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8050 HOUSE RESOURCES

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But as a functioning society, Alaska also was justified in considering whether leaving long stretches of beach with subsurface oil might affect how tourists viewed vacation opportunities, or how consumers viewed the quality and purity or Alaska seafood.

active in different ways) than originally assumed, and that subsurface oil did not appear to be changing much at some sites.[73]

State TAG representatives had bits and pieces of these studies over time. Taken together, they were not willing to stipulate to the assumptions that the oil was weathering fast at all sites, that it posed little or no risk to wildlife, and that aggressive treatment (such as tilling with heavy equipment or removing oiled rocks and sediment) was a bad idea.

As a matter of response strategy, it led state officials to two important conclusions that were opposite from the prevailing attitude among federal and Exxon representatives to the TAG in 1990 (and 1991). First, given the uncertainty about the lingering sub-lethal toxicity of subsurface oil (or oil around salmon streams), DEC and ADF&G assigned to weathered oil a higher level of risk than the federal government and Exxon. Second, given that many kinds of beaches were more resilient to aggressive work than previously thought, more extensive and aggressive cleanup could take place.

b) The state and the federal-Exxon officials viewed the issue of "more harm than good" in fundamentally different ways.

The issue, at root, was a matter of public policy, not strictly technical analysis. It also leads back to the "compelling reason" test mentioned briefly above. Under state regulations and state resource management responsibilities, Alaska had more "compelling reasons" for cleanup than the federal-Exxon bloc.

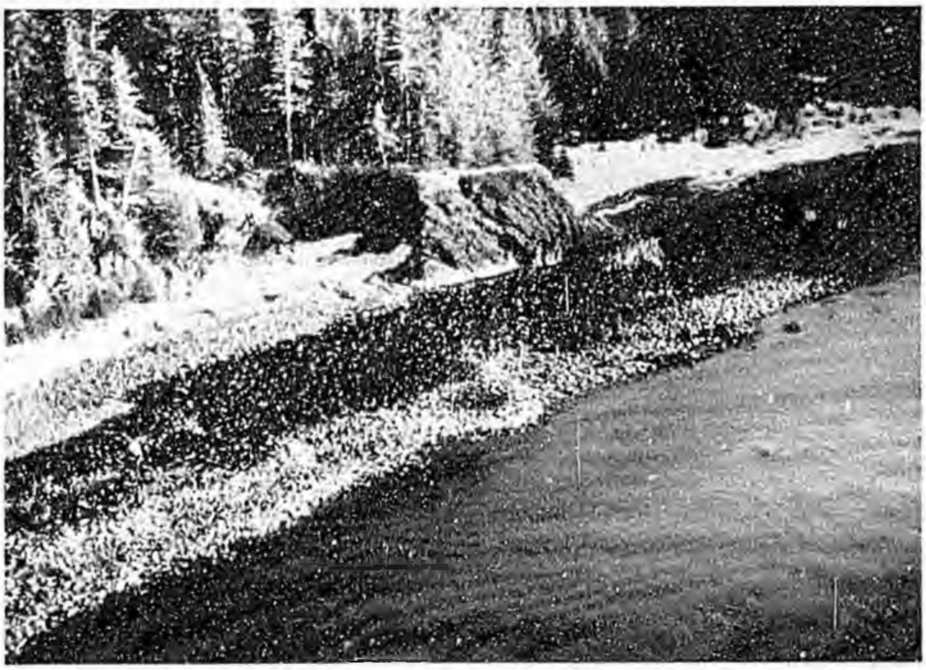
The state regulation setting DEC's general limits of pollution cleanup says that cleanup should continue until one has either reached the limits of technology, or until cleanup efforts cause more environmental problems than they solve.[74] The regulation is broad enough that it gives the DEC the latitude to make a decision based on existing conditions and available technology.

The federal government has a variety of regulatory requirements for a variety of pollution control and abatement programs, but basically, federal regulations aren't too different from the principal that the government can require cleanup only to the limits of technology and environmental good sense.

So when the federal government and Exxon promoted a TAG policy based on achieving what they termed a "net environmental benefit," it did not seem that it would be difficult to harmonize state and federal cleanup requirements within the TAG.

But there was, of course, a lot more to the shoreline cleanup of the *Exxon Valdez* response. Major cleanup decisions went far beyond a simple assessment of technology and a general look at the environmental health of a site. Had this been a cleanup concentrating on a single site, the questions would have been much easier to answer and the state and federal priorities much easier to harmonize.

But the size of the spill, the area it covered and — most important — the number of ways it affected resources, economies and communities meant that the *Exxon Valdez* cleanup calculus would have many more variables,



While a "bathtub ring" of weathered oil in a cove might pose little or no immediate environmental problem, it might discourage subsistence users from harvesting shellfish or seaweed there. Photo by Pamela Bergman many more dimensions, and much more complicated equations than your average contaminated site cleanup.

Under both state and federal pollution control schemes, the on-scene coordinator or the lead cleanup agency is supposed to weigh factors such as economic and social impacts of a spill along with the limits of technology and environmental good sense. But the rules don't say how much weight each factor gets, and they don't spell out a formula for setting priorities. As a general rule, one is always supposed to avoid doing "more harm than good." But who defines harm? What is good? Whose good is harmed more than someone else's good, and who says which good is more important than another?

The state's definition of harm was very broad, because the state's resource management responsibilities and its social and economic interests were more diverse and more acute than those of either the federal government or Exxon. The state viewed the problem, therefore, in different ways and came to different conclusions about what needed to be done.

The TAG was, in a piecemeal fashion, establishing overall State of Alaska policies on subjects wholly within the State of Alaska's authority. And in nearly every case, these *de facto* regulatory interpretations were something less than state regulators and resource managers felt were acceptable.

The state considered primary issues, such as how oiling might affect the health of fisheries. But as a functioning society, Alaska also was justified in considering whether leaving long stretches of beach with subsurface oil might affect how tourists viewed vacation opportunities, or how consumers viewed the quality and purity or Alaska seafood.

While a "bathtub ring" of weathered oil in a cove might pose little or no immediate environmental problem, it might discourage subsistence users from harvesting shellfish or seaweed there. This "displacement effect" could then have a real effect on a village, as people stopped collecting traditional foods and started relying on store-bought goods.[75]

One might correctly argue that leaving buried oil throughout a series of uninhabited ocean beaches away from commercial or subsistence fisheries posed little threat to the environment. However, if those beaches were in a specially designated state wilderness park — which requires a specific level of management and protection — then the state might perceive the oil as "harm" to state resources.

These are only a few of the kinds of issues that came up in the TAG, and on which state and federal-Exxon representatives differed. NOAA's general policy of "net environmental benefit," adopted by the Coast Guard and Exxon, put more weight on biological factors and less weight on other public policy variables. The federal government frequently took the position that active cleanup efforts were not necessary because the oiling was largely non-toxic and resource uses were not significantly disrupted by the presence of the oil. That is fundamentally different than the state's regulatory requirement for cleanup.

The state does not require cleanup only if the pollution causes a measurable problem; the state can require cleanup simply because pollutants are someplace where they shouldn't be. In the case of Prince William Sound and the Gulf of Alaska shorelines, Alaska consistently held to the position that as a matter of overall state policy, we should remove as much pollution as we can within the boundaries of technology and environmental good sense. NOAA's position was something less strict than that.

"[T]he state argued that removing the oil quickly meant that normal use (and full value) of the areas would return more quickly. The intertidal communities would reestablish themselves fairly quickly, despite initial impacts, and the beach profiles would not be irrevocably changed or damaged," state officials later explained in a management summary of the 1990-91 season.

"The federal government, which did not share the state's responsibility to manage those uses or protect those values, felt that it was acceptable to leave more oil to weather naturally. This was not an invalid position, of course; it simply did not fully reflect the state's needs."[76]

The state's "more harm than good" calculus was a more complex matrix of economic, social and environmental variables that frequently placed significant weight on intrinsic or intangible values of a resource. Displacement, special land designations, even the simply value of an oiled vs. unoiled site played important roles in many state decisions.

The state did not propose to protect these other values at the expense of the environment; rather, the state was willing to accept certain levels of short-term disruption in exchange for long-term use or preservation of values at a given site or area. NOAA and the Coast Guard, using a different set of variables based on their different perceptions of risk, and on different regulatory authorities, often came up with a different answer to their equations. In the TAG, these different methods of calculating harm and good often clashed.

From a broader perspective, it was especially important for the state that the Exxon Valdez "standards" produced in the TAG be understood for the compromises they were – the best possible compromises, given the existing conditions and availability of resources.

c) ***Despite its name, the TAG was not just a "technical" advisory group; it was actually an arbiter of public policy and regulatory issues.***

The TAG considered many technical issues, as its name implies. But as it developed, it was clear to state officials that the TAG had simply replaced the ISCC. However, where the ISCC was generally acknowledged to be a public policy group, blending resource priorities and public expectations for cleanup, the TAG was billed as a group that took a strictly objective look at what treatment would be best for which shorelines.

This was a noble, if naive, notion. As noted in *b)* above, it was impossible to separate economic, social, and overall environmental policies from discussions about what to do at which sites. These were not merely technical discussions about whether tilling or bioremediation[77] would do a better job of removing oil or minimizing threats to the environment. They were, at root, discussions about how public resources were to be managed and protected.

This presented two very critical problems for the state. First, the TAG was interpreting state regulatory standards and making important management decisions about state resources. Second, the administrative record being developed within the TAG had the potential to delay, thwart, or confuse any supplemental state effort to remove more pollution than the federal government would tolerate.

The TAG was, in a piecemeal fashion, establishing overall State of Alaska policies on subjects wholly within the State of Alaska's authority. The TAG recommendations set state policy about oiling near anadromous streams, acceptable levels of pollution in state parks, and basic levels of residual hydrocarbon pollution allowed by DEC. And in nearly every case, these *de facto* regulatory interpretations were something less than state regulators and resource managers felt were acceptable.

Yet the people with the most direct influence on setting these state policies were not even state resource managers: A private corporation — the company responsible for the pollution — and two federal officials made up an overwhelming majority of the group. State resource managers were daily in a position of negotiating state policy and pollution control standards so that they were acceptable to the spiller and the federal government.

There was plenty of reason to cooperate and communicate, but there was no reason why the State of Alaska had to share its regulatory and management authority with a private company and two federal agencies — which is precisely what was going on in the TAG.

Now, theoretically, the state was not bound by any lower standard for cleanup set by federal managers. If NOAA and the Coast Guard interpreted their regulations such that leaving buried oil was acceptable, or that a 10-year weathering process was better than a one-year removal program, the state was free to step in and set its own standards — as long as its standards were not in direct conflict with federal pollution control requirements. The general rule of thumb is that a state can require more stringent pollution control than the federal government, but it cannot require less.

A second test for stricter state enforcement of pollution cleanup standards would, of course, be whether any removal action was consistent with state regulations — the applicable state regulation being the one that says the state cannot require cleanup past the limit of technology or to a point where the damage caused by cleanup is worse than the damage from the pollution.

So again, theoretically, if the federal on-scene coordinator ordered Exxon to do something less than full removal, according to state requirements, nothing in federal or state law stood in the way of the state issuing its own work order to Exxon. The state might have to wait until the federal government was through with Exxon, but the federal government couldn't prohibit the state from having its own standard (again, assuming no direct conflict with federal law).

However, the structure (and the administrative record) of the TAG put this theory of state autonomy and independent authority in some jeopardy.

In other words, the official government survey records were produced by the spiller, and, in the TAG, subject to the same negotiation process (and in the state's view, the same policy imbalance) as other cleanup issues.

The TAG was understood and explained by both the federal government and Exxon as a group of technical experts reaching consensus on what was the best treatment for a given shoreline. Therefore, one could argue, any solution different than the one recommended by the TAG was technically unsound.

So, if the state argued in the TAG for removal of sediments, and the other three members of the TAG decided removal would cause "more harm than good," than the state would be in a difficult position if it later ordered Exxon to remove the oiled material. If Exxon chose to challenge the state's more stringent requirement, it could simply argue that the TAG had already considered and rejected the state's position as technically unsound. And if the state's recommendations were, indeed, technically unsound, then it was inconsistent with the state's own regulations concerning cleanup.

The TAG was not a purely objective forum for scientists and engineers. It was a group of people discussing public policy questions with technical aspects. The cleanup decisions in the TAG were no different than those at any other stage in the spill response: Nearly all response actions involve some subjective evaluation of whether the benefits of the action outweigh the negative side effects.

It would not be surprising that different agencies might make different subjective evaluations, and it would be reasonable to expect, for the sake of progress, that each would make concessions or compromises from time to time.

But the administrative record of the TAG did not truly reflect this dynamic. Instead, it portrayed the recommendations of the TAG as the best technical consensus of all parties.

The TAG was administered by Exxon, and dominated by a policy interpretation the state did not share. The "consensus" in the TAG was frequently less than what the state wanted — not surprising, since the cleanup resources were controlled by Exxon and the Coast Guard, and Exxon and the Coast Guard shared a similar philosophy about how much cleanup should be done.

"The state has been isolated in the decision-making process by Exxon, the Coast Guard, and NOAA," the state Fish and Game department reported in June 1990. "There are other federal agencies, local governments, and public interest groups . . . that have a legitimate stake in how decisions are formed."[78]

The challenge for the state was to work within the TAG, since it served as a useful vehicle for finding common ground with other parties in the cleanup — as long as that common ground were not portrayed as the only ground. In agreeing to a given course of action in the "joint" response under federal direction, the state had to make sure that it preserved its own options to enact stricter cleanup standards, if necessary, on its own.

From a broader perspective, it was especially important for the state that the *Exxon Valdez* "standards" produced in the TAG be understood for the compromises they were — the best possible compromises, given the existing conditions and availability of resources. The idea that the TAG recommendations represented the best possible technical solution might limit the state's ability to require more complete cleanup not only on the *Exxon Valdez* spill, but in other spills and other cleanups in years to come.

After the 1990 season, the state clarified its role within the TAG and defined the ground rules for its involvement in the TAG. For the state, the TAG was "a forum for our agencies to explain what action the spiller should take based on the state's priorities and requirements."[79] The state produced its own work orders based on its specific regulatory authority and requirements, and submitted them to the TAG. Under this plan, the federal government would have the option of accepting the state's policies and requirements, and including them in the federal work order. If the federal government chose not to, the state reserved its right to re-evaluate the situation and issue a supplemental work order later.

The ISCC and the TAG each had their strengths and weaknesses.

The ISCC better reflected the diversity of interests involved, and more directly dealt with cleanup issues as matters of policy. It also put the governments and the spiller in roles that were more immediately understandable to the public. Under the ISCC, the government — and the public it represents — established the policies and Exxon implemented them. The Coast Guard and DEC monitored the cleanup to make sure Exxon implemented the policies properly.

The TAG was less understandable and less accessible. It considered the same issues as the ISCC, only with fewer participants and in private. It was described as a strictly technical group, but its deliberations frequently spilled over into policy. It tipped the balance of influence, giving Exxon better access and control over government deliberations than the public. Because of fundamental misunderstandings among the parties about what was policy and what was technical, the TAG caused significant misunderstandings. It presented potential problems for the state in setting cleanup requirements and standards that fulfilled the statutory and regulatory responsibilities of state resource managers.

State reviewers did not give the TAG high marks. Although the theory might have been good — technical positions only, a single federal agency coordinating all the recommendations of their respective governments — in practice it was not.

By 1991, state agency managers had made enough adjustments in the administrative record to restore some of the eroded authority of the government to regulate and direct spill activities.

"The Exxon chairman said he expected the [Coast Guard] and ADEC reps to coordinate input from other state and federal agencies. In theory this might be okay. In practice it dilutes other agency and community input," a DEC analysis concluded. "... If TAG was supposed to provide the federal on-scene coordinator with a combined interagency, land manager/owner, public interest input to treatment decisions, it largely failed."[80]

The state Fish and Game department also felt that the TAG hindered the response rather than helped it. "More overall decision-making authority should be restored to an inter-organizational body like the ISCC and no authority to a TAG-like group. The 1990 TAG should have been restricted to what its name implied: technical advice for analyzing oiling conditions and devising cleanup procedures. The TAG of this year was too influenced by Exxon and the [Coast Guard]."[81]

Fish and Game also felt that its influence as the state's primary wildlife resource manager was blunted in the TAG because Fish and Game had to first pass its recommendations through DEC. While Fish and Game could advocate its position within the state policy-making structure, department representatives were uncomfortable at being kept at arm's length from the actual TAG deliberations.[82]

And, like DEC, Fish and Game questioned the wisdom of letting Exxon control the administrative record, and participate as a full partner in decisions regarding the management of state-owned resources and habitat. The department noted that the information gathered on the "joint" field surveys was accurately recorded, but that it was handled and presented by Exxon in the TAG. It was Exxon's role as the responsible party to propose how they intended to treat a particular shoreline, and it was the governments' role to accept, modify or reject the proposal. Then the company would then sit down and help form the official policies about the resources. "The State should not accede to any other organization or agency deciding what 'net environmental benefit' is or is not concerning our resources. Exxon is a commercial oil company having no legal authority to render management decisions about the status of our wildlife and habitats."[83]

DEC shared its sister agency's concerns about the production and presentation of the baseline TAG data by Exxon. The forms and maps developed during the surveys were drafted largely by Exxon and placed before the TAG for editing and approval. In other words, the official government survey records were produced by the spiller, and, in the TAG, subject to the same negotiation process (and in the state's view, the same policy imbalance) as other cleanup issues. Exxon was able to drive the recording of information it felt was important, even if the government did not. It was also able to control the flow of certain information to its advantage.

In 1990, there were two spring surveys. The first, dubbed the SSAT[84] survey, involved state, federal and Exxon personnel who recorded general oiling conditions and individual shoreline profiles. A second, smaller task force involving ADF&G, a federal government rep, and Exxon concentrated on anadromous streams in the ANADSCAT[85] survey. The ANADSCAT information formed the basis of specialized anadromous stream work orders (called AWOs). These were part of the package considered by the TAG for the basic shoreline work orders that went to the field.

During cleanup in 1990, Fish and Game monitors became concerned that cleanup crews were not fulfilling the intent of the AWOs, and when disputes or questions arose they requested that supervisors refer back to the AWOs. In one case, an Exxon supervisor (who, interestingly, had worked on the ANADSCAT) denied the AWOs existed; in another, Fish and Game reported that the AWOs were closely held and not distributed by a Coast Guard supervisor.[86] The AWO experience is an example of how a state agency, with full statutory authority to protect salmon spawning habitat, had to petition the spiller for release of information that could lead to full enforcement of state cleanup requirements.

"Throughout the spill, Exxon -- with extensive manpower, computer and technical resources beyond those of the governments — produced the documents and forms that became part of the official record. Further, as a charter member of the TAG group, the Exxon corporation began to take on a quasi-official, sub-governmental status," state spill managers reported in 1991. "Exxon was making recommendations about the effectiveness and the desirability of treatment techniques; it was offering comment on the health of fisheries, the recovery of the environment, the ability of people to use the areas according to previously established patterns."[87]

These comments and assessments were not included in the official record in the form of an Exxon letter or communication to the government, on Exxon letterhead. They were on the official recording forms, alongside, in equal standing, to those of the government. In fact, in the TAG, the shoreline profile and preliminary recommendation for cleanup came from Exxon. It was then up to the governments (or in many cases, the state government alone), to make a case for cleanup. This seemed to state managers a curious reversal of roles: Instead of the government informing Exxon what it needed to do to meet state and federal pollution standards, Exxon told the governments what was necessary, forcing regulatory agencies to work from Exxon's baseline. While the state was uncomfortable with this arrangement,[88] the federal government was not. In fact, the Coast Guard actively promoted the system and enthusiastically praised its effectiveness.

"The 'cooperative effort' that Exxon and the Coast Guard keep promoting is not in the state's interest since cooperation typically means that the state should go along with any FOSC [federal on-scene coordinator] decision without objecting publicly. Cooperation means that the state legitimizes Exxon's efforts simply through joint participation. Once the state agrees to participate in a project (TAG . . . etc.) Exxon typically assumes control by dedicating inordinate amounts of personnel, equipment, logistics, and administrative services that eventually overwhelm the state.

"Suggest the state modify its cooperation with the Coast Guard and Exxon by promoting performance criteria over process, that is, we state what we want to achieve and then critically review whatever policies or products Exxon develops. If they are unacceptable then the state should be prepared to either implement its own policies, or use public opinion to assist in convincing Exxon to modify its planned program," Fish and Game's chief response manager argued to other state responders in June 1990.[89]

By 1991, state agency managers had made enough adjustments in the administrative record to restore some of the eroded authority of the government to regulate and direct spill activities. The state wrote its own work orders and conducted supplemental treatment on its own, instead of bringing every issue to the TAG for resolution. Yet within the context of the "joint" response, the state could achieve only limited independent action without support from the federal government.

1.5 Summary

Neither the state nor the federal government had in place a management system that could be implemented quickly or run smoothly during a disaster as complex and as lengthy as the *Exxon Valdez* oil spill. The "joint" response cobbled together with the consent of both governments was a well-intentioned, but unrealistic effort to harmonize state and federal authority.

The public, which normally had access to and influence over its government's actions, was pushed aside by the emergency and never fully returned to the process. The spiller assumed an ambiguous role — part government, part polluter, part contractor — answerable only to government "coordinators" and insulated from public accountability.

Little doubt, then, that the spill and the response have led to changes and new suggestions about how the state and federal governments, and the industry, should prepare for and implement oil spill response.

Notes, Chapter 1

[1] *Meidt, Chief Warrant Officer R. M., 1991. "Public Perceptions in Oil Spill Response," (proceedings of the 1991 Oil Spill Conference), pp. 333-336.*

[2] *The "National Oil and Hazardous Substances Pollution Contingency Plan" is articulated in the Environmental Protection Agency's reglations, 40 CFR, Part 300.*

[3] *The spiller is still liable for criminal penalties beyond actual cleanup costs.*

[4] *Vice Admiral Clyde Robbins made this statement on many occasions, such as to a Multi-Agency Committee meeting in Homer and to a reporter for the Anchorage Daily News.*

[5] *"USA Today." July 5, 1989, p. 9A.*

[6] *A more complete discussion of this issue, and how it related to all aspects of the spill's bureaucr.... and decision-making structure, can be found in chapter 3 of this report.*

[7] *The "Alaska Oil and Hazardous Substances Pollution Contingency Plan." Alaska Department of Environmental Conservation, May 26, 1983. The statewide plan has since been revised, although the basic roles of the Coast Guard and DEC remain roughly the same as*

in 1989.

[8] *Captain Dennis Maguire, U.S. Coast Guard, memo to Mr. Craig Tillery, Alaska Department of Law, July 23, 1993.*

[9] *"Oil Spill Contingency Plan, Prince William Sound." Alyeska Pipeline Service Company, January, 1987.*

[10] *National Response Team, "The Exxon Valdez Oil Spill: A Report to the President." May 1989, p. 8.*

[11] *The following statements from Exxon chief executive officer Frank Iarossi all come from his deposition as part of state and private litigation taken August 5, 1992, in Houston, Texas.*

[12] *Ibid., p. 387.*

[13] *See, especially, Davidson, In the Wake of the Exxon Valdez. (San Francisco: Sierra Club Books, 1989), pp. 29-54.*

[14] *This is noted first in the National Response Team's report of May 1989. Iarossi elaborates on the company's general plan in his deposition.*

[15] *Notification came as a single comment in what was otherwise a routine filing of contingency plans for tank vessels owned and operated by Exxon on March 5, 1982.*

[16] *"Oil Spill Contingency Plan, Prince William Sound," Ibid.*

[17] *Kelso, D., Testimony before the House Subcommittee on the Coast Guard and Navigation, July 1989.*

[18] *See Chapter 4. While the state has clarified Alyeska's responsibility to implement the contingency plan, federal regulations remain murky on the question.*

[19] *Although the Coast Guard is, practically speaking, a military organization, its role is primarily civil and its command is in the U.S. Department of Transportation, not at the Pentagon.*

[20] *National Response Team report, p. 21.*

[21] *Author's note: Governor Cowper was interviewed in his office in November 1989, by Larry Persily, a member of the Alaska Oil Spill Commission staff. Persily summarized Cowper's comments in a memorandum to commission director John Havelock dated Nov. 28, 1989. Persily used a newspaper style, reporting on his interview and using quotation marks when using Cowper's remarks verbatim. In the interest of clarity, where Cowper's quote is used along with a citation from Persily's summary, I have used interior quotation marks to mark Cowper's statement; where using one of Cowper's quotes directly, without additional comment from Persily, I have simply used exterior quotation marks.*

[22] *Persily, ibid.*

[23] *Author's note: I have tried to not to rely solely on personal recollections in writing this report, attempting instead to always cite documents or audio-visual sources. However, I had several conversations at the time with Cowper, his chief of staff, his press secretary, and DEC commissioner Dennis Kelso. All of them said that in their meetings with federal officials, including the U.S. Secretary of Transportation, federal policy was to continue a team management approach.*

[24] *D. Kelso, personal communications, 1989, 1990, and 1993. The former DEC commissioner's recollection of this statement is vivid; according to Kelso's account, Yost told him this in a conversation (later reiterating it before a news reporter) during an April meeting with the commandant in Anchorage. In July, Yost told a Congressional subcommittee (July 20, 1989, U.S. Senate Committee on Commerce, Science, and Transportation, Subcommittee on Merchant Marine, Washington, D.C.) that the Coast Guard was making cleanup determinations "in consonance with the Regional Response Team, including the State of Alaska." This was consistent with Kelso's understanding of the Coast Guard's policy.*

In 1990, during a meeting with the new commandant, Admiral William Kime, and the federal on-scene coordinator, Rear Admiral Ciancaglini, state officials who mentioned their recollection of the "concert and consonance" statement were told by both Coast Guard *officers that no such statement had ever been made. In commenting on this report, Commander Dennis Maguire, who coordinated the preparation of the Coast Guard's history of this response, wrote in July 1993: "In conversations with Rear Admiral Ciancaglini, he states Admiral Yost denied making the statement, furthermore our own extensive research has failed to turn up any such quote. More important, however, is the fact that the commandant cannot extend more authority to the State than federal law allows. The NCP [National Contingency Plan] speaks in terms of consultation with the State. This theme was often repeated by Vice Admiral Robbins and Rear Admiral Ciancaglini and was the position taken by the federal government."*

The author has no reason to disbelieve either account; it may be that the parties involved misunderstood or misheard each other. However, regardless, the state's understanding of Coast Guard policy in 1989 and 1990 was based on a theme of "concert and consonance." In addition, Kelso' recollection is exceptionally vivid, and the author had a number of conversations with Kelso about it. Indeed , the letter that sparked Kime and Ciancaglini's 1990 statements about the "in consonance" theme was written by the author of this report, working with Kelso and DEC staff, who expressed a similar understanding of Coast Guard policy.

[25] *Vice Admiral Robbins, memorandum to state and federal agencies, April 20, 1989.*

[26] *Hull, R., Northwest EnviroService Inc., "Final Report on Exxon Valdez Oil Spill," December, 1990, pp. 30, 33.*

[27] *Alaska Oil Spill Commission, "Spill: The Wreck of the Exxon Valdez," January, 1990, p 40. One of the primary recommendations of the Commission was that, unlike the* Exxon Valdez *cleanup, the spiller should not be in charge of a large spill. A form of this recommendation was included in the Oil Pollution Act of 1990.*

[28] *The state ran into similar problems, and did not necessarily do a substantially better job of solving them. The state's approach is discussed in more detail later.*

[29] *Alaska Oil Spill Commission, op. cit., p 40.*

[30] *See Chapter 3.*

[31] *Although this section makes mention of specific actions or duties taken by various state agencies, it is not intended as a complete recitation of who did what at a given time. rather, it attempts to examine how the government responded to special organizational and management demands caused by the spill response in general.*

[32] *Personal communication, Bill Lamoreux, Sept. 3, 1992.*

[33] *Provant remains with DEC as chief of the team that oversees Alyeska Pipeline Service Company operations and facilities in Valdez.*

[34] *The most frequently quoted number for the 1989 response season was 11,000 workers, however, only about a quarter of that number were in Prince William Sound or the Gulf of Alaska at a time. Crew rotation, shoreside support contractors (caterers, etc.) and shoreside Exxon employees accounted for the rest.*

[35] *To put that number in perspective, the usual year-round population of Valdez itself is about 3,000 people.*

[36] *Not all fisheries were closed because of the spill in 1989. Terminal fisheries for pink salmon regular halibut openings, and new fisheries (such as Prince William Sound bottomfish) all went on during the spill. The most lucrative, highest visibility, and most important fisheries — mostly red and pink salmon — were frequently closed because they normally take place in nearshore areas, coves, bays, etc. These areas suffered season-long impacts due to "leaking" beaches, floating oiled debris or seaweed, or oil released from shoreline cleaning operations.*

[37] *Exxon reimbursed DEC for $8.2 in oil spill wages before the governments settled their claims with the company.*

[38] *In some cases, they weren't. Errors somewhere in the chain from employee to supervisor to central computer were frequent, especially in 1989. DEC auditors reported that the state*

underpaid workers a total of $145,000, and overpaid others a total of $40,000. The department made back payments to some workers and collected overpayments from the others.

[39] State agencies lend each other money through an internal system of Reimbursable Services Agreements when one department is carrying out an approved function for another.

[40] Also in 1989, the Legislature made an additional special emergency appropriation of $35 million to the Office of the Governor. The Governor was authorized to spend this money at his discretion, as long as the Attorney General reviewed the proposed expense and determined that it met reasonable criteria for reimbursement by Exxon. Most of this money was used for state legal costs and scientific damage assessment, not day-to-day operations. The state expected to recover its legal costs at trial, or in an out-of-court settlement; therefore, the attorney general concluded these costs were technically "reimburseable."

[41] At last accounting in late 1991, the billings of this nature came to roughly $300,000.

[42] This does not include the University of Alaska system, which, like most universities, has programs and faculty that conduct basic and applied research in a variety of areas.

[43] Perhaps the best, and most critical example of this was the "net environmental benefit" debate, detailed in Chapter 3, section 4.

[44] This came out of the $35 million special appropriation to the Governor's office.

[45] Results of damage assessment studies and their implications for restoration are discussed in Chapter 5, Restoration.

[46] In 1991, DEC and Fish and Game were requesting that the federal government pursue more complete cleanup of anadromous stream sites, even though oil was by that time heavily weathered. The National Oceanic and Atmospheric Administration and the Coast Guard maintained that the weathered oil posed a limited threat, if any, to salmon spawning, reproduction, and survival. Fish and Game provided general interpretations of damage assessment data from pink salmon studies that helped buttress state requirements for more complete cleanup. However, this type of interaction between response and damage assessment was the exception rather than the rule.

[47] See Chapter 3, section 4 for a more complete discussion of Fish and Game's role in the various committees formed with Exxon and the Coast Guard during the "joint" response period.

[48] DEC's field monitors began to assume greater responsibility and authority in 1990 and 1991, as experience on this specific spill response became more important than general technical knowledge.

[49] Kuwada, M., unpublished ADF&G summary of department oil spill activities, 1991.

[50] This requirement was not always met. DEC's personnel officer said later that the emergency hire provision was frequently ignored, and "emergency" hires were kept in the field and on the payroll.

[51] These lists for all state job classes are known as the "registers." They rank applicants according to objective analysis of experience, education, etc. Supervisors must hire from the top several names on the applicable register.

[52] Labor's involvement was required by both federal and state occupational safety laws (Alaska administers the federal program here); Community and Regional Affairs administered some small state grants and coordinated community meetings; Administration's telecommunications division set up and maintained the state's remote radio communications system.

[53] Personal communication, July 1992. In fact, Kelso and the DEC project staff often complained that the state's legal department was not working closely enough with DEC in its usual way, namely, providing legal support and advice on enforcing cleanup regulations.

[54] The problem was not endemic, but it cropped up on major issues from time to time: funding and procurement of equipment to protect hatcheries over the winter of 1989-90, comments on the federal government's proposed cleanup stragey for 1990, DEC's approval of Corexit testing in 1990, development of written standards for cleanup that integrated all agency

positions, and a few others.

[55] There were some occasional departures from this flow pattern. In the early stages, it was partly due to confusion; later, it would happen with tacit acceptance by the state and federal coordinators because a certain agency had an overwhelming interest in an issue or the primary presence in a region.

[56] This is the Incident Command System approach that is in use in Alaska today.

[57] The most controversial example of state permitting of cleanup activity occurred in 1989, when Exxon proposed to burn tens of thousands of tons of oily solid waste in large incinerators. The controversy is discussed in more detail in section 3.0, Cleanup Activities.

[58] Terminology differs among agencies. These teams were also called Shoreline Cleanup Assessment Teams, or SCATs, and tasks and focus sometimes varied from place to place. From here on out they are called simply "assessment teams," a term intended to include the various and changing groups that conducted assessments during the entire response.

[59] Knorr, J., Lethcoe, N., Teal, A., Christopherson, S., and Whitney, J., "The Interagency Shoreline Cleanup Committee: A Cooperative Approach to Shoreline Cleanup — The Exxon Valdez *Spill," (Proceedings of the International Oil Spill Conference, San Diego, 1991), pp 191-192.*

[60] David Kennedy, quoted in the October 31, 1991 issue of Pacific magazine, a Sunday supplement to the Seattle Times.

[61] Hull, op. cit., p. 44.

[62] Kuwada, M., Alaska Department of Fish and Game, unpublished summary of agency activities, 1991 (updated somewhat in 1992). Payroll records from DEC also show staff, almost uniformly, working extended st[r]etches of 10-18 hour days with irregular time off.

[63] Morrison, J., memorandum to Kuwada, M., ADF&G, Sept. 11, 1990. This is a common theme through state summaries, memoranda, field reports, etc. State monitors and contractors frequently expressed frustration about what they perceived to be a coalition made up of Exxon-Coast Guard-NOAA, whose policies and recommendations were often in opposition to the state's.

[64] Morris, R., unpublished DEC summary of ISCC and Technical Advisory Group activities, October 1991. The author was a member of the state teams that generated state recommendations for cleanup at specific sites from 1989-92.

[65] The MACs were not exactly the same as the ISCC, but they served a similar function. The MAC meetings in Homer and Kodiak and Seward were the principal forums for regional agency staff and the public to address spill issues and communicate with the federal on-scene coordinator. In addition to the MAC in the Kenai Peninsula area, there was a smaller agency group called the RMAC (Resource Multi-Agency Group) that dealt exclusively with resource concerns, as opposed to broader public policy concerns. Kodiak's local spill management was centered in an emergency response committee, which paralleled the Kodiak borough's normal emergency services management plan, and a Kodiak Interagency Shoreline Cleanup Committee.

[66] Personal communication, Steve Provant, DEC, September 1992.

[67] Morrison memorandum, op. cit.

[68] Randy Bayliss served as state on-scene coordinator (SOSC) from April 4 to September 25, 1990, when DEC Commissioner Dennis Kelso appointed Ernie Piper to the post. Piper stepped down March 16, 1992. Commissioner John Sandor then appointed Simon Mawson as SOSC.

[69] ADF&G staff notes from the Newport Beach meeting quote NOAA's Dave Kennedy, ADF&G files, February 1990.

[70] The primary exception cited by NOAA was the presence of oil in shellfish beds, such as clams.

[71] Stegeman, John J. and Bruce R. Woodin. "Cytochrome P450E (P450I) induction in fish from Prince William Sound." Unpublished preliminary report, August 1990. Woods Hole,

Massachusetts. The Stegeman study and associated ADF&G work used a marker enzyme — cytochrome P450 — to determine if the fish were absorbing hydrocarbons. When this enzyme showed up at a certain level in the livers of the fish, the researchers concluded that the fish were metabolizing hydrocarbons; there was a significant difference in the enzyme level between fish in the oiled zone and those taken from an unoiled area used as a control.

