

**Prevention,  
Response, and  
Oversight  
Five Years  
After the**

*Exxon Valdez*

**Oil  
Spill**



**Proceedings  
of an  
International  
Conference**

# **Prevention, Response, and Oversight Five Years After the Exxon Valdez Oil Spill**

**Proceedings of an International Conference**



**LOAN COPY ONLY**

**March 23-25, 1994  
Anchorage, Alaska**

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**Alaska Sea Grant College Program**

P.O. Box 755040

University of Alaska Fairbanks

Fairbanks, Alaska 99775-5040

Phone (907) 474-6707

Fax (907) 474-6285

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## **About the Conference Proceedings**

The International Conference on Prevention, Response, and Oversight Five Years After the *Exxon Valdez* Oil Spill was held March 23-25, 1994 in Anchorage, Alaska. March 24th was the fifth anniversary of the spill. The conference participants looked at the many local, state, and federal changes made in the United States since 1989 to assess whether enough has been accomplished regarding oil spill prevention and response preparedness for the next spill.

The conference was sponsored by the Alaska Sea Grant Program, University of Alaska Fairbanks in cooperation with the Alaska Department of Environmental Conservation, Cook Inlet Regional Citizens' Advisory Council, Exxon Valdez Oil Spill Trustee Council, Hazardous Substance Spill Technology Review Council, Regional Citizens' Advisory Council of Prince William Sound, U.S. Coast Guard, and U.S. Environmental Protection Agency.

Conference planning committee members were: R.K. Dearborn, Ernest Piper, Harry Bader, Kathryn Kinnear, Lisa Parker, Walter B. Parker, H.E. "Stan" Stanley, and Rick Steiner. The conference was organized and coordinated by Brenda Baxter.

## Summary

R.K. Dearborn

*Alaska Sea Grant College Program*

*University of Alaska Fairbanks*

*P.O. Box 755040, Fairbanks, AK 99775-5040*

I think there is no need for all of us to go away with a single view of this meeting. In fact, I think it's important that we not go away with a single view of this meeting because we are each playing a different role in life, and trying to make life better. I think we should take from the meeting what helps us do that.

I said at the beginning of the meeting that I thought five years ago change was needed. Some change has taken place, in fact much of it for the better. I'm a bit more optimistic at this hour than I thought I might be as we began. However, as Ernie Piper said, yesterday helped us point out to him that some of these changes are only on paper. With respect to oversight, I think it is clear there are more people spending time and energy in the area of oversight than there were five years ago. Stan Stanley pointed out that those who have the most at risk are the least likely to become complacent; but his partner, Stan Stephens, reminds us that complacency is among the greatest challenges we still face. Jerry Aspland, of all people, warned the overseers not to become part of the bureaucracy which they are overseeing.

I believe that a certain oil spill groupiness has developed, and I think it breeds some false security. When you finally win an argument with Jerry Aspland, Alyeska, or pipeline, it's not only your group that should be satisfied by the progress you may or may not have made. The public also must be kept informed and concerned to the level of electing officials who will remember that it's our mutual responsibility to use the ocean as a common property resource.

With respect to response, planning has great educational value. Even if not followed explicitly, I think it does help react. Anytime I walk out of the woods after a hunt with 90 pounds of raw meat on my back through bear country I have thought of that ahead of time, I do have a plan, I have no idea whether it's adequate, but I suspect my reactions would be better. When our plans are complete, those many plans that we've been talking

about, what will we use next to keep our minds on the issue? What will we use to take place of the 80 pounds or 90 pounds of raw meat on our back? Maybe it will be the challenge of forgetting some of our past differences on appropriate technologies for cleanup. Maybe we ought to look again at burning and bioremediation and some of these other things.

With respect to training, I think clearly we have much more active training under way now than we did five years ago. I personally do worry that the scale of that training and of that technology may not be quite up to the task.

With respect to prevention, I think Jerry Aspland is right. We need to examine our ocean transportation system, including appropriate vessel traffic systems, information systems, location systems, and control systems. I personally don't believe we have a transportation system. I think we have an inheritance. I also agree that we must examine the training, testing of personnel, their development, and their discipline. We've made some progress in the area of discipline. Drug testing does make a difference.

I think prevention ought to remain our top priority. Trying to be realistic, many people in this room have said over the last few days "oh, there will be another one." I think we must stiffen our resolve to reduce that likelihood.

I've received a number of compliments for the quality of the meeting. It has been a good meeting. I remind you to look again at the membership of the planning committee on the back of your agenda and the organizations from which those people come; remember to thank them as well. I also remind you that to have a good dinner party, all you have to do is invite the right people, you folks.

Some of you have come some distance, and Jonathan Wills, we thank you especially for the long trip. I've appreciated the help in serving up the dinner from Rick Steiner, Walt Parker, Ernie Piper, Patty Ginsburg, and Stan Stanley. We did have a good time; I had a great time. I thank you for making our small effort very much worthwhile.

## Welcome

R.K. Dearborn

*Alaska Sea Grant College Program  
University of Alaska Fairbanks  
P.O. Box 755040, Fairbanks, AK 99775-5040*

The fact that we are here indicates that the *Exxon Valdez* oil spill, 15 hours short of 5 years ago, has changed each of our lives at least a little. Change was due, not just in others, but in ourselves as well. One of the burdens of living in a democratic society is that we cannot fully shift the blame to others for the rules that are made and the fervor with which they are or are not enforced. Nor can we shift the blame to others for the consequences of our failures in oversight, response, or the prevention of social disasters.

We now begin three days of examining how we as citizens are doing. Have we learned? Have we learned enough? Does our vision remain clear? By Friday I hope we can grade the results of this self examination. Even before yesterday's presentation of the detailed scientific statistics at the *Exxon Valdez* Oil Spill Trustee Council's forum, those of us who planned this meeting, had individually and collectively concluded, regardless of the statistical body count, that oil spills are not good and ought to be prevented.

Before I go any further, I'd like to acknowledge the conference planners:

Ernie Piper, former Oil Spill Response Manager for the Alaska Department of Environmental Conservation

Harry Bader, Chair of the Citizen's Oversight Council on Oil and Other Hazardous Substances and faculty member in Resource Management at University of Alaska Fairbanks

Kathryn Kinnear, Citizen's Oversight Council on Oil and Other Hazardous Substances

Lisa Parker, Cook Inlet Regional Citizens' Advisory Council

Walt Parker, Chair of the Hazardous Substance Spill Technology Review Council

Stan Stanley, Prince William Sound Regional Citizens' Advisory Council

Rick Steiner, faculty member and Sea Grant Marine Advisory Program agent for the University of Alaska Fairbanks in Prince William Sound

To introduce the topic of oil spill prevention, response, and oversight we are privileged to have a man whose at-sea experience includes the command of five cutters; who during four years at U.S. Coast Guard Headquarters in Washington, DC, had responsibility for environmental response; and who presently has responsibility for all Coast Guard operations in Alaska, Admiral Roger Rufe, Commander of the Seventeenth Coast Guard District.



## Introduction

RADM Roger T. Rufe, Jr.

*Commander, Seventeenth Coast Guard District*

*P.O. Box 25517, Juneau, AK 99802*

Welcome to this Conference on Prevention, Response, and Oversight five years after the *Exxon Valdez* oil spill. That spill, an event whose effects are still with us, brought unprecedented attention to the need to do a better job of protecting our environment.

Those of you attending this conference have not forgotten the 1989 spill. That's good, because we cannot afford to let ourselves regress to the false sense of security that existed in March 1989.

Was it an isolated incident, one that couldn't happen again? The answer is, obviously, no. Soon after the *Exxon Valdez* spill we had the *American Trader* and *Mega Borg* spills in the United States and later the *Braer* spill in the Shetlands and several others overseas. Unfortunately, the transportation of oil will always present the potential for spills. We need to learn from these incidents and continually improve our spill prevention. But, recognizing we will never achieve a state of zero risk, we must also continually improve our spill response capabilities. And, through oversight, we can ensure everyone's guard is up.

We can't let an *Exxon Valdez* type spill happen again! None of us, by ourselves, can prevent a spill of this magnitude. But, together, working cooperatively we can achieve "environmental excellence" in Alaska. We can minimize the potential for a similar spill and improve spill response efforts, should they be needed. This conference is a step in that direction and can serve as the catalyst for setting the course for the future.

A lot has happened these last five years since the Valdez spill. A \$2.5 billion spill response effort was undertaken to clean Prince William Sound and other oil-impacted areas, new federal and state laws were passed, millions of dollars of spill response equipment has been bought, we've added tanker escorts and large oil spill exercises, expanded vessel traffic service (VTS) coverage, and the list goes on. Now is a good time to pause, reflect on where we were, where we are now, and where we want to go.

Where were we on March 24, 1989? At that time many of us let our guard down—the pipeline had been in operation for 14 years—approximately 8,500 laden tankers safely made the transit of Prince William Sound without spilling any oil. The Coast Guard's marine safety program underwent major cutbacks due to its focus on the current national concerns, drug interdiction, and military readiness. The state approved Alyeska's spill response plans but Alyeska laid up its primary spill response vessel for repairs. The master of the *Exxon Valdez*, having made the trip many times before without incident, felt this was just another routine transit and left the bridge of the vessel. This was the setting for a major catastrophe—the rest is history.

Have we learned from this? Are we better off now than in 1989? Is there still more to be done? Yes, yes, and yes!

The public screamed; our legislators listened and responded by passing rigid environmental laws—not just in Alaska, but nationally and internationally. The Oil Pollution Act of 1990 was unanimously passed by Congress. When was the last time everyone in Congress agreed on anything? This law is truly comprehensive. It addresses increased penalties and liabilities—very strong incentives for industry to improve their spill prevention efforts. It also mandates many other prevention and response measures such as double hull tankers, drug and alcohol testing, improved navigational systems, tug escorts of tankers, increased spill preparedness by both industry and the Coast Guard, development of Regional Citizens' Advisory Councils (RCAC) in Alaska, the conduct of regular oil spill exercises, and increased pilotage requirements, to name a few.

The spill response capabilities that existed at the time of the *Exxon Valdez* oil spill were abysmal in comparison to what exists today. Recent exercises in Prince William Sound, the North Slope, and Cook Inlet show just how much more equipment and capability we can roll out now. The best in the world is here in Alaska. I observed several drills this year. The one I saw this past fall in Valdez had several hundred personnel for the state, Coast Guard, industry, other governmental agencies, and the RCAC staff in a very effective "unified command." Hundreds more operated the fleet of response vessels, skimmers, and aircraft. It was truly impressive. In a matter of a few hours the response fleet was underway and in position to recover oil. We never accumulated such an effective on-water response capability during the entire *Exxon Valdez* spill response. The equipment simply did not exist at that time.

I've also seen laden tankers underway in Prince William Sound with two escort vessels alongside. We had 8,500 vessels sail through Prince William Sound without escort out of VTS range without grounding before the *Exxon Valdez* spill occurred. I can't see how that same incident could

happen now with expanded VTS coverage and two escort vessels. But there is no such thing as zero risk; that's part of life. Thousands die in automobile accidents every year. We've progressively reduced the risk through lowered speed limits, and better designed cars, seatbelts, and airbags; but people still have accidents and we still need ambulances and tow trucks.

