non-OSHA related information.

The information and recommendations contained herein are, to the best of Exxon's knowledge and belief, accurate and reliable as of the date issued. Exxon does not warrant or guarantee their accuracy or reliability, and Exxon shall not be liable for any loss or damage arising out of the use thereof.

The information and recommendations are offered for the user's consideration and examination, and it is the user's responsibility to satisfy itself that they are suitable and complete for its particular use. If buyer repackages this product, legal council should be consulted to insure proper health, safety and other necessary information is included on the container.

The Environmental Information included under Section H hereof as well as the Hazardous Materials Identification System (HMIS) and National Fire Protection Association (NFPA) ratings have been included by Exxon Company, U.S.A. in order to provide additional health and hazard classification information. The ratings recommended are based upon the criteria supplied by the developers of these rating systems, together with Exxon's interpretation of the available data.

FOR ADDITIONAL INFORMATION ON HEALTH EFFECTS CONTACT:
DIRECTOR OF INDUSTRIAL HYGIENE
EXXON COMPANY, U.S.A.
P. O. BOX 2180 ROOM 3157
HOUSTON, TX 77252-2180
(713) 656-2442

FOR OTHER PRODUCT INFORMATION CONTACT:
MANAGER, MARKETING TECHNICAL SERVICES
EXXON COMPANY, U.S.A.
P. O. BOX 2180 ROOM 2355
HOUSTON, TX 77252-2180
(713) 656-8949

EXXON CHEMICAL

MATERIAL SAFETY DATA SHEET

EXXON CHEMICAL AMERICAS • P.O. BOX 3272, HOUSTON, TEXAS 77001
A Division of EXXON CHEMICAL COMPANY, A Division of EXXON CORPORATION

08/01/89

NO. 795800

SECTION 1 PRODUCT IDENTIFICATION & EMERGENCY INFORMATION

PRODUCT NAME
Corexit 9580 7-9580

CHEMICAL NAME
Not applicable: Blend

CHEMICAL FAMILY
Shoreline Cleaner

PRODUCT APPEARANCE/DESCRIPTION
Clear Straw Colored Liquid
Hydrocarbon Odor

EMERGENCY TELEPHONE NUMBERS: EXXON CHEMICAL AMERICAS 713-870-6000
CHEMTREC 800-424-9300

SECTION 2 HAZARDOUS INGREDIENT INFORMATION

The composition of this mixture may be proprietary information. In the event of a medical emergency, compositional information will be provided to a physician or nurse. This product is hazardous as defined in 29 CFR 1910.1200, based on the following compositional information:

COMPONENT	OSHA HAZARD
Paraffinic Solvent	Combustible Liquid
Paraffinic Solvent, Organic Esters	Eye and Skin Irritant
Paraffinic Solvent	Vapors Irritant to Eyes and Respiratory Tract

For additional information see Section 3.

SECTION 3 HEALTH INFORMATION & PROTECTION

NATURE OF HAZARD

EYE CONTACT:
Irritating, but does not injure eye tissue.

SKIN CONTACT:
Low order of toxicity.
Frequent or prolonged contact may irritate and cause dermatitis.

INHALATION:
High vapor concentrations are irritating to the eyes and the respiratory tract, may cause headaches and dizziness, are anesthetic and may have other central nervous system effects.

INGESTION:
Small amounts of the liquid aspirated into the respiratory system during ingestion, or from vomiting, may cause bronchiopneumonia or pulmonary edema.

FIRST AID

EYE CONTACT:
Flush eyes with large amounts of water until irritation subsides. If irritation persists, get medical attention.

SKIN CONTACT:
Flush with large amounts of water; use soap if available.
Remove grossly contaminated clothing, including shoes, and launder before reuse.
If irritation persists, seek medical attention.

Figure 8. Corexit 9580 (TM) Material Safety Data Sheet.

INHALATION:
Using proper respiratory protection, immediately remove the affected victim from exposure. Administer artificial respiration if breathing is stopped. Keep at rest. Call for prompt medical attention.

INGESTION:
If swallowed, DO NOT induce vomiting. Keep at rest. Get prompt medical attention.

WORKPLACE EXPOSURE LIMITS

EXXON RECOMMENDS THE FOLLOWING OCCUPATIONAL EXPOSURE LIMITS:
300 ppm total hydrocarbon based on composition.

PRECAUTIONS

PERSONAL PROTECTION
For open systems where contact is likely, wear safety glasses with side shields, long sleeves, and chemical resistant gloves.
Where contact may occur, wear safety glasses with side shields.
Where concentrations in air may exceed the limits given in this Section and engineering, work practice or other means of exposure reduction are not adequate, NIOSH/MSHA approved respirators may be necessary to prevent overexposure by inhalation.

VENTILATION
The use of mechanical dilution ventilation is recommended whenever this product is used in a confined space, is heated above ambient temperatures, or is agitated.

CHRONIC EFFECTS
Laboratory animal studies have shown that prolonged and repeated inhalation exposure to light hydrocarbon vapors in the same naphtha boiling range as this product can produce adverse kidney effects in male rats. However, these effects were not observed in similar studies with female rats and male and female mice and in limited studies with other animal species. Additionally, in a number of human studies, there was no clinical evidence of such effects at normal occupational levels. It is therefore highly unlikely that the kidney effects observed in male rats have significant implications for humans exposed at or below recommended vapor limits in the workplace.