[72] *See generally* Exxon Valdez Oil Spill Symposium Abstract Book, *February 1993, Anchorage, sponsored by the* Exxon Valdez *Oil Spill Trustee Council, University of Alaska Sea Grant Program, and the American Fisheries Society, Alaska Chapter. A Symposium Proceedings is slated to be published in 1994.*

[73] *Throughout the response there were ongoing research projects into the effect of storm berm relocation conducted by Exxon contractor Woodward Clyde, the State of Alaska and also by a NOAA contractor. All of them showed the shorelines were fairly resilient, and they returned readily to the original profile or to a stable profile.*

[74] *The citation is 18 AAC 75.*

[75] *Despite a number of government tests showing that subsistence foods were safe to eat unless they looked, smelled, or tasted oily, many people (especially older Alaska Natives) simply stopped eating certain foods because of the perception of risk. State subsistence official documented this effect in a paper: Fall, James A. "Subsistence After the Spill: Uses of fish and wildlife in Alaska Native villages and the* Exxon Valdez *oil spill." November, 1990, presented at the American Anthropological Association annual meeting, New Orleans, LA.*

[76] *Piper, E., Winter, G., Gibeaut, J., Bauer, J., Kuwada, M., Copland, B., and Frechione, J., "*Exxon Valdez *Oil spill Response — Year Three,"* Exxon Valdez *Oil Spill Response Center, March 1991, p. 8.*

[77] *Bioremediation, in very simple terms, is the process of applying fertilizer to speed up the natural rate of degradation of oil by microbes that break down hydrocarbons.*

[78] *Kuwada, M., notes from presentation to state management meeting, June 19, 1990.*

[79] *Piper, et al., Year Three report, p. 12.*

[80] *Morris, DEC, op. cit.*

[81] *Morrison, ADF&G, op. cit. Other department managers, including Kuwada, the habitat division's chief spill representative, echoed this criticism in similar ways in a variety of other documents and forums.*

[82] *DEC sometimes came to the TAG with Fish and Game concerns, especially when the issue at hand was directly related to fisheries or spawning habitat. In 1991 Fish and Game (and Natural Resources) started attending the TAG meetings regularly, as the state took more of a team concept into the proceedings.*

[83] *Morrison, ADF&G, op. cit.*

[84] *Spring Shoreline Assessment Team.*

[85] *Anadromous Stream Cleanup Assessment Team.*

[86] *Morrison, ADF&G, op. cit.*

[87] *Piper, et al., op. cit.*

[88] *Kelso, D., Commissioner, DEC, letter to Rear Admiral D.E. Ciancaglini, July 18, 1990. This letter was the final piece of a long paper trail within the state agencies about how Alaska's interests were either ignored or diminished by the federal government.*

[89] *Kuwada, notes, op. cit.*

Chapter 2: Technology

Oil spill response is most effective when oil is on the water, rather than stranded on shorelines. The faster responders act, the better chance they have. The effectiveness of most on-the-water techniques drops substantially as the oil weathers, emulsifies, and large slicks break up.

Oil spill response has more in common with fighting fires than with cleaning up a mess. It is possible to control or extinguish a house fire, but in the end you're still left with a burnt house, and areas that were not damaged by the fire were damaged by water used to put out the fire. In the same way, oil spill response is damage control, not damage elimination. All techniques, to some degree, have adverse side effects. Nearly all response and cleanup decisions are a matter of weighing the negative effects of response and treatment against the negative effects of letting oil go free.

Oil spill response has more in common with fighting fires than with cleaning up a mess. It is possible to control or extinguish a house fire, but in the end you're still left with a burnt house, and areas that were not damaged by the fire were damaged by water used to put out the fire. Photo by Vanessa Vick

Every oil spill is different, and so is every response. The amount of oil spilled is often less important than where it is spilled, whether people or wildlife habitat might be affected, and how weather, wind and water affect the response strategy. However, in nearly all cases, the suite of spill response technologies and techniques is roughly the same. And, as noted above, each technique or technology has limitations; none, by itself, is a solution to spilled oil on the water.

However, almost as soon as the oil from the *Exxon Valdez* was on the water, the new ideas were on the way. The entrepreneurs were calling, faxing and flying to Valdez to try to sell their products. Everyone involved in the response was inundated with requests, offers, and demands from vendors selling everything from reasonably well-known solvents and products to off-beat and untried techniques. One vendor had diatomaceous earth, another had crushed cork, and yet another proposed spreading lemon juice on the oil. Backyard inventors sent hastily drawn schematics of new and as-yet unbuilt skimmers and other machines. People sent home videos and studio-produced efforts. In one of the most memorable homemade video promotions, a vendor stumbled over the slick cobbles of a Prince William Sound shoreline, hawking his product as he spread it on the rocks — all the while cradling a stuffed baby seal.

Surfing on that tidal wave of commercial communications were some outright hucksters, but there were also well-intentioned and thoughtful citizens, some creative-but-unrealistic inventors, and many reputable vendors. If one sorted out the greedy, the dreamers, and the opportunists, most of the suggested products fell into two general classes: absorbents and solvents. One group of products would, in theory, soak up or congeal floating oil; the second would loosen it from rocks or break slicks up on the water. Nearly all suffered from basic technical, chemical, or operational flaws.

First, many of the products were obviously limited in the same ways that burning or chemical dispersants are limited. Fresh oil is the best oil to work with. On weathering oil in cold, subarctic waters, or on oil that was quickly turning tarry and thick, or on emulsion that was primarily water, many of the suggested techniques just wouldn't work, based on the information provided to Exxon, the Alaska Department of Environmental Conservation (DEC), or the Coast Guard,

Next, the use of any solvent or absorbent usually means there is a by-product. During one test conducted in April on Naked Island, crews spread peat moss on oily rocks. Indeed, the peat moss soaked up free oil and emulsion. But like other absorbents, responders were still left with the problem of collecting the moss-oil mixture and disposing of it properly. Collection, storage, and disposal of oily waste would loom as one of the biggest problems in this massive spill response, and any significant addition to the volume of waste was judged impractical. An addition problem with loose absorbents is that when used on the water, they would likely create a thicker substance that could not be skimmed using existing equipment.

Many innovations for oil cleanup were tested: During this test conducted in April of '89 on Applegate Rocks, crews spread peat moss on oily rocks. The peat moss soaked up free oil and emulsion but left the problem of collecting the moss-oil mixture and disposing of it properly.

Photo by the U. S. Coast Guard

The most common technical problem with hundreds of products, however, was a lack of verified field testing or demonstrated use on other spills. This was not merely a problem with the new products that came across the fax machines and desk of DEC, the Coast Guard and Exxon; it is a basic problem with oil response equipment and products in the United States. Even the dispersants approved for use by the U.S. Environmental Protection Agency (EPA) have had limited actual testing, simply because it is difficult to conduct a properly controlled and monitored test of an oil spill product without spilling some oil. Only a few governments (Norway among them) authorize controlled spills for testing or for response drills, so vendors are dependent on "spills of opportunity" to try their luck — which probably explains, in part, why some vendors offered to do test applications largely at their own expense. Also, the level and scope of testing that a chemical product might require is a time-consuming and expensive proposition. In the United States, this task rests primarily with the private sector, and most, if not all of the small companies or vendors hawking their wares to the *Exxon Valdez* responders did not have the financial or technical capability to have conducted the right kinds of tests.

In addition, what were the "right" tests? At the time of the spill, there were no standard suite of tests and methodologies adopted by the federal or state governments for use in screening the wide variety of products people were selling.[1]

Since the *Exxon Valdez* spill, the state has begun to develop a product screening procedure, however, no large-scale or systematic screening program was in place at either the state or federal level in March of 1989.

In testimony before a Congressional committee on April 19, 1989, Governor Steve Cowper called for a nationwide program of intensive research into oil spill response. "We should not have to use a spill like that in Prince William Sound to find out the best way to contain and clean up oil. We should know in advance."[2]

The Alaska Oil Spill Commission, formed by Governor Steve Cowper to review the incident and make recommendations, found that government and industry had done little to prod development and testing of creative approaches in spill response.

"Despite two decades of rising public concern for the environmental consequences of oil spills, research on the subject is still in its infancy," the commission reported in 1990. ". . . Spill response technology is untested and underdeveloped. Research investment is low, and institutional commitment to the field is scarce . . . .

"Much of the available cleanup equipment had not been tested in the various circumstances facing cleanup crews. Due to caution or uncertainty, untested techniques were not quickly implemented."[3]

"Despite two decades of rising public concern for the environmental consequences of oil spills, research on the subject is still in its infancy," the Alaska Oil Spill Commission reported in 1990.

Vice Admiral Clyde E. Robbins, who served as federal on-scene coordinator for the U.S. Coast Guard in 1989, often said that he was shocked to find upon his arrival in Valdez that oil spill response technology was no further advanced than what he had seen 15 years before.

The most fundamental problem with essentially all the thousands of offers from vendors was that no one had the time, the people, and the equipment to devote to testing all these products right in the middle of the largest oil tanker spill in North American history. As a practical matter, most agencies were already devoting all available resources to immediate emergency response tasks. Also, state agencies, such as DEC, were not designed to function as research and development centers.[4]

As the response evolved, the DEC set up a Treatment Technology section within the *Exxon Valdez* Oil Spill Response Center. The section evaluated as many as 1,500 offers, requests and ideas over time, but the small section concentrated primarily on evaluating a solvent that Exxon and the Coast Guard wanted to use, and working with the EPA and Exxon on evaluation of fertilizers for bioremediation.

With the exception of the bioremediation project, spill response techniques and technology used in the *Exxon Valdez* response were confined to those in general use at the time of the spill. Most reviewers have pointed out that research and development of alternative response and cleanup techniques has been lacking in the United States.

In addition, most official reviews of the incident point out that planners had not designed the Prince William Sound response system to handle a spill of 240,000 barrels. The Alaska Oil Spill Commission found that the federal government had never properly determined if the industry had the resources to deal with a catastrophic spill.[5] A federal review prepared shortly after the grounding concluded that the regional and State of Alaska-approved contingency plans were similarly flawed.[6]

There was simply not enough of anything in the area to deal with a spill of 240,000 barrels — not enough mechanical equipment, not enough trained manpower, not enough boom, not enough dispersant, not enough gear required for burning. While it is well understood that there was not nearly enough of any of these, it is somewhat less well understood how the equipment and people actually performed, once deployed. A closer look at what worked and what didn't gives us a good idea of both the ingenuity of responders and the limitations of spill response.

2.1 On the water

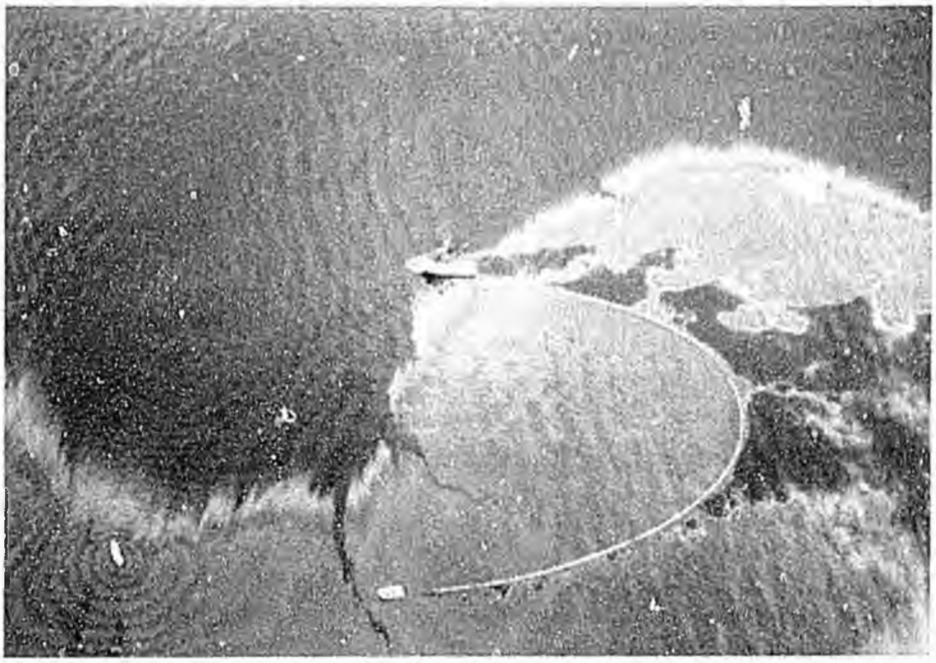
Efforts to contain and recover spilled oil and mousse[7] on the water continued, at varying levels, throughout the four seasons of the response. However, the principal on-the-water recovery phase began on March 24 and extended through roughly the middle of May, when shoreline cleanup began in earnest.

Boom

A boom works at the water's surface, and just below the surface, and can be used as a barrier, a deflection device, a corral for contained oil, an absorbent, and as a component in some other technique, such as burning. Boom of varying types is the mainstay of most response efforts.

Most containment, or "hard" boom, has a profile above and below the surface of the water. It is stored in containers in large rolls, or something like an accordion, and is played out over the side or stern of a vessel much like fishermen deploy nets. The size and durability of the boom varies depending on the conditions responders expect in a given area. An area with strong currents and tides, or large seas, needs a larger and more durable boom than one to be deployed in a quiet estuary.

The effectiveness of the boom depends on conditions and on the skill and training of the people deploying it. If boom is being used to corral an oil slick, much like a purse seine net, it must be towed smoothly and steadily at very low speeds — not a simple boat-handling skill, by any means. At a towing speed (or in a current) or anything more than two or three knots, the effectiveness of the boom drops considerably, as oil begins to slosh over the top, or slip underneath the bottom of the moving boom. Tides, wind, waves and current all raise similar problems, and boom anchored to fixed points needs nearly constant attention and maintenance.

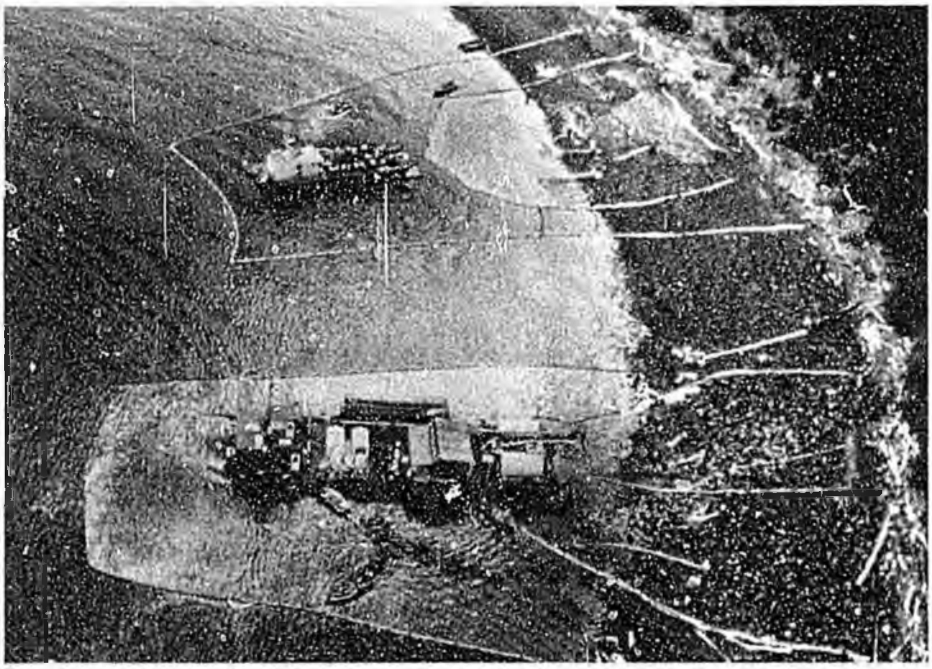


Boom deployed between two boats in an attempt to corral oil from the *Exxon Valdez*. Much like a purse seine net, the boom must be towed smoothly and steadily at very low speeds – not a simple boat handling skill, by any means.
Photo by Michael Lewis

Responders also may deploy smaller floating booms (many look like long sausages) made of absorbent material.

The effectiveness of booming and skimming operations varied widely from site to site. All operations that combined these basic technologies were affected by the skill of the people assembling and tending the boom, the condition of the oil, the amount of vegetation in the mousse, the tides and currents, the opportunities for cleaning, fixing or resupplying a site with gear, and the quality or ingeniousness of the design.

DEC field reports from the first six weeks of the spill are full of observations, complaints, and frustrations about boom deployment, tending, and maintenance. This was a product of both limited training and difficult conditions. However, local fishing vessel skippers were a tremendous source of skilled labor, since most quickly discovered that towing a boom was very similar to handling a purse seine.



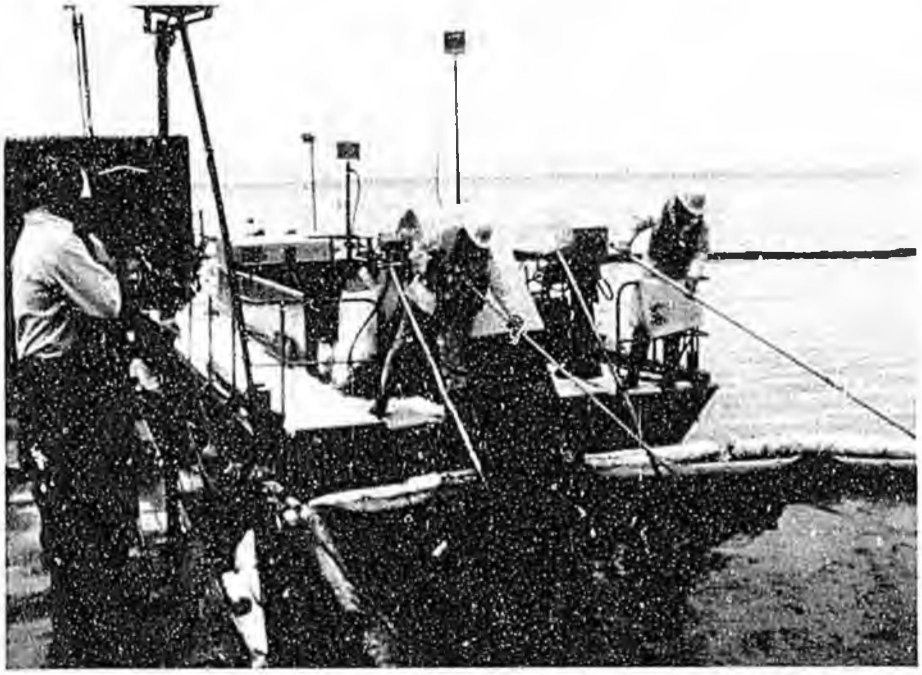
Several layers of boom contain oil washed from the beach until it is picked up by a skimmer.
Photo by Rob Schaeffer

Local residents and state workers also figured out, by trial and error, site-specific methods for maintaining boom "fences." Frequently, this entailed arranging different kinds of boom (absorbent and containment boom of varying sizes) in tiers, so that oil lost by one would be caught by the next one. This was, however, extremely labor intensive, requiring night patrols and other round-the-clock efforts at both tending and maintenance. Boom repair was a constant problem, since anchored boom was roughed up by waves, tide changes, and rocks. It also needed to be cleaned frequently, since once enough oil soaked into or coated a boom, it started to leak into areas of clean water. A crew of a dozen or so could clean about 1,000 feet of boom per day; however, at the height of the hatchery protection effort at Sawmill Bay, Evans Island, more than 28,000 feet of containment boom was in use.

The bottom line on defensive booming was that it required substantial resources and manpower to maintain even the most basic barriers, such as at the hatchery sites in Prince William Sound. And over time, even with the impressive amount of material coming into the Sound from around the world, defensive booming simply gobbled resources too quickly to be effective on a large or continuing scale. Although during the height of the April response, DEC reported that its local crew at Sawmill Bay (Evans Island) could repair 300 to 400 feet of boom per day, returning the gear to at least serviceable effectiveness, even the most rugged boom had a short life. Exxon estimated that nearly 30 percent of the boom deployed during the course of the 1989 response was damaged beyond repair or proper use.[8]

Also, while "boom" is an interchangeable term, boom types and brand names are not always easily interchangeable. In 1989, as many as 30 brands of containment boom, of various kinds (self-inflatable, foam flotation, etc.) and sizes (18 inches to more than four feet in depth) were in use, and it was generally mixed from site to site. Fittings, connectors, valves, and other hardware were not necessarily compatible and frequently had to be modified so they would work together. And there was no guarantee that the boom delivered on a given day to a given site was compatible with the actual conditions. DEC and Cordova District Fishermen United teams working in Sawmill Bay in early April noted with frustration that the first boom they received was in poor repair and too light to deal with currents that ran as swiftly as seven knots.

As the cleanup moved from on-the-water to shoreline cleanup, various boom combinations and configurations were used in tiers in the nearshore area to close off the cleanup zone from open water. Hard boom and absorbent boom were both used, and improvised boom made from absorbent "pom-poms" were strung throughout the cleanup area.



Conveyor belt style skimmer in use at Point Helen, Knight Island, August of 1989, on oil contained within boom. Photo by Patrick Endres

Skimmers

Most skimmers in use in the United States are shallow draft, small vessels designed to work in protected areas such as inshore or nearshore waters. There are a number of skimming systems, but all operate on a basic principal: Oil is lighter than water, and can therefore be skimmed off the surface, or separated from water in some kind of controlled tank or area.

Most skimmers are not designed to handle much of a sea. Their effectiveness also depends directly on the storage capacity available at a given site or in the area. Other factors affecting the effectiveness include the consistency of the oil, the sea state, the amount of debris in the emulsion, the thickness of the slick, etc.

The effectiveness of skimmers cannot be judged solely by the ability of the machines to pick up oil from the water. Skimming is a system, not just a vessel; an effective operation needs good containment, good maintenance and repair capabilities, and a good transfer and storage capability once the oil is recovered. And most important, skimmers in Prince William Sound needed instructions from the air.

"It's very hard to see the oil from the deck of a boat," DEC's chief contractor reported on April 20, 1989. "Some boats pass within 200-300 feet of a slick and can't see it."[9]

In the early days of the spill, DEC's overflight and mapping information was the principal source of direction for skimming operations. Observations from low-flying, fixed wing aircraft and helicopters were used to track the spill. DEC landed float planes in oil slicks to sample and measure the depth of the oil. DEC's computer services chief, working with a consultant from Arthur D. Little Co., devised a system in which overflight information could be digitized and transferred to computer-generated maps. The first accurate maps of spill size and movement were issued by DEC on March 27.[10]

However, federal, state, and Exxon reports all note that there was a shortage of aircraft, initially, to provide direction for skimmers. Further, weather was often a problem. Even when weather in the Sound was decent for flying, frequently the airport at Valdez — at the base of the mountains, at the back of a bay nearly surrounded by mountains — was fogged in for long periods. Cold morning air and ample humidity caught within the mountain barrier combined to make flight operations an iffy proposition on many days. Ironically, the problem was most pronounced when the weather was best, with windless mornings after cool and clear nights.

Two different kinds of skimmers at work: a disc skimmer in the foreground, attached by hose to a vessel, and a stationary rope mop skimmer in the center, which pulls the rope through the oil and around a pulley.

Photo courtesy of the Exxon Valdez Restoration Office

Despite the problems with targeting slicks and directing skimmers, more than 260 skimmers of varying kinds were acquired by various parties, primarily Exxon, in 1989; a limited number worked in 1990.[11] Exxon reports in April frequently mentioned as many as 50 skimmers deployed at a time in the Sound and in the Gulf of Alaska. However, DEC monitors noted that these numbers were misleading.

While a given number of skimmers might be deployed in the spill zone at a given time, it was unlikely that all were actually working at once. Maintenance and repair were one problem; field repairs were not always possible, and some skimmers had to be towed long distances to get shop work in port.[12]

Furthermore, a full skimmer was a useless skimmer.

"There was one major problem that plagued all the skimming efforts and repeatedly brought skimming operations to a halt," wrote one of DEC's chief monitors. "Both the skimmers and the super suckers [a vacuum machine used to transfer oil from skimmers to barges] often sat idle with full tanks of recovered oil due to an insufficient number of support vessels and barges for off-loading the oil. Fishing boats would spend one or two hours gathering oil within booms and then, after waiting for 10 to 12 hours for a super sucker or a skimmer to arrive, the boats would sometimes abandon the boom, allowing the oil to float free."[13] The skimmers themselves had limited practical working time when transfer and storage was a problem. The majority of skimmers in use filled up with water and oil in less than an hour.

An additional, completely non-mechanical problem was that the response team could not immediately put to use skimmers that were flown into Alaska from abroad. U.S. shipping laws make it difficult for foreign-flag vessels to conduct business in U.S. waters, and skimmers built in France, Norway, and other countries had to receive special clearance from U.S. Customs authorities in order to work. This was especially ironic because the most effective skimmer turned out to be a French-designed and built paddle-belt skimmer called an Egmopol.[14] And the largest skimmer available to work on the spill was in the Soviet Union. With help from the State of Alaska and the federal government, Exxon was able to put the 425-foot Vaydaghupski on contract on April 21. Unfortunately, by the time the vessel arrived, oiling conditions and the state of the oil were rapidly deteriorating for optimal recovery.

Skimmers working on free-floating oil worked fairly well at the start of operations in March and early April, but as oil weathered and emulsified it clogged gear and suction hoses with annoying frequency. Like defensive booming, recovery of free-floating oil with skimmers had a limited window of efficiency, given oil conditions and gear limitations.

Two innovative developments in skimming operations emerged. The U.S. Army Corps of Engineers sent a pair of dredges whose suction gear was designed for use in pulling sand and mud from ship navigation areas. The suction heads normally pointed downwards and pulled material up; response crews figured out that by turning the heads upside down, the suction head pulled viscous oil off the surface. It was a small innovation, but it worked well on weathered oil. Furthermore, the dredges had larger storage holds than the average skimmer, which made them a bit more independent.

The business end of a "supersucker," a hose attached to a vacuum truck on a barge, an innovation from the North Slope oil fields. The operator picks up oil contained by boom.

Photo courtesy of the Exxon Valdez Restoration Office

A second innovation came from the North Slope oil fields. At Prudhoe Bay, DEC contractors located two large vacuum trucks that were normally used to transfer spent drilling muds to disposal sites. The machines, mounted on trucks, had powerful vacuum heads that worked well on the weathered oil and emulsion. The two machines were trucked 800 miles down the Dalton and Richardson Highways in a high-speed trip under Alaska State Trooper escort from the Arctic to southern tidewater — quite an achievement under late winter driving conditions.

The supersuckers were mounted on barges and first used to pump some speed and volume into the tedious and halting job of off-loading full skimmers at Sawmill Bay. After seeing how effective the vacuums worked on weathered oil, DEC moved the barges to Herring and Northwest bays on Knight Island, where oil and mousse were thick enough to vacuum. The DEC recovery operation with supersuckers pulled about 450,000 gallons of mousse and oil from the water between April 3 and the first week of May.

Skimmers were used extensively in shoreline cleanup operations throughout 1989. As oil was washed off shorelines or freed by tilling, the oil floating in the nearshore zone was pushed by fire-hose spray towards a skimmer, which would pick up the mousse and oil. Exxon and the Coast Guard phased out skimmers during 1990 operations over the objections of state monitors and cleanup directors. State monitors frequently recorded that sheens released from cleanup operations were skimmable, while Exxon or Coast Guard monitors disagreed and skimmers were not deployed.

Instead, crews depended on various absorbents, such as boom, pom-poms, and pads. While this may have been an effective alternative to skimmers,[15] it also generated large amounts of solid oily waste. State monitors speculate that Exxon made the choice of sorbents over skimmers, in part, because the solid waste problem was easier to deal with than deployment, maintenance, off-loading and storage problems associated with skimmers. However, the reason given for denial of DEC's suggestion to use skimmers was usually simply that the sheens observed were too light to skim.

Burning

Burning is highly dependent on the freshness of the oil. The gases that ignite and burn most easily evaporate quickly; 12-72 hours immediately following the discharge is the optimal window for attempted burning of North Slope crude oil effectively on the water.

Also, while oil is, indeed, lighter than water, most oil in an oil spill does not settle into a homogenous, unbroken pancake. The thickness of the slick can vary from point to point, areas of water may alternate with patches of oil, wave and wind action may break up the slick, and oil and water emulsions may contain too much water to ignite. It is no easy trick to ignite oil and keep it burning on the water. In addition, burning oil produces a large volume of thick, noxious smoke. Any burn must take into account negative effects downwind for human settlements or possibly wildlife.

On the morning of the second day, Saturday, March 25, equipment needed to conduct a burn (special igniters and fire-resistant boom) was arriving in Valdez. Shortly before noon, the Alaska Regional Response Team (RRT)[16] agreed generally to attempt burning. Although Exxon had not formally applied to conduct the burn, DEC's on-scene coordinator gave a verbal go-ahead, on the general condition that the smoke from a burn did not threaten residents of any area. Exxon got its gear to the burn site late Saturday evening.

The burn reduced to tarry residue about 12,000 to 15,000 gallons of oil.[17]

Yet, as with other conventional response methods, the size of the spill and the variability of conditions showed the limits of even this relatively successful technique. The state, which actively encouraged the burn, gave the go-ahead the next day for Exxon to try burning in other areas. Unfortunately, the wind was rising, breaking up compact slicks and whipping water into the oil. On Sunday, sampling showed that the oil was becoming mousse, with a water content as high as 80 percent of total volume. Attempts to ignite the watery mousse failed. Shortly thereafter, the wind storm of March 26-27 made further burning impractical or impossible.

One of the principal factors in a decision to use dispersants is whether the immediate harm in the immediate vicinity of the slick is better than having the oil go elsewhere to cause more widespread damage.

Dispersants

"Dispersant" is a very general heading for a group of chemicals or formulations designed to break up large concentrations of oil on the surface into smaller and smaller concentrations.

Dispersing an oil spill doesn't make the oil disappear, and dispersants do not necessarily change the oil into something less harmful to the environment. Generally speaking, this class of chemicals disperses the oil into larger volumes of water. In a sense, dispersants dilute an oil slick by taking part of the oil off the surface and distributing it in the upper layers of the water column. Experts generally agree that putting oil into the water column, even in larger dilutions, can have negative effects on fish, plants and smaller animals that live or feed near the surface. One of the principal factors in a decision to use dispersants is whether the immediate harm in the immediate vicinity of the slick is better than having the oil go elsewhere to cause more widespread damage. Dispersants are intended less as a solution and more as a defensive technique.

"[T]he principal biological benefit of dispersant use is prevention of oil stranding

The charges and counter-charges [concerning disperants] received so much publicity that it is impossible to separate the technical information and field reports from the high-level, highly public arguments.

on sensitive shorelines," states a National Academy of Sciences report on the technique.[18] Decision-makers balance the potential harm of using dispersants against the harm of allowing oil to wash up on beaches, in marshes and in estuaries.

The effectiveness of dispersants, like other methods and technologies, depends on how well the chemicals are mixed and applied, what the conditions are at the site, and what the composition of the oil is at the time. Generally speaking, oil is more difficult to disperse as it weathers.

The dispute over the approval and testing of dispersants on the *Exxon Valdez* spill quickly left the realm of technology and science and leaped into the world of politics, popular media, and legal maneuvering.

The charges and counter-charges received so much publicity that it is impossible to separate the technical information and field reports from the high-level, highly public arguments that included the Governor of Alaska, the U.S. Secretary of the Interior, and the chief executive officer of the Exxon Corp.

On April 18, in a speech to the Anchorage Chamber of Commerce, the president of ARCO Alaska, Bill Wade, wondered aloud "Why did it take from 8:30 a.m. Friday to 7 p.m. Sunday evening to get permission to use [dispersants] on a full-scale basis?" Wade's comments pointedly implied that the response "could have been better" had Exxon received permission to spray dispersants earlier.[19] Then, in a national magazine interview appearing less than a week later, Exxon chief executive officer Lawrence Rawl was more direct in his accusations. The federal and state governments — mostly the Alaska DEC — did not let Exxon use dispersants that would have kept 50 percent of the oil from reaching the shorelines, Rawl charged.

"The basic problem we ran into is that we had environmentalists advising the Alaska Department of Environmental Conservation that the dispersant could be toxic," Rawl said.

Dispersant application equipment is tested in a spill drill conducted in March, 1992, in Prince William Sound. Photo by L. J. Evans

And in answer to another question, in which the reporter asked Rawl to state specifically who stopped Exxon from applying dispersants immediately, Rawl added, "It was the state and the Coast Guard that really wouldn't give us the go-ahead to load those planes, fly those sorties, and get on with it. When you get 240,000 barrels of oil on the water, you cannot get it all up. But we could have kept up to 50 percent of the oil from ending up on the beach somewhere."[20]

Just two days later, in an April 26 interview in the newspaper USA Today, U.S. Secretary of the Interior Manuel Lujan echoed and expanded upon Rawl's assertions — taking care to extract the U.S. Coast Guard from Rawl's assignment of blame. The newspaper's interviewer asked Lujan why the Coast Guard wasn't in charge, and why the response seemed so slow. Lujan replied, "The Coast Guard was in charge, very clearly. But when they started doing the things that they were supposed to do, the state of Alaska objected to it."

In answering another question, Lujan added, "The Coast Guard tried burning; Alaska objected. They tried chemical dispersants; Alaska objected. The Coast Guard, which is the federal cleanup agent, just didn't know what to do."

Lujan did lay some blame at the feet of the Coast Guard, but only "for letting Alaska intimidate them," presumably on burning and dispersant use.[21]

The story that was developing implied that the spill had been controllable — primarily through the use of dispersants — but that the government had blocked use of the chemicals because of pressure from environmentalists, ignorance of spill response, or plain indecision. Exxon and Alyeska would repeatedly claim that the state, in particular, had insisted too hard and too long on mechanical cleanup — booms, skimmers, etc. — a technique that was clearly inadequate for the size of the spill.

There are serious strategic and factual problems with such a claim.

Exxon and Alyeska had neither enough dispersant nor the equipment to deploy it. There was never a case in which loaded dispersant planes were held on the ground because the government couldn't or wouldn't make a decision. Whatever delays occurred came because the right equipment wasn't in Valdez, the equipment failed to work properly, or because the weather prevented the airplanes from getting in the air.

Exxon and Alyeska had neither enough dispersant nor the equipment to deploy it. There was never a case in which loaded dispersant planes were held on the ground because the government couldn't or wouldn't make a decision.

The problem with dispersant applications was essentially the same as the problems that plagued other early efforts to contain and control the oil: The spill was enormous, and the resources to deal with it were not available.

Exxon's upper management ignored these facts and chose, instead, to weave a tale of bungling bureaucrats and scheming environmentalists. It was an easier, perhaps less painful way to explain away a problem that was bigger than any control and containment technique on hand.

This dispersant story, as it unfolded, prompted Governor Steve Cowper to demand some kind of substantiation for these claims from Lawrence Rawl. The Governor called Rawl's statements "demonstrably false."

"I urge you to repudiate the inaccurate statements you and other Exxon officials have made regarding the State's actions on dispersant use," Cowper wrote in a letter to Rawl. "If your company decides instead to cling to its story, I think the public is entitled to see some proof."[22]

In a reply sent by facsimile the same day, Rawl wrote that all he had said was that "officials of the State of Alaska and the Coast Guard were in discussions during the first three days on whether dispersants should be used." He also stated flatly that the dispersants worked "extremely well" in the early tests. He did not repeat the implication from his Fortune comments that "environmentalists" were advising against dispersants because they were toxic. Rawl said proof of all his statements would follow during Congressional hearings the next week.[23]

The exchanges died down after that, and Exxon's position reverted largely to the contention that the dispersants worked and therefore should have received earlier approval. The "proof" became little more than a battle of conflicting opinions, rather than a battle of conflicting facts.

The whole incident generated more heat than light. Putting aside the anger, the rhetoric, the blame-avoidance and the potential legal posturing, the record from the field and from the Regional Response Team (RRT) gives a better picture of the technical problems associated with dispersant use during the first three days.

The story of dispersant use on the *Exxon Valdez* spill begins, actually, before the tanker ever hit the rocks.

Dispersants began to be considered as an first-line defense against spill damage in the 1970s, although the first formulations and applications proved to be extremely harsh, environmentally. By the mid-1980s, dispersants had been somewhat refined, although potential problems with wildlife and plant damage still exist. However, by the late 1980s the state and Alyeska Pipeline Service Company began discussions about how to improve Alyeska's initial response capabilities by adding equipment and stockpiles of dispersant. Alyeska was interested, but insisted that the Alaska RRT adopt guidelines for dispersant use before Alyeska went ahead with the investment in additional resources.

On March 8-9, 1989 — just more than two weeks before the *Exxon Valdez* spill —

the RRT adopted initial guidelines for dispersant use, making Alaska one of the few states in the nation to have a mechanism for pre-approval of dispersant use. The RRT divided a hypothetical response zone — Prince William Sound and the northern Gulf of Alaska — into three zones, adopting guidelines for each.

Initial Guidelines for Dispersant Use

Adopted March 8-9, 1989, by the Alaska Regional Response Team

for Prince William Sound and the northern Gulf of Alaska:

Zone 1: the approved traffic lanes for tankers entering and leaving the Sound, and large areas of deep, open water to the east and west of the lanes.

- Dispersants use acceptable with caution
- Federal or state on-scene coordinators had authority to use chemicals at their discretion

Zone 2: the Gulf of Alaska.

- Dispersants use acceptable in this area, but
- Actual approval would be on a case-by-case basis because of the zone's size

Zone 3 all of Prince William Sound outside the traffic lanes:

- Chemicals not considered an acceptable option because of critical nesting, rearing, and feeding areas for birds, marine mammals, fish and other wildlife

Zone 1 included the approved traffic lanes for tankers entering and leaving the Sound, along with large areas of deep, open water to the east and west of the lanes. In this area, dispersants were considered acceptable, and the federal or state on-scene coordinators had authority to use chemicals at their discretion.

Zone 2 included the Gulf of Alaska. The RRT considered dispersants acceptable for use in this area, but because of the size of Zone 2 the RRT decided that actual approval would be on a case-by-case basis.

Zone 3 included all of the Sound outside of the traffic lanes. In this area, chemicals were not considered an acceptable option because of the many islands and bays that were critical nesting, rearing, and feeding areas for birds, marine mammals, fish and other wildlife. This designation was consistent with both the prevailing knowledge about the harshness of dispersants and general strategy for using them. Chemicals were pre-approved for use in Zone 1 because it was important to do everything possible to keep oil out of the sensitive Zone 3.

Yet pre-approval did not imply that dispersants presented no potential dangers, even in Zone 1. The RRT, which includes EPA and DEC, knew very well that the scientific literature on oil spill dispersants warned of some potential harm to wildlife from dispersed oil.