As long as oil is transported in tankers, there will always be a risk of oil spills at sea and we aren't that good at recovering spilled oil. The law of physics and mother nature are very tough to overcome. So our best efforts must be spent on prevention. But when spills occur, as they inevitably will, we must be prepared to respond with the largest and most complete tool box there is. We still get a lot of resistance to putting some very effective tools in our arsenal, such as in situ burning and dispersants. That's not progressive, that narrows our options. We must work together to gain pre-approval for all possible techniques and measures to combat oil spills.

The next several days you'll hear presentations on prevention, response, and oversight. A lot has been done to date in all of these three areas, still more is under way.

With respect to Coast Guard programs and regulations, prevention is our priority. To this end we are installing the Automatic Dependent Surveillance System in our Valdez VTS—the first in the United States. Presently we can only monitor one-third of the VTS trackline in Prince William Sound. With the Automatic Dependent Surveillance System we'll be able to closely monitor tanker movements throughout Prince William Sound and 50 miles into the Gulf of Alaska. Escorts of tankers are now required throughout the Sound and tankers are required to comply with stringent restrictions on transits in bad weather and extended one way traffic zones in ice conditions. What remains to be done? The Prince William Sound RCAC, industry, and Coast Guard are conducting a study to evaluate the best mix of towing vessels and gear to handle a disabled tanker. When we determine the best mix, industry will procure the right equipment.

The response posture in Prince William Sound is the best in the world. The TransRec equipped barges, lightering equipment, and offshore supply vessels strategically located in Prince William Sound present a formidable response capability that is augmented with local fishing vessels. This capability was put to a surprise test for the first time in January. This unannounced drill resulted in the mobilization of three TransRec skimming task forces, two nearshore cleanup task forces, and one hatchery protection operation. Over 18,000 feet of boom was deployed and 43 fishing vessels were activated to assist. This was the first

ever unannounced major drill in Prince William Sound and it was highly successful. We need to further expand the tool box through obtaining pre-approval to use dispersants and in situ burning when appropriate. When you have a big spill you need every tool you can get your hands on; we cannot solely depend on mechanical response to do the job. The Coast Guard is bringing its law enforcement and rescue vessels and aircraft into the response arena to augment and supplement industry's response when needed.

With respect to oversight, the two Alaska RCACs are moving ahead smartly and adding value to the process of improving environmental protection in the state. They have good ideas, a different perspective, and a genuine—right from the heart—concern for their environment. The Coast Guard has also expanded oversight of the industry by implementing a critical area inspection program which leads to more stringent hull inspections of tankers calling on Valdez.

In summary, we are all stakeholders in this business. When oil is in the water, it's our problem. We must fight spills from a united front; the unified command helps facilitate this. The efforts presently under way by the state and industry to expand nearshore response efforts through better employment of fishing vessels is great. We have industry, the state, the Coast Guard, and fishers all working together. That's not as unusual a lashup as it first sounds because I believe that no one can live and work in Alaska, or even visit this great state, without becoming an environmentalist. We all want to preserve this pristine environment and with teamwork we can.

Nobody wants an oil spill. We all have different ideas on how to prevent them and how best to respond. There is no single right answer. We must work cooperatively to develop a suite of approaches. This conference will be useful only if we adopt this attitude while we are here. I challenge you all to work toward environmental excellence in Alaska through leadership, teamwork, and continuous improvement. We've come a long way to date and have a great base to work from. I trust you will make this a productive conference and more importantly, ensure Alaska remains this nation's crown jewel.

## Beyond Prevention

Michael F.G. Williams

*Cloverland North*

*6035 Tanaina Drive, Anchorage, AK 99502*

A month or so after the *Exxon Valdez* accident I visited many of the communities impacted by the spill. The team I was heading had just put together the new Interim Oil Spill Prevention and Response Plan for Prince William Sound, and the first vessels necessary to implement the plan were arriving in Valdez. As I was explaining the new "prevention" approach to oil spill response to the various communities, a phrase developed in my presentations that characterized this new philosophy. It was "an ounce of prevention is worth 11 million gallons." Today I want to go beyond simple prevention. I want to go beyond what we did in Valdez, beyond the establishment of what is possibly one the best oil spill prevention and response organizations in the world and help you set your sights on what we must really do to reduce the damage that will be caused by a future oil spill. That there will be another major oil spill I have no doubt.

I am reminded of a conversation I had with one of the elders from Port Graham during the early days after the spill. I had made a presentation on all of the new equipment that we were getting, and how we, the Coast Guard, and the state were giving high priority to oil spill prevention. I described the new equipment and procedures, with the two large escort tugs each capable of towing a fully laden tanker, the new pilotage requirements, the reduced transit speeds in Prince William Sound, the one-way traffic in the narrows, and no sailing in bad weather. At the end of this speech, the elder looked at me and said "And now I suppose, there will be no more spills?" I responded immediately without thinking of any repercussions. "Hell no, of course there will be spills." After what seemed an eternity of silence, he just said "I like you, you are being honest." If we are all being honest, we will all agree that there will be oil spills as long as we use oil, and therefore we must look at ways to reduce the risk of spills and to mitigate their impacts.

There are a number people who honestly believe that the answer lies in obtaining bigger and better escort vessels, new tractor tugs, and ocean-

going salvage tugs, etc., at our oil ports. I hope that by the end of my presentation, they will realize that attempting to get the last 10% improvement out of the current prevention programs is wasteful of scarce resources and that there are many other areas where we must and can improve the safety of all marine transportation. That is why today I want to look beyond prevention.

If you went out onto the street and asked a member of the public to list the main causes of the *Exxon Valdez* accident, I am pretty sure that at the top of most peoples' lists would be the statement that Joe Hazelwood had been drinking. There is no doubt that drunken crews have caused accidents, but the concept that a ship should be dry is a uniquely American tradition. To suggest that Hazelwood's drinking caused the accident, or that banning drinking on all ships would bring a dramatic improvement to shipping is much too simplistic an answer.

Who or what would I blame for the *Exxon Valdez* accident? Some of those who caused the accident are sitting in this room. Look around you and see. Your neighbor is one of the culprits, I am one also and so are you. We all wanted cheap oil and most of us benefited from high oil company profits, since anyone who has life insurance, or a pension, or a mutual fund investment benefited from their profitability. The oil companies and the shipping companies only responded to the forces of the market, which are determined by the consumer. Today I want to show you what the demand for cheap oil and large profits have done to the marine industry over the past 30 years. Add to this a gigantic program of social engineering, institutional conscience, governmental cowardice, and individual greed in an unregulated economic environment, and you will see why standards have deteriorated during this period.

When I first went to sea in the 1950s, the majority of the ships trading in the world belonged to the traditional maritime nations, the United States, the United Kingdom, the U.S.S.R., Germany, Holland, Scandinavia, and Greece. The oil companies were completely integrated, with a large percentage of the world's tankers owned by them, and the majority of the private ships chartered to them. Reliability of service was more important than the cost of an individual sector or process. Cheap oil could and would subsidize expensive transportation if the system as a whole produced a satisfactory financial solution. Toward the end of the 1960s new larger ships were being constructed to meet the anticipated growth in world demand. The independent ship owners were far ahead of the oil companies in this building program. Then suddenly, in the early 1970s this business scenario changed. Cheap oil suddenly disappeared. OPEC emerged and the predicted demand for oil nose-dived. The marketing and refining organizations were cut free from their producing affiliates

and had to buy their crude oil from OPEC suppliers or from brokers. The oil company shipping organizations had to compete for business against independent owners. Companies such as BP reacted quickly and reduced their fleet of owned ships from over 100 to about 40. The new high prices demanded by OPEC caused a significant downturn in the world's demand for oil. This, plus the large building programs for VLCCs, caused an extremely large surplus of crude oil tankers on the shipping markets. The cumulative effect was that effective control of shipping passed from the hands of the traditional owners into the hands of financial speculators and brokers. Although individual countries and individual ship owners have tried to maintain standards throughout this period, they have been forced to compromise their standards and principals in order to stay in business.

There have always been accidents at sea. Most accidents don't just happen, but are caused. They may be caused by vessel crews, by vessel management, or by vessel design. It was no use blaming the iceberg for the loss of the *Titanic*, it was either Captain Smith's fault for maintaining too high a speed for the prevailing conditions, or the company management's fault for encouraging him to go for a record-breaking performance on the maiden voyage. When the *Edmund Fitzgerald* went down with all hands on Lake Superior, the cause was either faulty design or too high a speed, not the storm that night. Other ships who were in close company with the ships in both of my examples, proceeded safely on their voyages.

Since the *Exxon Valdez* accident, and some even more significant accidents to bulk carriers that resulted in serious loss of life, the world's maritime authorities have attempted to improve the safety of shipping. The United States has introduced new rules to reduce crew fatigue. International Maritime Organization (IMO) is attempting to set bridge watch-keeping standards. The Port of Rotterdam is about to introduce a new Green Program that will make it economically advantageous for ships with good safety and environmental standards to trade to that port. All of these efforts may well improve the standards on some ships, but when the public still demands that oil prices do not rise, it does not matter what the responsible ship owner or oil company does, because some trader will fulfill that demand for cheap oil by chartering the cheapest vessel afloat that can be accepted in the country to which it is trading. Since we now live in a world economy, it will take more than the actions of one oil company, or one ship owner, or even one country to improve the abysmal state of the world's shipping industry.

I would like to describe to you some of the areas where improvements must be made.

## The Crew Effect

### Crew Size

Thirty years ago tankers had crews of about 50 men. Each four-hour watch had an officer and three sailors. At night or in poor visibility, one of the sailors kept a lookout, one steered, and one rested. The sailors' roles were rotated on the hour. Tankers that were in busy trades had an additional senior officer who managed the daily routine of the ship and was responsible for all cargo work.

The best found ships today have a crew of about 28, but some tankers are operating with crews of 18. The concept of an extra mate to deal with cargo work disappeared some years ago as crews were reduced to lower costs. Would an increase in manning levels improve safety? The obvious answer is yes. But how can a ship owner compete against Third World manned ships if his wage bill cannot be reduced through manning efficiencies? This is not just a U.S. problem, but one shared by British, German, Dutch, and Scandinavian ship owners. In other words, what we knew as the traditional ship-owning nations cannot compete in the world market unless they have highly automated ships with small crews. Larger crews would help in the prevention of oil spills, but how can this be implemented without driving the best ship owners out of business?

### Crew Training

In certain countries Certificates of Competency as Master have always been available for the right price from official and unofficial sources. Training programs around the world have ranged from marginal to excellent. Some training programs that may look good on paper are not always as practical as they might be. Academicians, whose business goal is to ensure that as many students as possible come their way, claim that all officers should have at least four years of college. With all due respect to those who live in ivy covered towers, how do you teach a junior officer seamanship in a classroom, or how do you teach him to deal with a bridge emergency without being on a bridge? I believe we have gone too far in the general education of our Mercantile Marine entries, and have ignored the efficiency of the hard school of at-sea training. I am not suggesting that the four years of virtual slave labor that was the old British apprentice system should be reintroduced, but I am advocating that before an officer is in sole charge of the bridge of a large tanker or cargo ship, he should have had at least two years of seagoing experience as a junior watch keeper. You cannot get an Air Transport Pilots license without 1,500 hours flying time, no matter what your academic achievements are, and it would



be a number of additional years before you were in charge of a plane on your own. The equivalent level of practical ship knowledge is not a requirement for ship's officer qualification in many countries.