CHRONIC TOXICITY DATA IS AVAILABLE UPON REQUEST

SECTION 4 FIRE & EXPLOSION HAZARD

FLASHPOINT: 174 Deg F. METHOD: Seta CC NOTE: Not available
FLAMMABLE LIMITS: LEL: 0.6 UEL: 7.0 NOTE: Not available
AUTOIGNITION TEMPERATURE: NOTE: Not available

GENERAL HAZARD
Combustible Liquid, can form combustible mixtures at temperatures at or above the flashpoint.
Toxic gases will form upon combustion.
"Empty" containers retain product residue (liquid and/or vapor) and can be dangerous. DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION; THEY MAY EXPLODE AND CAUSE INJURY OR DEATH.
Empty drums should be completely drained, properly bunged and promptly returned to a drum reconditioner, or properly disposed of.

FIRE FIGHTING
Use water spray to cool fire exposed surfaces and to protect personnel.
Isolate "fuel" supply from fire.
Use alcohol type foam, dry chemical or water spray to extinguish fire.

Respiratory and eye protection required for fire fighting personnel.
Avoid spraying water directly into storage containers due to danger of boilover.

DECOMPOSITION PRODUCTS UNDER FIRE CONDITIONS
Smoke, Fumes, Carbon Monoxide, Carbon Dioxide

SECTION 5 SPILL CONTROL PROCEDURE

LAND SPILL
Eliminate sources of ignition. Prevent additional discharge of material, if possible to do so without hazard. For small spills implement cleanup procedures; for large spills implement cleanup procedures and, if in public area, keep public away and advise authorities. Also, if this product is subject to CERCLA reporting (see Section VII) notify the National Response Center.
Prevent liquid from entering sewers, watercourses, or low areas. Contain spilled liquid with sand or earth. Do not use combustible materials such as sawdust.
Recover by pumping (use an explosion proof or hand pump) or with a suitable absorbent.
Consult an expert on disposal of recovered material and ensure conformity to local disposal regulations.

WATER SPILL
Consult an expert on disposal of recovered material and ensure conformity to local disposal regulations.

SECTION 6 NOTES

This product may contain trace amounts of ethylene oxide (CAS No. 75-21-8), a condition which creates the potential for accumulation of ethylene oxide in the head space of shipping and storage containers and in enclosed areas where the product is being handled or used. Ethylene oxide is considered by OSHA, IARC, and NTP as a potential carcinogen for humans. Ethylene oxide may also present reproductive, mutagenic, genotoxic, neurologic and sensitization hazards in humans. If this product is handled with adequate ventilation, the presence of these trace amounts is not expected to result in any short or long term hazards.

SECTION 7 REGULATORY INFORMATION

TSCA:
Components of this product are listed on the TSCA Inventory.

CERCLA:
If this product is accidentally spilled, it is not subject to any special reporting under the requirements of the Comprehensive Response, Compensation, and Liability Act (CERCLA). We recommend you contact local authorities to determine if there may be other local reporting requirements.

SARA TITLE III:
Under the provisions of Title III, Sections 311/312 of the Superfund Amendments and Reauthorization Act, this product is classified into the following hazard categories:
Immediate health, Delayed Health, Fire.
This product does not contain Section 313 Reportable Ingredients.

SECTION 8 TYPICAL PHYSICAL & CHEMICAL PROPERTIES

SPECIFIC GRAVITY:
0.81 at 60 Not available
Density: 6.8 lbs/gal at 60

SOLUBILITY IN WATER, WT. % AT °F:
Dispersible

SP. GRAV. OF VAPOR, at 1 atm (Air=1):
5.00 Not available

EVAPORATION RATE, n-Bu Acetate=1:
0.0 Calculated

VAPOR PRESSURE, mmHg at °F:
2 at 100 Calculated

VISCOSITY OF LIQUID, CST AT °F:
3 at 100 Cannon-Fenske
2 at 150 Cannon-Fenske

FREEZING/MELTING POINT, °F:
-65 Pour Point

BOILING POINT, °F:
429 Not available

SECTION 9 REACTIVITY DATA

STABILITY:
Stable

CONDITIONS TO AVOID INSTABILITY:
None

HAZARDOUS POLYMERIZATION:
Will not occur

COND. TO AVOID HAZARDOUS POLYMERIZATION:
Not applicable

MATERIALS AND CONDITIONS TO AVOID INCOMPATIBILITY:
Strong Oxidizing Agents

HAZARDOUS DECOMPOSITION PRODUCTS:
None

SECTION 10 TRANSPORT AND STORAGE

U.S. DOT CLASSIFICATION:
Combustible Liquid

ELECTROSTATIC ACCUMULATION HAZARD:
Unknown, use proper grounding procedure

STORAGE TEMPERATURE, °F:
Ambient

STORAGE/TRANSPORT PRESSURE, mmHg:
Atmospheric

UN NUMBER:
U.S. DOT Identification Number: NA 1993

LOADING/UNLOADING TEMPERATURE, °F:
Ambient

VISC. AT LOADING/UNLOADING TEMP., cST:
Not available

REFERENCE NUMBER: HDHA-A-12003

DATE PREPARED: August 1, 1989

SUPERCEDES ISSUE DATE: July 27, 1989

FOR ADDITIONAL PRODUCT INFORMATION, CONTACT YOUR TECHNICAL SALES REPRESENTATIVE
FOR ADDITIONAL HEALTH/SAFETY INFORMATION, CALL 713-870-6885