According to a committee looking at the general aspects of dispersant use for the National Academy of Sciences, "In open waters, organisms on the surface will be less affected by dispersed oil than by an oil slick, but organisms in the water column, particularly in the upper layers, will experience greater exposure to oil components if the oil is dispersed."[24]

More specifically, on the particular dispersant Exxon planned to use in 1989, a Canadian federal government report found that in laboratory tests, certain marine animals that live in the water column suffered greater mortality when exposed to dispersant-oil-water concentrations as opposed to the oil-water concentration alone.[25]

On the day of the spill, winds were light and seas were less than two feet; the dispersant was not mixing with the oil well enough to break up the slick.

The RRT action of March 8-9, 1989, also included some extra conditions for Zone 1 use based on whether birds, fish and other animals were present because of seasonal migrations, when they were giving birth or raising their young.

In other words, the RRT recognized the role of dispersants as a potential defensive measure against spill damage, but the state and federal agencies encouraged caution because dispersants were potentially harmful. This action reflected the realities of spill response: Every decision involves balancing the potential harm of the ailment against the side effects caused by the treatment.

A second reality — one that would present itself during the *Exxon Valdez* spill — is that dispersants are neither 100 percent effective nor 100 percent guaranteed. Field tests most dispersants are not common, and various monitoring methods to assess effectiveness do not often produce scientific or technical consensus. Therefore, before approving widespread dumping of potentially damaging chemicals on the water, a responder will want to be reasonably certain that the dispersants are going to do some good. Even in the case of Zone 1, where dispersants were pre-authorized for use by the RRT, an on-scene coordinator would be expected to use prudence, discretion, and experience to guide his or her actions before pouring tens of thousands of gallons of chemical into the ocean.

A third point to consider is that no single method of response was likely to solve the problem of 200,000 barrels of oil on the water. The volume of oil was so great, and so concentrated, that dispersing the oil with chemicals was hardly a sure thing.

Despite Exxon's claims of government interference and indecision, dispersant use was shut off by the limitations of the product and the unpredictability and force of Alaska's late winter weather.

"At this early stage of the spill, the oil slick was extremely thick," wrote DEC's technical expert on dispersants in a later analysis of Exxon's claims that dispersants would have effectively eliminated 50 percent of the oil. "Using tables from Exxon's Oil Spill Chemicals Training Seminar Handbook, I calculated that a slick of 240,000 bbls. [barrels] volume over 2,500 acres would have had an average thickness of 3.8 mm. This is simply too thick to disperse."[26]

Nonetheless, the first conversation between DEC and Coast Guard officials in the early hours after the grounding was about dispersants. At about 1:15 a.m. on March 24, Dan Lawn of the Valdez DEC office spoke with Commander Steve McCall of the Coast Guard, the captain of the port and the pre-designated federal on-scene coordinator.

"Within 10 minutes of the department being notified we had the discussion about dispersants, and we recognized that if conditions were right we'd use them," Lawn recalled.[27]

At 8:30 a.m. on Friday, March 24, Alyeska Pipeline Service Company made formal request to the federal on-scene coordinator to drop 50,000 gallons of dispersant, beginning that day. At the time of the request, Alyeska had less than 4,000 gallons in Valdez, although an estimated 8,000 gallons were stored in Kenai and another 8,800 gallons in Anchorage. However, Alyeska did not have the equipment or the aircraft to make any drop at all.[28]

The oil slick was in Zone 1, the area of pre-authorization, so Cmdr. McCall at 3 p.m. approved a test application. At 6 p.m., a special arm and bucket that could be hung from a helicopter arrived in Valdez from Kenai. After loading, the helicopter flew to the site of grounding and dropped its load on the thick, compact slick near the tanker.

The Coast Guard and DEC agreed that the dispersant did little good, if any. Dispersants are, in large part, designed to weaken the surface tension of the oil, thereby "breaking" the slick up. However, simply laying the chemical on top of a slick isn't the best way to get results; agitation, whether from wind or seas, is needed for optimal efficiency. Other factors, such as the size of the droplets of chemical, could not be properly controlled using the helicopter and bucket.

In fact, Exxon's consultant, Gordon Lindblom, was dead against the helicopter drop. According to Iarossi's deposition taken in August 1992, he and Lindblom heard about it while the two were in an Exxon jet bound for Valdez from Texas. Iarossi told the attorneys that Lindblom was visibly angered by the prospect of the helicopter drop, saying that it was likely to fail, and make it more difficult to get subsequent agreement to use more dispersant.

Especially when seas are calm and there is little wind. On the day of the spill, winds were light and seas were less than two feet; the dispersant was not mixing with the oil well enough to break up the slick. The Coast Guard and DEC concluded conditions were simply not right for depending on the dispersant because there was insufficient mixing.

The Coast Guard approved another test the following morning, in hopes conditions had changed or that better application might yield better results. It didn't. Once again, the light winds and calm seas did not mix the dispersant properly.

A third test, on Sunday morning, was hampered because the aircraft's deployment system did not work properly. The fourth, and last test in Zone 1 came on the afternoon of Sunday, March 26, as seas were building and a gale was brewing to the north. Commander McCall of the Coast Guard was satisfied the dispersants had a reasonable chance of working now that the weather had changed, and he approved full use of dispersants in Zone 1 on Sunday evening.

The weather was getting better, relatively speaking, for using dispersants to battle the oil slick. Winds had increased to 15-20 knots, and seas were kicking up. But the building winds and seas also began to break the large pancake of oil into smaller slicks and streamers; the main body of the slick was also moving out of the middle of the Sound and closer to the shore of the islands to the west.

On Monday, as a full-scale storm started to swirl in the Sound, Exxon applied about 5,500 gallons of dispersants in Zone 1, but the weather was driving the slick west-southwest, towards Disk, Eleanor, and Knight Islands — and into Zone 3. More than two weeks earlier, the Alaska RRT had considered the use of dispersants in that sensitive zone and rejected the idea. However, Exxon requested special permission to spray in that zone late Sunday afternoon. To spray there, Exxon would need special clearance from DEC; within an hour of the request, at 5:20 p.m., DEC determined that the water was deep enough and the drop zone was far enough from shore to allow a Zone 3 drop.

It never happened. Monday's gale turned into a 70-mph maelstrom by Tuesday. All aircraft were grounded. And more important, the window for effective use of dispersants had closed.

Despite Exxon's claims of government interference and indecision, dispersant use was shut off by the limitations of the product and the unpredictability and force of Alaska's late winter weather. Equipment problems, uneven application, and a shortage of the chemicals the responders needed exacerbated the problem.

2.2 Shoreline cleanup

Shoreline contamination was a major issue for state authorities and local communities. The rapidly fragmenting "fronts" and the limited recovery and storage capabilities were quickly overwhelming the response effort.

The oil started to wash ashore in large amounts, and over wide areas, beginning in early April. Throughout that month, resources and techniques were targeted mainly on the massive and expanding problem of on-the-water recovery, and on defensive booming. Although oil was weathering, breaking up, and was frequently concentrated at nearshore sites, there was no single or main "oil slick." The battle against the oil was more like a guerrilla war, fought in skirmishes on multiple fronts, rather than a concentrated attack against a massed enemy.

Yet even as on-the-water efforts expanded and Exxon mobilized more and more vessels and equipment, it was becoming clear that shoreline cleanup was about to become perhaps an even bigger priority. Oil was washing ashore at one site, only to be lifted off by the next tide cycle.

"It is discouraging for the crews to see oil come off a beach during a tide change and impact another (sometimes clean) beach," reported DEC's main contractor on April 19. The contractor added, the following day, "All attention is still directed to offshore recovery. Nothing being done to shoreline contamination."[29]

This was a major issue for state authorities and local communities. The rapidly fragmenting "fronts" and the limited recovery and storage capabilities were quickly overwhelming the response effort. Oil was not only heading out of the Sound for the outer Kenai Peninsula and Kodiak archipelago, but it was swirling throughout the Sound and hitting more and more shorelines.

"There is some kind of correlation between the tides and the movement or relocation of free-floating oil," the DEC contractor explained in that April 19 report. "The oil appears to be moving through Northwest Bay in a counter-clockwise direction, up and around Pt. Eleanor in a clockwise direction, down the east side of Knight Island and back to the west through Upper and Lower passages. Then (depending on the tide stage), when it reaches the west side, it either travels north to Northwest Bay or south to herring Bay."

A week later, on April 26, the report noted, "Lots of oil is being washed from Smith, Little Smith and Seal islands as well as the north east corner of Point Eleanor. These areas were heavily impacted during the major release of oil."[30]

The only way to truly stop the recurring cycle of oiling was to break it onshore, by recovering stranded oil and preventing it from getting loose every six hours when the tide changed.

This scenario, occurring around northern Knight Island and the smaller islands to the east that April, suggested that much of the on-the-water recovery was really becoming an endless — and losing — game of chase with familiar oil concentrations. The only way to truly stop the recurring cycle was to break it onshore, by recovering stranded oil and preventing it from getting loose every six hours when the tide changed. And there was plenty of oil to be washed off: A number of DEC field reports noted pooled oil and stretches of greasy, brown emulsion up to and exceeding two feet deep stranded on shorelines of the area.

The re-oiling pr[illegible]blem was starting to move south, as well, as prevailing currents and changes in wind carried oil off the beaches of the Smith Islands, Seal Island, and Green Island. Two of the most heavily oiled areas of 1989 — Point Helen at the southern tip of Knight Island, and at Sleepy Bay at the northern head of Latouche Island — were affected largely by secondary oiling from their northern cousins. These two southern Prince William Sound sites would be the focus of some of the most intense cleanup activity well into 1991, and even 1992.

While there was little activity on the shorelines during the first weeks after the spill, by the second week in April (around the 19th-20th day of the response), the Coast Guard and DEC were putting increasing pressure on Exxon to plan for and execute a full-fledged shoreline cleanup program.

Working off the relative success of vacuum equipment to pick up weathered oil from the water, there was one attempt at Smith Island to use vacuum equipment on the shoreline. The trick was to vacuum oil without pulling up cobbles and fine sediments. Where the oil was deep and the rocks were large, vacuuming actually worked. However, recovery was slow and the areas where it might work were limited.

Exxon made one highly publicized, almost desperate effort to do shoreline cleanup with workers literally wiping rocks by hand with absorbent material. This looked ludicrous on television, and supervisors from all parties thought it useless and impractical almost as soon as they saw it. State monitors reported during 1989 that contractor crews occasionally resorted to hand-wiping when waiting to be re-deployed or when equipment was down, but rock-by-rock cleanup was essentially eliminated as a realistic option after a single attempt.

Washing the beaches was generally regarded as the most practical method, but there were various theories about how to do it. Exxon tried several combinations of manpower and equipment. Under one arrangement, at the "top" of the beach (roughly the high-tide line) workers strung a perforated hose that could carry a high volume of cold sea water, which flooded the sediments at low pressure. Workers "down-beach" agitated the sediments with rakes and other hand tools to release the oil, which was lifted off by the flood and collected in front of booms strung just offshore. This worked fairly well, and DEC monitors reported that the tilling released more oil than flooding alone. However, while hand-tilling passed in and out of fashion throughout the response, it was rarely used with the flooding system after those [illegible] tests. Not all shorelines lend themselves to hand-tilling, and the amount of labor necessary for full-scale application was, at the time, a daunting proposition. At that point, there was still no firm plan to house workers, feed them, clean them, and dispose of all the waste they would produce.

A second variation of the header flooding system added workers using moderate-to high-pressure hoses to wash rocks. This released more oil than the flood alone, and it covered more ground at a faster rate than the hand-tilling method. It could also be used on many types of shoreline. This variation was not without some obvious problems. Biologists were concerned about blasting animals and plants off the shorelines. Coastal geologists were concerned that high-pressure blasts would wash away the fine sediments underneath big rocks and cobbles; that, in turn, might de-stabilize the beach and trigger serious erosion.

The temperature of the water was a problem, too: The nearshore waters in the Sound, even in the summer, rarely rise much above 45-50 degrees Fahrenheit. Lots of cold water tended to make the oil thick and tarry, making it harder to move and harder to recover. This also tended to encourage workers to use higher pressure to blast the tarry oil, which made biologists and geologists more nervous than before. Cold water would not cut the oil.

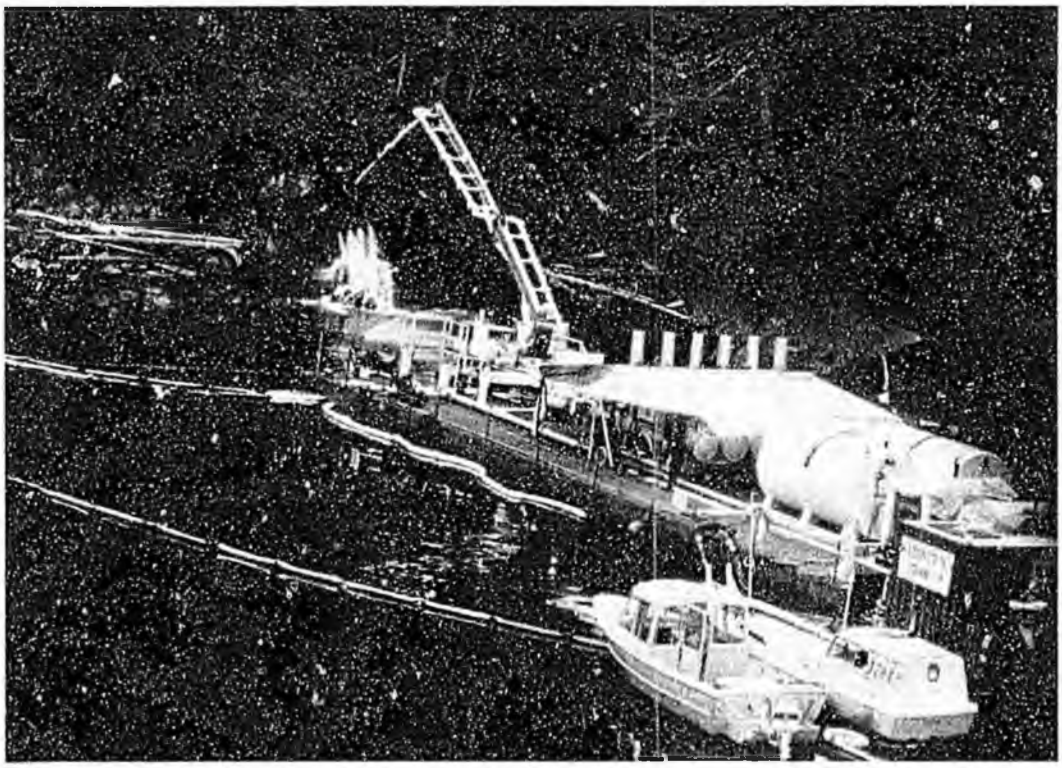
Little more than six weeks after full-scale hot-water washing became standard shoreline treatment, both the Coast Guard's scientific advisor and independent biologists expressed concern that the hot water was "cooking" the beach life and perhaps doing more harm than good.

Hot water and high pressure

One of the enduring images of the *Exxon Valdez* cleanup is of workers in hard-hats and yellow rain gear blasting at rocks with high-pressure hoses that fired hot water. Virtually every beach that had significant oiling (moderate to heavy, by DEC definitions) was washed with either hot-water hoses or hot-water mechanical washing devices called "omnisweeps" or "omnibooms." In all, as much as 150 miles of shoreline were probably washed with hot (140-160 degrees Fahrenheit) water in 1989.[31]

In terms of shoreline ecology, hot water hurts. As early in the cleanup as July, 1991, little more than six weeks after full-scale hot-water washing became standard shoreline treatment, both the Coast Guard's scientific advisor and independent biologists expressed concern that the hot water was "cooking" the beach life and perhaps doing more harm than good.[32] This group was not solely concerned with the immediate, acute impacts of the hot water and high pressure. These scientists were also concerned that the plants and animals on the shorelines washed with hot water would actually return to normal *more slowly* than those left alone, or those treated less harshly.

In an article published in 1990, two independent Alaska biologists questioned the wisdom of the hot water wash based on information gathered from a study site they established on Green Island.[33] A second paper expanded on this hypothesis, offering data that, the authors suggested, showed that hot water and high pressure had killed more animals and plants than the oil might have. They took their analysis a step further and suggested that recovery might therefore be slower.



An omnisweep, or omniboom in operation, washing oiled shoreline. Photo by Rob Schaeffer

"Complete loss of mussels and rockweed [due to treatment] at these sites has changed or eliminated several ecological niches," the study concluded.[34] Without the cover of the mussels and seaweed, the biologists said, it was hard for the usual array of small intertidal plants and animals to establish themselves and survive; the exposed rock surfaces were too dry, too exposed to predators, and too heavily pounded by wave action. Moreover, the normal progression of plant life was likely to be delayed because the exposed surfaces allowed so-called "opportunistic" species, such as various algae, to establish themselves in formidable and overwhelming numbers.

This paper was actually part of a larger study commissioned by the National Oceanic and Atmospheric Administration (NOAA), and financed by the EPA, the Coast Guard, the American Petroleum Institute and Exxon, among others. The NOAA study was much more forceful, and its conclusions more pointed, than the previously published work. NOAA released the paper[35] in April 1991 at a Washington, D.C. press conference. NOAA's top officials not only said hot water washing did more harm than good and set back recovery, but closed by suggesting that "sometimes the best thing to do in an oil spill is nothing."[36]

Having "survivors" of shoreline organisms, in other words, is an important step on the way to full recovery. But in hot-water, high-pressure treatment, there are few survivors, if any; therefore, recovery is likely to take longer.

"It is clear," the study reads, "that the data . . . strongly support the conclusion that hydrocarbon contamination and high-pressure, hot-water treatment each caused major adverse impacts to the intertidal biota of western Prince William Sound, but that the effects of the treatment predominated. Moreover, it appears likely that the treatment, while removing oil from the upper and mid-intertidal zone, where its effects were somewhat restricted to relatively tolerant organisms such as barnacles, rockweed, and mussels, transported the remobilized oil into the lower intertidal and shallow subtidal zones, where the oil was placed into contact with relatively more sensitive and productive organisms such as hard shelled clams and crustaceans."[37]

The authors of the study argue, in short, that a lot of the tougher shoreline organisms might have been killed by the oil, but that a fair number would survive. Therefore, while the overall health of the shoreline might suffer, populations would limp along and gradually re-establish themselves fully. Having "survivors," in other words, is an important step on the way to full recovery. But in hot-water, high-pressure treatment, there are few survivors, if any; therefore, recovery is likely to take longer.

The study also suggests that the high-pressure wash drove oil out of the upper beach, but the hoses also drove oily fine sediments into places below the tide line, thereby oiling places that would have escaped oiling otherwise.

Workers washed oil with hot-water hoses toward the water where skimmers picked up the oil. Photo by Patrick Endres

Before addressing the specific technical and scientific points raised by the NOAA study, it is helpful to look at the study first within the context of the larger technical debate about shoreline cleanup in general, and second, within the context of *Exxon Valdez* spill politics.

There has long been a debate among responders, biologists and policy-makers from industry and government about whether oil spill cleanup should proceed beyond anything more than simple pickup. Indeed, NOAA's introduction to the 1991 report cites several of the best-known references on the subject from the past decade or so. The NOAA report is not necessarily an isolated analysis; rather, the conclusions (and some of the principal authors and directors) of the study are a product of a certain school of thought about oil spill cleanup.

The NOAA Hazardous Materials section, which is the designated scientific support coordinator for the federal on-scene coordinator, leans towards the approach taken by the school of limited cleanup. John Robinson, who led much of NOAA's work on the *Exxon Valdez* spill, was not generally in favor of aggressive cleanup. He took direct control of the controversial Net Environmental Benefit Analysis study of 1990, which concluded that rock-washing or sediment excavation was ill-advised. It became the federal government's official policy.

Robinson's position was largely based on concern for intertidal communities, and the technical literature has a number of references to support his position. In addition to those cited in the NOAA report, other studies — including one conducted in part by DEC's chief technical consultant (Erich Gundlach, now of the Arthur D. Little Co.) — suggest that most oiled shorelines exposed to wind and weather have a good chance of recovering their biological health within periods often measured in years, not decades.[38] So, given the facts that Prince William Sound's ecosystems were largely not exposed to other external environmental stresses, that the weather is harsh, that ocean conditions are generally high energy, and that there are a lot of nutrients flushing into the marine ecosystems to aid recovery, it would not necessarily be unreasonable to suggest that minimal shoreline cleanup might be better than aggressive cleanup in such a situation.

This raises serious questions about the cleanup: Is the NOAA study accurate in its picture of hot-water, high-pressure washing during the *Exxon Valdez* cleanup? Are the results strong enough to prompt a conclusion that the technique should not have been used in Alaska, and should not be used in the future? These questions address both scientific and strategic issues.

The data collected by the NOAA researchers is thought-provoking, but it suffers from a certain imprecision — no fault of the researchers, really — because of the working conditions on the shorelines in 1989. It is impossible to generalize too broadly about hot-water, high-pressure washing, since that meant different things at different sites, with different heaters, different crew chiefs, different external pressures (meeting goals in scheduling, for example), and differing levels of fidelity to proper procedures. While this might have affected some of the data, this also might affect the general conclusions about washing mentioned by NOAA officials when the report was released.

Some washing crews were careful and some were not. Some basic problems in variability of performance included:

❒ **Uncoordinated spraying**

State monitors often observed Exxon crews spraying hoses randomly on the shorelines, rather than working systematically down a beach. This often meant that some people put more hot water and more pressure on a given area than others. Some workers were allowed to point hoses directly into fine sediments, which mobilized oil and sand and allowed it to be transported into the lower intertidal. In short, treatment was uneven, not just from site to site, but within sites themselves.

❒ **Ignorance or carelessness in application of treatment**

Everyone agreed that it was important for crews to avoid spraying the so-called "green zone," the rich, lower intertidal area characterized frequently by the presence of filamentous green algae.

"Generally, a cleanup squad was to wash a beach by following the tidal waters down the beach on the ebb tide and moving back up the shore with the flood tide, stopping intrusive treatment if the green zone were exposed. However, many crews ignored these restrictions, insisting on working the area rather than shutting down or moving to a less sensitive location," the DEC's cleanup monitoring section reported in its 1992 summary.[39]

Also, once oil was released from the beach into the containment zone for a skimmer to retrieve, workers were supposed to turn down the pressure on their hoses and gently push the floating oil towards the skimmer.

"Unfortunately, despite repeated explanations of this method, crews were often allowed to turn most if not all of their hoses on the oil without reducing the intensity of their spray," DEC's monitors reported.[40] This not only caused a lot of mixing and turbulence, but dumped a good deal of warm water into the nearshore area, which could affect the survival and recovery of the extreme lower intertidal areas.

❒ **Scheduling and reporting of results**

Throughout 1989, DEC pointed out to both federal and Exxon authorities that too much time and effort was being spent on shorelines that were not as heavily oiled as others. Crews were often deployed on moderately oiled shorelines that could be completed quickly, rather than on more heavily oiled shorelines that might take more time, and therefore throw off the crews' scheduled goals, and reports of progress, for shoreline miles treated.

From the standpoint of the NOAA study, this issue raises questions about whether the damage from hot water washing could have been minimized throughout the region by concentrating the harsh technique only on the most heavily oiled sites, using milder techniques on others.

❒ **Poor choices or combinations of equipment**

Shore washing was more effective at releasing oil when hoses and the omnibooms were used in conjunction with a low-pressure beach deluge system (such as the perforated hoses). However, some places used it and some did not, which meant that more work was done with the most powerful equipment. In addition, the omnibooms were originally intended to work primarily on steep, rocky faces and some large boulder beaches. However, Exxon gradually began using them on almost all kinds of beaches, with the exception of low-energy, fine-sediment shorelines.

Hot water and high pressure are harsh treatments, and the data gathered by NOAA give us a better idea of how harsh they might be.

NOAA's data did not, and probably could not, correct for these important variables. The study's model for hot-water washing was based on one actual observed test of the technique; the rest relied on imprecise or incomplete documentation. Records may show that a beach was washed with hot water, but the records used by NOAA did not show where on the beach the hot water and high pressure were applied.[41] There are some ways to reconstruct this,[42] but to DEC's knowledge NOAA did not know about them or chose not to use them. From the standpoint of science, this is a real problem: Data based on imprecise sources weakens the data and the conclusions based on them.

Biologists from the Alaska Department of Fish and Game (ADF&G) remarked, "The NOAA report attempts to circumvent this problem by relying on general segment reports and from observations by 'individuals working in the field (e.g. field bosses for specific locations).' While this may provide additional detail on beach cleanup efforts, one must question the ability of such individuals to recall the exact treatment that occurred (temperature, duration, number of passes, etc.) on a specific location where the NOAA transects were conducted. Where multiple treatments occurred, different individuals were involved."[43]

Hot water and high pressure are harsh treatments, and the data gathered by NOAA give us a better idea of how harsh they might be. However, because of the variability of the treatment from site to site, coupled with the scientific unreliability of some of the sources used, the conclusions NOAA reaches about setbacks to recovery caused by treatment are closer to hypothesis than proof. One year's data based on observations immediately after the spill makes for an incomplete data set, state reviewers suggested; several years of recruitment and recolonization data are needed to reach the kind of conclusions the report's authors suggested.[44]

NOAA was working under difficult circumstances, and it is not surprising that its data would suffer from the weaknesses described above. The state, in reviewing the report and in responding to questions from the press, tried to make clear that it did not dismiss NOAA's findings out-of-hand.

The state's reviewers agreed generally that the NOAA report's conclusions, especially estimates of rates of recovery, are not fully supported by the study's data. However, it would be imprudent to ignore the general picture the report draws about the harshness of hot water and high pressure on intertidal life. Applying this piece of science to oil spill shoreline cleanup strategy, one might conclude that:

a) Hot water and high pressure can be extremely harsh on intertidal communities.

b) Such treatment probably has implications for recovery as well as initial acute effects.

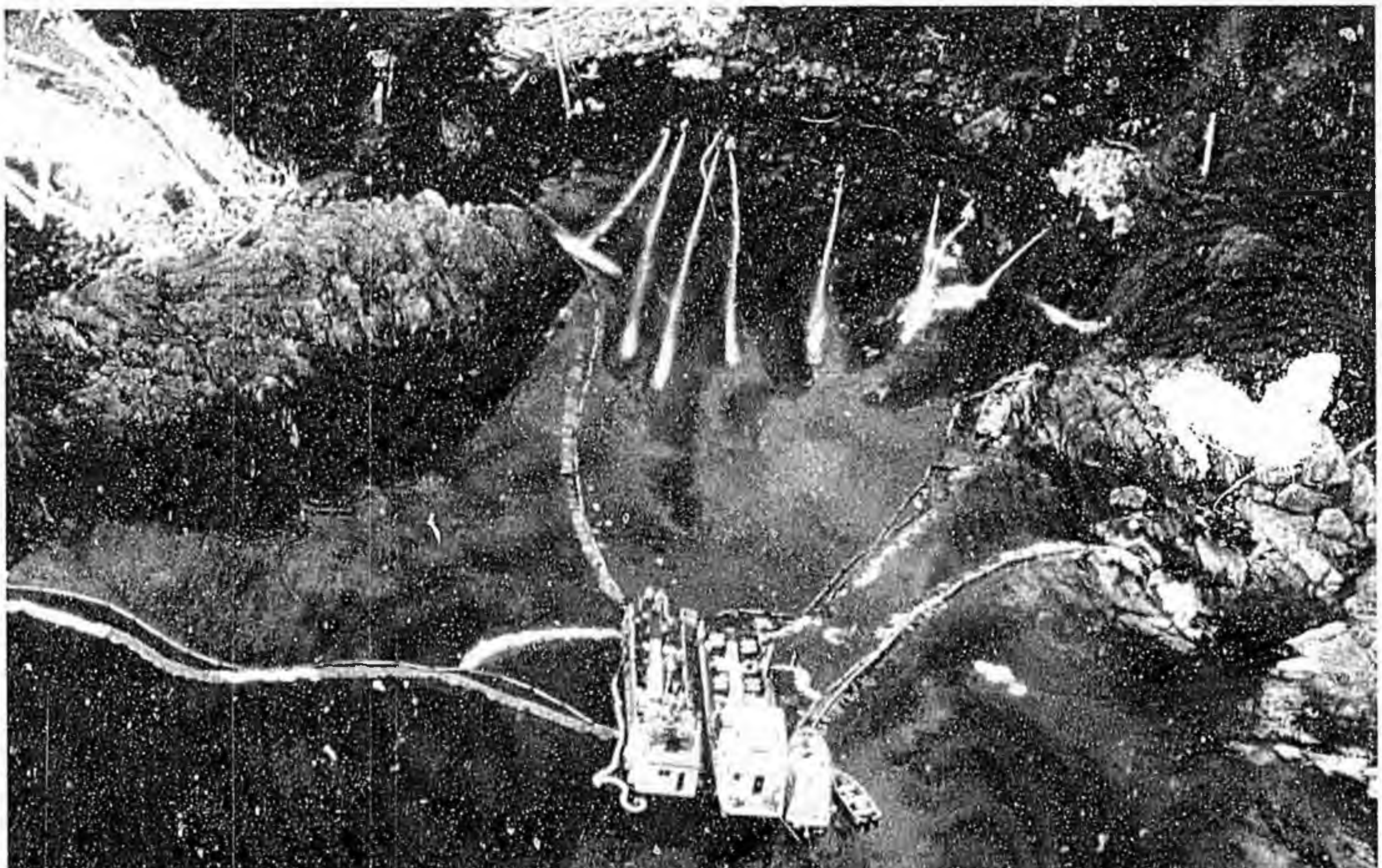
c) Therefore, before choosing such a technique, responders must make sure any damage from the treatment is acceptable based on the potential threat from the oil.

It was well known from the start that hot water and high pressure were a potentially harsh combination for shoreline treatment.

"[T]esting done on Block Island by Exxon and the USCG have demonstrated that water flushing and hydro blasting are both effective removal methods," wrote DEC's main contractor on May 3. "The only thing to determine now is the temperature range of the water. Admiral Yost seems to think that a clean, dead beach (using hot water) is better than a live, semi-oiled beach (using cold water)."[45]

In fairness, Yost, the Coast Guard commandant, was not alone in this assessment. The state's spill officials agreed that hot water flush had a role — perhaps a significant one — in shoreline cleanup. State and federal officials agreed that the potential damage of treatment was acceptable based on the potential threat from the oil.

And here is precisely where opinions separate, not just in this instance, but in the



Aerial view of beach cleaning using hot-water washing, skimmmers and boom. Photo by Rob Schaeffer larger and more common debate about conducting shoreline treatment after an oil spill: Who defines terms such as "threat" and "harm?" What resources, values, economies, and uses are most important and deserve protection — especially when protection for some may have negative results for others?

For the State of Alaska, the bottom line was that cleanup policy was a complex matter of public policy, not merely a scientific consideration. However, science provided the starting point.

First, the spill was enormous, and the shoreline impacts were unprecedented. The 11 million gallons lost from the tanker washed into hundreds of salmon streams, estuaries, bird-nesting areas, marine mammal haulout and rearing zones, and other critical habitat. The oil was not affecting a limited habitat for a single major species; it was coating tremendously large sections of habitat for a number of important species, some of which do not survive in large numbers outside of Alaska. Nothing in the literature gave clear guidance about what might happen to species that suffered widespread disruption due to oil over massive areas that supported them.

The potential harm to limpets and rockweed from hot water seemed acceptable, based on the potential harm to the region's economies and communities, and to higher trophic species such as fish, seals, and seabirds.

Second, the amount of oil that was spilled — and later, it was determined, the amount of oil that was locked underneath rocky shorelines and buried on other beaches — raised serious questions about the potential for sublethal effects due to long-term , low-level exposure to hydrocarbons.

Third, despite the general impression that Alaska is a rich paradise for wild things, it must be remembered that Alaska's subarctic climate puts most species on a razor's edge of survival. A tropical climate with endless summer has more energy, more diversity, better conditions for recovery, generally speaking. Prince William Sound is rich, compared to other areas, largely because it is not subject to the same barrage of environmental insults as other, more populated and industrialized areas.

However in Alaska, any disruption — natural or man-made — has the potential for driving a given animal population below the levels necessary for survival. Cold water, harsh weather, and limited solar energy at high latitudes can all combine to make recovery in such an area less dependable than recovery in a more temperate climate. This spill was so large, and its initial effects so widespread, anything less than a full-scale attempt at cleanup seemed like a biological gamble.

Last, the timing of the spill, in biological terms, was especially critical. Prince William Sound, the Copper River delta, the Kenai Peninsula Coast, the Barren Islands and the Kodiak Archipelago — all these areas were on the verge of the massive migrations of birds, marine mammals, and fish that begin in April and extend through the northern summer. The beaches and islands of the region are primary stops on migration routes, and preferred sites to nest, give birth, and raise young for many species. The oil, quite literally, was in the way, or on its way to vast stretches of critical habitat.

But biology was only part of the decision. The people and the economies of the region depend on the health of resources, the seasonal abundance of game and fish, clean water and wilderness islands. Subsistence, commercial fishing tourism, sport hunting and fishing, and recreation are the foundation of the local economies, and the very reasons the communities of the region exist.

Commercial fishing seasons were on the verge of opening, and the concern was not just over the 1989 season, but the 1990 season as well. Not only was it important to clear spawning beds from oil contamination, but it was just as important to clean beaches that held the potential for leaking oil into the bays and coves where fishermen made their living. Alaska tourism at virtually every level is based on pristine wilderness. Subsistence users demanded that oil be removed from their hunting and fishing areas as best as possible. It was simply not acceptable or practical to put these economies on hold for some period of years while oil degraded naturally.

And as a practical matter, a minimal cleanup raised the distinct possibility that oil being lifted off beaches and moved elsewhere would oil and re-oil many areas that had escaped the initial impacts, as described in field reports and overflights by state and federal agencies.

The threat from the oil extended far beyond the intertidal communities of the affected shorelines; the potential harm to limpets and rockweed from hot water seemed acceptable, based on the potential harm to the region's economics and communities, and to higher trophic species such as fish, seals, and seabirds. Arguments for limited or light cleanup, based on concerns about immediate intertidal impacts, lacked the perspective of both the broader ecological implications and important public policy considerations.

Did the hot water treatment work? Hot water and high pressure did, indeed, remove relatively large amounts of weathered oil from rocky shorelines. It did, however, suffer from serious drawbacks. It was probably harsh on intertidal creatures and plants that survived the oiling itself, and it probably drove some oil at some sites deeper into the fine sediments. In addition, variability in the way crews conducted the treatment caused secondary problems, some of which the NOAA 1991 study points out.

On balance, state officials were willing to accept some of this damage in exchange for removing the heaviest concentrations of oil from shorelines as much as possible, as fast as possible. The benefits to commercial fishing, tourism, and other human uses of the shorelines outweighed the potential damage and disruption caused by the treatment.

The treatment was most effective, and most acceptable, on shorelines that were heavily oiled. As soon as the heaviest oiling — the so-called "gross contamination" — was removed by the hoses and omnibooms, the balance tipped away from high pressure and hot water. By the middle of 1989, it was obvious that some other method would have to be used if the cleanup was to continue past the initial, rough washing program.

Solvents and chemical cleaners

Exxon's first attempt to get past the limitations of hot water washing (and perhaps, some of its harsh effects), was to propose the use of a chemical cleaner called Corexit 9580M2. This was, essentially, kerosene with most of the aromatics (the most toxic components of petroleum products) removed, plus some detergents. The substance was a modification of the dispersant that Exxon had attempted to apply during initial on-the-water response. Exxon said it looked at 40 potential chemical cleaners from several different manufacturers before settling on Corexit, which is manufactured by Exxon.

Corexit never got past the testing stage, for many of the same reasons that relegated hundreds of other products to the file cabinets during the *Exxon Valdez* response. It had not been tested, scientific data on its toxicity were either thin or incomplete, and it had operational problems. In addition, public acceptance of a new, widespread chemical treatment was lacking. To landowners, fishing groups, and conservation

Test application in 1989 of a chemical cleaner called Corexit, an Exxon product later rejected for beach cleanup. Photo by Rob Schaeffer organizations, the idea of dumping chemicals on hundreds of miles of shorelines that had just been oiled seemed much too risky — especially when there were other alternatives.

Like the earlier public flap over dispersants in April and May, the bitter arguments about Corexit were based, in part, on Exxon's insistence that it had an answer to the oil spill and the government was obstructing progress. A high-ranking Exxon executive bitterly complained to a U.S. Senate subcommittee in July that despite overwhelming evidence of Corexit's effectiveness, the State of Alaska would not allow the chemical to be sprayed. The executive said he wasn't sure Alaska even wanted the spill to be cleaned up quickly,[46] since the DEC wouldn't grant approval to use Corexit.

Again, like the dispersant debate, the issues and facts about Corexit were not as clear and easily defined as any side would have liked.

The public and the governments were uncomfortable with Corexit use because no one could prove that the chemical could be recovered. Crews would have to be retrained, a monitoring program had to be developed and implemented, and a new concern about worker safety would enter the picture.