### Certification

Although much has been said about ship owners reducing their costs to stay competitive in the global markets, very little has been said about governments who have neglected their responsibilities to the public in order to save money. To be certified for a U.S. license, applicants are tested by inexperienced Coast Guard officers, and by multiple choice questions. We all know that the latter were introduced because it saves money marking the answers. I personally despise them because they kill ingenuity and favor the lucky. But in the United States my main complaint is the Coast Guard examiner. When I first came to this country, the Coast Guard still had some real old seamen in their senior ranks. Men like Admiral Benket and Admiral Ray and my old friend Jack Hays were seamen first and foremost. Some of them had come into the Coast Guard from the mercantile marine and understood how a ship really works, which, by the way, is rather different from the textbook. If any of those gentlemen questioned you about your profession or your ship, you could not bluff an answer past them. Today very few even want to be in the branch of the Coast Guard that deals with merchant ships. To reach the senior ranks of the Coast Guard, you have to be a generalist, not a specialist. Would you like the young doctor who is about operate on you to have been certified as competent by an examiner who had never even seen the operation performed, but had only read about it? We must get back to professional seamen being responsible for examining officers. These examinations should not only have a written part, but a three or four hour oral test too. The oral examination should be repeated every five years, and high standards should be maintained. We must not be afraid of failing people.

This again raises the question of what is the correct level of competency that should be mandated? If one country sets very high standards, the cost of training their officers would price them out of the world market. When questions have been asked in the past about the low standards set by some countries, certain Third World countries have protested, stating that requiring similar standards for all mercantile marine officers is back door colonialism, since such regulation could effectively limit trade to the traditional maritime nations.

## Ship Design and Construction

Let's now examine the construction of tankers.

During the 1970s, prior to the start-up of the pipeline, there was a lot of pressure for ships to be fitted with retro thrusters, bow thrusters, twin screws, etc. Many of these suggestions were made by people who did not have a professional background, but were genuinely concerned about ship safety. For example, many thought that bow thrusters would improve maneuverability at operating speeds, not appreciating that the laws of physics were working against the concept. In the marine industry we continue to be besieged with ideas on how to improve ship design, including a suggestion I saw just after the *Exxon Valdez* accident. In that case, a lady wrote to suggest that the accident would not have happened if we had reloaded the oil back into the barrels that had been used to transport the oil down the pipeline. Although she did not know it, she had hit on a problem of modern ship design that has contributed significantly to the volume of oil spills.

It has always surprised me that not one of the marine industry's critics has to my knowledge commented on the design of the modern tanker and compared it to a ship built 30 years ago. Two major changes are apparent. In 1958 I went to sea on a "super tanker." It carried 30,000 tons of crude oil. That is not much larger than one of SERVS oil spill response barges (ship escort and response vessels system). Ships today carry up to 500,000 tons, with 250,000 ton vessels being common throughout the world. It is easy to see why such large ships are built. They have smaller crews than a 1950s super tanker, their fuel consumption is not much greater, and most significantly, the capital cost per ton of cargo carried is considerably less. This is due to the fact that there is much less steel in the ship per ton of cargo carried. One of the reasons for this is a significant change in design philosophy. The 1950s tanker's cargo tanks were subdivided into 30 compartments. If one tank was holed, the maximum outflow of oil would have been about 5% of the cargo. When, in the late 1960s we suddenly launched into building 250,000 ton tankers, it was concluded that the traditional design was unnecessary and an equally strong, but much more cost effective design could be built with the cargo holds being subdivided into about eight or ten cargo tanks, thus saving considerable amounts of steel. If a tank was holed with these designs, up to 12.5% of the cargo could be lost, say about 31,000 tons—a volume greater than the 1950s ships even carried. Why did we scrap all of the small ships of the 1950s and the 1960s? To reduce costs and to meet the increased demand for oil. The resulting low

transportation costs fueled the economic advances we've enjoyed since then.

I do not have time to discuss the question of ship inspections with the problems of classification societies that are more interested in their profits than removing unseaworthy ships from the seas, or of governments who register ships under their flag without even inspecting them. Nor do I have the time to discuss ship operators who put so much fear into the Master that he refuses to take a salvage tug until he is in such a desperate position his ship cannot be saved.

### **Is There a Solution Beyond Prevention?**

If we maintain our current attitudes about oil prices, very little can be done. If we believe anyone should be allowed to trade on the high seas no matter what their qualifications, then again nothing can be done. But if we believe that the major trading blocs, that is to say the North American Free Trade Agreement (NAFTA) countries, the EEC, and Japan, should and must be allowed to set high standards that must be met before ships can enter their waters, then we may get somewhere. We must set a high standard of professionalism for ships, their management, and their crews that must be met by all who wish to trade in the world's premier markets. We must get away from setting standards that reflect the lowest common denominator even if this means restraining trade. Ships that do not meet the agreed upon high standards should be barred from trading to these major blocs. The result would be that substandard ships would soon go to the scrap yard, and unqualified seafarers would soon find themselves on the beach. Such a system would encourage excellence in ship owning, a concept that has slipped from the world stage over the past 20 years.

### **Conclusions**

Today I have only spoken of prevention. Since the *Exxon Valdez* we have all recognized that it is the responsibility of every ship and every port to ensure that it has a competent, well trained oil response organization, ready to respond to any spill. We can no longer rely on amateur oil spill responders, no matter how enthusiastic they may be. We must all ensure that the demands of cost cutting do not emasculate a good organization. We saw what that did five years ago.

The benefits to the world from demanding a different design of tug or a specific type of port operation are insignificant compared to what can be achieved if the whole picture is considered. The time has come for you, the public, to demand that the major trading nations go it alone. IMO is the traditional vehicle to solve these problems, but IMO makes the United

Nations look efficient. Any answer out of IMO must by its structure be a compromise, and we have seen where that has brought us over the past 30 years. The three major trading blocs should set up a commission to draft rules to ensure that only the best found ships trade in their waters. Governments should be allowed to tax imported goods to pay for the efficient policing of the new standards. Good ship owners would benefit, poor ones would be reduced to trading with nations who do not subscribe to these new standards. I predict that over time more nations would wish to join the initial few. Direct costs of transportation would rise, but indirect costs such as insurance and environmental costs would probably fall. The burden of these extra costs would fall on us. Are we prepared to accept that burden?

## Prevention

Jonathan W.G. Wills

*Shetland Islands Council*

*Sundside, Bressay, Shetland ZE2 9ER, Scotland*

### Summary

"Too many unknowns about oil spill prevention . . ."? On the contrary. The experts have known for decades how to prevent the most common kinds of oil spill at sea. The technology and the human skills exist. It is the political and economic conditions for safe transport of oil and other hazardous cargoes that are still largely absent.

The problem is that responsible corporations who try to do a decent job with safe technologies are placed at a competitive disadvantage. Only national governments and international organizations can set uniform, global safety rules which allow environmentally conscious companies to compete on equal terms. That is taking a long time and the process appears to move at a speed proportional to the frequency of pollution incidents and the publicity which each spill attracts.

What is often forgotten is that state and local governments, ship charterers, and the insurance industry can make immediate, effective changes, using commercial sanctions rather than new laws to enforce higher standards. The experience of BP and Exxon's Sullom Voe oil and gas terminal in the Shetland Islands since 1979 shows how it can be done. It was a unique collaboration between citizens' representatives and the oil industry. And it worked. But Shetland's much-admired safety net had a hole in it. On 5 January 1993 the U.S.-owned tanker *Braer*, which had nothing to do with Sullom Voe but happened to be passing the islands on a voyage from Norway to Canada with 84,500 tons of oil, ran aground and became a total loss.

The *Braer* disaster points to the continuing failure of national governments and international agencies to outlaw ships with serious design flaws and technical/organizational deficiencies. The dangers (and the answers) were known as far back as the *Torrey Canyon* in 1967 and the *Amoco Cadiz* in 1978. *Exxon Valdez* sounded further warnings and led to a unique collaboration between the local authorities in Alaska and Shetland.

But the warnings were ignored by the British Government and the *Braer* wreck was the result.

Learned conferences can create the impression that spill prevention is a very complicated subject. In fact, the issues are extraordinarily simple. Radar surveillance, interception by helicopters, radio interrogation, and assistance or intervention by escort/salvage tugs can massively reduce the risk of tanker grounding and collisions. It can happen now. There really is a quick fix. This is a political problem, not a technical problem. And, surprisingly, the ordinary citizen can do quite a lot to make things happen.

## Discussion

Every disaster is different. Every disaster is the same. The government immediately sets up an inquiry. It may take a year or more to report. During that time government agencies take little or no action (in public at least) to prevent the next disaster. Even if there is an obvious and technically simple solution, it is delayed. Bureaucrats and ruling politicians are paralyzed, pleading "Wait for the results of the inquiry." When the inquiry does report, a blizzard of conferences follows. Governments eventually sanction inadequate, mostly voluntary safety schemes whose marginal benefits were apparent to all knowledgeable people years beforehand and do little to prevent further trouble.

We are often told that there are "too many unknowns about oil spill prevention . . ." In fact, the experts have known for decades how to prevent the most common kinds of oil spill at sea. One good way is to stop tankers hitting each other or the bottom. The technology and the human skills exist. Radar can give us early warning of tankers straying into no-go zones; spotter planes and helicopters can identify tankers who refuse to answer radio calls from the Coast Guard; salvage tugs can patrol danger areas and move in to offer help to ships which appear to be in trouble—in time to stop them going aground. We have known how to do all that for many years. We also know how to maintain ships properly, how to train crews, how to prevent fatigue in navigating officers, and how to ensure safe navigation.

Developing technologies such as Differential Global Positioning Systems, ship-borne transponders, double hulls, and intermediate oil-tight decks will greatly improve safety in 10 years' time, but we do not have 10 years to spare. We can and should make better use of what is there today—and be prepared to pay for it. Governments, shipowners, and oil companies may pay in the short term. In the long term the consumer and the taxpayer will pay. That is as it should be.

It is the political and economic conditions for safe transport of oil and other hazardous cargoes that are still largely absent. Most politicians

in power, worldwide, do not yet regard oil spills as a big enough problem to do anything serious about reducing the risk to a level where accidents really are accidents, rather than incidents like the *Exxon Valdez* and the *Braer*. The politicians get away with this because, so far, not enough voters think it's a serious problem either. We're working on that. And I'm glad to see that President Clinton and Congress are too.

As a result of inaction by governments like mine, responsible corporations who try to do a decent job with safe technologies are placed at a competitive disadvantage. This is glaringly obvious from a brief survey of the world tanker fleet. At least a fifth of current tonnage should be scrapped. Some ship inspectors say a quarter. But elderly, cheap ships with poor standards of maintenance, crew training, and operation are still allowed to trade. They are getting cargoes because they undercut respectable companies who run safer, more modern ships with better qualified and better paid crews.

Unrestricted market forces can only make this situation worse because they have an innate tendency to destabilize the tanker charter market, encourage opportunism, and prevent the investment that is needed to improve standards. It would not be so bad if the profits made by older, cheaper ships were used to build new tankers. But, mostly, they are not. Vessels like the *Braer* (by no means the worst of them) are commonly owned by short-lived, self-liquidating companies whose only object is to maximize financial return for the shareholders. As little as possible is reinvested, and then usually in another elderly ship. In the tanker market of recent years, it is hard to blame owners for following this course. They can get away with it because governments allow them to get away with it.

Only international agreements between governments can set uniform safety rules which allow environmentally conscious companies to compete on equal terms. That is taking a long time and the process appears to move at a speed proportional to the frequency of pollution incidents and the publicity which each spill attracts.

What is often forgotten is that individual state and local governments, ship charterers, and the insurance industry can make some immediate, effective changes, using commercial sanctions rather than new laws to enforce higher standards. The experience of BP, Shell, and Exxon's Sullom Voe oil and gas terminal in the Shetland Islands since 1979 shows how it can be done. It was a unique collaboration between citizens' representatives and the 30 or so oil industry partners in the terminal. And it worked.

Following a spill of 1174 tons of heavy fuel oil from an Exxon tanker at a Sullom Voe jetty in late 1978, and a spate of ballast dumping incidents in the following months, the oil companies agreed to enforce

what was then a unique safety regime. It relied heavily on implementing existing legal standards which many other ports had been ignoring. But there were some special local rules also. Ships bound for Sullom Voe had to radio in their speed, course, and position when 200 miles from the pilot station. Masters were obliged to complete a faxed safety checklist before arrival and to sign guarantees that essential ship systems were functioning.

The deal was in place by April 1979. I have described it in detail in my book *A Place in the Sun—Shetland and Oil* (Mainstream, 1991). Since 1979 it has been rigorously enforced, not so much by law as by commercial sanctions. If a ship breaks the rules, she can be delayed and even refused a cargo. This is written into the contracts for uplifting parcels of oil and gas from the Shetland terminal.

I have mentioned this at a number of conferences now and in several books, TV documentaries and films. People nod and say "That's interesting" and move on to the next topic. I see some of you nodding. So I'll say it again: Commercial pressures can be used to enforce safety standards and can produce enormous improvements very quickly. You don't need new international laws to do something NOW—if, that is, you really want to do something.

The question we have to ask ourselves is: "Do the oil companies really want to do something globally or do they think they can escape bad publicity by taking words like 'Exxon' and 'Amoco' off the names painted on the bows of the tankers?" Wouldn't it have been nice, some people might think, if that ship had just been called the *Cadiz*, and the other one *Valdez* (or even *Sea River Valdez*)? And who remembers that the *Braer* was carrying a cargo for Ultramar? Or that she was managed by an American company called B&H? Or that she was registered in Liberia—a register that is run from offices in Reston, Virginia?

The effect of the Shetland Standard, as we like to call it, has been to set enviable safety records at Sullom Voe. It has driven away from the port most of the substandard tonnage. But the problem has just been shifted a little further out to sea, because those bargain basement tankers still ply their trade elsewhere and considerable numbers of them pass the Shetland coastline on voyages to and from oil terminals in Norway, loading buoys in the North Sea, and terminals elsewhere in northern Europe and arctic Russia. There are no commercial sanctions on them.

So Shetland's much-admired safety net had a hole in it. On 5 January 1993 the U.S.-managed tanker *Braer* ran aground and became a total loss on the southern tip of the islands. On that voyage from Norway to Canada with 84,500 tons of oil she had nothing to do with Sullom Voe, although she had called there 99 times during her career until she fell foul of the strict safety rules in October 1992. She just happened to be passing,



exercising her right of “innocent passage” through British territorial waters. She was actually following the mid-channel route recommended for Sullom Voe tankers between Fair Isle and Shetland when she broke down and drifted 10 miles in four hours during a storm. A rescue tug arrived too late to save her. The crew had been taken off by helicopter and there was no one aboard the hulk to take a towline. And she had no “grab n’ clip” towing package.

The *Braer* disaster points to the continuing failure of national governments and international agencies to outlaw ships with serious design flaws and technical or organizational deficiencies, and to institute sensible traffic control and navigation information services. The dangers (and the answers) were known as far back as the *Torrey Canyon* in 1967 and the *Amoco Cadiz* in 1978. *Exxon Valdez* sounded further warnings and led to a unique collaboration between the local government and the oil industry in Shetland. But the warnings were ignored by the British Government and the *Braer* wreck was the result.

We have just gone through another winter with not much more protection than we had when the *Braer* grounded. There are new and purely advisory “areas of avoidance” (sort of “please-don’t-go zones”) which are supposed to keep tankers 20 miles off the western and northern shores of the islands. But it is still legal to bring a loaded tanker within a mile of the shore on the eastern side, where some of our biggest seabird and seal colonies are to be found, to say nothing of rich fishing grounds. And the new recommendations, thanks to what the charitable amongst us call a clerical error, do not apply to tankers in ballast—which can be carrying 30,000 tons of oil-contaminated water in their tanks. Not all tankers have segregated ballast, even now.

In any case, the new areas of avoidance are unenforceable, even if they are now sanctioned by the International Maritime Organization. They are unenforceable because there is no radar cover or aerial surveillance outside the approaches to the port of Sullom Voe—a small part of our islands’ 900-mile long coastline. Without surveillance we do not know if the ships are breaking the rules at night—although many of them have come close enough, since the *Braer*, for us to see them in daylight. Midwinter daylight in Shetland is six hours, if you’re lucky. The Sullom Voe radar may be extended next year—but at the expense of the local council, not the government whose duty it is to guard all of the British coastline, including those parts of Shetland which lie outside our council’s legal responsibility. And the extended radar will still cover only a part of the huge area of Shetland coastline at risk.

As with the *Exxon Valdez*, academic research into the effects of the *Braer* oil spill continues. Partly because we are an archipelago in the

middle of the ocean, rather than a landlocked inlet like Prince William Sound, severe weather quickly dispersed the oil. We do not have anything like the problems you experienced. Our beaches really are clean again. Mother Nature did it for free.

This is very gratifying but all the research by the scientists into the subtle, long-term effects of the *Braer* will not stop the next one, even if it does give us some numbers upon which to base insurance claims. Don't talk to me about insurance claims!

Oil spill clean-up technology also continues to develop, and we hear about it at conferences like this, which have become a major industry in themselves. But as far as I can see (and I read as much of the literature as a 46 year old layman with failing eyesight can be expected to) even the best of it usually does not work very well. Conditions have to be pretty good to recover more than 10 to 15 percent of the oil. At the *Braer* wreck it was too stormy to launch the booms and skimmers.

Nor would a double hull have saved the *Braer*—safer hull designs do nothing to keep tankers off the rocks. And our rocks are so sharp and our seas so violent that a double hull would just have delayed the inevitable—maybe long enough to pump off a little of the oil but, given the weather, maybe not. The *Braer* was a sturdy old ship. Today there is nothing much left of her on the seabed. The biggest bits are the size of domestic freezers and conference hall doors, apart from the main engine block, the propeller—and the bows, which sit like a dunce's cap on top of a pointed rock, their anchors still firmly held in place by the clamps which were never released to slow her drift to destruction. (Now there's another bit of simple technology that we could have on tankers but don't—equipment to release the anchors from the bridge by remote control when it's too rough to send crew to the bows to work the winches—it's been used on big container ships for quite a while now).

Those anchors remind me that learned conferences often create the impression that spill prevention is a very complicated subject. In fact, the basic issues are extraordinarily simple. Radar surveillance, interception by helicopters, radio interrogation and assistance or intervention by escort/salvage tugs can massively reduce the risk of tanker grounding and collisions. That's the answer until we have satellite beepers on every tanker so we know where all of them are, all of the time.

Radar, aerial surveillance and tugs can happen now. There really is a quick fix. This is a political problem, not a technical problem. And, surprisingly, the ordinary citizen can do quite a lot to make things happen. Just by raising hell and continuing to raise hell. In this room there are citizens who have done just that—members of the Prince William Sound Regional Citizens Advisory Council. They have done it by bringing these

supposedly complicated matters into the public arena, hiring their own experts, and insisting that their findings are presented to the public in clear language.

You have many remarkable citizens in Alaska and I'd like to conclude by paying tribute to three of them who have been at the forefront of this revolutionary activity of making the technical intelligible and bringing the facts before the people. They are my good friends Dr. Riki Ott, Professor Rick Steiner, and Dan Lawn. Two biologists and an engineer who share a great gift of honest communication and are not ashamed to campaign. They don't hide behind scientific 'impartiality' and the jargon of the "expert." They use plain, everyday words but they base their findings on fact. They have been an inspiration, not only to concerned citizens in Alaska and the Lower 48 but also, I can assure you, in places a long way east along our shared parallel of sixty degrees north.

And let's not forget a man whom I first met with in Valdez five years ago and whom I regard as an honorary citizen of Alaska—Chuck Hamel of Alexandria, Virginia. "The Virginian" as a certain Anchorage newspaper of loving memory used to call him. I've also heard him called "The Mouth Out Front." Well, he certainly put his money where his mouth was. He did more than most to bring the causes of the *Exxon Valdez* disaster before the court of public opinion. His reward was to be spied upon and brought to the brink of ruin. I am glad that happier times are here again for him and his wife, Kathy. So, thank you, Chuck, and thank you all for listening to me today.



## Oversight

Stan Stephens

*Prince William Sound Regional Citizens' Advisory Council  
P.O. Box 1297, Valdez, AK 99686*

I want to thank University of Alaska Sea Grant once again for putting together such a fine program. I know it has been hard work. We from RCAC really appreciate the work they put into putting this together.

As president of the Regional Citizens' Advisory Council I would like to recognize a number of people who are concerned, not only about the environment but also about the movement of oil. I think it is important that they be recognized for the amount of hard work they put in, especially over the last five years.

Alaska's Conservation Foundation held a public forum this week where the Celia Hunter and Olaus Murie awards were presented. One award was given to Riki Ott, a scientist and resident of Cordova, for her exemplary volunteer service to the environmental movement in Alaska. Riki Ott probably couldn't be a member of RCAC because Riki Ott, no matter what is going on, is going to speak her mind. And I think that has been very healthy for the rest of us. She was there when we needed her to give an opinion, and I think the award she received last night was well deserved. But just think, when it comes to Riki Ott, Exxon probably has to have five extra lawyers and 20 extra staff just to keep up with her. I think she does a great job for the state of Alaska.

Rick Steiner is another person who has always been there. He may be the quiet one, but he has always been there for us, the environmental community. He's always gotten the job done for us without raising a flag; he's been behind the scenes. He's constantly working to make things better and he's very concerned about what happened to PWS and what is going on out there now. Not just with the oil industry, but with the rest of us too; the lumbering, the pollution that you and I cause. He's really concerned about these things. He received the Olaus Murie award which I also think was well deserved.