Exxon's experts stated that the toxicity was low, the cleaning efficiency was high, and their ability to recover the chemical and oil was good. State and federal environmental scientists (including DEC, Fish and Game, and EPA) felt that the toxicity information was limited and incomplete. Both governments agreed that Corexit took oil off the rocks, but neither felt that Corexit was much more efficient or less disruptive than hot water. And most observers had serious questions about the ability of Exxon crews to contain and collect the oil-water-Corexit mixture that washed off the rocks into the water. In most of the 1989 tests, Exxon used more chemical — in at least one case, twice as much chemical — as it could actually recover.

Did Corexit get oil off the rocks? The answer, according to state and federal observers, was yes, although it worked better under dry conditions.[47] Could Exxon recover the mix of water, oil and Corexit once it was in the water? Not so well, the government observers said. "There is little evidence to indicate that an appreciable amount of washed oil (let alone the applied Corexit) was recovered after the test applications," the EPA reported.[48] State and federal observers reported that Corexit tests generated a reddish-brown plume that sneaked outside containment and absorbent booms and was difficult to recover.

Federal and state agency staff, including EPA and the state Department of Fish and Game, were not satisfied with the limited information available on the toxicity of Corexit. The existing tests told regulators something about the acute effects of Corexit, but they were silent on the effects of longer-term exposure — a critical point if Corexit were to be used in large quantities covering hundreds of miles of various wildlife habitat. There was also little firm information about the longer-term effects of a mix of Corexit and oil on wildlife — again, a critical point, considering that Exxon had not demonstrated its ability to contain and recover what it washed off; the elusive reddish-brown plume was troubling.

In short, the public and the governments were uncomfortable with allowing a chemical dispersant to be sprayed throughout hundreds of miles of the spill area because no one could prove that the chemical could be recovered. Crews would have to be retrained, a monitoring program had to be developed and implemented, and a new concern about worker safety would enter the picture.

No one, on either side, could claim that the existing test data in 1989 supported his position without equivocation. But like most major cleanup decisions, this one hinged on more subtle, less technical points. It was part science, part risk assessment, part operational, and part practicality. Test data were just a part of a complicated judgment call.

From the standpoint of operations, Corexit was far from a sure thing. When the chemical-oil-mix came off the beach and went into the water, conventional skimming equipment had difficulty picking it up and absorbent booms didn't necessarily soak it up. On August 28, Exxon applied 73.8 gallons of chemical to a test area and could recover less than 42 gallons of oil-water-Corexit mix; the next day, Exxon applied almost 60 gallons of chemical and could retrieve less than 42 gallons of mix. In both cases, the reddish-brown plume escaped from the testing area, and no one could tell how much of what got free into the ocean was chemical and how much was oil.

"Another disturbing observation was that [Corexit] appeared to carry oil into the water column . . . and we have little assurance about its toxicity and/or knowledge of its ultimate fate in the marine environment," EPA's observers wrote.[49]

And it didn't seem to work well when it was raining — a serious drawback in rainy Prince William Sound.

NOAA maintained that washing with Corexit would be less harmful than washing alone, since the solvent worked at lower water temperatures. It was an interesting theory, but there was nothing in the science that suggested that hitting marine life with a solvent and 100-degree water was significantly less harmful that hitting the animals with 160-degree sea water alone.

And finally, from the standpoint of public policy, allowing a company to introduce many, many thousands of gallons of chemicals over many hundreds of miles of Alaska shorelines — based on limited scientific and public review — seemed irresponsible, especially when there was nothing to suggest the chemicals worked any better than sea water.

The question came down to this: If hot water washing, manual pickup, and other existing methods did an acceptable job of cleaning within an acceptable range of side effects, why gamble the rest of the cleanup on a chemical that hadn't been shown to be much less damaging or much more effective?

Exxon never retreated from its position that Corexit should have been used. The Coast Guard, meanwhile, sent mixed messages. On September 10, 1989, the federal on-scene coordinator told Exxon that he wasn't convinced Corexit was effective,[50] yet within a few months, the Commandant of the Coast Guard would lobby the Alaska Governor directly to approve Corexit in 1990. Federal on-scene coordinator Ciancaglini was also quoted in a March news story urging use of Corexit during 1990 cleanup.[51]

Exxon continued to press its case for using Corexit in 1990. The debate stumbled along on the same legs as before: toxicity and operational efficiency. The toxicity argument against Corexit got somewhat weaker and Exxon's ability to recover the stuff got somewhat stronger.[52] DEC approved limited testing at five sites that summer, with the intent of finding out whether Corexit could be used as a spot washer, rather than a blanket treatment.

The 1990 tests provided little new information to decision-makers. The state's observers of a July 14, 1990 test reported that a Corexit-and-water wash again proved to remove more weathered oil than washing with water alone.

DEC's Judy Kitagawa observed in a memo to her supervisor that "this is the seventh Corexit 9580 demonstration I have observed" since 1989. She reiterated her observations of the chemical's effectiveness in a brief passage that betrays some weariness with the exercise.

"We already learned from the 1989 trials that COREXIT plus hot water removes oil better than hot water alone and that COREXIT/oil mixtures are difficult to contain and collect from water. All agencies agreed with this last year. The demonstrations of spot washing with COREXIT in July, 1990 have reconfirmed this," she wrote.[53]

A second DEC monitor agreed with Kitagawa's evaluation, writing that "Corexit was unquestionably superior in removing oil from the bedrock surface."[54]

But each monitor made additional observations that suggest, once again, that decisions about technology and evaluations of effectiveness in oil spill response are made within the context of conditions and risks existing at a given point in time.

State monitors observed that applying Corexit, followed by a wash with hot water, was certainly a good cleaning combination. However, it took a long time. A Corexit application, followed by a waiting period (the stuff had to soak in to be effective) and a wash, took about 90 minutes; washing alone took 15. Was it worth the wait?

And Kitagawa observed that using Corexit to spot-wash tarry oil took oil off rocks, but it put oil and chemical into the nearshore area — in short, it took a stable environmental problem and made it a mobile environmental problem. Was it worth it, in environmental terms?

There was never much of a doubt that Corexit could remove oil from oiled shorelines. There were doubts about whether it could be contained and recovered, and there were doubts about whether it was toxic to marine animals, and if so, to what degree. Given this set of facts, different government observers came to very different conclusions about whether Corexit should be used on the *Exxon Valdez* cleanup.[55]

State agencies shared both operational and ecological concerns. Fish and game officials were wary about introducing the chemical into nearshore areas without a better handle on its short- and long-term effects. DEC had similar concerns, but based its decision primarily on the fact that Exxon used too much chemical to recover too little oil; Corexit didn't appear any better than washing.

Federal government's officials had mixed opinions. The Coast Guard wasn't sure the Corexit was much better than hot water washing, and the EPA was concerned that Exxon's inability to contain Corexit and clean it up could put oil and chemical into the water. NOAA's John Robinson in 1989 vigorously promoted the use of Corexit, which in his judgment would speed up the response. He was concerned that the slow-moving cleanup effort would leave oil to harden and weather over the winter, making it difficult to clean.[56]

In 1989, the public agencies directing the cleanup concluded that Exxon's chemical was not a better alternative than the methods available at the time. In 1990, they reached the same conclusion.

But really, the differing opinions were not really based on whether the chemical was or was not a good cleaner. Rather, each observer was heavily influenced by individual assessments of risks (from the oil as well as the chemical), the range of other choices that were available (hot water and high pressure vs. the chemical), assumptions about time (whether all cleanup would end in September), public accountability (whether the emergency allowed the governments to circumvent their responsibility to consult the public about putting a chemical into the environment), and other public policy issues.

Cleanup decisions have a context beyond science and technology, and the Corexit issue was no different. In 1989, the public agencies directing the cleanup concluded that Exxon's chemical was not a better alternative than the methods available at the time. In 1990, they reached the same conclusion. Nothing in the tests suggested to the state agencies that dousing beaches with a kerosene-based solvent was any better than washing (1989) and mechanical and manual removal (1990). It wasn't any faster, and no one could prove that it was any less harsh than washing. It added something new to the environment, and presented additional containment problems. It raised more questions than it resolved.

Mechanical treatment

Backhoes, tractors, front-end loaders and other small and large mechanized units were used on shorelines primarily in 1990, and to a limited degree in 1991. In most cases, there was nothing especially complicated about the work; it was generally a mechanized magnification of what workers were doing by hand.

Front-end loaders scraped up and removed large tar and asphalt patches (such as at Aialik Glacier Beach on the outer Kenai Peninsula coast); tractors pulled thick, steel tines through concentrations of buried oil to release them (an excellent example was the work at beach segment LA20,[57] in Sleepy Bay, on Latouche Island); backhoes dug up pockets of heavy, buried oil or pulled oiled sediments from high intertidal areas to mid-intertidal areas for either removal or bioremediation (KN405, on Point Helen, on Knight Island and other places).

There was little dispute about the crude effectiveness of mechanical equipment: It moved a lot of material that could not otherwise be moved by hand. The state favored wider use of mechanical equipment based on the risk-benefit analysis that has been discussed throughout this report. The federal government (and to some degree, Exxon) began resisting wider use of mechanical equipment in mid- to late summer of 1990, largely based on the risk-benefit conclusions reached by NOAA.

However, there was some agreement about what the machines could do well, assuming one accepted the short-term disruption the machines caused.

On cobble beaches with moderate slope (such as the LA20 example), a small tractor pulling steel tines of various depths could agitate the sediments and release large amounts of buried oil, particularly if the tilling was done on a rising tide, when water lifted the oil out and made it easier to collect. On beaches dominated by small or mid-size boulders,[58] a backhoe was very effective at pulling back larger rocks so workers could either scoop or shovel mousse into buckets or bags for removal.

Backhoes and other equipment were used to "pull down" oil and oily rocks that were stranded in the high upper intertidal areas where storms and high tides had left berms far up the beach. The method became known as "storm berm relocation," and was generally accepted as a good way to expose oil to weathering or bioremediation [see next section]. The oil had wound up in these upper beach areas largely as a result of high tides and storms that occurred in 1989, when oil was on the water.

Front-end loaders scraped up and removed large tar and asphalt patches; tractors pulled thick, steel tines through concentrations of buried oil to release them; backhoes dug up pockets of heavy, buried oil.

There were ways of increasing the efficiency of a mechanical operation — such as tilling on a rising tide only — but Exxon and the Coast Guard thought this impractical, since staying at a site and waiting for the right tide cycle prevented a crew from moving to a new site. In addition, in some cases, oil was stranded so high on a beach that tilling on a rising tide could only be done during the few times during a month that tides were running higher than average. This, as well, was viewed by Exxon and the Coast Guard as an unacceptable scheduling and logistics problem.

Storm berm relocation, while generally accepted as a legitimate method by all parties, occasionally highlighted differences in approach between the state and federal governments. The state sometimes favored mechanical treatment that removed the oil: As long as one was going to send a piece of heavy equipment to a shoreline, why not make it one that could remove the pollution?

Exxon and the Coast Guard preferred an approach that simply exposed the oiled sediments for limited removal, weathering, bioremediation, or all three. They argued against large-scale removal first because of fears that the removal would promote erosion. When that proved later not to be a problem, they argued against it because it caused logistical and disposal problems they found unacceptable.

And overarching all these operational arguments were the concerns about mobilizing oil into the environment by tilling it with heavy equipment. NOAA, in particular, thought that heavy tilling could take an unacceptable, but relatively stable problem (buried oil stranded below the surface) and turn it into an unacceptable, mobile problem. The concern was that oil could be released into the water where it could, for example, disrupt an area fishery, or cause fine, oily sediments to migrate down into the lower, unoiled intertidal zone.

The state viewed all the counter arguments — logistics, oil mobilization, etc. — as valid concerns, but generally DEC and other state officials felt that quality work and good timing could alleviate some of the more pressing environmental concerns. In some cases, the state and federal government found common ground; in others, it didn't. Generally, everyone viewed mechanical treatment as a high-impact treatment that made sense at some sites based on which risk-benefit conclusion one tended to favor.

Bioremediation[59]

The limitations of large-scale washing and the shortcomings of solvents like Corexit highlighted the emerging fact in 1989 that if an extensive and area-wide cleanup program were to continue, some other technique would be necessary.

The U.S. Environmental Protection Agency (EPA) proposed in May and June of 1989 to try and speed up the natural rate of degradation of the oil by applying fertilizers to rocky shorelines. The general term for this type of cleanup is bioremediation.

The idea of using some kind of artificial stimulus to speed up the natural breakdown of pollutants had been around for some time, although the idea began to have some limited application in the 1960s and early 1970s. In 1967, the famous cruise liner

Queen Mary was permanently moored in Long Beach, California. At the time, it contained about 800,000 gallons of oily waste water in its bilge. Contractors used bioremediation techniques to break down the hydrocarbons in the bilge water, and the owners received approval to discharge the bilge tanks after six weeks of treatment.[40] Other field experiments and trial applications over the course of the next 20 years included efforts to improve the quality of underground water sources and contaminated soils by applying biotechnology.

The *Exxon Valdez* oil spill was hardly the best time to embark on a broad program of research and development of oil spill response technology. However, a targeted program for a specific technique or product was possible.

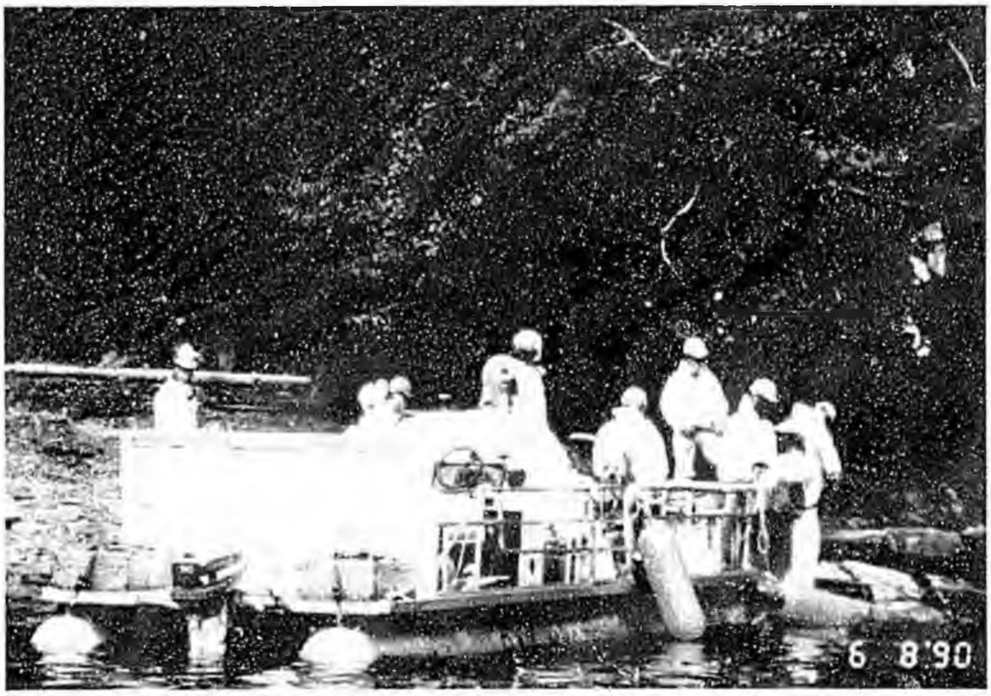
Most of these early efforts had one major thing in common: The work was done largely within the confines of a closed or controlled system. Under those kinds of conditions, a scientist or contractor or engineer could tinker with the variables that optimize the effectiveness of the treatment. Controlling temperature, nutrient levels, and other physical factors can have a tremendous effect on the results.

The *Exxon Valdez* oil spill was a very different matter. Prince William Sound was anything but a controlled system. It was a wild, remote marine environment subject to extreme weather, big seas, 10-foot tidal changes four times a day, and seasonal swings in solar energy, temperature, and nutrient availability. The Alaska Bioremediation Project, as EPA called it, was an unprecedented exercise in applied biotechnological research, even if judged on nothing more than the area that was treated and the amount of fertilizer that was applied.

As noted before, the *Exxon Valdez* oil spill was hardly the best time to embark on a broad program of research and development of oil spill response technology. However, a targeted program for a specific technique or product was possible.

At the EPA's urging, and with funding from Exxon under a special technology development agreement, bioremediation became the focus of the effort.

There is nothing magic about bioremediation, especially in the form it took during the *Exxon Valdez*. Crude oil was a good candidate for bioremediation, primarily because of its chemistry. In terms of volume, about a third of the oil is made up of light, volatile gasses that evaporate fairly quickly; the middle third (or more, in some crudes) is made up hydrocarbons that can be broken down relatively easily by natural forces, and the last third or so is made up of compounds that are more resistant to quick degradation: waxes, asphalts, and so on.



Bioremediation took the form of applying to oiled shorelines fertilizers which added nitrogen and phosphorous, which stimulated the already good population of oil-eating bacteria in Prince William Sound. The compounds were brought in by boat.
Photo by Mike Ebel

Chemically, the oil breaks down naturally for several major reasons. Exposure to sunlight and air causes some degradation, and some is the result of microbial activity. The microbes don't actually "eat" the oil; the image of bugs chewing up chains of molecules and spitting out the leftovers is not quite right. It is more like they make the chains "rust out." The microbes use carbon in various biochemical ways; as they pull carbon out of the chains of molecules that make up the different parts of the oil, the chains fall apart. They break down into their basic elements. So the theory behind bioremediation of crude oil is simple: If you put more microbes to work on this process, you will get faster degradation.[61]

To test this theory, EPA put up about $5 million, Exxon committed additional funding, and the state threw its staff and support into a high-speed research project.

The project could take one of two basic approaches: a) inoculation, in which vast numbers of oil-degrading bacteria would be introduced into the ecosystem, or b) enhancement, in which the existing microbial population would be boosted by the addition of various nutrients.

The process was neither well-explained nor well-understood, particularly by the public, and particularly at the outset. Most people envisioned a kind of biological warfare, in which new, engineered bacteria would be unleashed on the environment. To the public, this conjured up the image of the Mutant Microbe That Ate Prince William Sound, as out-of-control bacteria overwhelmed an already-stressed environment. Even as late in the spill response as the spring of 1991, a national news reporter would describe the bioremediation effort as a process of spraying millions of oil-eating microbes on the shores of Prince William Sound.[62]

That was not really what was proposed in 1989. Although EPA considered inoculation, researchers rejected the idea primarily because Prince William Sound already seemed to have a good population of oil-eating bacteria. Not all kinds of bacteria are hydrocarbon degraders, but it turned out that Prince William Sound had the right bugs — about five percent of the basic microbial population.[63] This relatively high level of degraders in the "unfertilized" population was there, researchers think, because of natural drips of turpentine-like hydrocarbons coming from the spruce-hemlock evergreen forest of the Sound. It was a fairly good scientific bet that the increase in available carbon — the spilled oil — would cause a jump in the hydrocarbon-degrader population in the area anyway. But if the overall population of bacteria could be multiplied exponentially, then the modest, natural increase in oil-degraders could be turned into a population boom. The EPA-DEC-Exxon project would not use artificial means to put more oil degraders into the existing population. Instead, crews would simply boost the overall bacterial population; five percent of a billion bacteria is much more than five percent of a million.

The alternatives, beyond hot water washing, were limited. The oiling, even after washing, was substantial. Frustration was high, and expectations were low. Suddenly, it appeared someone had found the answer to the problem.

The best way to stimulate microbial growth was to add nitrogen and phosphorus to the available nutrient mix; the best way to put nitrogen and phosphorus out there was to spread fertilizer. The research team narrowed the choices down to Inipol EAP22, a French-manufactured liquid fertilizer, and several kinds of slow-release pellets or briquettes. On July 31, 1989, Exxon began applying fertilizers to oiled beaches at Green Island. By the end of the cleanup season, somewhere between 74 and 110 miles of shoreline had been sprayed or peppered with fertilizers.[64]

The three months from conception to widespread approval and application for a new oil spill cleanup technique was extremely brief — especially one that introduced chemicals and massive doses of additional nutrients to an open environment. EPA started scouting for field test sites in May and conducted lab tests in June. It started a 90-day field test at Snug Harbor, Knight Island, on June 8 — but approval for widespread use of fertilizers came barely halfway through the test to determine whether fertilizers worked.

In fact, when both the state and federal government gave tentative approval to the use of fertilizers, the program stood on a few lab tests, thin field test data, and literature searches that gave only limited evidence about whether the fertilizers were toxic. There was virtually no broader ecological analysis about what the addition of all those nutrients might do. There had been no public hearings and no real opportunities for independent scientific review of the data. On the day Exxon submitted its proposal for area-wide use, there were not even any accepted guidelines for application.

This was an unusual process for approval, to be sure, but the state and federal governments were operating in interesting times. The alternatives, beyond hot water washing, were limited. The oiling, even after washing, was substantial. Frustration was high, and expectations were low. Suddenly, it appeared someone had found the answer to the problem.

In July, after a month or so of treatment at Snug Harbor, the EPA project leaders produced what has become known as the "postage stamp" photo, an aerial shot of a clean rectangle stamped on a black background of oiled beach. While EPA could not conclusively prove that this "striking disappearance" of the oil from the rocks was due to bioremediation, they found 30 to 100 times more microorganisms on the treated plots than on the unfertilized plots.[65]

A second field test was conducted in July at Passage Cove. On July 25, following application of Inipol, EPA toxicologists collected water samples and brought them back to the lab. There, they ran standard acute toxicity tests on several kinds of marine animal larvae (a stage of development at which one would expect animals to be most sensitive to pollution). The preliminary results from the toxicity tests suggested that Inipol could be harmful to small marine animals, but it could be mixed in weaker solutions. So, the conclusion was not that Inipol was "safe," in the broad sense of the word; the conclusion was that one could apply the chemical in solutions weak enough to both accelerate degradation and minimize harm to marine life. In addition, the EPA data suggested the risk to animals would disappear fairly shortly after application — perhaps a day or two. The relative risk was high immediately after application, but dropped off steeply after that.

What decision-makers had, therefore, was another incarnation of the same basic cleanup balancing act: Most methods (including leaving the oil alone) had risks that accompanied the benefits. How badly one wanted or needed results drove one's judgment about how much risk was acceptable.

State and federal scientists on a joint research and development team sat down with Exxon to come up with guidelines for a large-scale field trial of bioremediation. The group decided that fertilizers should be applied only to certain kinds of shorelines, primarily those where beach hydraulics and tidal flush provided a good opportunity for the runoff to be diluted.

The momentum behind bioremediation grew considerably after the 1989 trial application. By January, even without complete reports on 1989 activities, the Coast Guard and NOAA were banking on bioremediation, as was Exxon.

They also made some practical decisions about application methods. The sprinkler system used at Snug Harbor appeared to deliver the best results; the slow, steady, light wetting of the surface by the sprinkler allowed a slow and steady release of nutrients from the solid fertilizers. The group decided, however, that this was impractical on a large scale. They settled on two basic methods. The first was application of Inipol using backpack tanks and spray wands; the second was spreading of Customblen pellets using the kind of hand-held whirler used to spread fertilizer on suburban lawns. These methods would be refined over time, but they stayed basically the same.

The next step was to train supervisors to make sure the Customblen was properly weighed and measured, that Inipol solution was properly mixed and maintained, and that workers knew what they were doing and were properly protected. The Customblen didn't present much of a problem, since the pellets could be easily weighed and workers simply needed to spread the stuff evenly within a specified area (essentially "x" pounds of Customblen over "y" square feet of shoreline). Worker safety was primarily a matter of keeping the pellets from direct contact with the skin, since Customblen, like most garden fertilizers, irritates the skin and can cause a fertilizer "burn."

The Inipol was more of a problem. The solution included more than just a nitrogen- and phosphorus-based fertilizer, because there was more to bioremediation than simply delivering more bugs to the work site. The foundation of the process was the increase in the microbial population, but the additional components of the Inipol were needed to keep the microbes on the oil.[66] These additional components included butoxyethanol, which when fresh can be harmful to both marine life and humans. The butoxyethanol evaporated relatively quickly (within about 24 hours), but it was important to keep wildlife away from it during that period. Workers had to avoid breathing or absorbing the fumes through the skin.

The solution also included the surfactant laurel phosphate, sort of a detergent, that tended to produce a dispersant-like effect if the Inipol were sprayed too heavily or mixed too "rich." When workers applied the Inipol improperly, it would actually wash oil off the rocks. A telltale sign of this mistake would be clean streaks striping down an otherwise oily rock. During the 1989 trial application program, some poorly trained work crews didn't understand how and why bioremediation was supposed to work, treating the Inipol as a beach cleaner instead of an additive.

Inipol also had to be kept flowing at the right level of viscosity. In the cool climate of Prince William Sound, left to itself the Inipol would get thick. It had to be heated gently and its temperature and mix maintained.

The R&D committee considered these scientific and operational questions, and put the proposal before the Interagency Shoreline Cleanup Committee, the interagency review group that included fishing and conservation public interest groups. The ISCC approved the guidelines, as did the Regional Response Team. Exxon received formal authorization from the Coast Guard to proceed on August 1, although Coast Guard officials had already told Exxon the federal on-scene coordinator would approve bioremediation as quickly as possible.[67]

It is important to note that no one had confirmed that bioremediation was effective on the rocky shorelines of Prince William Sound. Both the state and the federal government expressed their intention to revisit the bioremediation issue in 1990. A decision to put fertilizers "in the toolbox" (to use the response vernacular) would be based on whether the 1989 trial program produced data that supported the hypothesis that fertilizers were both safe and effective. The burden of proof — and the responsibility for collecting the necessary data — would be on Exxon.[68] EPA would also be involved to a large degree, since more complete analysis of the Snug Harbor and Passage Cove studies during the 1989 season would be available over the winter of 1989-90.

However, the momentum behind bioremediation grew considerably after the 1989 trial application. By January, even without complete reports on 1989 activities, the Coast Guard and NOAA were banking on bioremediation, as was Exxon. The materials prepared by all these organizations for the principal winter planning meeting in February, 1990, made strong claims about the effectiveness of bioremediation (Exxon and EPA), dismissed most concerns about the possibility of any adverse ecological effects (Exxon and EPA), or identified bioremediation as the best treatment option because of it was assumed to cause little disruption to shorelines (NOAA).

Exxon's researchers claimed, based on their laboratory studies, that Inipol worked not only on surface oiling, but also on subsurface oiling as deep as one foot into the beach.[69] NOAA recommended that bioremediation be a "primary option" for treatment, especially in sheltered areas that could suffer the most ecological disruption from "overly aggressive" cleanup.[70] Hap Pritchard, one of EPA's lead researchers on the project, concluded from the 1989 field tests that there was only one reason to explain the differences between test plots and (unfertilized) control plots, and the reason was that the added nutrients enhanced degradation.[71] Shortly thereafter, Pritchard and a colleague, Chuck Costa, began a speaking tour of the major communities in the spill area. They expressed their enthusiasm about the 1989 tests and advocated for use of bioremediation in the coming season.

It was clear that the state and general public had a different understanding than the federal government and Exxon about the status of bioremediation as an approved cleanup technique for widespread use in Prince William Sound. The state expected both Exxon and the EPA to produce for review — not only for principal agencies, but also for the Regional Response Team and the public — completed reports on effectiveness and toxicity. At the time that EPA's Pritchard was calling bioremediation "the only reasonable response technique" for the 1990 season,[72] DEC had not received the information it had requested.

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This presented a significant communications problem. The public was being presented with bioremediation as a *fait accompli* for 1990, a primary treatment that would be used throughout the spill area. However, DEC insisted that the issue had not yet been resolved. Members of the public, including commercial fishing groups, Alaska Native landowners and subsistence users, local governments, and conservation groups, were confused. Some were outright skeptical. It appeared to them that a decision had been made with no more information than before, and no consultation with affected resource users.

State agencies became concerned that the bioremediation bandwagon was rolling forward without stopping to properly consider the problems and the questions from 1989.

The state and public concerns about bioremediation could be separated into three categories: procedural problems regarding the approval process, differences in approach to the cleanup, and gaps in the scientific knowledge about bioremediation.

"Whereas NOAA identified bioremediative treatment as a primary option for the 1990 cleanup, the state considers bioremediation as only one option that may be useful and that treatment decisions will have to be made on a site-specific basis," state on-scene coordinator Steve Provant wrote to his federal counterpart on Feb. 15. "NOAA's recommendations should acknowledge that land owners, land managers, resource managers and user groups, including state and federal agencies, do play a legitimate role in making site-specific assessments and decisions on the treatment methods."[73]

The state and public concerns about bioremediation could be separated into three categories: procedural problems regarding the approval process, differences in approach to the cleanup, and gaps in the scientific knowledge about bioremediation.

The state still expected the bioremediation question to come before two important committees: a) the Interagency Shoreline Cleanup Committee, which had reviewed and approved the previous year's bioremediation program, and b) the Alaska Regional Response Team (RRT), which, under the National Contingency Plan, had to be consulted about the use of new technologies by the federal on-scene coordinator. It should also be noted that in the RRT, the state had critical authority regarding the approval and use of chemical cleaners such as dispersants or Inipol, the fertilizer. As plans for the 1990 cleanup season unfolded, the state was concerned that the federal government was, by design or by misunderstanding, going around two critical groups of resource users and owners.

NOAA's recommendation that bioremediation be a "primary treatment" had more to do with the agency's basic approach to cleanup than with any specific claims about the effectiveness of the fertilizers. The agency generally favored a strategy of leaving stranded oil to weather naturally (with some exceptions), but if various parties preferred to go ahead and actively treat a site, the relatively light touch of bioremediation was best. NOAA's 1990 cleanup recommendation specified that fertilizer treatment should cease if it turned out that the boost from fertilizers was no better, or only marginally better, than natural rates of degradation.

This was another example of a basic difference between state and federal responders: Based on its priorities, NOAA felt it acceptable to leave more stranded oil than did the state, based on its priorities.[74]

"It is apparent from this recommendation that NOAA does not support actual oil recovery . . . but instead recommends that oil be merely exposed to microbial degradation or the effects of future storms," the state Fish and Game department wrote in its comments on the NOAA plan. "The state should clearly object to this proposal on the basis that significant quantities of oil still remain, and treatment should continue if technologies exist to allow further recovery without undue harm to the environment."[75]

This position is one of the first hints of what would become a major cleanup disagreement over bioremediation in 1990. The state would insist that bioremediation was a finishing step, the last treatment after all other efforts to *remove* the oil had been exhausted, either because the technology was played out or the removal was becoming too disruptive. By establishing bioremediation as the "primary" treatment throughout the spill area, the spill responders would miss an opportunity to get the pollution out of the environment altogether, the state felt. The state resource agencies agreed unanimously that agreeing to this federal policy would mean agreeing to do less than state regulations required.

As a technical and scientific matter, there were still large gaps in what was known about bioremediation, and major questions that had not been addressed. Both Exxon and EPA said repeatedly that no adverse ecological effects had been "observed," but visual observation was not the same thing as scientific inquiry. Fish and Game noted that the existing data did not even begin to address questions about long-term effects of dumping thousands of gallons of liquid fertilizer and thousands of pounds of solid fertilizer into the Prince William Sound ecosystem.

Finally, the federal government was assuming approval of bioremediation without considering a detailed set of operational and wildlife protection guidelines. NOAA and Exxon were offering up fertilizers as the treatment of choice, but they hadn't demonstrated that they could get the fertilizers to the oil. The public, particularly commercial fishing groups, were especially concerned about what they considered a high-speed rush to use fertilizers.

Kelso laid out the state's position. No, Alaska did not object to bioremediation; the state merely needed all the available information, it needed time to review it, and it needed to include key public interest groups in the decision.

The state didn't oppose bioremediation, but it certainly favored a more cautious approach. State officials also felt that any major policy choice, such as this one, had to include the fishing groups and subsistence users of the spill area.

Federal officials appeared to construe the state's caution as potential obstruction or opposition. On March 23, Coast Guard Commandant Admiral Paul Yost met with Governor Steve Cowper to press for state approval of both bioremediation and Corexit. Cowper said the state would make its decision by May 1, in time to make plans for the 1990 cleanup.[76]

Misunderstandings had risen to such a level that on March 30, 1990, state and federal officials called a kind of summit meeting in Anchorage to discuss bioremediation policy. The meeting included some of the highest-ranking public officials working on the spill: DEC Commissioner Kelso, Deputy Federal On-scene Coordinator Captain Dave Zawadski, and Dr. John Skinner, deputy assistant EPA administrator. Also present was Jack Lamb, a leader of the Cordova fishermen's union.

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EPA agreed to provide all its toxicity testing information in time for the state to meet its May 1 decision deadline; one of the most important toxicity analyses was then in progress. Exxon agreed to provide the state with all its study papers; several were not complete at that time. The most important study concerned effectiveness of bioremediation on subsurface oil — a critical piece of the puzzle, since Exxon and the Coast Guard were, at that time, widely assuming that bioremediation would be the treatment of choice for subsurface oiling.[77]

Kelso said that based on what the state knew at that point, he was assuming bioremediation would be in the toolbox for 1990. However, he added, the state would require better operational guidelines — before application started — and it would also require a scientific monitoring program.

During April, DEC, working with the University of Alaska Fairbanks, convened a group of independent reviewers to look at the available information on the Alaska bioremediation project. The reviewers generally felt that the technique was still worth pursuing, and that it could probably go ahead safely with good operational and monitoring controls.

On April 26, Governor Cowper gave the go-ahead for state approval of bioremediation for 1990, but the decision was contingent on the development of the monitoring and operational guidelines DEC had suggested. After six weeks, he said, the state would reassess both the performance of the application teams and any new scientific information that had become available. The state felt this approach balanced the need for new approaches to dealing with the stubborn oiling conditions with the need to assure the public that the product was safe.

At the end of the six-week "conditional" application program, DEC gave approval to continue applications on July 20, 1990. However, the DEC approval was largely a formality, as fertilizers had become a common and accepted part of the treatment program. Bioremediation would, however, remain controversial.

Throughout the 1990 season, state monitors clashed repeatedly with the Coast Guard and Exxon over the issue of when a shoreline was ready for fertilizers. The rule was that bioremediation was primarily a finishing technique, to be applied when conventional removal efforts were complete; the work orders from the federal on-scene coordinator usually followed that general rule. However, in the field, monitors battled with each other's somewhat subjective assessment of when conventional removal was "complete." This on-going struggle led to higher-level consultations and an aborted effort by the DEC to set a standard that was more scientific and less subjective. The state eventually found a way around this problem, and there were few conflicts about fertilizers in 1991.

But for all the assurances that bioremediation caused no adverse ecological effects, and for all the claims that fertilizers had worked in 1989 and would work on subsurface oil in 1990, both the state and federal governments gave their approvals based on very limited scientific data. It was not until the winter of 1990-91 — nearly two years into the project — that the governments began to assemble more convincing scientific justifications for actions they had already taken.

Fish and Game continued to take a conservative approach to bioremediation near critical habitat and set up buffer zones around streams. Treatment could generally be timed to coincide with the narrow windows of time when fish and fry weren't coming or going.

As time went by and more scientific monitoring was done, the toxicity question would be answered fairly definitively. Dr. James Clark of EPA concluded, based on his field tests, that the acute toxicity of the fertilizers (Inipol, particularly) was limited, and that the pulses of ammonia released by the fertilizers, and mixed in the nearshore waters, were well within established EPA water quality standards. Clark's conclusions were backed up by independent reviewers hired by DEC in 1990-91.[78]

However, the state Fish and Game Department still favored a cautious approach to using bioremediation in and around salmon streams, and other fisheries habitat. The toxicity tests and literature search done by Clark gave a general picture of the problems one might expect, however, they did not (and could not, really) draw an accurate picture of how bioremediation might affect eggs, fry, and so on at different critical times in the growth cycle. They also could not take into account the margin of error presented by variabilities in the training of crews, their efficiency and their accuracy during application. For these and other reasons, Fish and Game continued to take a conservative approach to bioremediation near critical habitat and set up buffer zones around streams. Treatment could generally be timed to coincide with the narrow windows of time when fish and fry weren't coming or going. The department preferred to use those windows to get rid of the oil by removing it, rather than simply spreading fertilizers.[79] Actual removal was, theoretically, the best choice, since it removed one potential toxicity problem (oil) and eliminated the possibility of a second one (Inipol and Customblen).

EPA's Science Advisory Board, in reviewing the data from the Alaska bioremediation project in June 1992, came to similar conclusions regarding environmental safety of the project:

"Given the site-specific conditions of this Alaskan ecosystem, the timing of the onset of bioremediation, the limited areas of application and the limited application rates, adequate field information was gathered to conclude that the bioremediation effort would not negatively impact the Prince William Sound ecosystem."[80]

The next question is, of course: Did the stuff work?

The answer is probably yes, based on the assembled science. There is not widespread agreement, however, on whether it worked everywhere equally, whether it worked equally as well from year to year, and whether the rate of degradation achieved through the use of fertilizers was significantly higher than the natural rate of degradation.

First, let's deal with the general question of whether fertilizers worked, the definition of "worked" being determined by whether the addition of fertilizers accelerated degradation beyond naturally-occurring levels.

Everyone agreed that putting fertilizers on a beach caused a population boom for the microbes who already lived on the beach. The University of Alaska Fairbanks scientists doing the microbiology work on the joint research project were satisfied that boosting the overall population also boosted the population of hydrocarbon degraders. So far, so good.

The next part of the analysis was considerably trickier: Now that you had all these microbes, did they attack and break down the oil, according to the hypothesis?