Then there is Patty Ginsberg who made a statement about me just a minute ago. I'll tell you a little story about how I used to be and how I want to be again. I used to be one of the biggest backers of Alyeska that

they ever had. I used to take people by the terminal and I had nothing but good to say about Alyeska, and what was going on. Even today, I move some 25,000 people past the terminal between my three boats and we say only good, positive things. But along about 1984, through the help of a very dedicated individual, I started to realize we had problems with Alyeska. I was starting to fall off a little bit from being the extreme backer that I had been, and I was invited by Alyeska both to Anchorage and the terminal. One of the things that really stands out in my mind was that when I went to the terminal, everywhere I went, everywhere I looked, (and I didn't have the knowledge and the skills to know which way it was which) I was told how hard and difficult Dan Lawn was for Alyeska to get along with. I want you to know that was in 1984, five years before the oil spill. I was able to look at some these things. I was able to get some of the material that was sent to the state of Alaska warning the Department of Environmental Conservation (DEC) that they had problems at the terminal, that things needed to be done, that things needed to be corrected, but they never were. The state never listened to Dan. And what happened? We weren't prepared. But worse than that, was what happened later.

Dan worked very hard at the oil spill. I met him the first morning as he came back from coming off the tanker during the night and I was heading to get my boats ready. I could see the concern in his face, the hollowness in his face. Believe me, after you have spent your life, or a good part of it, doing something which all of a sudden has a problem and that problem hits you, who do you blame? You blame yourself. You blame yourself for not doing more. But what did it get him? A cowardly act by the state of Alaska that reduced his job position because he had done the right thing, and they didn't want to stand up to the oil companies. I think we all owe Dan a great deal. Through the last five years he has stood in there, he's been behind us, and done a great deal of good for the environmental movement and also for the movement of oil; he's been very balanced. He understands what the industry is all about; he's just very hard and honest and straightforward, and neither industry nor the state of Alaska could take that. We have to change; that can't continue. We have to be able to speak out and without losing a position because of it

I want to talk very briefly about another individual who is close to us. He gave a couple of talks here, but he also does a great deal on the Shetlands trying to make things right. He's kind of a loner on an area that needs someone like him to speak out and I'm glad Jonathan Wills is here. Jonathan, we have a great appreciation for you.

The next two people I want to talk about, I have a great deal of appreciation for, but I also have a many differences with. One of them is Jerry Aspland. I Have a great appreciation for Jerry Aspland. I'm going to

tell you a story I learned a while back. A pilot came to me and we were talking about wind conditions. He said he refused to bring a tanker contracted to BP, chartered to BP, because of the high winds. He said the captain of the vessel backed him up. The captain of the vessel refused to bring that vessel in during those winds. BP called Jerry Aspland and Jerry Aspland told BP that if his captain said that the vessel shouldn't come in, it was not coming in. I think that speaks well for Jerry Aspland. I'm not sure how well it speaks for BP (because we can't have that kind of pressure which implies that we have to move oil no matter what). Jerry Aspland understood that. I am concerned though about what has been said here by Jerry, and I think if I am going to talk, maybe I should talk a bit about myself to put it into perspective.

A couple of years ago, someone from ARCO said I was kind of a loose canon and very difficult to work with. And I think that probably fits me. I've had to learn to adjust. I now think that for the RCAC system to work, we *have* to work as a unit. We can't work separately. I am going to try to stay within that range, but I don't know when I am going to speak out. Jerry is a little bit the same way. I think if I were to say anything to Jerry now, it would be, "Jerry, be careful you are not a loose canon because we can't *have* a loose canon in another oil spill." We saw how Exxon was. No one would listen to Exxon, though they knew what they wanted to do, they knew their direction. So we need to make sure that we work with an IC assistant. I think we do *have* problems with too many contingency plans, too much paperwork. I agree totally with that. But I think Jerry Aspland's showing up here is a great thing and I *have* a great deal of respect for that and I think we all learned a lot from him.

There is one other individual that I would like to talk about but we haven't heard much from him, he is sometimes on the quiet side. I also have many differences with him, he's Roger Gale from BP. I started to know Roger back in the late 1970s-early 1980s when he worked for SOHIO. Roger was involved in figuring out whether the icebergs were going to be a safety hazard to the terminal. We had actually put a piece of equipment with infrared on one of my vessels, and we tried to see where the icebergs were. We took one of our vessels out and had one of the tankers come in so we could see whether the tanker could locate that iceberg, and whether the radar could pick it up or not. He's done a great deal to try to make things safer. I have again a lot of differences with him. When one of his charter vessels hit a piece of ice, he immediately tried to solve that problem by having ice escorts, and he probably knew if he hadn't we'd probably have put some pressure on to see it happened; but he reacted right away. I think there are people out there like Jerry Aspland and Roger Gale who in their own way are trying to do the right thing. And

they are under very tough operating conditions with the pressure these men have to operate under.

Another individual I have had differences with, whom I think hasn't known exactly how to take me, but about whom I want to say something is Gary Bader from Alyeska. Gary has had to work with the opinionated individuals of RCAC, and he's had to be the intertie between the two working with both Alyeska and RCAC. Believe me, that is not an easy job. And Gary, I think you do a great job and I have great appreciation for you.

In RCAC there are a couple people I want to mention. Joe Banta gets his regular pay but let me tell you, he also puts in as many hours as any other volunteer on his own to make sure that things go right. Along with Joe Banta is Joe Bridgeman from TOEM.

Stan Stanley, who is executive director, is one of the best things that ever happened to RCAC. The staff like him and he does a great job. He was voted in unanimously at our last meeting. No one had anything negative to say about Stan. He speaks out when he needs to speak out. But yet he keeps the rest of us in line. He does a good job.

I haven't anything good to say about the legislators. I think it's really too bad that at this point we have a legislature willing to back the oil industry in a tax cut instead of backing the citizens of Alaska. And I think if any of you have a chance, you should make that very clear to your legislators. I think the cutting and gutting of the 470 Fund is moving back, way back. And I think we need to take a look at it the next time we have an election and see if we can get people who represent us, not only the oil industry. We are an oil state, there is no doubt about it, but we can't do anything about it if we don't have a strong legislature when there are 40-50 lobbyists walking the halls in the state of Alaska. How can we as citizens overcome that? So we need to have strong legislators, and when you vote next time, vote for somebody who can at least balance the Alaska Legislature because oil is very important to the state, but so are the citizens and the rest of our industries.

This is the last comment before I start my speech. I can't say enough for the Coast Guard and I don't know if all of you realize under how constrained a budget these people have to work. These are some very dedicated people that put in many long hours, well over the eight hour day, trying to get the job done within a very reduced budget. We need to go to our congressmen to say if we are going to have safety in the water, we need a Coast Guard that has funding to back them up so that they can protect us. Right now funding is being cut and that's going to affect the oversight by the Coast Guard that we need on the water. There are a very dedicated bunch of people in the Coast Guard and they risk their lives for



the fisherman of Alaska and there is very little return for them. Those are the people I wanted to mention before I start my talk.

I was asked to cover several topics at this luncheon, including citizen involvement, holding regulatory agencies accountable, and how oversight has improved since 1989, which I alluded to yesterday. Also, I am to give my views looking ahead 20 years from now, to a situation which might be a dream, but should be a reality.

Prince William Sound Regional Citizens' Advisory Council (RCAC) has a contract with Alyeska that pre-dates the Oil Pollution Act of 1990 (OPA 90), but the similarities are not coincidental. Many of the people involved in the establishment of the RCAC had promoted citizen involvement provisions in the Federal law, also. Between the two, RCAC has a heavy load to carry in giving advice and recommendations.

Earlier I gave a talk on the changes since the *Exxon Valdez* oil spill. The Council also has produced a booklet called *Then and Now*. Another pamphlet which could help update you on our involvement is our report *1993, A Year in Review*.

Since 1989, there is more openness in communication, sharing of ideas, participation in working groups, and listening on the side of the regulators, Alyeska, DEC, the Coast Guard, and now of citizens.

More and more, the citizens have had a chance to be part of the regulatory process. Both DEC and EPA keep us informed of their progress in air and water issues. We work with and offer advice to the Coast Guard. We also have a full-time person working with the Coast Guard on OPA 90 issues in Washington D.C.

Our working relationship with Alyeska has greatly improved, as both parties strive to open up communications. Independence is important to RCAC, as is being fair to all parties. Alyeska respects and realizes the importance of our need for independence.

What is citizen involvement and how well has Prince William Sound RCAC worked since the 1989 oil spill? When RCAC started it was as a newborn without parents to guide its future. The baby was also very emotional, mad, and hurt.

Citizens who represented this new formation had to lay a foundation for something almost never done before. The group had very little trust for the oil industry and had a long and bumpy road ahead. Also, I don't think at the time the industry as a whole had any desire for oversight.

RCAC would never have been formed except for the vision of the dedicated individuals from the oiled communities, and the willingness and cooperation of Jim Hermiller, the president of Alyeska. This has been a completely new experience for everyone, from those who have been

involved from the beginning to those who have recently jumped on board. We think that through trials and tribulations, RCAC is now close to working the way the original founders envisioned it should work.

Alyeska and the regulators are still learning to work with us. And we are still learning to work with them. But I think that everyone has accepted the citizens' input as part of the process.

You have to ask the question, "What makes citizens put in so much time and energy to make these Regional Citizens' Advisory Councils work?"

In Eric Nalder's book, *Tankers Full of Trouble*, he ends with three sentences that strike to the heart of the reason for citizen involvement. He says, in talking about tankers, "The difference between an uneventful trip and a disaster is attitude. Our real enemy isn't the elements or anything like that. It is complacency, indifference, and arrogance."

This statement really fits the period of time before the *Exxon Valdez* disaster, the disaster itself, and the months that followed. It fits the *Braer* disaster in the Shetlands. Our real enemies are complacency, indifference, and arrogance. This is why citizens have to be involved. This is why the grand experiment of RCAC must work. No industry, under any circumstances, has the right to destroy the environment or other industries for monetary gain.

One thing that Eric Nalder's book left out in his last statement is that greed for its own sake is what leads to complacency, indifference, and arrogance.

This is where citizen involvement is good for both industry and the people. Offering advice and reminding industry of their environmental responsibilities will help keep us all in tune and on top of problems before they become an actuality. This is the driving force for the citizens who give from 5 to 40 hours a week of free, volunteer time. They want a future that has clean air and water, and to restore their land as closely as possible to its original state.

Citizens also think industry needs to survive, for they realize they are some of the heaviest users of oil. We demand big cars, RVs, boats, heated homes, and electricity. We expect industry to meet these high demands but we are critical when they move oil in unsafe conditions. So it is not just greed on the part of the industry, but greed on the part of the consumer.

Let me leave this subject for a minute and talk about myself; why I am involved with RCAC.

I will take you back to 1961, my first introduction to Prince William Sound. I just never could have believed that a fairyland like this existed if I had not experienced it. My relationship with Prince William Sound became an instant love affair that lasts to this day.

I'll never forget my first trip back into Port Fidalgo; every turn, every mile, I encountered scenery and wildlife I never dreamed possible. Birds of every kind wherever my eyes rested. Porpoise were so plentiful you couldn't travel on the water without them for companions. There were whales feeding on the unspoiled bounty of the Sound. And every few miles a bear was walking the beaches, feeding from the rich ecosystem. I remember brown bear trails as wide as a sidewalk and a foot deep. I couldn't step into the woods without smelling them. There were goats on every mountain and the streams were full of fish. Creek fishing was great for Dolly Varden and cutthroat trout. Silver salmon used to be so plentiful, I didn't have to fish them—they seemed to jump into the boat.

If I have seen changes, what about those whose heritage goes back long before we have records. These people totally lived from the Sound and survived and enjoyed a special way of life. It was a way of life only those who are part of that heritage can understand. They have survived winds and rains, storms and hurricanes, and earthquakes. It is the intrusion by white man that has changed their way of life.

I'll never forget the comment made by a father from New Chenega, a village recently built to replace the one lost 30 years ago this week because of a major quake. He was worried about his son, because he wasn't going to be able carry on the hunting traditions that he himself had known, to teach those traditions and let his son experience them. The oil spill was the last straw in destroying a life style. As he explained this, tears came to his eyes and he stopped the conversation so he could regain his composure. How do we restore this way of life that has been here for hundreds of years? I do not think it is an exaggeration to say that I believe the Sound can be restored. But we must stop abusing it!!!

It is not just earthquakes and oil spills that have hurt this area, but a total disregard for tomorrow by all of us. We are all to blame. The number of seals is depleted. Sea lions are endangered. You hardly see porpoise any more, or the whales. It is hard to find a goat on the mountains. The birds are fewer, and the wild stock salmon are nearly gone. Some of the fishing creeks, as in Irish Cove, are now mud streams from improper clear cutting at Two Moon Bay. Yes, we have carelessly overdone the harvesting of trees. We have overfished some of our waters. We have overharvested with hunting of wild game animals. We cannot control earthquakes, but we can control man-made problems. It is not just the oil companies that have damaged the Sound. We all have.

We surely cannot handle another oil spill. That is why citizen involvement must work! Citizens promoting environmentally safe operation of the Alyeska terminal and associated tankers is what RCAC is all about. This is why citizens of Chenega, Tatitlek, Cordova, Valdez,

Whittier, Seward, Homer, Seldovia, Kodiak, and other communities are giving their all to prevent another spill through RCAC.

Again I wish to say that I think RCAC, Alyeska, and the different regulators have come a long way. I also think it is fair to say that industry is only going to do that which they are required to do. The motive of private enterprise is profit. Free enterprise built this country, either for good or bad, depending on your perspective. Regulators were created by government to protect the citizens, not industry. It has tended though to work for the latter, at least in Alaska.

The oil industry is the economic backbone of this country, and also the main political force. You vote for your state and federal legislators, persuaded by a strong public relations media program to win your vote. Your single vote, for most of you, is the extent of your political involvement. That is where it ends. The oil industry spends millions, perhaps billions, of dollars controlling the political process. If you doubt this, spend a day walking the halls in Juneau. Look how many bills are before the Legislature that are there only because of oil lobbyists' hard work.

It is difficult for citizens to keep up with paid lobbyists, but we, the RCAC, try to on bills which directly affect us.

When you see an RCAC ad in the paper describing a bill and asking for help, it is a signal the citizens are losing once again. Remember, our real enemies are not the elements or industry. They are complacency, indifference, and arrogance, and outright greed. Cut the 470-Fund so we can give the oil industry a tax break, *why?* Change the way we deal with offshore drilling in bill 308 so citizens lose their input, *why?* It is more than industry that needs citizen oversight. It is also our state and federal legislators who sometimes forget whom they represent.

I think it is fair to say that because RCAC's oversight has improved, we have held regulatory agencies accountable for their actions. That's not to say that we always win, but the citizens' perspective is being heard.

There is still much that needs to be done to make moving oil safer. It is fair to say that we are closer than we have ever been in putting in place safeguards that are needed to make this a reality. Prevention is where our efforts should be. Once oil is spilled, the chance of a successful cleanup is very small. Better designed navigational systems and communication are almost a reality. Technology exists today which could nearly eliminate water and air contamination. The world is now using tractor tugs because of their advanced engineering and mobility, but we still reject them here. Improved weather reporting technology is available. Congress needs to be convinced to spend the money so we can use this tool to help prevent another spill. The tanker fleet must be upgraded with new technology.

I was asked to give my views looking ahead 20 years from now.

- I see the Valdez Marine Terminal as the safest, environmentally cleanest in the world. I see 90% of the tanker vapors captured and turned back into product.
- I see double hull tankers built to withstand the heavy seas of the Gulf of Alaska, carrying segregated ballast so that we no longer have any dirty ballast.
- I see a satellite traffic system for use with all vessels, so refined and so accurate that it is nearly impossible to have a navigation accident.
- I see the most modern technology in escort tugs being used.
- I see full weather reporting instrumentation throughout the Sound, and established weather restrictions enforced.
- I see most of the human factors solved so that overwork and fatigue are no longer problems.
- I see constant updates on new oil recovery equipment that will recover oil in high winds and 10 foot seas.
- I see true science, honest science, producing the one scientific answer for all, not suggested science for a price.
- I see 20 years without an oil spill.
- I see citizens and the oil industry working hand in hand to insure a healthy oil industry and a clean environment.

One last thing. Everything I just mentioned will cost money. There is a glut of oil on the market. It will get worse when Iran, Iraq, China, and Russia all start back into full production. Alaska might have a lot of oil, but it might cost too much to remove and still remain competitive. Production could slow way down.

If we move 700,000 barrels instead of 1.7 million, has the threat of a spill changed? No. As long as we are moving oil, we have a threat.

Can the oil companies afford technology to protect the environment? Yes, they can!!!

So far, according to Richard Fineberg's report, *Hidden Billions, The TAPS DR&R Provisions*, the profit to the oil industry's stockholders at today's inflation rate has been over \$80 billion after taxes.

Plus, by the year 2015, they will have removed some \$22 billion for restoration, which probably would only need \$2 billion, at today's rate. If they were not to make another penny, they have already made profit enough to protect the environment.

The future depends on open communication, citizens working together with the oil industry, with a positive attitude, so that complacency, indifference, and arrogance do not once again set in.

Most important, the industry must be willing to spend profits for technology to protect the environment, so when the oil runs out, Alaska will be restored to the same undefiled condition that existed before oil.

## Prevention Discussion

Moderator, Rick Steiner

*Marine Advisory Agent*

*Alaska Marine Advisory Program, University of Alaska Fairbanks  
P.O. Box 830, Cordova, AK 99574*

R. STEINER: This session is intended to be an open discussion between the audience and the presenters in the prevention session: G. Stock, J. Lee, J. Wills, J. Sikora, and J. Regg, with two additions, Capt. Jerry Aspland and Mr. Walt Parker.

Questions can be directed to the entire panel or to individuals on the panel.

I think prevention is without question the most important element of this conference. First, after the hundreds of millions of dollars that have been spent on damage assessment for *Exxon Valdez*, we find that oil, fish, water, and wildlife do not mix. That sounds trivial, but we knew that before, we know that now. Oil is harmful. Second, we generally cannot fix the harm that oil does in the marine environment, and third, once you've spilled it, seldom can you recover or contain more than 10% of it. There's a threshold phenomenon beyond which it probably wouldn't lessen the amount of biological damage any more than if you recovered none. So prevention is where it's at.

It's interesting that in putting this conference together we put out a call for papers and got flooded with papers on response and oversight. We also had good response for prevention, but there are many fewer discussions today than there will be tomorrow on response and the next day on oversight. I think to some extent that's symptomatic of the problem. We're much more prone to reacting after the bomb's gone off than preventing the bomb from going off in the first place. That's what this discussion should be all about. Any questions on oil spill prevention?

J. GRIKIS: A university is typically a major asset for research programs. Aside from the program that you're currently involved with at the University of Alaska, can you talk a little bit about any applied spill prevention programs that the university might be investigating?

R. STEINER: As far as I know there are none.

J. GRIKIS: Are there any efforts to develop those types of programs?

R. STEINER: Your question's very well taken. I think it's indicative of the sorry state of affairs that we've gotten into with focusing on damage assessment rather than on preventing these things from happening in the first place. We have long since passed the stage where we've learned anything about oil and marine life; we know it's harmful. But for some reason, the lack of creativity among a number of scientists in every university that I know of points them to doing research that they're used to doing. A lot of people I see use oil spills as an excuse to do projects they've always wanted to do, and we're all human, we're all prone to doing things like that, but I think your point is very well taken. Not only should the University of Alaska get involved in prevention and response research, but I think every coastal university has a responsibility to do that.

The Oil Spill Recovery Institute mandated by Congress in OPA 90 to be administered by NOAA through the Prince William Sound Science Center is established to do that. They were authorized but not appropriated. Part of their mission is to do research specifically on spill prevention and response technologies, but they have not yet been able to actually start anything.

M. O'LEARY: Jonathan, my question is for you. If I heard you right, you said that the tankers going into the terminal had a 50 knot wind restriction, is that correct? And the tankers exiting had a 30 knot restriction?

J. WILLS: No, Michelle, it's the other way around. The wind speed restriction for inbound tankers in some directions of wind is 30 knots. That's because of calculations of the windage on the side of the ship. When a tanker's fully laden you can actually sail it in quite strong winds because most of the forces acting on the ship are below the water, they're not affected by the wind.

M. O'LEARY: We recently had a tanker come into Prince William Sound in winds over 30 knots; they were actually in the 45 to 50 knot category. One of the issues that came up was the force of the wind on an unladen tanker versus a laden tanker. So if I am to understand you correctly, the Shetland Island Council feels that there's a greater risk to an unladen tanker because of the windage?

J. WILLS: There's a greater risk of losing control of an unladen tanker. Our requirement is that the ship must be 35% in ballast or she's not



allowed in. That's so that you keep the screws submerged and keep steerage way on the vessel. But it's been recognized in a number of incidents that in high winds you can lose a big tanker. So it's usually 35 knots. Our channel's a long avenue that the ship comes down. If the wind is on the beam, then the windage effect is going to be worse, if it's a headwind, it's not so serious, and we have four tugs available for every berthing and every sailing. If you need them, the tugs can be there alongside. Because two of them are always tractor tugs, they can push sideways alongside a ship, and they make them fast to the ship as they come in. So it's possible to control it very precisely. We have a system of leading lights and bearings and very close radar control as well so you can see what's going on the whole time. But sailing tankers, 50 knots is normal. The port closes over a certain wind speed, I think it's been reduced recently to 45 knots in certain directions.

One of the worst things that happened to us was with a nearly fully laden tanker, the *Chevron North America*. She's one of the biggest ships we've ever had in; we get much bigger tankers than you do. A hurricane swung her around about 40 points and blew her off the berth, taking the bow line, the stern line, the spring line, and the loading arms. This was a very expensive and messy business. But she was saved by having the tugs always up and running, ready to roll. After that the wind limits were changed in certain directions. That's how you learn to do things right; by making mistakes and preventing the ship going ashore.

M. O'LEARY: Hopefully we can learn from what you've experienced to bring our ships in through Valdez Narrows and having the four tugs tight alongside.

J. WILLS: The tractor tugs are there by agreement with BP, Exxon, and Shell and all the other partners in the oil terminal. The tugs are owned by a company which the local borough council has 50% share in, and the other 50% is with commercial tug companies. But the contract to provide towage is with the terminal. BP has just agreed to renew the contract, and on that basis new, bigger tractor tugs are being built. BP and Exxon certainly accept the concept of the tractor tug as the ideal tug for our conditions.

J. ASPLAND: I'd like to make a couple of comments to the question. First, there should be general guidelines for every port regarding when to operate and when not to operate, i.e., high winds, low winds, and sea conditions. The comment is correct that in windy environments there actually are worse conditions for unloaded tankers than for loaded tankers.