The most convincing answer to this question would lie in an analysis of the changes in the chemical composition of the oil. If one could show that over the same period of time, oil on an unfertilized beach showed less chemical change than oil on a fertilized beach, one might be able to link the change to the microbes.

This was not so easy to do, for several reasons. First, there was a lot of "noise" to deal with, in terms of collecting and analyzing data. This science was being conducted in the middle of a treatment zone, so while scientists tried to start their analysis using oiling conditions that were similar to each other, there was a certain unavoidable imprecision in making that call. Next, while work crews were supposed to stay away from the bioremediation study sites, it isn't certain that they stayed away completely, or that their treatment of one section of beach didn't stray too close to the study sites. And as a practical matter, the control sites and the study sites were close to each other.

The bottom line in this regard is that any analysis of chemical degradation had to assume that the chemical composition (and concentration of oil) in any given of set of samples might not have exactly the same baseline. This is not a fatal flaw by itself, since all scientific studies have to deal with some assumptions of variability. Scientists get around this by taking enough samples that, based on standard statistical formulas, they have neutralized or minimized the chances that one set of samples will throw the whole thing off.

The researchers generally acknowledged in their monitoring study that, given the variables on the shorelines, a statistically bomb-proof result would have required many, many more samples from the study and control sites. This was judged to be physically impractical, especially given the time constraints under which they were working. It is important to note here that the state-federal-Exxon study was not intended as a research project for publication in a professional journal, but rather as a tool to give reasonable guidance to responders working under time and emergency deadlines.

Next, the laboratory techniques for chemical analysis (primarily gas chromatography) could not pin down the changes in the particular hydrocarbon — hopane — that would be the best "marker" of any true chemical changes.[81] Again, not a fatal flaw, since there are other hydrocarbons that can give reasonable indications of what might have been going on.

Researchers in the joint study, as well as the EPA Snug Harbor and Passage Cove studies, looked at other chemical hints that increased degradation might be taking place.[82] For example, they measured the levels of "by-products" of degradation — such as carbon dioxide — and compared results from test and control sites.

As time and analysis went on, scientists added up all the different hints from all the different studies and concluded there was a pretty good chance that fertilizers made more microbes and more microbes meant faster breakdown of the oil. Policymakers looked at this information at various stages and, given the fact there weren't a lot of other available options, gave the go-ahead for the program.

The most optimistic supporters of bioremediation on the *Exxon Valdez* response say the fertilizers speeded up the process at least three-to-five times over naturally-occurring levels. The lower-end estimates put the rate at one-to-two times faster.

The most optimistic supporters of bioremediation on the *Exxon Valdez* response say the fertilizers speeded up the process at least three-to-five times over naturally-occurring levels.[83] The lower-end estimates put the rate at one-to-two times faster.[84] And some reviewers looked at the DEC-EPA-Exxon study and said they could find no statistically significant difference between the data collected at fertilized and unfertilized beaches.[85]

An additional, extremely important question from an operational perspective was whether the rate was constant over time. Microbes take the path of least resistance, so to speak; they work first on those hydrocarbon fractions that are most amenable to degradation. As the chemical composition of the weathered oil begins to be dominated by waxes and asphalts, it is more resistant to degradation. That is not to say that it won't eventually break down. However, it is a reasonable hypothesis that since all fractions of the hydrocarbons do not biodegrade at an equal rate (pretty easy to prove, since the ratio of asphalts to total mass is higher in old, weathered oil than in fresh crude), one should not expect bioremediation of old asphalts to go as quickly as bioremediation of oil with more medium-weight residues.

The testing and research done on bioremediation should not be viewed as a quest to find the silver bullet for oil spills. If judged by that criterion, it fails. What we found is that bioremediation is a realistic option under certain conditions, and within certain windows of chemical opportunity. It has the best chance to give the best results under controlled circumstances, and on hydrocarbons in their fresher states. Interestingly, the research in Alaska also showed that at least in Prince William Sound, natural degradation rates could be higher than we ever suspected, thanks to the relatively large population of resident hydrocarbon-degraders.[86]

The rush to bioremediation in Alaska was a function of the size of the problem and limited availability of options. The EPA, the Coast Guard, and Exxon tended to overstate the results and benefits of bioremediation from time to time. Yet as time passes and reviewers sit back for less hurried analysis of the situation, a more conservative view of the project is taking shape.

The EPA's Scientific Advisory Board, a group of independent scientists from universities and laboratories around the country, takes a view of the Alaska Bioremediation Project that is roughly consistent with that of the state.

The board points out that the project produced a great deal of new knowledge, and provided some confirmation that bioremediation can work. However, the board cited in its report many of the same gaps identified by the state. Specifically, the review board noted the problems in gathering data during the emergency response, the variability of sites and oiling conditions, and the ability to draw firm and broad conclusions.

"A large amount of useful data was collected by the Alaska Oil Spill Bioremediation Project," the reviewers wrote in 1992. "If these data are to be used to their fullest extent, rigorous interpretation is essential. Only in some of the field studies was convincing evidence of bioremediation obtained, yet many of the summaries and conclusions read the same."[87]

The Science Advisory Board concluded, however, that at least two of the four EPA Alaska studies proved that bioremediation worked to some degree. The board noted that it is difficult to pin down actual rates of degradation because the condition of the oil varied from site to site at the beginning of treatment. In addition, it was weathering all the while, and not necessarily at a rate equal among all sites. The EPA review is a cautious endorsement of the potential for bioremediation to work in marine oil spill shoreline cleanup. However, the results of the study do not necessarily prove that adding fertilizers to oiled shorelines speeded up the cleanup.

"The conclusion that bioremediation reduced cleanup time must be qualified in view of the high variability in oil chemistry at the sites, the fact that some beaches were prewashed and the fact that the oil was continuously aging and weathering during the bioremediation period. Moreover, the specific estimates of cleanup time in this report have considerable statistical uncertainty. Quantification of the effect of bioremediation is difficult because of the limited number of sites that received different treatments and the fact that the sites had different geological characteristics."[88]

The board further speculated that bioremediation has, perhaps, more promise as a treatment for subsurface oiling than for surface oiling conditions.

What all this means is that bioremediation was the subject of intense debate, some study, and probably yielded some results at some sites. It did not turn out to be the silver bullet that many hoped it would be.

[1] *The State of Alaska, through DEC, has been one of the principal participants on an EPA-sponsored task force designed to develop a national strategy for testing and approving a class of oil spill response products falling under the loose heading of "bioremediation." See p. 73, this chapter, for a more complete discussion of this technique and its possible future application.*

[2] *Governor Steve Cowper, Testimony before the U.S. Senate Subcommittee on Environmental Protection, Washington, D.C., April 19, 1989.*

[3] *Alaska Oil Spill Commission, "Spill: The Wreck of the Exxon Valdez," January 1990, p. 56.*

[4] *The Alaska Oil Spill Commission recommended in its report that a state research center be established within the University of Alaska system.*

[5] *Alaska Oil Spill Commission report, p. 5.*

[6] *National Response Team report, The Exxon Valdez Oil Spill: A Report to the President, May 1989, pp. 8-9.*

[7] *Mousse is an emulsion of oil and water, the general consistency and color of its chocolate namesake.*

[8] *Noerager, J.A., and Goodman, R.H., "Oil Tracking, Containment, and Recovery During the Exxon Valdez Response," Proceedings of the 1991 International Oil Spill Conference, at pp. 193-203.*

[9] *Hull, R., Northwest EnviroService Inc., Final report, December 1990, p. 25*

[10] *Bayliss, R., Janssen, J.H., Kegler, A., Kendziorek, M., Lawn, D., and Gundlach, E., "Initial State of Alaska Response to the Exxon Valdez Oil Spill, Proceedings of the 1991 International Oil Spill Conference," pp. 321-323. (Hereafter this paper is referred to as "Bayliss and others.")*

[11] *Various state, Coast Guard and Exxon documents.*

[12] *The National Response Team report of May, 1989, relates as an example that a skimmer with a gear box problem had to be towed for 12 hours to Valdez, where it joined two other skimmers in the shop as mechanics worked all night to repair the vessels.*

[13] *Gardner, D., unpublished DEC internal report on cleanup operations, Exxon Valdez Oil Spill Response Center, 1991. Other DEC reports cite shorter waits for off-loading — sometimes five or six hours — but the problem, from most accounts, was endemic.*

[14] *There is widespread agreement among state and Exxon reports on the effectiveness of the Egmopol skimmer.*

[15] *Various state and Exxon estimates say that pom-poms, the shredded plastic absorbents that look like things cheerleaders use, absorbed anywhere from 5 to 20 times their weight in oil and mousse.*

[16] *The RRT is described in Section 1.1, p. 10 of this report.*

[17] *Estimates such as these are not precise, but when properly computed they can give a reasonably accurate figure. To arrive at a figure like this, one first does a series of calculations to determine the area covered by the slick, the thickness of the slick, and the volume of oil contained in the slick. These calculations are based on observation, sampling, and known characteristics of crude oil. Variables can include the freshness of the oil (a third of a fresh crude's volume can be made up by volatile gasses that evaporate quickly), the percentage of the slick that is watery emulsion, and any other physical factor that might affect the volume, area, or composition of the slick. From there, a simple multiplication exercise produces the estimate.*

[18] *National Research Council, "Using Oil Spill Dispersants on the Sea," National Academy Press, 1989, p. 4.*

[19] *ARCO Alaska's Bill Wade, quoted in the April 18 issue of The Anchorage Times.*

[20] *Lawrence Rawl, interviewed in the May 8, 1989 issue of Fortune magazine, pp. 50-51. The magazine appeared on newsstands on April 24-25.*

[21] *Manuel Lujan, interviewed in the April 26, 1989 issue of USA Today, p. 11A. All quotes above come from that article.*

[22] *Governor Steve Cowper letter to Lawrence Rawl, April 28, 1989.*

[23] *Lawrence Rawl letter to Governor Steve Cowper, April 28, 1989.*

[24] *National Research Council, Committee on Effectiveness of Oil Spill Dispersants, Using Oil Spill Dispersants on the Sea, (Washington, D.C: National Academy Press, 1989), p. 4. More detailed discussion of this issue at pp 81-164.*

[25] *Environment Canada, "Acute Lethal Toxicity of Prudhoe Bay Crude Oil and Corexit 9527 to Arctic Marine Fish and Invertebrates," Report EPS 4-EC-82-3.*

[26] *Hahn, B., memorandum to Commissioner Dennis Kelso, May 1, 1989.*

[27] *Lawn quoted in Bridgman, J., unpublished department draft of DEC response history, Feb. 1990.*

[28] *The figures on available dispersant come partly from the National Response Team report to The President in May 1989, and partly from DEC records. Federal and state records agree that no aircraft or equipment were available in Valdez.*

[29] *Hull, p. 24.*

[30] *Hull, p. 30*

[31] *"Valdez Oil Spill Technology: 1989 Operations," Exxon Production Research Company, 1990.*

[32] *Robinson, J., NOAA scientific support coordinator, to members of the Alaska Regional Response Team, July 21, 1989. Robinson wasn't alone. A number of other coastal biologists were expressing informally that they had concerns about it and were getting this infomation back to the State scientists.*

[33] *Juday, G, and Foster, N.., "A preliminary look at effects of the* Exxon Valdez *oil spill on Green Island Research Natural Area," Argoborealis, University of Alaska Fairbanks, vol. 22, pp. 10-17.*

[34] *Houghton, J., Lees, D., Driskell, W., and Mearns, A., "Impacts of the Exxon Valdez Spill and Subsequent Cleanup on Intertidal Biota — 1 Year Later," Proceedings of the 1991 International Oil Spill Conference, March 1991.*

[35] *Houghton, J., Lees, D., and Ebert, T., "Evaluation of the Condition of Intertidal and Shallow Subtidal Biota in Prince William Sound following the Exxon Valdez Oil Spill and Subsequent Shoreline Treatment," NOAA Report No. HMRB 91-1, March 1991.*

[36] *Anchorage Daily News, April 10, 1991, page B 2, also "Report: Spill cleanup method was harmful," Associated Press report, Anchorage Times, April 10, 1991, page A 10.*

[37] *Houghton, Lees, Ebert, p. ES-5.*

[38] *This is somewhat of a generalization. A lot of factors can affect recovery, such as the relative health of the shorelines before the spill, the amount of oil spilled, the wave and wind action, the weather, and so on. The point, however, is that the extant literature includes a number of reputable sources that suggest an oil spill is not necessarily the ecological equivalent of a nuclear explosion.*

[39] *Gardner, D., and others, "Review of field activities during the Exxon Valdez shoreline treatment operations." Unpublished DEC review, Spring 1992, p. 17. Gardner was the principal author, although all the monitors who worked from 1989 through 1991 provided field notes, observations, and general comments for the review.*

[40] *Gardner and others, p. 18.*

[41] *A massive state-federal coastal habitat damage assessment study ran into the same kinds of problems. In some cases, the researchers on this $19 million study cannot establish whether damage is from oil or oil and treatment together.*

[42] *The most reliable would be the individual field notes of DEC monitors and the Daily Shoreline Assessment reports they filled out.*

[43] *Kuwada, M., Alaska Dept. of Fish and Game Habitat Division, memorandum to Piper, E., Alaska Dept. of Environmental Conservation, Jan. 30, 1991. Kuwada provided his department's comments on a draft of the report reviewed by ADF&G biologists several months before NOAA released the report.*

[44] *Kuwada memorandum, Jan. 30, 1991.*

[45] *Hull, Northwest EnviroServices, p. 35.*

[46] *Testimony of William K. Stevens, Exxon USA president, before the U.S. Senate commerce committee's subcommittee on the environment.*

[47] *Viteri, A., DEC, memorandum to Provant, S., DEC on-scene coordinator, August 12, 1989. Also, Glasser, W. and Gangmark, C., EPA, memorandum to Vice Admiral Clyde Robbins, September 5, 1989.*

[48] *Glasser and Gangmark, ibid.*

[49] *Glasser and Gangmark, Ibid.*

[50] *Vice Admiral Clyde Robbins, letter to Otto Harrison, Exxon, Sept. 10, 1989. Robbins disagreed with the state and other federal agency conclusions that Exxon hadn't shown it could contain and pick up Corexit as it washed off the beach. The language in his letter is interesting because it hints at the way many of these decisions hinged on various thresholds. Robbins wrote that Corexit wasn't a good alternative because, "there are no further heavily oiled beaches in suitable locations" for using the chemical, and that he couldn't tell from the tests whether the chemical was really effective. In other words, under different circumstances — i.e., a more desperate situation of widespread heavy oiling — the uncertainties about Corexit might be outweighed by the magnitude of the problem.*

[51] *Admiral Paul Yost lobbied Governor Cowper in person and in a letter in April 1990. Rear Admiral Ciancaglini was quoted in the Anchorage Daily News, March 31, 1990, supporting use of Corexit, "Beaches May Get Excavated," page A 1.*

[52] *See DEC's June 14, 1990 summary of the issue and discussion of all relevant facets of the debate, signed by state on-scene coordinator Randy Bayliss.*

[53] *Kitagawa, J. memorandum to Kendziorek, M., July 16, 1990.*

[54] *Vincent, J., memorandum to Bauer, J., July 17, 1990.*

[55] *Exxon's position never changed. The company simply maintained that the chemical was safe, that it was effective, and that containment and recovery were not a problem.*

[56] *Robinson, J., memorandum to Vice Admiral Robbins, July 21, 1989.*

[57] *Uniform abbreviations such as this were used for mapping purposes by the participating response agencies. The lengths of beach segments varied but were generally several hundred yards long.*

[58] *For some reason, the accepted unit of measurement for "moderate" boulders was the standard office desk chair.*

[59] *This section looks at bioremediation primarily as it related to critical decisions about the cleanup. Many of the footnotes in this section give the reader some sources of more complete technical analysis of bioremediation.*

[60] *This is a second-hand citation from a federal report on bioremediation: U.S. Congress, Office of Technology Assessment, "Bioremediation for Marine Oil Spills — Back ground Paper," OTA-BP-O-70, Washington, D.C. 1991. p. 2. The original citation comes from Applied Biotreatment Association, "Case History Compendium," November 1989.*

[61] *This is a grossly simplified statement of the theory, but it suffices as a preliminary introduction to the idea.*

[62] *John Enders, Associated Press, in the Anchorage Times, May 15, 1991, page A 1.*

[63] *Dr. Ed Brown and Jon Lindstrom, University of Alaska Water Research Center, personal*

communication.

[64] *It is extremely hard to come up with an exact "number of miles" treated with fertilizers in 1989, primarily because different mapping and recording systems counted a "mile of beach" in different ways. DEC's number is 74, and probably comes closer to the actual distance covered than the Exxon and EPA number of 110 miles. In any case, it was a field trial of unprecedented proportions.*

[65] *EPA Fact Sheet, Alaska Bioremediation Project, July 6, 1989.*

[66] *A more technical description of this process would be "sequestering nutrients at the oil-water interface," but basically it means using various chemical processes to optimize the effectiveness of the microbes once their population has been stimulated. To use a crude metaphor, Inipol is designed not only to create more microbes, but to make sure they keep their food right in front of them.*

[67] *Letter, U.S. Coast Guard Captain Zawadski to Bob Mastracchio of Exxon, dated July 26, 1989.*

[68] *Vice Admiral Clyde Robbins, letter to Otto Harrision, August 1, 1989. See also Viteri, A., and Kitigawa, J., DEC, "The Development of Policy to Review and Approve Bioremediation Enhancement Methods, etc." June 1990.*

[69] *Exxon workshop materials, Newport Beach treatment workshop, February 1-2, 1990.*

[70] *NOAA, "Recommendation to the Federal On-Scene Coordinator for 1990 Cleanup of the Exxon Valdez Oil Spill" January 25, 1990, p. 9.*

[71] *ADF&G notes, Newport Beach meeting, February 1, 1990.*

[72] *Piper, E., memorandum to Governor Steve Cowper, April 26, 1990. Pritchard made this statement at a briefing for state personnel in mid-February at DEC's Anchorage spill response headquarters.*

[73] *S. Provant, DEC, letter to Rear Admiral D.E. Ciancaglini, Feb. 15, 1990.*

[74] *See section 1.4, pages 30-32 of this report for a better idea of the role of the Interagency Shoreline Cleanup Committee on the cleanup, and on the basic differences in cleanup philosophy between the state and federal governments.*

[75] *Kuwada, M., ADF&G, memorandum to Provant, S., DEC, January 29, 1990. This statement from Fish and game is a good example of the different interpretations of pollution cleanup requirements described in Chapter 1.*

[76] *Cowper did not make any commitments about Corexit. Also, Yost may have misunderstood the Governor's promise about bioremediation. On March 30, Yost wrote a letter to Cowper to recap the conversation between the two men. The Commandant thanked Cowper for agreeing to* authorize *bioremediation by May 1, as opposed to the Governor's actual promise to render a decision by that date.*

[77] *EPA did not deliver the toxicity analysis until May 1; by that time the state had gone ahead and made its decision without the promised information. Exxon did not deliver its third, and last, study paper on the topic until April 26, which was actually the day the issue came before Governor Cowper.*

[78] *Clark's basic conclusions were drawn from standard toxicity tests using water samples in the nearshore area of a bioremediation test site in 1989. His secondary conclusions were based largely on literature searches conducted over the winter of 1989-90. These analyses were not exhaustive, nor were they intended to examine the full range of broader ecological questions. However, for purposes of designing a controlled, conditional program of fertilizer use, state and federal officials felt they had enough information to reasonably make a decision. Dr. Judith Capuzzo of Woods Hole Oceanographic Institute reviewed Clark's data (which appeared in a larger, joint EPA-Exxon-DEC study) and came to the same general conclusions. Capuzzo did her review at DEC's request.*

[79] *On those occasions when Fish and Game felt bioremediation was the best option available, they would sometimes allow fertilizers to be applied right up to stream banks, as long as the application occurred during one of the "open" windows for treatment.*

[80] *EPA Science Advisory Board, "Review of the Alaskan Bioremediation Oil Spill Project," Washington D.C., August 11, 1992.*

[81] *Exxon took the data back to the computer in 1992 and produced what company researchers feel is confirmation that the hopane ratio did change significantly at fertilized sites vs. unfertilized sites. But this information was unavailable at the earlier, critical decision points on bioremediation.*

[82] *Exxon also conducted some laboratory studies using various simulations of beach conditions, which lent some support to field data from other studies.*

[83] *Roger Prince of Exxon and Hap Pritchard of the EPA take this position. At times, each has hypothesized that the rate might have been even higher at certain sites, and under certain conditions.*

[84] *Brown and Lindstrom of UA-Fairbanks generally hold to a more conservative estimate than their colleagues at Exxon and EPA. A number of reviewers we consulted at a 1991 EPA symposium in Las Vegas leaned towards more conservative estimates, as well.*

[85] *Dr. Scott Kellogg of the University of Idaho and Dr. John Farrington of Woods Hole, whom DEC asked to review the study, came to somewhat similar conclusions in this regard. They were not asked, however, to review* all *available data and give DEC a recommendation about whether it was a good idea or bad idea to bioremediate. What we wanted from them was a realistic look at the single study, so that the state could keep its conclusions in perspective, and so that the joint study alone was not presented as definitive "proof" of certain rates of degradation.*

[86] *Lindstrom, of UA-Fairbanks, also suggested that the seasonal fluctuations of nutrient levels in the Sound might be a factor in deciding when to bioremediate. In the spring and early summer, when the flush of mountain snowmelt carries high concentrations of organic nutrients into the system, natural degradation rates might be very high. As an operational issue, that may mean it is an excellent time to bioremediate, or it may mean there's no need to bioremediate; it would depend on the oiling conditions and other factors. In the late summer and fall, when nutrients levels drop, fertilizers might provide an important boost, but one might not expect even a fertilizer-aided rate to be very high.*

[87] *U.S. EPA Science Advisory Board, "Review of the Alaskan Bioremediation Oil Spill Project," June 1992.*

[88] *Ibid., p. 3.*

Chapter 3: Cleanup, 1989-92

The T/V *Exxon Valdez* ran aground on Bligh Reef, about 25 miles from the Trans-Alaska Pipeline terminal at Valdez, on March 24, 1989, at 12:03 a.m. Eight of the 11 cargo tanks were ruptured and Alaska North Slope crude oil began gushing from the tanker into the waters of Prince William Sound. The state and federal governments estimate that 250,000 to 260,000 barrels of North Slope crude oil (11 million U.S. gallons) spilled from the tanker.

The state's response effort began with Dan Lawn, the Valdez District Office manager from the Alaska Department of Environmental Conservation (DEC). Lawn was notified of the spill by Alyeska at 1:05 a.m. He then spoke with the Coast Guard captain of the port, CMDR Steve McCall, and made arrangements to accompany the Coast Guard to the site of the grounding. Before setting off for the high-speed trip to the tanker in a Valdez pilot vessel, Lawn triggered (within state government) a chain reaction of notification that called up responders from Anchorage, Wasilla, and Juneau beginning about 4 a.m. Within 24-30 hours, DEC would have more than 30 people in Valdez setting up the aerial surveillance, general monitoring, computer mapping, and other programs that would function in one form or another for the better part of three years.

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Lawn would remain on the tanker for the next 15 hours, using the ship's satellite telephone to call Anchorage and Valdez with regular updates on the amount of oil lost and the stability of the vessel. He also made regular calls to the Alyeska terminal, asking when the equipment and responders required by the Alyeska contingency plan would arrive. Alyeska officials repeatedly assured Lawn that the gear was on the way, when in some cases it was not even loaded on barges or vessels.

Commissioner Dennis Kelso of the DEC got word of the spill about 6 a.m. from his deputy, Amy Kyle, who had been phoned at home by Anchorage DEC staff at approximately 4 a.m. Kyle and the department's environmental quality staff set up some preliminary plans and arranged a full briefing for the Governor and the commissioner at 8:30 a.m., as the magnitude of the spill began to become clear. Governor Steve Cowper had learned of the spill about an hour earlier, from a reporter who was conducting an early-morning interview with the Governor in his hometown of Fairbanks. At the close of the interview, the focus of which was completely unrelated to oil or the environment, the reporter asked Cowper his thoughts on the spill. When Cowper heard the details, he immediately began making arrangements to get to Valdez. After speaking with Cowper by phone from Juneau, Kelso caught a regularly scheduled flight from Juneau to Cordova, on the southeast rim of Prince William Sound. From there, a U.S. Coast Guard helicopter took him to Valdez, where he met the Governor. About 4 p.m., the Governor and Kelso flew by float plane to the *Exxon Valdez*. On board they met Lawn and DEC investigator Joe LeBeau, who pointed out that equipment was overdue, and that what was on-scene was not working very well.

Two skimmers — which were full at the time — were motoring somewhat aimlessly around the massive slick. There was little or no boom deployed, and what was in the water were tiny strings of boom that were neither containing nor deflecting any significant amount of crude. Cowper was incensed by what he would later call a slow and inadequate response. He was also aware of the possible use of dispersants. Kelso and Lawn gave him a quick briefing on the zones of use and the approval process, and Cowper gave no instructions that would alter or affect the preapproved strategy. He understood, correctly, that the system had been designed to make sure that chemical dispersants were used in a controlled and effective manner, and that critical habitats would not be put at risk by bad targeting or misuse of the chemicals.

Back in Valdez, after visiting the tanker, Cowper appeared at a community meeting and press conference at the Valdez civic center. Exxon's chief executive officer Frank Iarossi had spoken to the group earlier, noting that Exxon would be moving quickly to use dispersants on the growing slick. This made the public, especially the fishing community, somewhat uncomfortable. The implication of Iarossi's statement was that dispersant use was the response of choice, and that Exxon was moving ahead to do it. This was at odds with the plans in place — which the fishing organizations had reviewed — and it implied that Exxon had some authority to take controversial and potentially risky steps to deal with the oil spill that threatened public health and public resources. Fishermen wanted some assurance that someone other than Exxon was at the switch, someone or some entity that was accountable to the public. They were not eager to hand over to a private company the authority to make critical decisions about public resources — resources that were literally the foundation of the area's economy. And from Iarossi's comments, it seemed the decision was all but made.

When Cowper stepped before the group, he was asked about Iarossi's statements. He replied, "There has been a lot of speculation on the use of dispersants. Everybody realized the risk that that poses to marine life . . . . I want to assure everybody that dispersant is not going to be used in anything other than a carefully targeted way. We want to make sure that we check back with the fishing community, that we check with the [Alaska Department of] Fish and Game, and do as little damage as possible. You can't use dispersants without doing damage to marine life. That's clear. But we want if possible to keep the oil off the beaches."[1]

Cowper had crystalized in his comments exactly the type of discussion the Alaska Regional Response Team and state agencies had gone through in developing the preapproval process for dispersants two weeks before the spill. He was merely assuring the people in the Valdez civic center that there was an established mechanism for making these public policy decisions, and that no one had unilateral authority to circumvent the process or change the rules.

At the time Iarossi made his comments, he was not familiar with the process[2] and was, perhaps, assuming more authority than Exxon actually had. Cowper's comments were not some new state policy; the Governor was, instead, letting people know that the government understood the risks and the benefits of dispersants, and that the protection of the fisheries and the local economy was among the government's central concerns.

Aside from the obvious priorities of public and environmental health and safety raised by the tanker disaster, the first three or four days of the spill were dominated by four principal issues:

a) the inadequacy of the Alyeska response;

b) the confusing and unauthorized "hand-off" of the spill by Alyeska to Exxon;

c) the dispersant disagreement;

d) the gross lack of cleanup resources.

Aside from the obvious priorities the first three or four days of the spill were dominated by four principal issues:

- the inadequacy of the Alyeska response;
- the confusing and unauthorized "hand-off" of the spill by Alyeska to Exxon;
- the dispersant disagreement;
- the gross lack of clean-up resources.

Alyeska's response was slow and weak; it did not meet the requirements of the contingency plan. It is important to keep in mind that the contingency plan was not so much a set of requirements established by the government, but rather a set of response standards that Alyeska had agreed were reasonable and attainable.

The "hand-off" of response authority by Alyeska to Exxon caused confusion and delays. Exxon assumed for itself a role as chief responder, and comments made by Exxon officials sent a message to the public that the governments were not really in charge of making key decisions and protecting public resources and the public interest.

The dispersant issue was discussed in more detail in chapters one (The Oil Spill Response Organization) and two (Treatment Technology). From the standpoint of the progress of the response, Exxon's insistence on following its own preferred strategy — and its reluctance to concentrate on the strategy preferred by the government, even after the technical results of dispersant drops were inconclusive — compounded a botched response by Alyeska.

All of this, however, is tangential to the real issue, which was becoming increasingly clear to the Alaska public: No one was fully prepared to deal with a spill of this magnitude. There wasn't enough equipment, and technology did not provide deep redundancy or a broad range of options. The mechanical capabilities were overwhelmed, and the chemical possibilities had severe limitations. Burning worked for a little while, but the window of opportunity closed quickly as the oil slick began to have a higher water content. The conditions were marginal for dispersants, regardless of the risks the chemicals presented.

The public was outraged. The fishing community, especially in Cordova, was suddenly and unexpectedly confronted with the fact that industry and government either didn't know or didn't fully explain the fragility of the safety net underneath the Trans-Alaska Oil Pipeline System and the tankers that cruised almost daily through Prince William Sound.

In any case, the weather put a quick end to the initial response. Late on Easter Sunday, March 26, a severe, late-winter storm was approaching the Sound. Between Sunday and early Monday morning, the wind blew gusts up to a maximum of 73 miles per hour (70 mph is considered "hurricane force"). Flight operations were seriously curtailed, although a National Oceanic and Atmopsheric Administration (NOAA) helicopter got into the air before noon Monday. Observers noted that the oil was no longer in a single, compact slick. Breakaway patches and thick windrows of oil and mousse hit shorelines in the vicinity of Smith, Seal and Naked islands. Oil stretched as far as 40 miles south-southwest of the grounding site. Skimmers and other response vessels had retreated into more sheltered areas, away from the oil, to wait out the weather.

By March 30, a week after the spill, various estimates of oil recovery hovered around 5,000 barrels (about two percent of what was spilled).

By afternoon, the winds had fallen somewhat, but were still high. Within Valdez Arm itself — more protected than the relatively open waters between Bligh Reef and the western islands of the Sound — northeast winds were running a steady 30 knots with gusts to 40; seas were four feet within the arm, higher and choppier and sloppier outside.[3] A few surveillance aircraft got into the air that afternoon. Later reports showed that oil and mousse were already on or near the shores of Eleanor and Knight islands.

If the spill was at first overwhelming, it was now out of control. Throughout the rest of March and most of April, various configurations of skimmers and boom and barges would attempt on-the-water cleanup, but actual recovery of oil was extremely low, compared with the size of the problem. By March 30, a week after the spill, various estimates of recovery hovered around 5,000 barrels (about two percent of what was spilled), and even that figure was somewhat misleading, considering that the total estimate of recovery included water and mousse, not just oil. NOAA estimated that an additional 75,000 - 100,000 barrels had probably evaporated, as the lightest fractions of the crude oil turned to gas and dispersed in the atmosphere.

After the Easter storm, the effectiveness of on-the-water recovery could really not be judged in a cumulative sense. Oil patches were spread widely throughout the western Sound and, as the weeks went by, to the Kenai Peninsula and the Kodiak archipelago. Recovery varied from site to site, and success could most realistically be judged against a specific threat to a specific resource or shoreline. As a whole, on-the-water recovery was hampered by weathering oil, long distances, equipment limitations, storage limitations, and spotting capability. By the first week of May, there was no real effort to contain and collect free-floating oil.

The agencies and responders turned to several major tasks: planning and coordination for shoreline cleanup; defensive booming, especially at the Prince William Sound hatcheries; and stabilizing the *Exxon Valdez* and getting the remaining one million barrels of oil off the ship.

3.1 The *Exxon Valdez*

Oil tankers are designed to be full. The stability, seaworthiness, and structural integrity are all based on the assumption that the vessel will be full (or partly so) with oil or water most of the time. Storage tanks are designed such that the volume and weight of the fluid in the tanks is balanced among various sections of the vessel. The *Exxon Valdez*, hung up on a rock and spilling its guts rapidly into Prince William Sound, was more than a boat with some holes in it; it was an extremely unstable and unbalanced container exposed to abnormal stress and pressure within and without. It was also still full of about one million barrels of oil, and in danger of breaking up and spilling its entire cargo.

Within a few hours of the grounding, the Coast Guard and DEC authorized an inbound tanker, the Exxon Baton Rouge, to discharge its dirty ballast. The Baton Rouge then steamed for Bligh Reef and its sister ship, and by 9:45 p.m. on March 24 the ships were rafted up. Portable pumps, hoses, line reducers and other equipment were hooked up, and the lightering operation began. It was not a simple matter of pumping oil from one vessel to the next; it would be also a tricky process of maintaining the vessels' stability and balance as oil came off the Valdez and sea water came in.

The first lightering hoses were connected about midnight, and pumping began about 7:30 a.m. on Saturday, March 25. Lightering operations would continue for the next 11 days[4] and include three tankers: the Baton Rouge, the Exxon San Francisco, and the Exxon Baytown. Transfer rates varied from a few thousand to 12,000 gallons per hour. The Baton Rouge took off 460,000 barrels before leaving on March 30; the San Francisco received about 450,000; the Baytown took 120,000 barrels. About 20,000 barrels remained aboard the Valdez at the close of lightering operations April 4. The ship was refloated at high tide on April 5 and moved to an anchorage off Naked Island. The vessel was towed to drydock in San Diego beginning June 20.

Lightering and salvage of the crippled *Exxon Valdez* was one of the few success stories from the first month of the spill response.

3.2 The emergency order

The *Exxon Valdez* oil spill — and the problems with the response — threw into question the entire Valdez-based prevention and response system. Alyeska had shown that even with ideal weather, it could not meet the requirements of the state-approved contingency plan. While the port of Valdez was temporarily closed during the early days of the response, the limited holding capacity at the Valdez terminal meant that at some point — some point relatively soon after the spill — tankers would be again loading oil at Valdez and making the passage through Prince William Sound. The Coast Guard had imposed several emergency restrictions on traffic in and out of the port, but a longer-term and more comprehensive plan was obviously necessary. DEC moved quickly to come up with an order for emergency upgrades in the response capability and the prevention system at the Valdez terminal.

Boom that sits much deeper in the water than that on hand during the initial response to the *Exxon Valdez* spill is now part of Alyeska's response equipment. Alyeska and the 13 oil companies which ship oil from Valdez all have beefed up their reponse equipment, which is deployed in periodic spill drills. Photo by Rob Schaeffer

During the first week of April,

DEC staff began preparing a list of emergency requirements. The list would be presented in the form of an emergency order from DEC that also required a new contingency plan. DEC's director of environmental quality, Larry Dietrick, came up with the list and delivered it to Alyeska on April 7. Dietrick's list had the approval not only of the commissioner, but of the Governor as well.

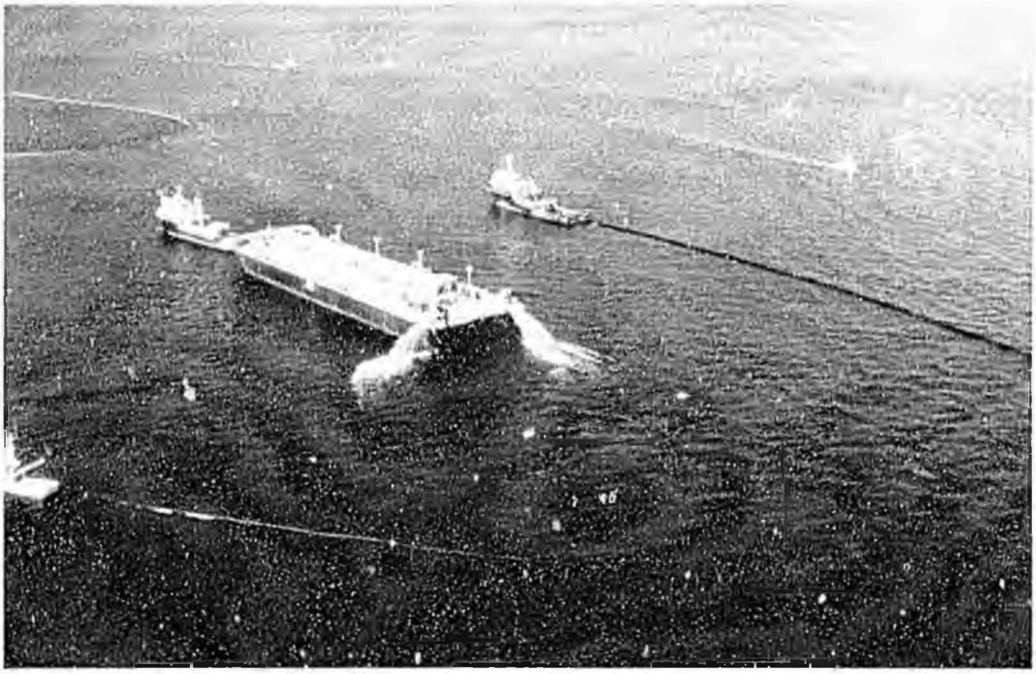
The emergency order requirements included:

- Alyeska had to do a complete inventory of "core" response equipment available *other than what was in use on the Exxon Valdez response.*
- The company must create a fulltime spill response team at the Alyeska terminal.[5]
- At the terminal, tankers were to be boomed immediately upon arrival, with boom inspection to be conducted every hour.
- Outgoing (i.e., loaded) tankers had to have two escort tugs from the terminal to Hinchinbrook Entrance, southeast of Cordova and the Copper River Delta.
- A marine pilot was required to be on the tanker or on the accompanying escort tug all the way to Hinchinbrook; until the *Exxon Valdez* groundings, pilots left the vessel soon after passing through Valdez Narrows and the village of Tatitlek.
- DEC specified a laundry list of new spill response equipment, along with several specific standards for recovering and lightering oil, and new deadlines for deployment of equipment from the Valdez area all the way to Hinchinbrook.
- Alyeska was also required to upgrade both its radio communication capabilities and the procedures for tracking radio messages.