One thing we have to get better at is using the weather to our advantage. I think that we need to think about that across the United States and other places. In other words, it would be better to bring a ship in over the limit if the wind's straight ahead than it might be to bring it in with a 20 knot beam wind, because the conditions change. So if we're going to devise some guidelines and rules, we have to remember to consider their affect.

I'd like to give you my perspective on the tractor tugs. I think we at ARCO and Foss have probably done more than anyone in the world to understand what it is tractor tugs can and cannot do. It's true that we have a contract for a tractor tug and the boat is on station; it is called the *Lindsay Foss*. She has 7900 horsepower and she's over 150 feet long. We did this because in the Rosario Straits we run at 9 and 10 knots, which is a heck of a lot faster than anywhere else.

We, at ARCO decided that we wanted to be sure that we had a piece of equipment that in fact could help us in that situation. Our two organizations did a tremendous study which cost us almost \$700,000. After the study we had to decide what we were going to do. We considered large tractor conversion, all kinds of different tractor tugs, cycloidal propulsion, Z drive propulsion, and other kinds of propulsion. The propulsion is a key point in what you want a tractor tug to do, because each one operates differently.

We decided all we wanted this boat to do was to be an escort. It wasn't to be a oil spill boat, it wasn't to be a docking boat, and it wasn't to be a firefighting boat. The result is that we built the *Lindsay Foss*. The only change we made was to have firefighting capability, probably the largest firefighting unit in the world, and she can dock.

The *Lindsay Foss* is now in the process of training with the pilots, with the tugboat captains, and with our own people. We had to modify the sterns of the ships so that we could use this piece of equipment. The reason we have the equipment there is because in those circumstances at Rosario Straits going somewhere between 9 and 11 knots we wanted to have a piece of equipment that in fact could help us.

Tractor tugs do not work in all places; sometimes they get in their own way. The application has to be right for tractor tugs.

E. NALDER: I'd like to ask Jerry a question. First, why do you want to run 9 to 11 knots in Rosario Strait? And second why don't you do the same thing with tractor tugs up in these waters?

J. ASPLAND: First question. We run 9 to 10 knots because the currents and the wind are such that we can't go any slower because we can't keep

steerage that way. The reason we slowed down is a pilot in the Puget Sound was at the simulator doing some work and said, "we're going too fast," and that slowed us down. And that also led to development of the tractor tug.

Quite frankly, I believe if we're going to go 6 knots or less through the Valdez Narrows it is not necessary to have a tractor tug because we're at a speed where conventional tugs can do the work. We can argue this for days because I know some in the audience have a whole different view. But at this point in time, we do not advocate tractor tugs going that slow.

E. NALDER: As a follow-up, what about the 10 knots out on Prince William Sound, then?

J. ASPLAND: I think 10 knots on Prince William Sound is too slow; we ought to get out of there. This is because escorts can't keep up. I think we're kidding ourselves when we delay ships' passage through wide open waters.

E. NALDER: Would a tractor be appropriate out in Prince William Sound as an escort?

J. ASPLAND: I say no.

E. NALDER: Jim Atkinson, the ex-Coast Guard captain who did the study in the early 1970s, used your vessel the *ARCO Fairbanks* as a test. He said then that there ought to be tractors here.

J. ASPLAND: At that time there were no tractor tugs big enough to do the job.

J. WILLS: I had the great pleasure to be on board the *Lindsay Foss* in Anacortes on Sunday afternoon, and she's a magnificent vessel. I think it's ideal for escorting when you're just approaching or in the harbor. I hope to take a trip on her in rough weather, because it was certainly rough outside on Sunday afternoon but that part of the deal fell through, so I can't say what it's like as an escort boat. It's certainly highly maneuverable. In fact, at one point I suggested they should have an annual championship. You know, like these hydraulic diggers; they have formation dancing teams of them; it's a big thing in Britain. I think you could have formation dancing with tractor tugs, they're so nimble.

We have slightly smaller vessels as harbor tugs, and we find them ideal, very maneuverable. Our big issue at present is getting escorts like the Prince William Sound escorts, but a few other councilors and I would

like our escorts also to be able to act as ocean-going salvage tugs, because we are out in the middle of the ocean, not an inland sea. I have some doubts still whether a tractor tug is ideal for that ocean-going escort and salvage role. I may be wrong, I just haven't seen it proved yet. So perhaps the stern drive conventional twin-screw tug is the right one for that. But I'm sold on tractor tugs in the approaches to harbors, and I can't honestly see how the Valdez Narrows scenario is any different from the opening to Sullom Voe. If anything, it's more hazardous. I would've thought a tractor tug is the ideal tug to have there; and have two of them, one forward, one aft, made fast to your incoming and outgoing tanker.

J. ASPLAND: I have two points. First, Jon I think I have the same kind of doubts about how one of those big boats will work in the open sea. I would caution you about one thing. If you take a platform as big as a tugboat and put too many different features into it, you sacrifice the primary purpose. That's why we were very careful on the *Lindsay Foss* not to sacrifice her ability to escort. If you're going to use the tugs you have to go to sea for salvaging, I think you'll compromise so much that you'll end up with nothing. Second, two big surprises to us were the amount of training necessary for the tractor tug operators, and that the pilots have to learn how to use them correctly, and they have to be willing to use them. The key to the whole issue is how quickly can the boat get hooked up and begin to pull full force from the time you tell it go. We're not talking about minutes, we're talking about seconds. It is very critical how fast you can hook up. We're very proud of what we have so far, both vessels going in the same direction and the tug boat turning around to come and pick up the tanker. The little boats can do it in a minute and a half, and that's picking up the line and pulling full. The best the big boats have done at this time is about two and a half minutes.

S. STEPHENS: We can sit here today and say we're not going to take laden tankers out when the winds are 40 knots, but that's really not the case. If the West Coast oil is shut down and we have four or five days where the line is shut down, they're going to move oil. The decision is not going to come from the oil companies, it's going to come from political power somewhere else. So the 5 or 6 knot speed that we're going to travel at through the Narrows is no longer valid because if you're going to move it in 55 or 60 knots, you'd better be doing 8 knots or better in order to get through the Narrows. The conventional tugs we have now don't meet the requirements we need in order to be able to handle a tanker under those conditions, at least not with the computer modeling I saw. I want to be very careful that we don't take a chance with Prince William Sound

because of economics, and that we take a good look at what the most extreme condition is going to be.

My question is, do you feel that you can avoid moving a laden tanker under any conditions if the winds are above 40 knots?

J. ASPLAND: Everything is always possible. I can't sit here and say to everyone that that won't happen. I think all of us at one time in our careers have been in a situation where we promised we wouldn't do something and somewhere along the line the circumstances changed so that it occurs. I notice on the slide today that the David Taylor Basin is guaranteeing that if we put on double hulls we're not going to have spills on small tankers. I really want to ask that gentleman if he will guarantee that, and if we have a spill will the government pay for it?

Stan, I think your question is very good, I struggle with that question in all kinds of operations every day as I'm sure you do in your business. No one could say you wouldn't take a ship out in over 40 knots, regardless of the circumstances. I don't believe you can take a look at every circumstance that occurs because economically you can't afford it. There's some risk in everything we do.

E. NALDER: I'd have to look at the logbook again for the exact number, but when we came out on the *ARCO Anchorage* in January of 1992 the winds were really screaming. Two more escort vessels were added to our little parade on our way out of Valdez Harbor and through the Narrows.

J. WILLS: Jerry has a point, it does depend very much on the conditions. And one of those conditions is the number, type, and capability of the tugs that are available. You can move a ship in 60 knots if you've got the right tugs there. But there is a definite cut-off point at Sullom Voe where you stop operating. One reason we can do that is we've got plenty of storage space. As an outsider, I think most of the problems at Valdez arise from the fact that that terminal does not have sufficient storage capacity. It would cost a lot less to put in some more storage capacity than to pay for some of the very expensive other safety measures that may be needed.

S. STEPHENS: If we can't say for sure that we're not going to move a tanker at 40 or 50 knots because we need to, it's not going to be safe to take it through the Narrows at 5 or 6 knots. So if we're going to take it through at 8 or 10 knots, we'd better have the same equipment available that works in Puget Sound which might work in the Narrows.

E. NALDER: Yes, and what Jerry said is probably true. I think the important factors are whether the tanker's laden or light, which direction

the winds are coming from, and what the currents are like. There are more factors than wind to consider in determining what your operating conditions are going to be like.

J. WILLS: There are a lot of variables in the equation. That doesn't mean you can't have an equation and set operating parameters. It's entirely possible to do that. It'll vary on the type of ship. But does Valdez not have operating parameters?

J. ASPLAND: There are operating parameters and I think we can do more with the parameters, but everybody has to come to the table and look at what we can or can't do with each of them. Let me give you an example. I think that we could do more with the weather. If you have one-way traffic, depending on how the wind blows maybe you ought to be in one side of the channel or the other. We don't take advantage of that right now. Those things need to go into the equation.

W. PARKER: It's obvious from the discussion with the shipping industry that it has much more flexibility on its weather parameters than most transportation. The reason for that, of course, is because ports differ so drastically and because the industry's grown up that way for the last several thousand years. As Jerry says, you can work on these things.

One of the problems is in the way we run our ports. Each port is run somewhat differently and while one port authority may resemble another, there are vast differences between them in the way they reach their decisions. While the Coast Guard has the authority to set the parameters, it has to deal ultimately with the port authority or whoever's operating the port in reaching a conclusion. It's not the simple clear-cut engineering scheme you can get to when you're designing the operating parameters for an airport or a highway. It's something I think we need to continue to work on. I think the increased availability of various types of simulators is going to start to give us the tools which we can start fine-tuning to accomplish some of these things.

Right now in most ports you'll find that the agreements between the port, the Coast Guard, and different shipping companies are somewhat different. Some skippers refuse to go into some ports where others are plowing right on ahead if they're allowed to. That's where I think if it applies to one shipper, it's got to apply to all. I think we're getting closer and closer, but there's still work to do.

R. STEINER: Which brings up the question of the port needs study and the various other studies the Coast Guard has been mandated to do in the

context of OPA 90, including vessel traffic service (VTS) expansion, tug escort expansion, or needs in different ports, etc.

J. ASPLAND: I want everybody to understand where I'm coming from. Many of you here know me as kind of out in the wilderness and doing things that are different from others. I'm not opposed to tractor tugs, but I'm not going to sit and see things change when there's no reason to change them. We're all in the study on escorts and the tug boats, and when that's finished we're going to have to look very carefully at the recommendations that result from the study and proceed from there. I don't want you to think that we intend to fight to the death.

R. FINEBERG: In terms of what has been described as the glacial pace of change in the shipping industry, and I think solidly documented, Mr. Aspland, you're on record as encouraging the public to keep after you, to keep the pressure on to make changes. We've very clearly got a glacial pace. I am hearing from you "when we get the study done," the studies have been delayed interminably. And so far the two arguments I have heard against tractor tugs are that they're not necessary at six knots, which is argued by some. This isn't a very strong argument against the tug; it doesn't speak to the scenarios in which it might be necessary. Your argument there is far more reasonable than what I heard from Mike Williams last night and from the aide to the president of Exxon Shipping saying we are opposed to the tractor tugs because people think they are a panacea. That is just mind-bogglingly stupid logic. It's a nonreason. What's wrong with the thesis that the other companies, if not your own, want to stall it for economic reasons until we're so late that we are convinced, I believe falsely, that the North Slope is winding down and it's no longer economically feasible or necessary?