The order included deadlines for compliance, and Governor Cowper said he was ready to shut down the pipeline if the oil companies did not follow through in good faith and in a timely manner.

Alyeska chose not to challenge the order. Instead, in a series of negotiation sessions and meetings with state officials, the government and Alyeska worked out mutually agreeable alternatives to some of the order's provisions. DEC agreed to give Alyeska more time to procure certain equipment, and worked on several solutions to communications problems. Alyeska also outlined a plan that went considerably further than the idea of escort tugs. The company instead committed to the purchase and outfitting of larger escort vessels, which included special dedicated response crews and equipment on board.

This, along with other changes due to the emergency order, became the foundation for Alyeska's upgraded response system and the implementation arm of the new contingency plan. Alyeska now operates the Ship Escort/Response Vessel System (SERVS). The 10-vessel SERVS fleet includes three, 210-foot tanker towing and oil recovery vessels; all outgoing tankers have a two-ship escort.



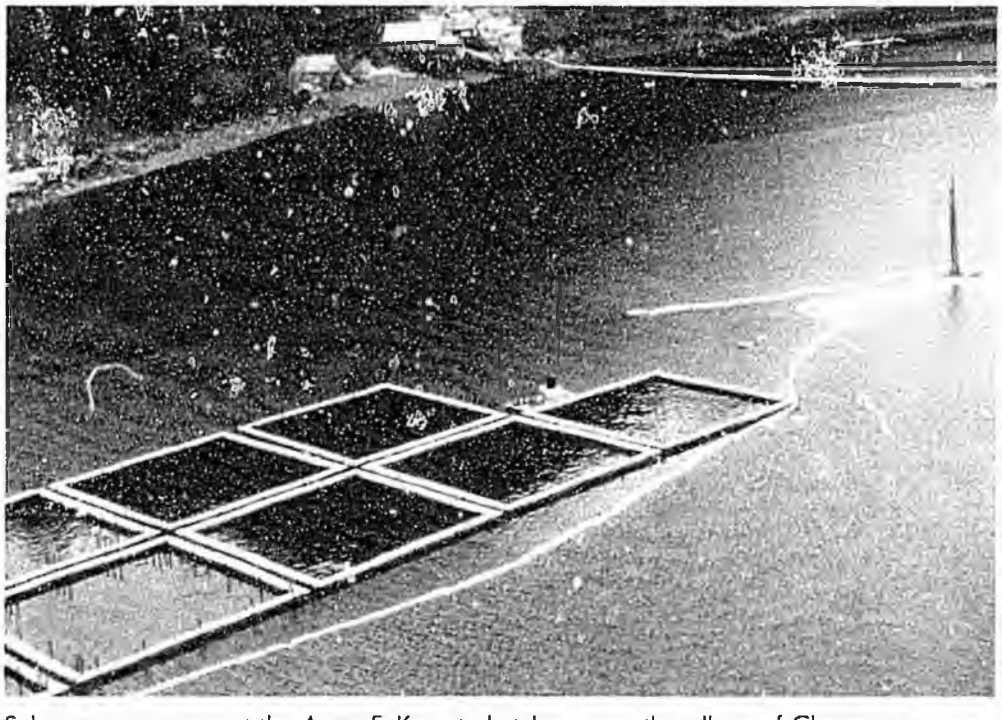
A barge for recovered oil trails two powerful skimmers, cradled by boom and support vessels during a Chevron test of new response equipment in Prince William Sound, March 1992. The equipment is part of Alyeska's new Ship Escort/Response Vessel System.

Photo by Patrick Endres

By Sunday, March 26, state officials had decided to expand the state's usual oversight role. Governor Cowper authorized DEC to do whatever was necessary, regardless of cost and regardless of legal strategy.[6] Frustrated by the size of the problem and the holes in the response, DEC began working with the local fishing fleet, primarily from Cordova, on a series of defensive measures and cleanup actions. The Cordova fleet had been trying, without success, to convince Alyeska to include the local vessels and skippers in the response. DEC Commissioner Kelso and environmental quality director Larry Dietrick made a point of including the fishing community in deliberations, discussions, and plans for action. At 10:30 a.m. Sunday, DEC informed the Coast Guard that the state was taking independent action.

The storm that scattered the spill on Sunday and Monday delayed the arrival of the Cordova seiners in Valdez. Upon arriving at the dock in Valdez, the vessels took on fuel and supplies, as well as DEC and contract staff. On Tuesday, March 28, the seiners headed for Disk Island; when they awoke on Wednesday at Disk, oil was already floating around them.

The principal task facing the Cordova fleet was protection of the handful of salmon hatcheries on the west side of the Sound, especially the Armin F. Koernig hatchery at Sawmill Bay, Evans Island, and the town of Chenega. Based on weather, currents, and information provided by the fishermen themselves, DEC estimated that the main body of the floating oil was three days away from Sawmill Bay. There was one DEC oil spill response veteran and an expert on contract, and they began stringing defenses with the help of Chenega residents, using some boom already at the hatchery.



Salmon-rearing pens at the Armin F. Koernig hatchery near the village of Chenega at Sawmill Bay on April 8, 1989. Photo by Erich Gundlach

The original plan called for deploying three strings of boom, 12,000-15,000 feet each, in layers from the entrance of the bay back towards shore and the hatchery. The group needed heavy duty boom, but all they would have for the first few days were various types of relatively light-duty containment and absorbent boom.

A second cluster of Cordova District Fishermen United (CDFU) seine vessels arrived at Sawmill Bay on March 29-30 and began to help string deflection boom. Flying weather was poor (either due to fog at Valdez or low weather in the Sound), which delayed the delivery of boom by helicopter. However, by midday on Thursday, March 30, Alaska Air National Guard helicopters began dropping absorbent and containment boom into the bay, the seiners and skiff operators picking it up and stockpiling or stringing it. While the first flights allowed the Sawmill Bay responders to begin building defensive lines, the material they had was not well suited to the task.

"The water, moving 7-8 knots or faster through here, is faster than the rated performance of the boom," DEC's field supervisor wrote on March 31. "So far we are

Bags of absorbent and containment boom were dropped into Sawmill Bay by Alaska Air National Guard helicopters. The material was picked up by seiner and skiff operators to be stockpiled or stockpiling or put to use. Photo by Geoffrey Orth ©

experimenting with multiple anchoring systems and radical boom angles. Continuing to use lighter duty boom for additional levels of protection between main containment boom and hatchery ...

"[The main containment boom] is really taking a beating where we have it in a deflection mode, and we are replacing several hundred feet of it per day. This boom is nearly ten years old and has spent much of its life stored on the North Slope, being used maybe once or twice a year for spill drills."[7]

The Cordova fishermen and DEC used various creative configurations of absorbent boom, pom-poms, and containment boom to build defensive lines whose strength was the sum of many improvised parts. Onshore, crews rigged cleaning and repair lines for the many hundreds of feet of damaged and soiled boom. On-the-water patrols improvised repairs and connections to the lines with whatever they could scrounge.

"Since we have many different types of boom (most of which have incompatible end connectors), Bryson [Twidwell, DEC], armed with a battery-powered drill and all the spare nuts and bolts from the hatchery and the village he could find, managed to connect the boom together."[8]

Meanwhile, back in Valdez, CDFU leaders and DEC officials realized that the Sawmill Bay defenders needed more logistical and vessel support. Several people suggested that the state send one of its ferries. In a 2 a.m. call to Alaska Department of Transportation commissioner Mark Hickey, DEC commissioner Kelso asked if he could "borrow" one of the state ferries. Hickey's immediate reply was simply, "Which one?"[9] Hickey arranged to divert the M/V Bartlett (which normally works the Valdez-Cordova-Whittier route) to Sawmill Bay; the ferry, which would be used primarily for repairs, supplies, housing and storage, arrived April 2. The Bartlett had fresh workers, fresh water, and supplies, including two dozen aluminum skiffs to augment the 16-skiff CDFU workboat fleet.

During the two weeks of intense operation at Sawmill Bay, most of the oil skimming was done by fishermen, contract workers, and DEC staff, who used simple tools such as five-gallon plastic buckets.

The Bartlett arrived the same day as the oil. Until April 2, most of the oil that had arrived had come in the form of tendrils or patches spun off the main body of the slick. That Sunday, a big tidal surge brought large slugs of oil and mousse to the brink of the defensive lines. Some oil got through, but most of it was deflected or contained by the booms.

Over the next few days, more vessels and equipment arrived at Sawmill Bay. A larger state ferry, the M/V Aurora, replaced the Bartlett; several large work and holding barges arrived, as well as the first of the "Supersucker" vacuum trucks from the North Slope oilfields. The vacuum trucks had been hauled by road from the slope to Valdez, then mounted on barges. The vacuum barges quickly became critical to the skimming and transfer operations at Sawmill Bay, sucking oil and mousse from containment boom corrals and transferring it to barges for removal.

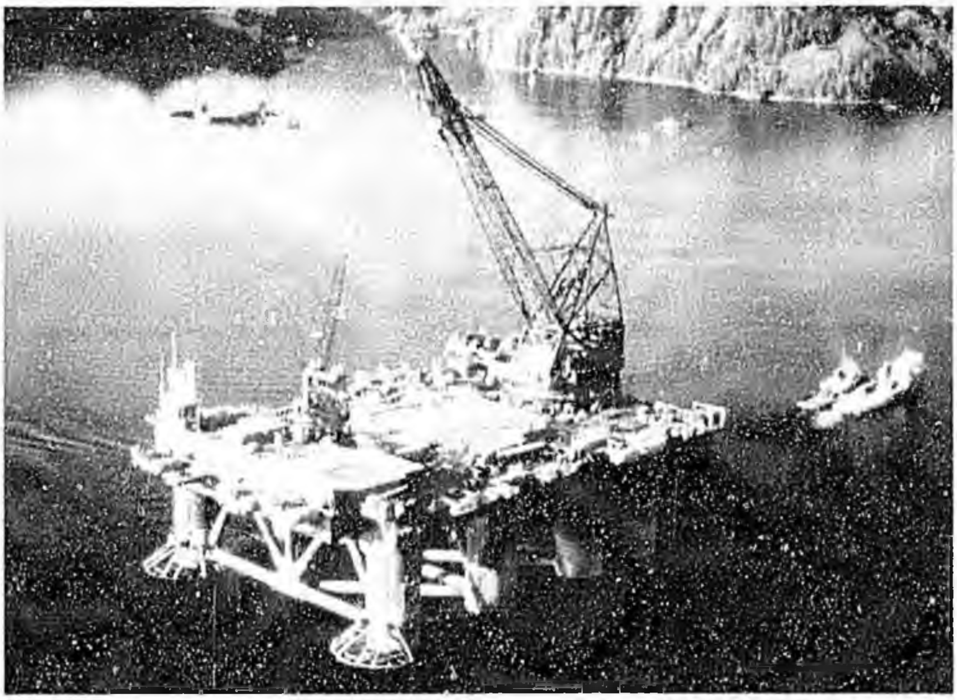
Yet during the two weeks of intense operation at Sawmill Bay most of the oil skimming was done by fishermen, contract workers, and DEC staff, who used simple tools such as five-gallon plastic buckets. Fishermen were literally scooping oil from the surface by hand, yet DEC reported several days in which the so-called "mosquito fleet" recovered more than 1,000 barrels of oil/water mix.

The "Battle of Sawmill Bay" was a successful partnership of private and government efforts. It was the focus of the efforts to protect the three west side hatcheries and the Eshamy Lagoon, site of one of the areas most important wild stock (red) salmon fisheries. These areas are the foundation of the Prince William Sound commercial fisheries, and therefore the foundation of the local economy.

More than 50 Cordova fishermen, the village of Chenega Bay, The Prince William Sound Aquaculture Association, 60 DEC and contract staff, 40 private vessels, two state ferries, the Alaska National Guard and the Alaska State Troopers played central roles in the operation. At a time when oil was swirling throughout the western Sound and fouling beaches, when skimming and containment in other areas was only occasionally successful, the defense of the hatcheries provided both a substantive and psychological lift to the oil spill response. The state worked hard to bring the Cordova fleet into the response as active partners, but it is important to note that much of the initiative for the effort — from mobilizing vessels to finding the North Slope vacuum trucks — started with the fishermen of the Sound.

3.4 Cleanup operations

April was more a month of planning than cleaning in 1989. There was the brief, almost bizarre effort at individual rock wiping at Naked Island the first week of April, as well as some limited efforts to rake and collect oiled seaweed. On April 12, Coast Guard Commandant Admiral Paul Yost arrived in Alaska and told Exxon to produce a shoreline cleanup plan. During the next few days, Yost made it clear that hot water washing was his preferred method of treatment.



A piece of irony in the spill's aftermath, this huge North Sea drilling platform was used for housing of cleanup workers in Lower Herring Bay.

Photo courtesy of the Exxon Valdez Restoration Office

Within two days of Yost's arrival, Exxon submitted a preliminary shoreline cleanup plan, one most government and public agency representatives considered more of an outline than a plan. The 21-page document stated that Exxon would wash about 300 miles of shoreline with cold water, employ about 4,000 workers, and be done September 15.

The Interagency Shoreline Cleanup Committee, recently formed, said Exxon was not thinking big enough: Aerial surveys and other information put the total amount of oiled dshoreline inside and outside the Sound at more than 1,400 miles. The Coast Guard gave preliminary approval to the plan, but Admiral Yost and others clearly felt they needed more information, more complete planning, and better assurance of performance. The DEC and other state agencies mentioned similar concerns, but also insisted that Exxon produce a comprehensive plan that included waste management, additional surveys, and other associated activities.

The state also questioned an early plan to put workers in land-based camps, citing, among other things, the problems with human waste and the impact of the camps on the uplands.

As it would turn out, all workers throughout the response would be based on vessels, barges, and other watercraft. The state ferries that appeared on the scene in early April were just the first — and by no means the largest — vessels that joined the cleanup navy. Real U.S. Navy vessels, Coast Guard cutters, commercial cruise ships, barges with portable trailers, and a huge North Sea drilling platform all came into service in Prince William Sound and the Gulf of Alaska.

The decision to house workers offshore in some ways limited actual cleanup operations; housing and transferring workers from vessels to shore, and shore to vessels, cut down on some of the time spent on the beaches. However, it eliminated or minimized several very importrant potential problems: bear encounters, destruction or disruption of archeological sites, disagreements over land use and land ownership, and others. In April, no one really knew how large the cleanup presence would grow; by August, when thousands of people and support personnel were involved, the decision to base everyone the water seemed, in hindsight, a practical one despite the limitations and challenges it presented. In fact, over time, control of access to shorelines and uplands became a central aspect of the cleanup. Private landowners (almost exclusively Alaska Native corporations) did not want people swarming onto private uplands. Waste disposal and destruction of vegetation were only part of the issue. Protection of archeological or other culturally significant sites was of paramount concern, as was the "discovery" concept. Private landowners were concerned that people would "discover" new areas for hunting, fishing, camping, archeological searches, etc., and return to the sites long after the spill, visits that would amount to trespassing at best, and looting at worst.

Artifacts taken from cleanup bags. Photo by Dave McMahon

In fact, archeological experts for the state noted that archeological disruption in Prince William Sound had been occurring for a number of years before the spill, but it happened primarily on a few established routes.[10] These routes evolved over time and were defined almost exclusively by the fuel tank size of the average recreational or fishing vessel working out of ports such as Whittier, Valdez and Cordova. Because there was no fuel or other service available outside of these ports, most vessels could only go so far, and usually turned around at well-known, common points of reference on the shoreline. A map of sites prone to vandalism or artifact hunting[11] could, until, the *Exxon Valdez*, be drawn entirely within the boundary of an arc defined by one-half a tank of fuel for the average-sized vessel out of a given port. But during the *Exxon Valdez* response, fuel caches were left at various sites around the Sound and Kodiak Island. Vessels could run to the limit of their fuel capability, then refuel far from home. This increased the range of most vessels and allowed local skippers to "discover" new areas of interest that they otherwise would have never seen.[12]

A second access issue was raised by various wildlife management agencies, primarily the U.S. Fish and Wildlife Service (USFWS) and, to a lesser degree, other state and federal fish and game officials. Federal officials developed, over a few months, special restrictions on shoreline access and activity depending on whether eagles were nesting nearby, or marine mammals regularly hauled out at certain sites, or where shorebirds nested and reared young. The complexity of the ecological system — not to mention the overlapping authorities of government agencies and private landowners — made any long-range planning effort especially difficult. In some cases, special wildlife protection restrictions were established by agencies specifically for the *Exxon Valdez* response, becoming, in a way, *ad hoc* regulations promulgated in response to Exxon cleanup proposals.[13]

The sensitivity of certain kinds of habitats — salmon spawning areas, most often — were part of the cleanup plan from the start. Cleanup was scheduled at most sites during "windows" that were open when animals were away.

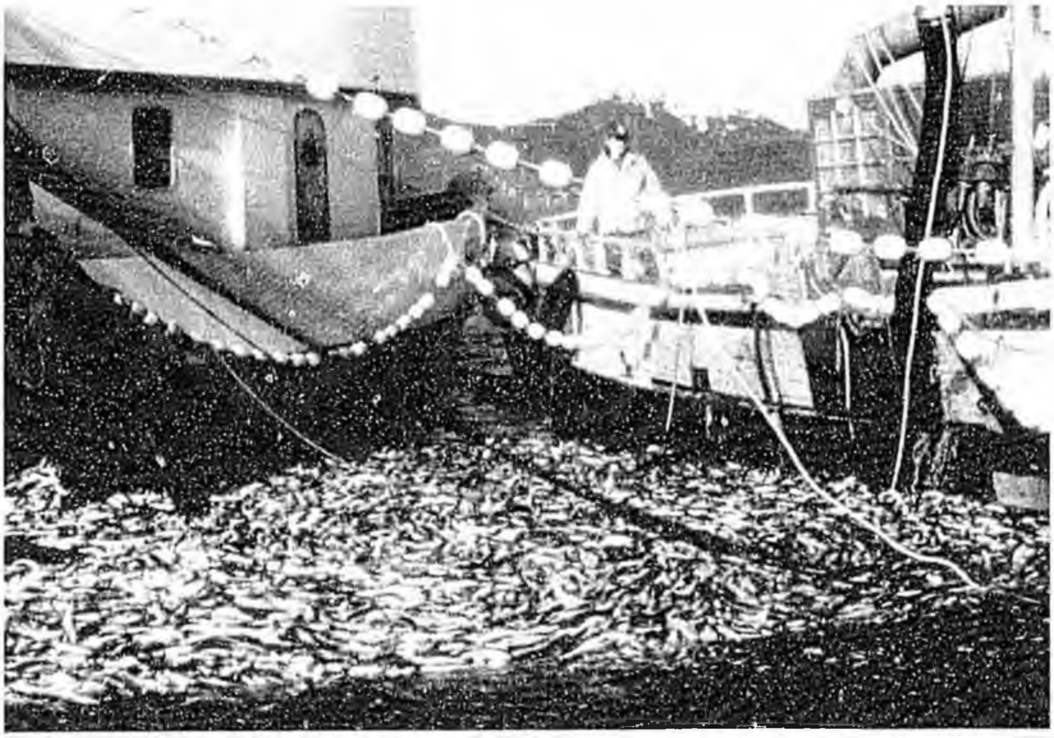
The sensitivity of certain kinds of habitats — salmon spawning areas, most often — were part of the cleanup plan from the start. The state fish and game department was one of the primary planners in the resource assessment effort, and salmon streams remained the single most consistent cleanup priority from start to finish. However, the cleanup schedule and habitat concerns were based primarily on timing, rather than topography or vegetation. Cleanup was scheduled at most sites during "windows" that were open when animals were away, and closed when animals showed up to spawn, give birth to young, or nest.

For this very reason, the state and federal governments pushed Exxon to get crews in the field, doing meaningful cleanup, before May 15. This was the date that biologists expected many animals to show up in large numbers; the biggest immediate concern was to clean seal "haulouts," i.e., the rocky sites where seals come ashore to give birth to their pups. In the northwest part of the oiled area, these pinniped haulouts were concentrated in and around Smith, Little Smith, Green and Seal islands, along with Applegate Rocks, a shoal that is exposed at most low tides and awash at high water. It was at Applegate Rocks where crews experimented with peat as an absorbent, spreading the soil on rocks and on pools of oil. Peat was not used elsewhere, however, as officials decided that cleaning was just as difficult as spreading, collecting, and disposing of the peat.

The cleanup window for pinniped haulouts was opened only narrowly, a biological and logistical problem that was never really solved during the cleanup from 1989-92. Little Smith Island, which had seabird restrictions as well as pinniped haulouts, was neither cleaned nor completely surveyed after the spring of 1989. Seal Island, a small, relatively remote and exposed island, was the site of brief cleanups through 1991, but crews never were able to spend enough time there. In May 1991, the state convinced Exxon to send a crew to Seal Island to work on a heavily contaminated shoreline adjacent to a rocky spit used heavily by the seals. The narrow work window was shortened even more by weather delays, crew changes, and other logistical problems, so the few days of work never really approached the solution that was necessary. Several other sites, including Perl and Elizabeth islands, also got limited cleanup due to wildlife windows; they were not even surveyed in 1991 or 1992.

The point here is not that wildlife restrictions hampered the cleanup; rather, it should be understood that the very sensitivity of the Sound's ecology and habitats often prevented adequate, site-specific cleanup. Whether it was as a result of marine mammal restrictions, seabird colony protection, buffers around eagle nests, or other measures designed to protect migratory or resident species, cleanup was often curtailed or eliminated, even if it was technically possible to remove the oil. Schedules for cleanup were determined not so much by sequential logic — i.e., north to south, inshore to offshore, etc. — but by wildlife windows. In the end, at some places the cleanup ran out of time, not out of oil.

This is a lesson that should not be lost on the people preparing contingency plans and risk assessments not only for Alaska, but other rich wildlife areas: Plans should never assume that damage can be mitigated by cleanup, since cleanup may be impossible.



A herring catch, using seine nets. Photo by John Hyde

Commercial fishing

The next major phase of cleanup planning revolved around the openings of salmon seasons and the return of salmon to spawn in their home streams and coves. At first, state biologists and fishermen assumed that some commercial fishing could take place in the Sound, Cook Inlet and Kodiak. During the 1987 T/V Glacier Bay spill in Cook Inlet — occurring near the peak of the red (sockeye) salmon harvest season — fishermen were allowed to work areas that appeared to be free of oiling.

However, the *Exxon Valdez* lost almost 100 times more oil than the Glacier Bay. The oil swirled throughout every fishing district from Prince William Sound to Cook Inlet, Kodiak, and even parts of the Alaska Peninsula. The problem was not with the fish, crab or shrimp — at least not directly. The creatures were below the surface, for the most part, away from the oil and unlikely to be directly tainted.[14]

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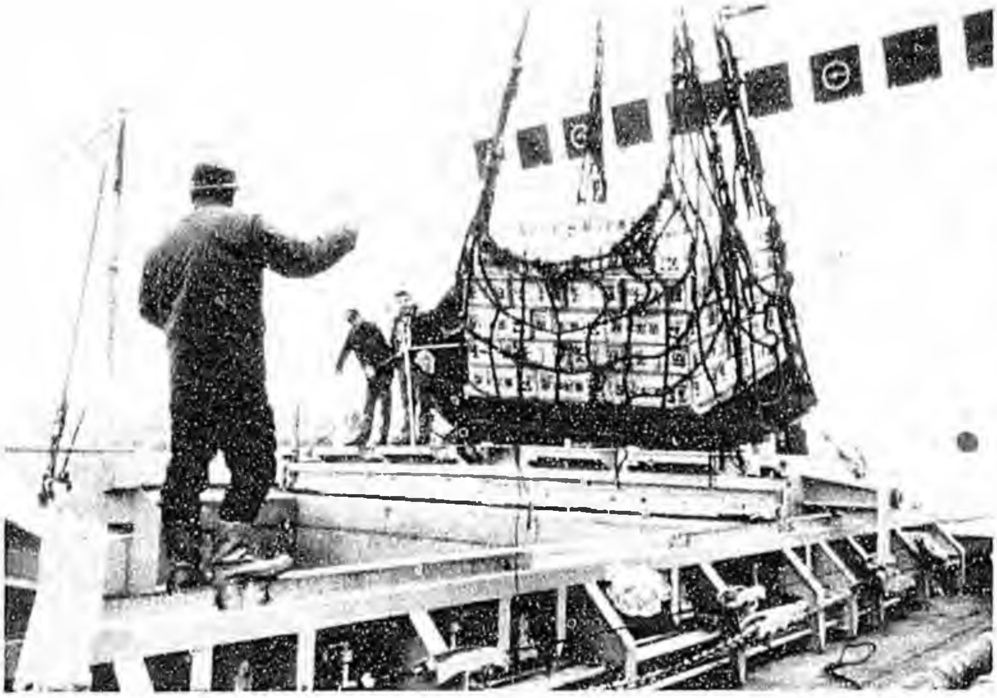
The problem, instead, lay with the gear and the fishing techniques. Fishermen pulling pots, longlines, nets, and other gear up through the water's surface — and perhaps through oil — raised one potential oiling problem. A second problem could occur on deck or in the holds, if a part of a catch were oiled and stored with unoiled fish in the hold. A third problem could occur in the transfer of fish from the hold of a vessel to a tender (a larger collection vessel), and from the tender to the shoreside processing plant. A fourth potential path for contamination was in the processing plant itself; if any contaminated product inadvertantly moved through the processing line, the machinery and work areas would be fouled for every other fish coming through.

The chain of problems, from net to processing plant, was potentially overwhelming, and the risk was real. Fish and Game considered opening parts and subparts of various districts, but this was judged to be a management nightmare. Managing fisheries cove by cove would have required massive numbers of trained observers working from the air. It also would have required communications and coordination that could shut down a part of an area on a moment's notice, since oil was mobile throughout the fisheries districts.

For the fishermen, the job would be just as difficult. Fishermen were reluctant to gear up their vessels — which requires a substantial, up-front investment in food, gear, fuel, etc. — to show up for a fishery that could be closed on that moment's notice. Further, finding oil from the deck of a vessel was a tricky and frequently imprecise operation. Skimmers, for example, could not properly operate without aerial surveillance support; there was no reason to suspect that fishermen could do better without similar aerial backup.



A South Korean ship loading boxes of herring roe. Photo by Vanessa Vick

And finally, cleanup itself posed problems for commercial fishing. Shoreline cleanup knocked tremendous amounts of oil back into the water, and some crews were sloppy in their recovery efforts and ineffective in setting secondary containment booms at cleanup sites. Areas slated for cleanup were frequently areas that were close to, or "upstream" from, commercial fishery areas. It would have been impossible to conduct cleanup and fisheries at the same time.

Different combinations of these problems forced fisheries closures from Cordova to Chignik Lagoon (on the Alaska Peninsula) in 1989. Alaska officials adopted a "zero tolerance" policy for fishery closures; although regional fish and game department biologists had some latitude in their ability to judge the threat from oiling to a fishery, they were instructed to take a very conservative stance. Alaska's multi-billion dollar commercial fisheries employ more people than any other industry in the state, and Alaska's seafood inspection program is one of the most stringent in the country. Fishery managers, who saw the canned salmon market collapse in 1983 after a (false) botulism scare in Europe,[15] knew well that there was no room for gambling with the freshness and quality of Alaska seafood.

The first closures, for herring fisheries, came April 3, 1989, at the height of the defensive battle for the hatcheries.

The area's herring fishery is for the roe, not the fish themselves. Alaska fishermen from Sitka to Norton Sound sell herring roe to Asian markets, where it is sold salted, pickled, or fresh. It is a very lucrative series of fisheries, but, like many high-value Alaska fisheries, timing is critical and openings are short. For a number of fishermen, the early-season herring roe harvests generate the cash flow that helps them gear up for salmon, halibut, or other fisheries later in the season.

The oil spill occurred almost exactly at the same time herring began spawning in Prince William Sound. Females lay eggs on seaweed, and males release sperm, en masse, in the vicinity. Under certain lighting conditions, the herring spawn on the surface looked like an oil slick.[16] The Sound's vessel-based herring fishermen work with gill and purse seine nets; the roe is eventually sold in its membrane, or sac. Other roe fishermen set floating corrals, or pounds, in which long leaves of kelp hang down; the females lay eggs on the kelp, which is then harvested. Still other fishermen cut wild leaves of kelp, along with the herring eggs. All these types of harvest occur at or near the surface, in nearshore areas, and were therefore most exposed to dangers of oiling —

Alaska officials adopted a "zero tolerance" policy for fisheries closures. Alaska's multi-billion dollar commercial fisheries employ more people than any other industry in the state, and Alaska's seafood inspection program is one of the most stringent in the country.

especially at that point in the spill. The state did not open the fisheries at all in 1989 because of oil on the water.

Other closures followed quickly throughout Prince William Sound: shrimp fisheries (both trawl and pot), king and dungeness crab, and virtually all salmon fisheries, both wild and hatchery-based. Some bottomfish openings were held in the Sound. Halibut opened statewide in June, and there were no reports of oiled gear or fish. Some fishermen who could not work their usual fisheries turned to other deep-water species, such as rockfish; ironically, fish and game reported that rockfish stocks in Prince William Sound may have been seriously overfished in 1989, as more fishermen put more effort into catching a species for which there was little population or harvest data.

The effects of fisheries closures — especially for salmon — reached far beyond individual fishermen and a lost season of fishing income. In Prince William Sound, the closures caused severe financial problems for the non-profit associations that run the hatcheries. The closures also disrupted markets, displaced workers, and (some fishermen argue), drove down prices in subsequent years.

The hatcheries, built in the 1970s and 1980s with state grants and loans, are run by non-profit corporations made up of groups of fishermen. The fishermen pay a tax (about two percent of their gross catch income) to the association to cover costs of operations, and the fishermen then make the bulk of their money on harvests of fish "spawned," reared and released by the association.[17] They concentrate on raising and releasing pink salmon, which is the smallest and least commercially valuable of the five species of the Pacific salmon. However, the pinks spawn and return in two-year cycles, unlike other salmon, which spend anywhere from three to five years at sea before returning to their home streams to spawn. This quick turnover gives fishermen a product they can raise, harvest, and sell in relatively short timeframes. Almost universally, pinks are caught and sold for the canned salmon market, partly because the flesh of the pinks doesn't hold up as well to handling or freezing as does the flesh of other larger, oiler salmon.

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In 1989, this financial and biological cycle was thrown out of whack. The fishermen were obviously closed out by the fisheries shut-downs, and they sought compensation from Exxon. The hatcheries lost their regular source of income (fishermen), so they resorted to "terminal" fisheries — i.e., fisheries close to the hatchery as the fish returned to their "spawning area." Hatcheries hired a handful of local fishermen to fish a tidal wave of returning pink salmon, hoping to sell at least some of the fish to canneries so they could cover their 1989 operating costs.

The terminal fisheries were bizarre for both their abundance and their waste. Fishermen literally dropped their nets into an ocean of fish, and with little or no effort, pulled in the biggest netfuls of pinks anyone had ever seen. But even with fishermen seining as fast as they could, there were too many fish — fish that were scheduled, according to nature's plan, to die immediately after they spawned. The coves in which the hatcheries were located were in danger of being smothered by a putrid and oxygen-burning carpet of pink salmon detritus. Many fish were caught, then hauled farther out to sea, ground up, and dumped overboard.

Meanwhile, the hatchery associations had trouble unloading the fish they intended to sell. All salmon begin to deteriorate physically as they enter their spawning streams and begin the process of reproduction. Because the terminal fisheries caught the fish so close to home, so to speak, the flesh was far past its peak of marketable quality. Buyers were finicky about the quality, and even when the hatchery found a taker for its pinks, the price was down. The associations all ran big losses for 1989, and none could meet its operating costs and debt service without borrowing further or depleting financial reserves.

In addition, the disruption in supply may have triggered changes in the canned salmon market, as buyers turned more to new products and new salmon sources, such as the fish farmers from Canada, Chile, and Norway who raise salmon in nearshore pens. There is some debate about whether the oil spill was a prime or contributing cause to a crash in salmon prices in 1990, and the sharp turn away from canned salmon as a market staple. Some fisheries economists argue that the change was coming regardless. However, the oil spill certainly accelerated the changes and exacerbated the effects, at least locally. And it is indisputable that local communities and economies were ill-prepared for such a sudden change. In Cordova, for example, the 1989 fisheries closures shut down the three local processing plants for all or part of the season. Instead of the usual 200 - 225 people working in the plants, there were less than 100. Even when fishermen worked other fisheries, such as halibut, the flow of fish to the local processors was sharply reduced, since many fishermen were working on oil spill cleanup rather than fishing. Processors tried to make up their shortfall by flying in fish from other areas of the state, but the extra trip for the fish meant more time between the ocean and the processing plant, with meant a further decline in quality — and price.

Workers in Cordova protest the closure of their cannery. The three local processing plants were closed for all or part of the fishing season in 1989. Photo by Rob Schaeffer

Unfortunately for the local economy, the plants have not reopened, and the salmon markets are not the same. This has caused problems and changes for local workers and fishermen, and it has also affected city tax revenues, services, and rates that local people pay for electricity and city water. The plants were the largest consumers of electricity from the city-owned utility, and therefore the biggest rate-payers. The high volume of revenue coming from the fish plants allowed city managers to charge lower residential rates throughout the city, and the resulting loss of that revenue stream has hit every Cordova rate-payer in the pocketbook.

In Port Graham, a small Alaska Native village on the southern Kenai peninsula, the fisheries closures shut down the local processing plant, which served the local economy as both a market for fishermen and an employer for the village. The plant did not reopen in 1990 for many of the same reasons the Cordova plants stayed closed. Furthermore, the plant was owned by the local village corporation; because the corporation was dealing with relatively small economies and markets, it was, perhaps, more vulnerable to changes and less able to muster the economic and business resources needed to recover.

Lower Cook Inlet (roughly the area around Homer and Kachemak Bay) did have some salmon openings in 1989, but the big-money fishery of Cook Inlet — sockeye salmon harvested by the gillnet fleet in the upper Inlet area — did not. As oil streamed out of Prince William Sound and splattered the outer Kenai coast, tarballs, debris, and weathered oil swung up with the prevailing currents and were sucked into the tiderips of Cook Inlet. The oil was hard to locate and hard to track in the silty, swirling waters whose tides flood to 25 and 30 feet, and whose currents run as fast as many rivers.

The drift gillnet harvest in upper Cook Inlet is the second most important sockeye salmon fishery in Alaska, ranking in run strength and commercial value only behind the massive Bristol Bay harvest in western Alaska. During the 1980s, the fishery was worth anywhere from $100 million to $200 million at the dock — and this does not count the economic activity generated by the shoreside processing plants and local businesses every year.

Every year, that is, except when there is an oil spill: In 1987, Cook Inlet drifters had their season interrupted by the Glacier Bay spill, which occurred at the peak of the season. Many fishermen were unable to fish their usual areas, and many more lost money as more boats crowding the same areas split the harvest in diminishing shares. Fishermen, like farmers, spend the year betting their debt and capitalization costs against the coming summer's expected cash flow from fish they haven't caught. The 1987 spill disrupted this cycle for much of the Cook Inlet fleet, and the 1989 *Exxon Valdez* closure compounded it. Exxon, unlike the shipping company that owned the Glacier Bay, made partial payments and full settlements with many vessel owners the same season as the spill. However, Cook Inlet fishermen were poorly positioned to absorb another season of lost income or altered cash flow in 1989. Moreover, Cook Inlet fishermen did not have the same options for replacing that income as their counterparts in the Sound and Kodiak. Exxon and its contractors hired fishing vessels to work the cleanup in those areas. But Cook Inlet, where there was little cleanup activity, did not provide the same opportunities.

Finally, Cook Inlet fishermen became more frustrated as attention on improvements to tanker operations and oil spill response were concentrated on Valdez and Prince William Sound. Cook Inlet, unlike the Sound, has more vessel traffic, more older and foreign-flag tankers, more kinds of dangerous products in transit, many oil and fuel pipelines crossing the Inlet, several large tank farms and terminals, more sites where product is transferred, and more than a dozen offshore production platforms handling crude oil or hazardous drilling fluids. Furthermore, the Inlet, unlike the Sound, is a shallow, fast-moving, narrow waterway that presents a number of more difficult challenges to shiphandling and navigation. Taken together, it could be argued that while the risk from a catastrophic spill from a supertanker was lower in Cook Inlet, the risk of smaller, chronic pollution from a variety of sources was much higher than in Prince William Sound. The fishermen and the local borough government lobbied hard for the same kinds of protection DEC had ordered for the Valdez terminal after the *Exxon Valdez* grounding. DEC attempted to meet some of the concerns from Cook Inlet by instituting a task force to work on solutions, but solutions would not be so quickly or easily found.

The number of players in Cook Inlet is much higher than in Prince William Sound. There was no single entity, no major permit holder, to whom DEC could address the kind of sweeping emergency order it issued for Alyeska Pipeline Service Company on April 7. Shipping companies, drilling companies, small oil companies, pipeline consortiums would have to come to the same table. This would take time. It would also take time to build a consensus among them, since different companies were operating on different margins of profit, and Cook Inlet operations meant different things to different companies. On the other hand, the incentive for Alyeska's owner companies to act was powerful — powerful in the companies' own economic terms. Much is made of the fact that the State of Alaska depends on Prudhoe Bay for as much as 80-85 percent of its income. Yet for British Petroleum (BP) and ARCO — the two biggest producers on the North Slope — Alaska reserves and Alaska production are the reason their companies turn the profits they do, and that their stock trades at the prices it does. BP has two big production sites in the world — the North Sea and Alaska's North Slope — and the company would not be the same without one or the other. ARCO's Alaska holdings and production are the envy of other domestic producers. For these companies, the stakes in Alaska are high, and therefore their incentive to make changes in the operation was high.

But perhaps most important, the profits from Prudhoe Bay and Valdez are high. Because the oilfields produce so much cash for the companies, they can afford to invest $150 million up front (the estimated start-up cost of the Ship Escort/Response Vessel

Closures also affected other fisheries: shrimp, king and dungeness crab, shown above.
Photo by Vanessa Vick

System now in place) for new prevention measures, and the state can afford to forgo $10 million a year in extra revenues to help pay for the changes.[18]

Cook Inlet is no longer a high-production, high-profit oil province. Oil production peaked more than a decade ago. Most wells are producing much less oil, and, as in most older fields, the cost of keeping the wells active rises as production goes down. There is less cash available for improvements, and the ratio of benefits to cost — in strict economic terms — is markedly different in Cook Inlet.[19]

By 1992, Cook Inlet would have, like Prince William Sound, a citizen oversight group funded by the industry and a revamped and improved response organization, also funded by the industry. However, the improvements were more incremental than those at Alyeska, and the citizen group has had many more struggles with the industry over funding than its Prince William Sound cousin.

By 1992, Cook Inlet would have, like Prince William Sound, a citizen oversight group funded by the industry and a revamped and improved response organization, also funded by the industry.

For Cook Inlet fishermen, the combined effects of the *Exxon Valdez* oil spill, the fisheries closures, the economic disruption and the frightening realization of the risk the area faces were much more damaging than the sharp and fresh wound in Prince William Sound caused by the spill. This events of 1989 were, to Cook Inlet fishermen, a painful reinjury, another break in a leg that had just started to heal.

Kodiak's fisheries were shut down, with some of the same problems as Cordova and Kenai, but a few different or magnified ones as well. Kodiak, always one of the top three or four U.S. fishing ports, has a fishing economy based not only on local fisheries, but on offshore and remote fisheries as well. A significant portion of the Kodiak fleet works the wild waters of the Aleutians and the Bering Sea for crab and bottomfish, and so, in many respects, a part of the Kodiak economy was insulated from the effects of the closures. However, like Cordova and the changes in the pink salmon markets, Kodiak had its own unrelated problem to deal with: The Bering Sea pollock fishery, which supplied Kodiak's shoreside processors, had been shut down months earlier than anticipated due to overharvest by large processing ships. The row of producers on Kodiak harbor that had invested in new equipment and employed workers on the economic promise of a year-round fishery suddenly found themselves idled. Their secondary, seasonal fisheries — halibut, crab, salmon — were then crippled or curtailed by the *Exxon Valdez* closures. It was a one-two punch that staggered the city's processors and left hundreds of cannery workers in the unemployment line.

Kodiak's different gear groups for salmon (gillnetters, setnetters, seiners) were largely supportive of the state's decision to close the Kodiak Island salmon fisheries as oil and tarballs hit the archipelago in a shotgun effect. While Prince William Sound fisheries managers had to cope with an ocean of oil, in Kodiak the problem was smaller in volume but almost more difficult to deal with. The oil came in large slugs and isolated windrows; it hit some places hard while leaving other neighboring areas alone; the concept of micromanaging fisheries cove by cove was therefore even tougher to handle. Further, the long distances, open ocean shorelines, and bad weather made any prospect of tight oil-fisheries management a logistical challenge and a question of safety. The salmon season, scheduled to open in the islands June 9, was postponed until June 19, then shut down in nearly every area for the rest of 1989.[20] Some fishermen managed to work herring sac roe fisheries, since 22 of the 56 management areas opened for herring, and some found work on oil spill cleanup. However, oil spill work was not universally available.

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Much was written that first year about the fishermen who made money working on the oil spill, and indeed, many people made a lot of money. A skiff owner could make $20,000 for the season; large vessel owners could make ten times that. However, the jobs were not as plentiful nor as equitably spread out as popular folklore would have it. Kodiak, like Cordova, was the scene of frustration and competition as local fleets tried to handle the job of assigning vessels and dividing up available work among those who needed it. Roughly 300 Kodiak-based vessels normally work the area's fisheries, and the majority did not work on the spill response.

The claims system set up voluntarily by Exxon produced mixed results. While many fishermen opted for up-front payments or partial settlements from Exxon, getting the payments was not always a simple matter.

There were disagreements about whether those who took oil spill work would forfeit any right to recover damages for lost fishing income. Some fishermen were reluctant or unsure whether to accept response contracts because of those questions.

The uncertainty surrounding possible closures in early June also forced fishermen into potentially risky choices. Exxon was paying claims only to those fishermen who were ready to fish at the time the closures occurred. The state was closing areas one by one, based on the absence or presence of oil. Fishermen literally had to be geared up and standing by, ready to fish, when the fisheries were closed by emergency order — even if it was a forgone conclusion that the fishery would probably be closed. This created a ludicrous situation in which fishermen bought fuel, pulled in the crew, bought groceries, and got ready to fish, even though they knew the fishery would be closed. To make matters worse, from an economic standpoint, going through the motions of gearing up for fishing cut off a number of opportunities to get oil spill response charter work. The result was that those who gambled on getting oil spill work — and got it — made more money than they usually make fishing, while those who gambled on the claims system may not have made as much — or anything at all.

Generally, fishermen were able to settle claims with Exxon as long as they could demonstrate from tax statements, receipts from tenders or processors, or state records that they had worked a given fishery in previous years. This was a relatively simply matter for those who had a consistent record as a skipper or vessel owner. However, if someone had missed a year (due to working another fishery, working as a crewman, other economic reasons, etc.) or more, it caused some delay or raised some questions with claims adjusters about whether the individual was a bona fide fishermen. Some people lease permits, and don't always work the same district. In a few cases, people had just purchased vessels and/or limited entry permits, and the 1989 season was going to be their first in the fishery; they had no record on which to base a claim. In addition, the basis for computing claims was the state's projected catch of 15 million salmon for 1989; in fact, the runs turned out to be about 40 percent stronger. Theoretically, fishermen would have caught more fish, and therefore their settlements should have been adjusted upwards. And, of course, no mathematical formula could properly

In mid-September of 1989, a subsistence user in Chenega prepares salmon to dry. Photo by Vanessa Vick

adjust for the fact some fishermen are more skilled than others and some get luckier than others.

Finally, there were the issues of cash flow, crew payments, debt structure, and other components of the commercial fish business that the claims system could not address, regardless of how well-intentioned it may have been. Skippers frequently pay a variety of expenses for longtime or trusted crew members before the season starts. It is a system in which a skipper has people other than his own family depending on him economically. The uncertainties, the disruption of normal cash flow patterns, and the unavoidable inequities of the situation took a heavy toll on the fleet, both financially and emotionally.

But at least the commercial fishermen had a claims system, and many of them had access to alternatives, such as oil spill cleanup work. Subsistence users of wild fish and game — essentially all the Alaska Native families of the spill region — did not have the same kinds of options open to them.

Subsistence

Commercial fishing is the dominant cash economic activity in the spill region, and it commanded high and immediate concern from policy-makers, reporters, and responders. The fishing fleets of Valdez, Cordova, Kodiak, Homer and Seward, tied up at the docks in the busy ports where response forces mobilized, were visible evidence of one of the interests most at risk from the spill. Fishermen from Cordova were at the press conferences and briefings and meetings in Valdez almost from the start; the organized fishermen's unions and marketing cooperatives had the staff, structure, recognition and experience to deal with government agencies and Exxon; reporters (especially those coming from outside Alaska) immediately understood the threat to fisheries and the role commercial fishing plays in coastal communities.

The disruption in the lives of people in the subsistence-based villages was one of the most drastic and damaging of the entire oil spill. These effects are probably among the most lingering – and measurable – of the spill.

It was not the same for the Alaska Natives of the remote coastal villages, where subsistence harvest of fish and game is the dominant — and defining — social and economic activity. Dealing with the concerns and priorities of subsistence users — and explaining the risks from oil contamination — was one of the most frustrating and least successful exercises of the oil spill. The disruption in the lives of people in the subsistence-based villages was one of the most drastic and damaging of the entire oil spill. These effects are probably among the most lingering — and measurable - - of the spill.

Most of the villages learned about the spill on public radio, or from television news. They did not have a well-organized political and economic lobbying group, and were not part of the early discussions among the key organizations planning the response.[21] Subsistence is not only hard to see and touch, but its role in the lives of Alaska Native villages is hard to communicate briefly, forcefully, and completely. It is harder still for people coming from outside Alaska to truly understand quickly.

An example: In May 1989, Vice President Dan Quayle came to Alaska, briefly visited a beach on Smith Island,[22] then returned to Anchorge's Elmendorf Air Force Base to meet with mayors from the affected communities. A woman representing the village of Eyak, near Cordova, spoke for more than five minutes, concentrating on the meaning of subsistence to her people, the threat they felt from the oil, and the anger and fear among Natives. The vice president listened intently and replied, "All the fishermen will be paid."[23]

His reply missed the point — widely. This was not just a matter of whether the Native community was paid damages, or if they were given money to buy alternative foods. The real fear, especially among village leaders and elders, was that the spill would so damage or disrupt subsistence harvest that yes, a food shortage might result, but more important, that the foundation of the communities would crumble.

Subsistence is part of a rural economy, but it has little or no relation to western views of economic value. Subsistence is about eating, but wild foods can't be simply replaced by a processed substitute. Subsistence is about kinship and social cohesion, but it is not a ritual or ceremony. Subsistence is one of the markers that helps Native people define themselves, but it is neither cosmology nor religion, as western people understand religion and theology.

Subsistence is about eating, but wild foods can't be simply replaced by a processed substitute. Subsistence is about kinship and social cohesion, but it is not a ritual or ceremony.

The Alaska Department of Fish and Game maintains a fulltime Division of Subsistence that collects harvest data, documents subsistence patterns, and serves as a liaison to many subsistence-based communities. Alaska government officials are used to dealing with subsistence issues in the normal course of land and resource management. However, much of the response structure was staffed by people from outside Alaska, or from agencies that do not normally deal with Native peoples. In addition, at least at the outset, Native villages did not have representatives or advocates in the management and planning centers, such as Valdez and Anchorage. Chugach Alaska Corportation, the regional Native corporation, did have some access, but the villages do not consider Chugach the appropriate representative for all Native issues in the region, and Chugach did not attempt to speak for all the villages. Exxon representatives did not visit most of the villages early on, and when they did, they were either consumed with emergency response tasks (at Chenega Bay, for example) or the overtures were clumsy (at Tatitlek).[24] Villagers reported that the managers from Exxon's contractor, VECO, were especially inept at dealing with the cultural differences and methods of communication in Native villages. Rapid turnover of Exxon personnel meant that it was difficult for villagers to build up a rapport or level of trust with the company.[25]

A certain amount of bitterness also developed among village residents as they learned of the millions of dollars being poured by Exxon into wildlife rescue and rehabilitation. Throughout that summer, Alaska Natives — and other locals, for that matter — spoke with cynical humor or resentment about the amount of attention paid to animals, while the human residents of the spill area struggled to get the kind of attention and support they felt they deserved.

Villagers also pointed out what seemed to them a confusing inconsistency in the state's policy about the safety of seafood. All around the Sound and Kodiak, commercial fisheries were being closed, ostensibly because of the threat of contaminated seafood; yet, subsistence users were told that seafood was safe to eat unless it smelled or looked oily. The difference, of course, was that subsistence takes place on a different scale, with different equipment, and subsistence harvest was not really analogous to commercial harvest with drag, seine, or gillnet gear. Remember, for the commercial fisheries, the problem was with oiled gear, not oiled fish. Certainly a lot of people understood this difference, but acceptance of the explanation was not universal, especially among older Natives.

The uncertainies, communication gaps, cultural gaffes, and mixed messages all combined with the basic upheaval caused by the spill. In the villages, during the early weeks of the spill the seeds of doubt and resentment were sown. As these problems grew, the subsistence issue came to be a focus for all the cynicism, anger, and fear. Communication stalled, even as efforts to open lines of communication and spread information intensified.

Understanding the role of subsistence in the villages of the spill region helps one understand the reaction to the spill in the villages.[26] Area residents harvested and consumed an average of 200 to 600 pounds of wild fish and game in pre-spill years; by contrast, the average family in the American west buys a little more than 200 pounds of meat per year.[27] Village residents of the spill region have reported that 100 percent of the households used subsistence foods in various years before the spill — and they used many different kinds. The mean number of resources used hovers around 20 per household per year, from large marine mammals such as seals and sea lions, to salmon and halibut, deer and ducks, gull eggs, and even tiny marine invertebrates collected on the seashore. Clearly, subsistence harvest is the foundation of most village diets.[28]

Basically, things didn't look right. Villagers noted strange behavior among animals (seals becoming lethargic or unafraid of people), birds didn't show up the places they usually did, shellfish that normally clung tightly to rocks seemed to fall off easily.

In addition, subsistence harvest is just one link in an extended system of food preparation and sharing that is one of the principal social activities of Native peoples.

"Harvesting and processing groups are generally composed of members of extended families, and subsistence foods are often shared with relatives, elders, and others in need. For example, in English Bay, one harbor seal was shared within a family of eight households and 25 people. Such extensive sharing is commonplace in all 15 villages [of the spill region.]"[29]

And finally, the patterns of village life are dominated by seasonal harvests, and seasons themselves are defined and described in terms of animals. People understand their place in the natural world based on the traditional understanding of how the natural world works. Summer is the busiest season, when people catch and preserve salmon for the winter by drying, smoking, pickling, or some other method. Fall is the time for hunting game. Spring — when the spill occurred — is just when people break out of winter and begin the harvest cycle again, going for herring, birds, and other resources.

The spill and the cleanup threw this pattern of life all wildly and frighteningly out of sync.

Basically, things didn't look right. Villagers noted strange behavior among animals (seals becoming lethargic or unafraid of people), birds didn't show up the places they usually did, shellfish that normally clung tightly to rocks seemed to fall off easily. It is hard to make a scientific determination about whether the observations were actually due to the spill, or even if they were entirely out of the ordinary. Researchers noted that people may have been noticing some things that they had never noticed before because the spill had made them more aware or more likely to observe even subtle changes. Yet regardless of whether all or some of the changes were really due to the spill, the cumulative effect was a kind of disorientation, which produced doubt, which magnified fears.

"Clearly, the oil spill had created conditions that were completely unfamiliar to the hunters and fishermen of these villages," the state's Jim Fall wrote. "Their skills in understanding their environment and making informed decisions had been undermined. Consequently, in many cases they discarded traditional foods or refrained from harvesting entirely for fear that the resources had been poisoned."[30]

And refrain, they did. The state's subsistence division researchers collected harvest data from 1989 and compared it to data collected in previous years. They tried, when possible, to compare 1989 against data from two previous years to get a better sense of the difference.

They found that in Chenega Bay and Tatitlek, within Prince William Sound, the total pounds of food collected dropped by more than half. In Chenega, where residents normally collected 300-400 pounds of subsistence foods per capita, the 1989 total was less than 150 pounds; in Tatitlek, where per capita harvest was as high at 650 pounds per year, the total was just a little over 200 pounds in 1989. The Lower Cook Inlet communities of English Bay and Port Graham showed similar declines. In the six Kodiak Island villages, more distant from the spill and where impacts varied more from place to place, average declines ranged from 12 percent in the extreme south (Ahkiok) to 77 percent in the north (Ouzinkie). Yet all showed substantial and aberrant declines in overall harvest compared with the previous years.[31]

These declines do not represent something like a voluntary avoidance of a few favorite desserts or delicacies. The subsistence division also found that fears caused by the oil spill led area residents to eliminate a large array of foods from their usual and customary diet. Where the subsistence harvest mix usually included about 22 different components in Tatitlek, in 1989 the figure fell to about 11; in Chenega Bay, the mix dropped from 18 sources to eight. Overall, more than 80 percent of the households in Prince William Sound and Lower Cook Inlet reported that the oil spill caused them to limit or avoid subsistence harvest; the figure was about 40 percent on Kodiak Island.[32]

A woman cuts up seal fat in Port Graham. Photo by Ron Stanek

Exxon provided groceries to replace some of the foods, and cash employment on the oil spill cleanup allowed many people to buy food as well. However, this solution was neither long-term nor entirely acceptable. Residents simply had no idea if foods were subtly contaminated, if animals would continue abnormal migration patterns, if populations would be devastated, or if hunting would exacerbate problems caused by the spill.

"As a Tatitlek hunter explained regarding waterfowl, ' When you hear thousands of them are dying every day, it's tough to harvest them. We didn't know what the number would be coming back this year.' "[33]

But more important, store-bought foods did not replace — either by tradition or by nutritional standards — the fresh and preserved local foods. There is no question that in most Native villages around Alaska, the overall family diet includes a mix of processed grocery-store food and wild fish and game.[34] However, in the villages of the spill region, the "Native" foods are what people prefer, and one can expect subsistence foods to be part of most main meals, or the central dish, at least several days a week. Substituting chicken for seal or clams may be acceptable as a stop-gap, but over time, people want to eat what they are used to eating. Asking Alaska Natives to eat western processed foods on a consistent basis would be no more acceptable to them than asking Texans to get rid of their cattle herds and eat squid everyday.

Or octopus, for that matter. Tatitlek villagers identify octopus as an important food during the winter months, but after the spill, they reported that they were having great difficulty finding octopus in the usual places. This led them to question the health and organization — or reorganization, more precisely — of the natural world around them, which in turn increased their fears and frustrations about foods that once made up the bulk of the villagers' diets. If the octopus aren't there anymore, what happened to them? Did the oil kill them? What about the fish, then, or the birds? What about the seals that eat the fish? If it's all screwed up, what do we do?

In very crude ways, one can begin to understand the disorientation and fear by thinking of the shutdown of subsistence harvest as the shutdown of all the steel mills in Pittsburgh, or all the automobile assembly plants in Detroit. In fact, during the 1970s and 1980s, these rust-belt cities experienced something close to that. There was a massive outmigration from these areas as people looked for work in California or Texas or other southern manufacturing states. Other people tried to retrain for new jobs in health care or other service industries. For the people who moved, the new states and climate might present some cultural and regional changes, but the basic structure of the society — the markers of the physical, economic, and social world — remain essentially the same from one region of America to another.

But people in Tatitlek don't have the option of moving to Anchorage or Seattle or Sacramento, retraining into some new food manufacturing process, and rebuilding their lives and relationships somewhere else. This gets back to the point that subsistence is not simply about eating, and it can't be truly described as an alternative economic system. There's food and there's an economy involved in subsistence, but those things are just the visible products of a subsistence culture. People of the villages viewed the oil spill as much more than a threat to one or two years of food; they feared it was something more dangerous and more lasting, an additional, crippling assault on a culture that had already been faced with rapid economic and social change in the span or a generation or two.

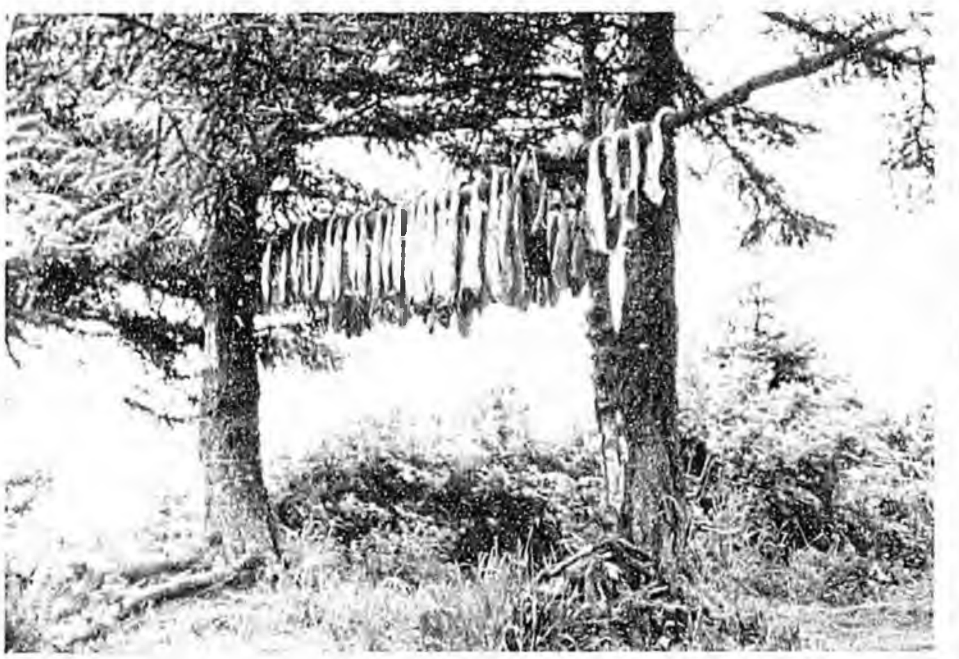
When village residents began asking state officials if seafood were safe to eat, DEC gave the seemingly obvious advice that foods that smelled like oil or looked oily should not be eaten. The technical name for this type of assessment is "organoleptic" testing, and, in fact, it is the basic test employed by state's commercial seafood inspectors. On the whole, it is dependable and rational, especially in the relatively pristine and clean waters of Alaska. A fat, firm-fleshed salmon with bright scales and no fin deterioration[35] is, in Alaska at least, a fresh and safe-to-eat fish. After inspecting a fish visually, an inspector will literally take a good sniff to make sure there is no abnormal odor that indicates the fish has been improperly stored or been out of the water too long. This type of test wouldn't be the perfect and foolproof way to determine the safety of seafood taken from a chronically or heavily polluted waterway, since the organoleptic inspection can't tell you whether the flesh contains abnormal concentrations of heavy metals or other toxins. However, Alaska's oceans are unpolluted and the water is clean.

Village residents tend to eat and use more parts of the animals – livers and other organs, for example – than the average consumer. They wanted to know if oil was getting into the food chain, and whether it would find its way into their own bodies.

In most cases, that is. In the spring of 1989, there were 11 million gallons of crude oil on the water. Throughout the summer, there was oil on more than 1,200 miles of beach. In the fall, a number of shorelines released sheens when the tide came in. Local residents watched all this. They walked the shorelines, ran through oil slicks in their skiffs, and observed changes in animal behavior. They understood the "organoleptic" test because they used their own observation skills and accumulated knowledge to make decisions about the health and safety of certain foods. But what they wanted to know was whether the food was safe to eat, not just now, but well into the future. This was especially important to them, because fish, shellfish, and marine mammals made up a much larger perecntage of their diet than the average seafood consumer. In addition, village residents tend to eat and use more parts of the animals — livers and other organs, for example — than the average consumer. They wanted to know if oil was getting into the food chain, and whether it would find its way into their own bodies.

Scientists said generally that they doubted the oil was spreading widely through the food chain, especially in the case of salmon and marine mammals. Residents wanted to know how they could be so sure: Had the scientists done tests? Well, no, said the scientists, but we don't think that kind of contamination is likely. The villagers matched these seemingly vague assertions against what they were seeing — and not seeing, in some cases — in the natural world around them. If the oil wasn't affecting seals, why were they acting so strangely? Where are the ducks? Why is the liver of this deer I shot so white and puffy? Why did the liver of this seal just turn runny instead of staying firm, like normal? If there's oil floating all around this island, what makes you so sure these clams from the beach that looks clean are safe? If I eat these things now, based on your comments instead of a real test, are you going to tell me sometime in the future that my kids and I are going to get cancer?

Within a month of the spill, the Oil Spill Health Task Force came together. It included state and federal agencies, the non-profit social service representatives of the Chugach and Kodiak area Native corporations, and Exxon. The recommendations of this task force formed the basis for an endorsement of the organoleptic test as part of a general health advisory on subsistence foods on May 5. However, it was obvious to everyone involved that the villagers wanted more detailed analysis.



Fish drying in English Bay for subsistence use. Photo by Ron Stanek

What they wanted, of course, is what every American living near an industrial site wants to know: Am I safe? Are my kids safe? Isn't there some more definitive way for you to assure me that my family and I are safe?

In May, the Alaska Department of Fish and Game subsistence division started a pilot study, collecting samples of fish and shellfish that would be taken to the state's testing laboratory in Palmer. Exxon, to its credit, began to grasp that the subsistence foods testing issue needed more money and attention, and the company poured substantial money and support resources into additional, expanded collection and testing beginning in June.[36]

In both collection efforts, biologists and technicians consulted with village leaders, taking samples of the animals identified as important by the villagers from areas chosen by the villagers. The samples from the state's pilot study were analyzed by the U.S. Food and Drug Administration; the Exxon-funded tests were conducted by the Northwest Fisheries Center under the direction of a nationally known leader in seafood safety and toxicology. The Exxon-funded study included extremely sensitive (and expensive) measurements that could detect polyaromatic hydrocarbons (PAHs) down to one part per billion.

These tests — and subsequent testing from 1990 and 1991 — backed up the general advice that seafood was safe to eat as long as it didn't look or smell oily. The flesh and organs of fish analyzed in the tests detected neglible levels of PAHs. Some clams showed high levels of contamination, but they had come from areas of obvious oiling. A panel of scientific experts pulled together by the National Oceanic and Atmospheric Administration (NOAA) discussed the results of the tests and came to a unanimous conclusion: In short, subsistence foods were safe to eat, and common sense and observation were the best guide of which areas and animals should be avoided.

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There was one principal problem with this whole effort: The results weren't available in preliminary form until August, and the expert panel did not deliver its opinion until September. This was probably unavoidable; the group had enough money and resources to collect samples and get them to labs as quickly as possible. However, science — especially science including very delicate tests that require expert interpretation — does not occur overnight. The results of the fish and shellfish tests were not truly made final until February 1990, and test results from marine mammals, birds and deer did not appear until June 1990[37] — in other words, far into the next season's subsistence harvest cycle.

In practical terms, the fast-track of science was slower-moving than the problem. Throughout the summer, village residents consistently asked if there were some middle ground between organoleptic testing and the lab work being done in Seattle.

On the request of some village leaders, NOAA investigated the use of four different kinds of devices that use fluorescent light and special instrumentation to screen fish for contamination. The Oil Spill Health Task Force concluded that this solution wasn't the one the villages were seeking. For one thing, the testing involved special technical training and analysis, and, like the organoleptic testing, some of the conclusions were based on qualitative assessment. The machines were not necessarily easy to set up and maintain in a village setting, either.

NOAA attempted to use another conventional scientific screen — the literature search — to give villagers some sense of why scientists had come to the preliminary conclusion that oil was probably not contaminating fish and getting into the food chain. Unfortunately, the language of science is tinged with caution; researchers never stretch their conclusions beyond their data, and extrapolation is never off-the-cuff. One of the sources cited in the NOAA literature search noted that eating PAH-contaminated food does not appear to lead to cancer or other diseases. However, it cautioned, "Exceptions to these conclusions may arise in localized areas, as in the case of isolated fishing villages where seafood constitutes a major portion of the annual diet. No data are available, however, for these cases."[38]

This was hardly reassuring to these Alaskans who lived in isolated fishing villages where seafood constitutes a major portion of the annual diet. The literature search reinforced more doubts than it relieved.

By the time more detailed scientific, quantitative information became available in September and October 1989, the main subsistence harvest season was over. Doubts had solidified into firm skepticism. The skepticism was magnified by the fact that Exxon played a central and visible role in the operation. The company not only funded the results, but it produced high-quality brochures and sent its company representatives to the villages with the scientists. Exxon can certainly claim credit for a vigorous effort to address the questions of villagers about subsistence foods, but in hindsight, its involvement should have been limited to writing the checks. At town meetings in the fall and early winter of 1989-90, a number of villagers felt that Exxon-sponsored studies were not independent, since the company had a vested interest in positive news about safe seafood.[39]

By the time more detailed scientific, quantitative information became available in September and October 1989, the main subsistence harvest season was over. Doubts had solidified into firm skepticism.

This skepticism about Exxon's involvement brings us back to a basic structural and management problem that cropped up at nearly every stage of the response: People could not understand why Exxon was running a public health and public safety operation. Exxon was actually paying for it, not necessarily running it, but the perception was that the company was taking charge of the public interest. This, coupled with Exxon's public relations stance that tended to minimize the magnitude of the problem, made people in the villages wary of Exxon's participation.

As with other aspects of the "spiller-running-the-response" issue, this happened largely because of the inadequacies of the various national and state strategies and plans for pollution control: "Since there were no specific provisions in the [National Contingency Plan] for addressing fisheries and human health effects, the issue is not raised automatically and thus tends to be ignored until fishermen, fishery management agencies, or the public calls attention to it," NOAA's health researchers concluded in 1991.[40]

Further, since the issue comes up as a result of public pressure rather than government initiative, the perception is that the government doesn't care, or doesn't understand the scope of the problems. Then, even if the government moves quickly to deal with the problem or fill an information gap, its actions are viewed with some skepticism. Walker and Field of NOAA note that the Food and Drug Administration had no established guidelines for seafood safety based on polyaromatic hydrocarbon contamination at the time of the spill. While the agency eventually produced a risk analysis for PAHs in the summer of 1990, it was too late: People had already established, in their own minds, that any level of contamination was unsafe. The FDA's advisory, however scientifically or statistically valid it may have been, was viewed, in part, as an attempt to play catch-up, to cover up a previous oversight.

All of this — governments without firm information, the public perceiving that its problem was initially overlooked, the involvement of the vested interest (Exxon) — combined to present the Oil Spill Health Task Force with a daunting communications problem. While certain segments of the operation may have been viewed as caring and credible — an individual agency, an individual staff person — as a whole, the public (i.e., Alaska Native villagers) did not have a great deal of confidence in the information they were getting.

The depth of the doubt in the villages can be measured, in part, by the persistence of the disruption in subsistence harvest and consumption patterns into 1991 and 1992 in some of the villages.

The Department of Fish and Game's Jim Fall followed up in 1990 and 1991 on the 1989 surveys done by subsistence division staff. He found, "During the second year [after the spill], subsistence harvests were up for all but Chenega Bay and Tatitlek, but generally remained below pre-spill averages."[41]

Specifically, as in 1989, both the range of resources and the total volume of resources used were lower when compared to years before the spill. While the number of households that participated in subsistence harvest in Chenega Bay in 1990 matched a pre-spill year, the percentage using marine invertebrates and birds remained low. Moreover, although the number of households engaged in subsistance activities had returned to normal, all but one of those households reported that their harvest was still below pre-spill levels. Results from Tatitlek were similar.

As in previous years, the numbers generally went up the further one went from Prince William Sound. However, more than 80 percent of Lower Cook Inlet households said their harvests were still depressed, and half of the Kodiak Island households reported lower harvest levels.

While numbers have been coming up, the attitudes have not changed markedly, according to the state study. People continue to note changes in animal behavior and abundance, and they still express doubt about the long-term safety of eating subsistence foods at their previous levels of consumption. And while people say their subsistence harvests may have gone up, some said it was *in spite* of their fears, not because their fears had been resolved or alleviated. The desire to eat traditional foods and to participate in subsistence activities — hunting, fishing, food preparation, sharing — "outweighed their caution or fears of contamination."[42]

Fall quotes one Tatitlek resident on this subject: "We started craving seal meat. We could only go so long without it. We get tired of eating beef and chicken. We wouldn't touch seal that first year after the spill [1989]. Now subsistence food is on our table at least twice a week."[43]

It is important to note here that a gradual return to subsistence harvests in these villages was probably inevitable, regardless of the absence or presence of oil. One factor, noted above, is that as time passes from the event, the "cravings" for the foods people are used to started to overcome or overwhelm some fears. But more important, these villages have no other realistic option for replacing the foods they gather from the ocean and the shorelines. Cash income for the villages is limited and jobs are nearly non-existent; some people have commercial fishing permits, but they generally are for lower-va[illegible]wer-volume fisheries than the big income generators of Cook Inlet and Kodiak. A[illegible] the rest of rural Alaska, so-called "transfer payments" — Social Security, the state old-age pension, the Alaska Permanent Fund dividends, federal nutrition supports, etc. -- make up the bulk of the cash that comes into the villages. Putting cultural imperatives and tradition aside for a moment, the basic fact ab[illegible]t subsistence in coastal villages is that subsistence is how people eat. Cash inco[illegible], more likely, goes to buying processed foods that supplement the regular diet — coffee, powdered milk, flour, etc. — as well as clothing, heating oil, gasoline, ammunition, and so on.

When subsistence harvest was threatened and uncertainty about the future was the highest, people in the villages felt remote and occasionally excluded from the process and the people who made the decisions about cleanup. This is why many of the village residents — people with a keen understanding and appreciation for the day-to-day

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workings of nature — were embittered when millions of dollars were immediately poured into wildlife rescue, while subsistence users had to work extra hard to get the attention of decision-makers.

Even almost four years after the oil spill, the disruption of the spill and the cleanup persists in the coastal villages of the spill region. Some villages are faring better than others, because people and regions are different, oiling impacts were different, and the ability of local leaders to influence the process differed as well. However, just as subtle changes in wildlife behavior give a clue that nature has not yet readjusted, the lingering problems with subsistence harvest are a clue that villages have not entirely readjusted to the post-spill realities. To many village residents, things still just don't look right.

"For a people whose survival has long relied on their observations of the natural environment, such signs continue to warn of danger," writes Jim Fall. "And people have continued to respond in a culturally appropriate manner — with caution. Our analysis of data about subsistence uses in Alaska Native communities following the *Exxon Valdez* oil spill suggests that while these signs have persisted, certain traditional foods have been avoided by many households. Until such signs disappear and people are able to place confidence in their own abilities to again interpret and understand their environment, recovery from the *Exxon Valdez* disaster will likely remain incomplete."[44]

Trailers and portable housing were rolling into town on trucks, temporary buildings and modifications were going up without safety and building inspections; the mayor and the city council felt they had lost control of their town.

The invasion

The towns and villages of the oil spill region were turned upside down by the staging, logistics, and politics of the response. In the summer of 1989, the regular business of fishing and tourism was completely overwhelmed by the business of oil spill cleanup. Town by town, from Valdez to Kodiak and everywhere in between, normal patterns were either disrupted, interrupted, or completely wiped out. It would be a surreal summer, marked by wide swings in economic and social activity.

Some people made a lot of money. Businesses that supplied gear — everything from groceries to raingear, rakes, and outboard engines — boomed. Hotels were full, all the time. In Valdez, national news organizations rented hotel rooms like apartments, paying the daily rate even when the room was empty, because they would be unable to get a room if they left it. People rented basements, spare bedrooms, garages, tent space — anywhere you could park a visitor for the night.

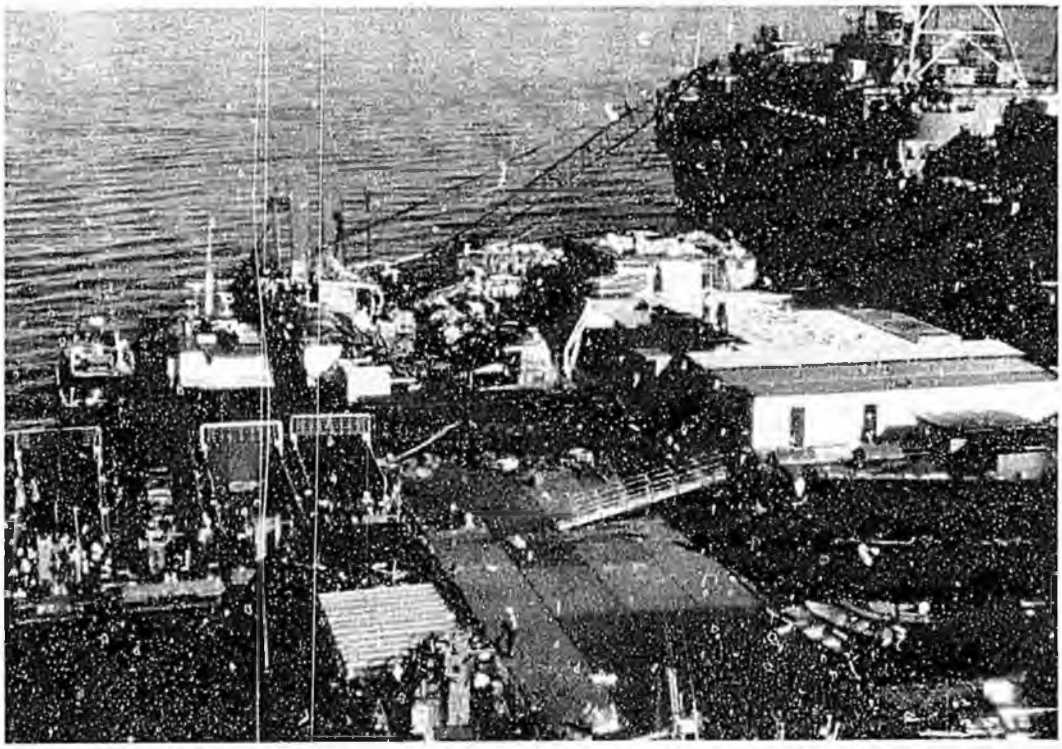
The lines at local restaurants were so long, and housing was in such short supply, that the state began providing meals and housing (both transient and seasonal) for its workers in Valdez. The catered meals (similar to the operations at North Slope oilfield bases) kept nutrition and morale up, while limiting the time wasted by people standing in line.

The Valdez airport, which usually handled no more than 20-30 flights a day, handled hundreds of flights every day, all day, all summer. The Federal Aviation Administration added Valdez tower staff, and for a time, a U.S. Coast Guard cutter served as an air traffic control center in the Sound itself.

Across from the airport in Valdez, Exxon and its contractor brought in portable housing, some of which had last seen duty during the construction of the Trans-Alaska Pipeline more than a decade before. The "man-camp," as it was called, was the dormitory for more than 1,000 people at various times. Outside of the housing centers, transients seeking cleanup jobs parked their cars and pickup trucks and campers in informal camps along the highway leading north out of town. These shanty towns were clustered in gravel pits, on sand bars of the braided glacial rivers that flowed out of the mountains, in the alders and cottonwood groves off the highway, and in the unofficial campground behind the city's softball fields. The presence was so overwhelming, in fact, that Valdez — a city that built a special complex to accommodate its famous softball tournaments attracting teams from around the state and northern

Canada — played no softball that summer of 1989. The season was canceled.

Estimates vary, but even the most conservative figures place Valdez's 1989 summer population at more than 10,000 people. The town has about 2,500 year-round residents, and an influx of summer visitors, cannery workers, and other seasonal traffic usually adds 1,000 or so people to the total. But this was a massive invasion, and it caused everything from a boom in various entrepreneurial circles to a fear of infectious disease spread by uncontrolled human waste dumping and disposal. Trailers and portable housing were rolling into town on trucks; temporary buildings and modifications were going up without safety and building inspections; the mayor and the city council felt they had lost control of their town.[45]



Just a small part of the tremendous influx of supplies, housing units and cleanup equipment.
Photo by Pamela Bergman

The other coastal towns on the highway system — Seward and Homer — had similar experiences, although the influx was generally smaller than in Valdez. The command centers for government were in Valdez, so more people — and more people who wanted to talk to or sell things to those people — gravitated to Valdez. Valdez was also the dateline for most news stories, so people drifting north for work or intrigue tended to wind up in Valdez more than Seward or Homer. Still, Seward's population more than doubled, and Homer — always a magnet in summer for transient fisheries workers and adventurers — was, literally, up all night every night. It was several orders of magnitude above the normal summertime activity.

Kodiak and Cordova fared somewhat better than their highway neighbors, simply because those towns are harder to get to. The transient problem was somewhat reduced, although various cleanup command stations brought a high number of Exxon, VECO (Exxon's cleanup contractor), federal and state government people to towns whose housing, service industries, and government services were not prepared to handle either the increase in demands, or the speed with which the increase happened. Services, tempers, and budgets were stretched to their limits — and, in many cases, they snapped.

However, as Governor Steve Cowper once observed wryly, environmental disaster is a poor economic development strategy.

There were some positive economic aspects to the influx of people and cash. Service companies, such as those that provided catering and other support to the Exxon-VECO offshore cleanup forces, had a prosperous season. Retail sales in all towns were generally high. The state's unemployment rate dropped, and economists generally agree that the mini-boom of the cleanup years (especially 1989-90) provided Alaska with a brief respite from several consecutive years of economic stagnation caused by falling world oil prices.

However, as Governor Steve Cowper once observed wryly, environmental disaster is a poor economic development strategy.

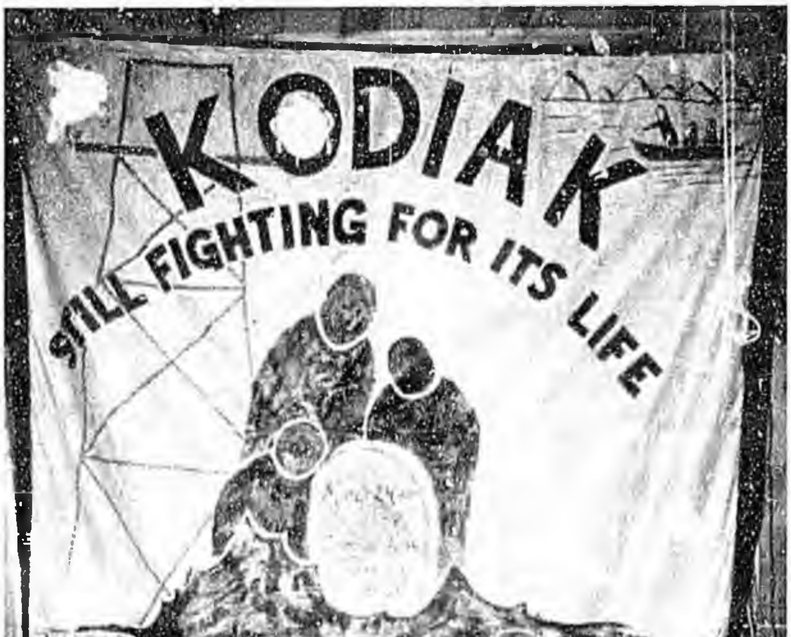
The stress levels, the sudden flow of money, the influx of transients with no obligations or connections to the communities, all helped make day-to-day life in the spill towns in 1989 a bizarre, unsettling, and occasionally dangerous experience.

Much of the summer, many small retail businesses were rich on paper, but desperately short of cash flow. A critical problem reported throughout the major towns in June and July was the backlog of unpaid invoives by Exxon and, more commonly, by its contractor, VECO.[46] The system was simply buried in purchase orders, delivery orders, receipts, invoices and bills, and many people were not getting paid. Especially in the smaller towns, retail businesses had limited cash reserves available and could not carry inventory and large amounts in receivables at the same time. One contractor — the computer provider to the Kodiak offices of Exxon and VECO — shut down the system in protest of slow payment; when VECO tried to log on its computers one day, all it got on the screen was a message from the contractor demanding payment. Eventually, payments caught up with bills, but things were in some disarray for several months.

A good deal of Exxon's $2 billion[47] stayed in Alaska, but much of it went outside with people who left the state after the summer jobs ended. The jobs themselves were transient and largely unskilled positions, hardly the kind of jobs that build economic stability. And with the sudden influx of unskilled workers seeking high-wage jobs came the petty crime and social disruption normal to frontier boomtowns.

Fights, thefts, domestic violence and drunkeness all rose substantially in all the towns of the spill area. In Seward the city manager reported that crime went up 100 percent. In one month late in the fall, there were 134 drunken driving cases on the local court calendar; this was, in raw numbers, as if seven percent of the whole town — men, women, schoolkids and babies — were up on DWI charges at the same time.

Mental health suffered, and so did the service providers. In Kodiak, mental health admissions were up 72 percent; in Homer, the increase was 177 percent, with a 200 percent increase in demand for substance abuse treatment; in Cordova, mental health workers handled a 28 percent increase in drug and alcohol abuse referrals; in Valdez, court-ordered substance abuse treatment for convicted drunk drivers rose from an average of five per month to 15 per month that summer.[48] Domestic violence reports on the Kenai Peninsula rose steeply, and the local women's shelters in Kenai-Soldotna and Homer were full.



Protests such as this one in Kodiak mourned the loss of more than sea life – the social disruption made life in many communites chaotic.
Photo by Rob Schaeffer

Child care was a particular problem. For one thing, normal work patterns were completely altered by the spill. Mothers and fathers were gone longer, working odd or inconsistent hours, and worn out when they got home. This caused both a problem in scheduling and a problem in behavior; stress worked on the children as well, making things harder on care-givers. In addition, there was a severe shortage of child care workers and home care-givers. The high wages of oil spill cleanup pulled workers from the traditionally lower paying child care jobs, so there were simply fewer people available to work in the child care centers. All small businesses suffered from a similar problem in the spill area. Grocery stockers, retail clerks, mechanics, and all kinds of wage workers left their regular jobs for oil spill work, leaving the business owners either working continuous shifts, or losing business because of staff and service shortages. But this problem was especially acute for child care centers, since workers must not only be certified as qualified by the state, but also deemed safe and dependable by the parents. Exxon offered, at one point, to bring in transient workers from Valdez to serve as child care givers in Cordova, a prospect that was not only impossible under state rules, but troubling to parents.

The stress levels, the sudden flow of money, the influx of transients with no obligations or connections to the communities, all helped make day-to-day life in the spill towns in 1989 a bizarre, unsettling, and occasionally dangerous experience.

The smaller towns — Seldovia and the villages — had their own kinds of problems. They, too, had to accommodate a relatively sharp increase in strangers. Native villages tend to be somewhat closed societies. There are few really public spaces, in the American sense. Villages are more a series of private places, and the streets are more like the hallways between the rooms of a private family home. Visitors roaming around at will, using the airstrip, storing materials, or using the community hall or the school without getting full permission or consulting with village leadership, are all viewed as rude or inappropriate behavior.

As in the bigger towns, good mixed with the bad. Employment, in the form of $16.69-per-hour beach cleaning jobs, provided significant floods of cash into towns where money is usually in short supply. People were able to buy all-terrain vehicles, diesel heaters (to supplement wood heaters), and luxuries such as video cassette recorders; there were scattered reports of people investing oil spill earnings into satellite dishes for their televisions. Several of the villages (English Bay and Chenega Bay, for example) rented community-owned facilities such as docks, bunk houses and heavy machinery to Exxon or VECO, giving the local government or village corporation unexpected income.

Like in the bigger towns, however, drug and alcohol abuse rose, sharply in some cases. Alcohol abuse is probably the biggest social and health problem in rural Alaska, and villages struggle with it and against it on a regular basis. Ahkiok, at the southern end of Kodiak Island, had in previous years developed a growing sobriety movement. Where alcoholism had once affected 90 percent of the population, community efforts had nearly reversed that number by 1988, as 85 percent of the population of 100 people were considered sober. Yet by mid-October 1989, after a season of cash employment and a disruption of the local support network, sobriety had dropped to 55 percent. Crime rose with the drinking. The village had to hire a village public safety officer to handle night calls and accidents.[49]

The details of the spill response – where equipment was stored, where transients slept, how garbage and human waste were handled, how local cops dealt with the population explosion – fell to local elected officials, most of whom are volunteers or part-timers.

Local governments found themselves on the front lines more than they wanted to be. The details of the spill response — where equipment was stored, where transients slept, how garbage and human waste were handled, how local cops dealt with the population explosion — fell to local elected officials, most of whom were volunteers or part-timers.[50] City administration in most places was swamped with spill-related work: processing bills, chasing repayment from the state and from Exxon, handling extraordinary payroll and accounting duties, providing staff support to the explosion of official activities — the multi-agency coordinating committees, the "oiled mayors" group, town meetings, etc. City service workers — the police, fire department, parks managers, garbage collectors, road and street maintenance workers, dock managers and harbor masters — were working seven-day weeks. City facilities — landfills, sewage treatment plants or lagoons, community halls, schools, docks — were being filled up, overworked and under-maintained. It sounds a bit petty to stack these problems against the pollution washing up on the beaches and the animals dying, but it was a problem nonetheless. These were the details of the oil spill response system, and if the details weren't handled, the whole thing would have collapsed, stalled, or caused collateral damage.

It cost money. Some governments had good cash flow or cash reserves (Valdez, which gets most of its revenue from property taxes on the Alyeska pipeline terminal), while others did not (Cordova and Kodiak depend on sales taxes, personal property taxes, and raw fish tax shared with the state). Every extra expenditure required some kind of official approval by elected officials, and elected officials were nervous about the fact that they were authorizing extraordinary expenditures without a guarantee they would be repaid.

Politically also, the mayors and city councils were also right on the front lines. They were, in every case, dealing with an unsettled, angry, and frustrated population with a wide variety of complaints and problems: The business owner who wasn't getting paid by VECO, the property owner complaining about the transients cutting down his trees for wood or defecating in the creek near his house, the local activists demanding more action on the beaches, the vessel owner who wasn't getting called for spill work, the taxpayers wondering who was going to cover the extra response costs if Exxon didn't.

In May, a handful of mayors from the spill-area communities coalesced into a group that came to be known as the Oiled Mayors Committee, which was loosely connected to the Alaska Conference of Mayors. The mayors met frequently throughout the summer of 1989, mostly to exchange notes, information, problems and solutions. The core membership included the mayors of Kodiak (city and borough), Valdez, Cordova, Whittier, Seward and Homer; the Kenai Borough mayor joined the group for key discussions, and some village mayors were gradually included. Attendance was flexible, depending on the issue at hand, the fatigue level of certain mayors, the patience of others, the cash available for travel, and the mood of the applicable city council or electorate in a given town.

The first issue that drew the group together in May and June was money: specifically, repayment for incremental city or borough expenses due to the oil spill response.

Some of the communities had managed to get commitments or cash from Exxon, the state government, or both. The state, through DEC, set up repayment agreements with some of the principal governments — the Kenai borough, Valdez, and Cordova — and eventually nearly all the communities were covered by agreements at one time or another. These repayment agreements were based on a provision of state law that allows the commissioner of the DEC to use the state's response fund to reimburse communities for spill-related expenses. However, the law and its prevailing interpretations at the time defined spill-related expenses fairly technically (or narrowly, as the mayors saw it). DEC, with its specific responsibility for technical aspects of spill response, traditionally paid for things with oil on them, so to speak: money for boom or supplies or wages paid directly for cleaning oil. The mayors were interested in repayment for a broader range of costs, more like emergency disaster funding than oil spill response.

In May, a handful of mayors from the spill-area communities coalesced into a group that came to be known as the Oiled Mayors Committee, which was loosely connected to the Alaska Conference of Mayors.

The mayors turned to Exxon, which had already expressed a willingness to repay out-of-pocket expenses. In some cases, the company had already made up-front payments or made commitments for specific amounts to certain communities.[51] However, the mayors were concerned because there was no equitable distribution or pattern for distributing impact funds or reimbursements. Governments with quick-thinking officials, those who had people in the right place at the right time, or those with the money and people required to travel and get access to the right Exxon officials, were able to secure commitments early. Others were not.

The mayors proposed to develop a standard community agreement that would guarantee repayment to all affected communities under the same terms, schedules, and rates. In late May, they asked Exxon officials to meet with them in the Anchorage office of Governor Steve Cowper.

The meeting went badly. The mayors had sent a draft agreement to Exxon and expected a negotiating session; Exxon sent, instead, two public relations officials who appeared to have neither the authority nor the information necessary for negotiation. The mayors, already frustrated and already under pressure from their constituents to alleviate problems at home, were left empty-handed and angry. Negotiations never got much better. Exxon eventually sent over a proposal that would have turned the cities into Exxon contractors, a prospect the mayors either found politically distasteful or contractually inappropriate. The effort to establish community agreements with Exxon fell apart in a blaze of publicity and bad feelings.

In fact, the agreement the mayors was seeking was little more than a written, contractual expression of what Exxon was doing already. The company had already told communities it would repay them for legitimate spill-related expenses, and, even without the agreements, it paid almost $10 million in reimbursements to affected local governments in 1989. And according to one of the most influential mayors, Exxon tended to reimburse promptly.[52] The main problems, from the mayors' standpoint, were that the *ad hoc* reimbursement policy favored larger, better-staffed communities over smaller ones (since bigger cities had accounting staff or could hire lawyers and accountants to handle the issue), cities were put in the uncomfortable position of making emergency expenditures without a guarantee Exxon would accept it as legitimate, and cities were spending their own taxpayers money — up front — on a problem the taxpayers didn't cause.

Government officials burned out. Several mayors did not seek reelection in the fall. The turnover on city councils was unusually high (most of Seldovia's city council just resigned in the middle of the summer). The towns were a mess.

"Some local jurisdictions did have reserves that could accommodate such expenditures, but others did not," a summary report commissioned by the Oiled Mayors' group reads. "There were instances where Exxon advanced funds for expected expenditures. However, there was no consistent policy or mechanism to advance funds to communities. Thus, it was the quality of individual relationships with Exxon officials, chance, political leverage, or the negotiation resources of communities that assisted with getting reimbursement or cash advances."[53]

Rebuffed by Exxon in early June, the mayors then turned to the state for relief. The state, while sympathetic, did not have exactly what the cities wanted, either. The rules about use of the state reponse fund were strict; it was not a disaster relief fund, and it would probably be illegal to use those public monies on many of the things for which the cities sought payment (legal fees, for instance). The money the state Legislature had given to the Governor for emergency expenses carried a similar requirement. And in neither case could the state legally give communities up-front grants, for unspecified expenses, from response funds. As long as Exxon was willing to make reimbursements — and it was indeed writing the checks — state officials did not feel it was appropriate or necessary to stretch the rules governing the use of response funds.

All this would be little more than a discussion of intergovernment wrangling and accounting minutiae if it were not a symptom of a larger problem. There were, indeed, legitimate concerns and accounting gaps in the system the cities had to deal with. However, in a larger sense, the apparent inability of local government leaders to make Exxon do what the locals wanted done contributed to the sense of powerlessness and frustration in the towns. Government officials burned out. Several mayors did not seek reelection in the fall. The turnover on city councils was unusually high (most of Seldovia's city council just resigned in the middle of the summer). With a few notable exceptions, local governments were in upheaval. Some local taxpayers were stuck with unpaid bills. The towns were a mess.

When September rolled around and Exxon pulled out of the spill towns for the winter, there was a mix of sadness and relief. People generally didn't feel Exxon had finished the job, but they were happy to be left alone again. The summer of 1989 had presented lots of opportunities for some people to make money, but it came at a high price in the coastal towns. Local governments fell apart, friendships and relationships were stretched and broken, nerves were scraped raw, and normally small towns were confronted with big-city problems and stress.[54]

Miles of beach

The shoreline cleanup of Prince William Sound and the Gulf of Alaska began in early April, as a few work crews comprised of a handful of people each came ashore at Naked and Eleanor islands. What started on April 2 as a cluster of people wiping rocks with absorbent pads would, within six weeks, turn into the largest single private project (in terms of employment) in Alaska since the construction of the trans-Alaska pipeline.

At the height of the summer season, Exxon and its two prime contractors[55] had more than 10,000 people working on the project. The skippers and crews of contract vessels providing support services and transportation pushed the total of the private workforce over 11,000. Exxon coordinated a military-style flight command center in Valdez that provided helicopters and fixed wing aircraft to all parties, almost on demand.

The principal complaint about the "miles of beach" standard, from the state's viewpoint, was that it had little or nothing to do with the quality of work, or even the state of the shoreline at the close of the work.

Exxon's first attempts at shoreline cleanup were limited to manual wiping and pickup of seaweed and debris, beginning at Naked Island. That project was quickly abandoned as impractical, and by April 15, a consensus had developed on the use of hot- and cold-water flush systems. Exxon and the military began bringing in barges, boilers, hoses, and portable pumps to support beach-cleaning crews, and by the first week of May, shoreline cleanup was the focus of the entire operation.

There was a considerable amount of debate and discussion in the first few weeks about Exxon's cleanup plans, the amount of shoreline targeted for treatment, and the schedules for getting it all done. Exxon would list a number of beaches, often using miles or yards as a measurement; the public and the governments usually said it wasn't enough; Exxon would expand its targets, and the process would begin all over again. The paper trail of cleanup frequently led to Exxon's daily reports, which reported in exquisite detail the number of vessels deployed, number of workers involved, number and types of various skimmers and boilers — and, finally, miles of beach treated per day, per scheduled period, and total.


Aerial view of a stretch of shoreline cleanup.
Photo by Peter Montesano

The miles of beach became the standard measurement of cleanup progress. Not surprisingly, when Exxon's final day of scheduled cleanup came around, crews were reportedly hitting that last 0.7 mile of beach scheduled to be cleaned in 1989. The schedules and numbers became their own, closed reality. If you're counting, Exxon says it treated 1,088 miles of beach in Alaska in the summer of 1989.[56]

There were several basic problems with the "miles of beach" measurement and the way it was generally perceived outside of the actual reality of the shorelines.

First, no one agreed on what constituted a "mile of beach" treated. The state had one measurement, the Coast Guard occasionally had its own, and Exxon had a third measurement that didn't match either of the first two. Shorelines were divided into segments and subdivisions, which were generally defined by natural shoreline features — headland to headland, large outcrop to small bight, and so on. Oiling was not always continuous. State monitors claimed that Exxon would count an entire segment (sometimes they were more than a mile in length), even if only a small part of the segment were actually treated, in an effort to inflate progress reports. Monitors reported instances in which crews concentrated on working light- or moderately-oiled segments, rather than the heavily oiled spots, because they could cover more "miles of beach" and again, inflate progress reports. Competition among VECO and Exxon workcrews was sometimes intense; state monitors reported that workcrew supervisors were often more interested in meeting their schedule than doing a thorough job because they didn't want to appear to be lagging behind competing crews.

The principal complaint about the "miles of beach" standard, from the state's viewpoint, was that it had little or nothing to do with the quality of work, or even the state of the shoreline at the close of the work. A shoreline segment reported as treated, and rolled into progress figures, could easily be reoiled on a subsequent tide change — but it would not be deleted from the total.

Viewed from a perspective that brings the whole, three-year cleanup effort into the picture, the miles of beach issue becomes almost inconsequential. It disappeared from the oil spill stage after 1989, and cleanup began to be viewed more as a site-by-site operation. However, in 1989, the issue of cleanup progress was central to planning, strategy, perceptions and politics.

Exxon's first cleanup plans listed September 15 as the close of cleanup operations — not the close of operations for the winter, or the close of operations for 1989, but simply, the close of operations. Exxon's top management told its shareholders, meeting in mid-May, that the shoreline cleanup would be complete September 15.

Moreover, the oil was mobile; while Exxon's May 8 shoreline cleanup plan had listed a little more than 350 miles of beach to be treated, by June the official mileage of oiled shoreline had doubled to 700.

There were no guarantees Exxon would continue the work, and no assurances that the Coast Guard would require Exxon to continue work if the state felt it were necessary. State officials did not know if they would be left with oiled shorelines at the end of the summer, and if so, whether anyone else would be there to conduct cleanup.

By mid-summer, Exxon continued to march towards its statistical goal, dutifully adding more "miles of beach" to cleanup totals each day. Meanwhile, its top officials were pointedly vague on the issue of whether they would continue cleanup if the shorelines needed it — and it was clear to many, especially at the state level, that knocking the surface oil off the beaches was not getting most of the oil at many sites. Moreover, the oil was mobile; while Exxon's May 8 shoreline cleanup plan had listed a little more than 350 miles of beach to be treated, by June the official mileage of oiled shoreline had doubled to 700, including large stretches in the Gulf of Alaska and Kodiak. Exxon was forced to revise its plan to deal with that new reality.

Unfortunately, Exxon was not revising its ultimate target — September 15 — nor was the company altering its position that cleanup would cease on that date. However, the language of the cleanup was changing. Exxon's promise to clean the beaches had been officially downgraded to making beaches "environmentally stable." The operative term became "treating" beaches rather than "cleaning" them.[57] Moreover, the newest problems were those occurring "downstream" from the sound, along the Kenai Peninsula and Kodiak beaches. Yet, Exxon was slow to make commitments for extensive cleanup outside the sound. In the state's eyes that summer of 1989, Exxon appeared to be basing its plans primarily on what the company wanted to do, not on what the state and the public wanted. Instead of altering its overall target to match the changing state of the problem, Exxon was changing the problem to match the original goal. It was also beginning to mount a public relations campaign that portrayed the conditions in Alaska as vastly improved, and the cleanup as an orderly and effective operation. In a pamphlet sent to the company's seven million credit card holders and handed out at Exxon gas stations in June, the company claimed that the oil was "essentially" gone from the water by mid-May, and that the company was following its comprehensive plan for cleaning shorelines "to meet our mid-September target completion date."[58] It did not mention the extent of the shoreline oiling, surface or subsurface, and it made no reference to the fact that shoreline cleaning was a messy and difficult operation in which oil was lost into the water with regularity. To state officials, it appeared Exxon was gearing up for an exit that would allow the company "to declare victory and go home."[59]

On July 15, 1989, DEC commissioner Dennis Kelso wrote a letter to Coast Guard Commandant Paul Yost, requesting that the Coast Guard secure a commitment from Exxon to continue work past September, if necessary. Kelso's letter didn't have much of an effect.

Then, four days later, news reporters obtained a memorandum from Exxon's general manager in Alaska, Otto Harrison, to other key managers in the operation. Harrison informed his staff that the September 15 date was firm, that no one should commit to anything more than a survey in 1990, and, finally, that the pull-out decision was "not negotiable." At a special Congressional hearing less than a week later, Exxon officials again stopped short of committing to continue work in 1990. This further amplified the doubts state officials had about Exxon's willingness to follow through on its earlier promises to bring the project to completion — completion to state and federal standards, that is.

The most common operating problem, reported widely and frequently in daily shoreline assessment reports from state monitors, was poor containment and minimal recovery of oil that was washed off the beaches.

From the state's perspective, all this was troubling news. The state had committed to a cleanup structure in which the spiller controlled the operation, not government, and now the spiller was claiming that the company would take unilateral action regardless of what the government wanted. As a practical matter, a unilateral departure could leave the state and federal government with the unexpected job of taking over the cleanup machinery — procurement and deployment of equipment, hiring people and contractors, collecting and disposing of the tons of waste — or actually rebuilding it from scratch. That posed the obvious threat of delays and more confusion.

Exxon's position also put the "miles of beach" issue in a new and troubling perspective: If Exxon left the cleanup and the state attempted to force the company to return, the effort would probably involve some kind of court order. And if the issue came before a judge, would Exxon contest the state's request by trotting out its charts showing that it had actually treated the requisite number of miles of beach? Was this really a measure of progress or was it part of some legal strategy? For all the company's commitments to follow through and its stated desire to have a cooperative response, Exxon had now made it clear that it felt bound by no requirements other than its own, and that its position was "not negotiable."

In reading through the popular literature surrounding the spill response in 1989, one can tell that Exxon had some doubts of its own. Top Exxon officials speculated that the state was trying to keep the cleanup going because it helped the state's legal position, or because it put jobs in Alaska and money into the economy.[60] These were preposterous assumptions, but clearly they affected how Exxon viewed the situation and expressed its position.

Looking back, this whole tempest can be viewed as occurring in a time of heightened emotions and serious uncertainty about the fate of the environment. In the longer view, the value of discussing this incident lies in its effect on the shoreline operations, not on the relations and debate among public figures.

The state's monitors on the shorelines were watching a cleanup effort that did not match the smiles of the progress reports back at headquarters. Exxon's contractor, VECO, was moving too fast and not getting satisfactory results. Those "miles of beach" showing up on the progress reports were not necessarily cleaned, and the oil coming off the beaches wasn't necessarily being picked up.

The most common operating problem, reported widely and frequently in daily shoreline assessment reports from state monitors, was poor containment and minimal recovery of oil that was washed off the beaches.[61] Among other problems, VECO crews put boom in the wrong places, took boom away before the oil inside was recovered, and left boom "gates" open too long, allowing oil to escape. It was not until July that VECO and Exxon began leaving boom at cleaned sites until adjacent areas had been cleaned; this was designed to prevent cleaned spots from being reoiled by "rogue" slicks, or by oil released because of sloppy containment at nearby areas.

However, oil containment and recovery was not as high a priority as simply washing oil off the beaches. At Snug Harbor (Knight Island) in mid-July, the state's chief contractor reported, "The same basic problems exist. They knock more oil off [the

State monitors would not "sign off" beaches when they felt work was incomplete or new oiling had been found. They were wary of signing off shorelines because they did not want to imply that this particular "mile of beach" was clean.

beaches] than they can either contain or skim." He reported that as oil washed free, away from the boomed areas, "Work boats are racing through the slicks trying to disperse them with propwash."[62]

A week later, DEC monitors observed another crew at Block Island, to the northeast. "We observed a crew set up, blast oil off, pull their boom, and leave, letting all the oil go. There was not even a skimmer in the area. The same thing is happening at Ingot Island."[63]

The skimmers deployed at many work sites were either inefficient, the wrong models, or even inoperative on occasion. One type of skimmer, the rope-mop variety, was so inefficient that Exxon supervisors sometimes refused to use them.[64]

On one occasion, state monitors reported that a cleanup supervisor had ordered skimmers into the water, even though they weren't working, so that observers passing over by air would be fooled: "Since we have gotten good at finding where they stash equipment on barges instead of using them they are now putting some of these things in the water whether they work or not. I've found three mini-skimmers this week that were put in the water even though the crew said they were not operational. They said that the foreman told them to do it because it looked good if someone flew over and everything was out on display."[65]

The real problem with skimming and recovery was that it took time to do it properly. With speed and "miles of beach" as the operating goal, it was easy for some crew chiefs to get lazy and concentrate on washing rather than collecting.

In addition, there was virtually no effort to address the problem of oil beneath the surface of the beach — a problem that had not necessarily been anticipated, and which was becoming increasingly obvious to state monitors. The problems appeared to be running ahead of the plans, and the people making the plans seemed unwilling to acknowledge this fact. When state monitors raised these issues — incomplete work, sloppy containment, an emphasis on speed rather than quality — it led to daily confrontations on the shorelines. Generally, Coast Guard monitors were willing to leave behind more oil than the state monitors. When state monitors refused to certify a beach had been completed — or, "signed off," since the federal-Exxon work order had a spot for the three officials to sign on completion — it led to constant and daily reports of conflict.

Ultimately, the decision to end cleanup of one area and move on came down to two sets of eyes: The Exxon or VECO supervisor, and the Coast Guard monitor on the scene. The state was somewhat isolated, as its status was viewed as diminished in authority to that of the Coast Guard. Photo by the U.S. Coast Guard

State monitors would not "sign off" beaches when they felt work was incomplete or new oiling had been found. They were wary of signing off shorelines because they did not want to imply that this particular "mile of beach" was clean, and they didn't want it to show up that way in the official progress reports. They didn't know if Exxon would ever be back, so they did whatever they could to get the VECO crews to get as much oil as possible whenever possible. When they saw crews moved because of schedules, rather than oiling, they saw work delayed or not done unnecessarily.

"Perhaps these delays and deferrals of treatment would not have been so controversial if time had not been a factor as well," one of the state's chief monitors wrote in a

1992 summary of cleanup actions. "Time factored into the situation in two ways. First, there was a limited season in which to accomplish all the cleanup work that was necessary before foul weather and winter storms prohibited further work. Many felt that it made sense to concentrate energy toward treating the more heavily oiled areas as completely as possible rather than spreading out the resources in order to nominally attend to all the areas."[66]

Trying to hit everywhere, rather than hitting heavily oiled beaches and staying there until the work was done, had an effect on recovery rates at the heavily oiled beaches. The longer the oil sat there, the tougher it was to remove, and the more it was able to soak into the beaches. From the perspective of the monitors working the beaches, Exxon or VECO's apparent desire to increase tallies for reporting purposes had a negative effect on the recovery effort at the heavily oiled and damaged beaches.

The deterioration of relationships or the lack of real cooperation should be considered as something more than petty bickering or intergovernment turf battles, or as subjective judgments about who was the good guy and who was the bad guy.

Much of this shoreline trouble can be attributed, perhaps, to differing subjective interpretations of general instructions and goals. The first year's mission was to remove the "gross contamination," and while headquarters tried hard to put some kind of consistent, less subjective standards to that instruction, ultimately, the decision about moving came down to two sets of eyes: the Exxon or VECO supervisor, and the Coast Guard monitor on the scene. The state was somewhat isolated, as its status was viewed as diminished in authority to that of the Coast Guard. If the Coast Guardsman went along with the Exxon man's call, the state monitor either had to use persuasive powers to keep the crew on site, work out some kind of compromise, or make a protest back to the home office.

Additionally, Exxon mounted, for much of the summer, an aggressive campaign to gain approval of its kerosene-based solvent, Corexit.[67] Exxon lobbied for test after test, each time insisting — over the observations of state and federal monitors — that the test was a success. The people in the field, who observed in test after test the inability of crews to contain and recover the solvent mix that washed off the beaches, grew more skeptical of Exxon's motives with each successive, unsuccessful test. It did not help when, during one test, DEC caught Exxon contractors racing around outside the boomed-off test area, using the propwash from their skiffs to break up or disguise any Corexit-oil-water mix that got away.[68] Many DEC staff viewed the Corexit campaign as an attempt by Exxon to take a cheaper, easier cleanup route. The solvent would get oil off the surface and get the pressure off Exxon to really clean all those "miles of beach."

The "miles of beach" figure was a hollow statistic. Monitors in the field saw how hard VECO and Exxon (and, to some degree, the Coast Guard) tried to fulfill quotas, satisfy schedules, and rack up miles, sometimes to the point of putting the quotas above results.

It is hard to ignore the fact that relations among the various representatives on the shoreline were poor more often than they were good. While some crews were better than others, some supervisors were more helpful than others, some Coast Guard monitors were more cooperative than others, and some state monitors were more skillful and better-trained than others, down on the beaches, mistrust and misunderstanding were more common than cooperation and mutual support. It is hard to quantify what effect, if any, this had on the effectiveness of the cleanup, but it certainly led to short nerves and high stress.

State monitors tended to have disagreements with Coast Guard monitors, but the most frequent and most troublesome often included Coast Guard reservists, rather than fulltime active duty officers and non-commissioned officers. The Coast Guard also tended to rotate people in and out after fairly short stints. This meant that every two weeks, there was a new person's personality to gauge, a new bridge of trust that had to be built; any spoken or unspoken agreements with the previous "Coastie" were rendered moot, and any lessons the previous one learned had to be relearned by the next one.

The deterioration of relationships or the lack of real cooperation should be considered as something more than petty bickering or intergovernment turf battles, or as subjective judgments about who was the good guy and who was the bad guy.

First, from an organizational standpoint, entities such as the Interagency Shoreline Cleanup Committee (ISCC) and the Technical Advisory Group (TAG)[69] were fertile ground for misunderstandings. The rules were developed over time, and at times the intent, authority, and the procedures of the joint response were somewhat fluid. There was no commonly developed set of administrative procedures, no manual, and little precedent. Indeed, the roles of Exxon, the public, and some government agencies themselves were alternately unclear, unprecedented, or truncated.

In addition, training of field staff was not consistent or always complete. Definitions used in making decisions were sometimes subjective. Field procedures (such as the "signing off" of treated segments) were not clearly understood or defined, especially in terms of what effect the action would have on future cleanup efforts.

Exxon burned some of the waste from cleanup at an empty gravel pit near Valdez. The waste before separation was a mix of oiled seaweed and debris, oil-soaked absorbent pads, oil-soaked plastic stringers (pom-poms), oil-soaked absorbent boom, rocks, sand, wood, and garbage generated by the cleanup crews.

Photo by Rob Schaeffer

Dispute resolution was not good, especially in the field; it nearly always involved someone losing face or being embarrassed. A DEC monitor could get a Coast Guardsman or VECO or Exxon supervisor overruled, but that meant an appeal to a higher-ranking officer or supervisor at DEC and the Coast Guard and Exxon. Someone was bound to lose — and lose out in the open for everyone to see — under this system. And given the high stress, the pressure, and the importance of the operation, there were frequently poor losers and ungracious winners. This caused more stress and further broke down trust and working relationships. Making up the rules and the structure as one goes along simply will not work in an emergency.[69]

Similarly, the lack of an established procedure for testing, certifying the safety, and approving of new techniques or products — rapidly — also helped exacerbate whatever bad feelings existed. The first real problem was with Corexit, the second was over bioremediation. The state and public felt Exxon and the federal government were pushing the products too hard and too fast; Exxon (and sometimes some federal agencies) felt the state and the public were too cautious or had ulterior motives for opposing the product or requesting more testing.

A third major dispute, this one about waste disposal, flared and subsided several times through September. Exxon wanted to burn most of the tons of oily waste coming back from the work crews. The waste was a mix of oiled seaweed and debris, oil-soaked absorbent pads, oil-soaked plastic stringers (pom-poms), oil-soaked absorbent boom, rocks, sand, wood, and garbage generated by the cleanup crews. The primary storage site was an empty gravel pit at at the base of a mountain off the Dayville Road in Valdez, about halfway between town and the Alyeska terminal. At the site, workers took the waste from plastic bags, separated organics and plastics, rebagged the separated waste and stored it in separate piles building up in lined pits. The main pile was about 100 yards long, a bit smaller across, and by July the waste was more than 30 feet high.[70]

Exxon was burning some of the waste in three small, gas-fired incinerators brought to the site. The company got an air quality permit for the burning from DEC with relative ease. The problem arose when Exxon proposed to bring in one or more larger