J. ASPLAND: Let me see if I can answer it this way. I'll only speak for ARCO Marine and Atlantic Richfield. Atlantic Richfield said we will put an investment into Alaska, so I believe we're going to continue to put that investment in, and we will continue to operate out of the port of Valdez.

The study will be finished, I think, in June. Before you make an investment in something, you need to be sure there is a return. Let's see if I can put this in the context of Puget Sound.

We felt the escort we were providing up through the Rosario Straits was really not adequate. So we started into the study to see if there was a different machine to use. We found there was, we made the investment. If we'd found there wasn't a different platform to use, we would not have made the investment because it would give people a false sense of

security. As an example, I'm very concerned that people believe double hulls are the panacea to everything. They are not. I'm not opposed to double hulls, but I am afraid that the public believes that once double hulls are in use we're all going to be safe. We're not going to be safe.

I want to be sure that if an investment is made in different equipment that it is in the right equipment for our needs and that the system gets us the most for prevention.

**R. FINEBERG:** There's a chance that Jonathan Wills is completely wrong about the tractor tugs being the superior vessel because they are being used elsewhere. I know that promises were made to have the safest port in the world but that's still a gray area.

**J. ASPLAND:** I'm not going to get into the promises that were made. You all know the story better than I.

Jonathan and I do not disagree on the tractor tug. I believe that the tractor tug with a cycloidal engine in a port area is a superior piece of equipment in the application it's used for. I have not today been convinced that that application is necessary in Valdez. I think that we have one of the most modern ports there is, compared to other places I've been in the world. I think that we're on the right path. It's my understanding that some of the changes that were made in Sullom Voe came about because of some of the ways things operate here.

I think we need to keep things in perspective and know where we're going. I would like to see some changes in Prince William Sound to make it safer, and that may or may not include tractor tugs.

**E. NALDER:** When are you going to order new double hulls to replace the ships you have out there now?

**J. ASPLAND:** We plan to put double hulls on the vessels as they come due according to OPA 90. You all know here that ARCO's program for drilling and finding oil on the North Slope and other places in Alaska has not been good this year. We have to see if the amount of oil we find meets the necessity to renew the fleet. If it does not, vessels will go out of service as their times come due. There is nothing wrong with the vessels we have; this year alone we're putting \$800,000 into training. We can sit here and argue double hulls, radars, and anything we want to argue, but when you get right down to it, it's the people running who are going to make the difference. I prefer to put the money into training people rather than into technology and double hulls. We did not fight double hulls, they are probably going to prevent 40% of all of the spills. In 1985, the *ARCO Anchorage* would probably not have spilled any oil if it had a double hull.



We cannot justify the investment at this time. If there were to be a big oil strike, we would probably change that particular scenario.

D. LAWN: I'm from Valdez. Any comments I make are my personal comments and don't necessarily represent the views of my employer. I would like to say this about ARCO. I've had the pleasure to work with many of the people in ARCO's organization for about 17 years. Long before the *Exxon Valdez* oil spill they were pushing their partners for a better oil spill response system. I know that for a fact because I know the people who were involved. And they've been leaders. They've been criticized a great deal by their partners and by the oil industry. Jerry Aspland's pursuit of the big gulp concept is right on target; it's where we need to go. Maybe not with a tanker but with some device that's capable of 40,000 barrels an hour. But they're leaders in that area. They're obviously leaders in getting cycloidal tractor tugs in the right conditions. We have a minor disagreement about whether we need them in Valdez. I'm very much in favor of them; I've traveled in other parts of the world and seen brand-new ones being built. Nothing as big as ARCO's and Foss's, but they're out there working in extremely rough weather in the North Sea when anchor handling boats are running for cover.

I want to also compliment ARCO for being open and honest and Eric Nalder for doing such a fine job in detailing what life on board a ship is like and what happens there. I know a lot of people in the industry are trying to do the job right. But we need Jerry Aspland and we need ARCO to push the system. We need to push it a little further and we need to push Jerry Aspland. He's said many times that the regulators and the people need to tell them what to do and make them do it. "Keep the heat on" I think he's quoted as saying. But I have great confidence that we'll have a better system if some of the things that Jerry's pushed for for a long time are implemented by the rest of the industry.

And there are a few things that I think could be done right now and I'd like to ask Jerry this. The VTS system that we're waiting for in Prince William Sound can be used to track ships. We've been able to track ships for many, many years, we track airplanes all around. When your systems are installed on your boats, and I think some of them may already be, will you track your ships down the coast outside of Prince William Sound and wherever they happen to be, or will you only be looking at them inside Prince William Sound?

J. ASPLAND: We don't have any intention of tracking the ships down the coast. We've had people come and talk to us about that. With communications and the way things are today, I don't see the necessity. We also are

operating the crude ships at least 85 miles off the coast as we go down, and we make right turns or left turns into the areas that we go. I put a tremendous amount of faith into the masters and that they, in fact, follow that pattern. I really don't see at this time, Dan, where VTS is going to get us anything else.

We need to get people on the ships to work as a team so that as decisions come up we get better decision making and more vigilance. We have to make that transition before we give them more things to do. Some of you in the audience who are in electronics are going to be mad. But the gadget people are still out there. We don't need more gadgets because people are doing more with the gadgets than being vigilant and paying attention.

So I look at VTS up and down the coast as another gadget for someone to look at. I'm concerned that we're going to do too much of this and we're going to take people away from their basic responsibilities. I am really concerned when people continue to come to tell us that we have another gadget that's going to save the world, and there's absolutely zero regard for the personnel that are involved.

T. LAKOSH: Jerry, I'd like you to address this policy of response to a burning marine spill. You mentioned that the *Lindsay* was specifically outfitted with fire equipment and is the largest firefighting tug in the world. My question is, if you feel that it's necessary to protect the citizens of Washington from a tanker fire which would land on shore, why not protect Alaskan citizens from a fire burning on the exact same oil delivered from our ports to your ports through Rosario Strait? Why wouldn't we have, through ARCO and Alyeska, the proper equipment to respond to a burning marine spill from three sources, either the pipeline south of Thompson Pass which could leak into Valdez Harbor, from the terminal facilities which could leak into the harbor, or from a vessel fire. What has ARCO done to get Alyeska to get this equipment on line?

J. ASPLAND: We paid for two of the big boats to have up-to-date firefighting systems on them. I don't know which two they are.

T. LAKOSH: Do they have any fire boom?

J. ASPLAND: No, we don't have any fire boom in Puget Sound. As far as I know, the firefighting equipment on board the terminal at the docks was upgraded a number of years ago, and is considered to be able to meet the needs. The reason I made a point of putting the fire equipment on the tractor tugs in north Puget Sound is because there was none. I think you have adequate coverage here. If you want to talk about hard-headedness,

discussions went on for almost ten years about firefighting equipment in north Puget Sound before anything was done about it. It's there now because we put it there.

T. LAKOSH: Well, how do you contain a burning slick if you don't have fireproof boom?

J. ASPLAND: Fireproof boom is probably not going to do anything for a burning slick. The reason you buy fireproof boom is so if you're going to try to light the spill you can control the oil within the boom and only the oil within the boom is lit. If you have a fire on the water, what you really want to do is use your firefighting capability to keep it contained. That would mean using fire nozzles, etc. and letting it burn itself out, not using a boom.

A. DEKIN: I was pleased to hear Mr. Aspland talk about the importance of training and the importance of the human factor in preventing spills in distinction, perhaps, of an overemphasis on technology. I think, however, that Mr. Nalder this morning, to whom I'd like to address the question, made a key conceptual discussion when he talked about the cascade of errors that is very commonplace in large spills and disasters and other events. I wonder if he could comment from his experience in reviewing accidents as he describes in his book, on how to stop a cascade once it's started?

E. NALDER: That's an important question, you know, I think it's one that a fleet manager like Jerry Aspland's looking at pretty hard, too, because he'll probably tell you as well that what happens on a vessel is that it's usually a number of causes that lead to a problem.

There are two ways to prevent a cascade of errors. One is regulation so that the elements of the cascade can be controlled by a regulatory body that says you shall not do certain things. For instance, you shall not go faster than a certain speed in Rosario Strait, or you shall have an escort vessel beside you. That prevents one of the parts. Perhaps the regulation prohibits having crew members working 20-hour and 30-hour shifts. That also prevents part of a cascade of errors.

The second important element is training. Jerry is working very hard in his own company to train these crews as teams, which I think is very important. If the crew members work together well, then that prevents another element of the cascade of errors.

On the ARCO Anchorage I watched a potential for trouble develop through a cascade of problems. One key crew member in the engine room was ill, another key member of the engine room crew was doing some

things he probably shouldn't have, and some equipment overdue for overhaul may have contributed to a little problem. It didn't end up being anything drastic. But I watched it happen. It shows in the accident reports that it's one little thing here, one little thing there, maybe something somebody did a year ago, maybe the fact that the International Maritime Organization (IMO) doesn't pass a regulation or the Coast Guard doesn't inspect the ship well enough, and it gets down to the crew making a mistake. So it's regulation, it's training, it's teamwork. And finally, it's proper equipment. A more robustly built ship is less likely to have trouble than one that's built with too little steel. An engine that's in good shape is less likely to have a problem.

J. LEE: The cascade of errors is really a reflection of what is called latent pathogens. These are, to use a medical analogy, sort of germs that reside in the system that are there even when things are operating normally. So you have the potential for this chain of errors to occur even during normal operations where everything appears to be operating correctly. And this was documented in Bhopal where before the accident you could've gone in and seen the state of the system, the state of the maintenance, the training of the operators, and predicted that there would be a problem. And there are probabilistic risk assessment techniques, that allow you to go in and catalog these latent pathogens so you can predict with a little bit of assurance that certain systems will encounter these sorts of chains of errors that will result in catastrophes.

A. STOLLS: I have eight pages of notes about all the measures we could take to prevent or mitigate the effects of oil spills, everything from ship maintenance to design to crew training and manning and fatigue. I don't have a sense of which is most important and what we can do and should be doing. Would you prioritize for me?

W. PARKER: There is no first priority because if you would take it on that point you'll always have the weakest point in the system waiting for you, so you've just got to take it in order. As has been pointed out, the problem with the ships is that they are aging. OPA 90 has a slow replacement schedule. We lost the double hull fight twice before we won it in 1990. We lost it in 1973, we lost it again in 1978. After we'd won it domestically we lost it internationally. And that fight's not over yet. Double hulls is not the complete answer on the ships, there are a lot of things that need to be done on the ships to make them better. Some people are doing them and some people are not.

I've been advocating to put the emphasis on the crews for the past couple years and it looks like I'm making some progress because that

can be done more quickly than building new ships. One of the big advances was getting a second officer on the bridge in coastal waters in OPA 90. This adds a tremendous safety factor.

Nobody talks much about power plants and redundant power. The primary reason we require tug escorts in Valdez in the first place was to save a tanker that has lost power because tankers lack redundant power.

For most skippers, radar is still the most important tool. VTS is going to be a big aid to vessel traffic control because they will be able to see ships in some locations for the first time. None of these things is more important than the others. You can't say that double hulls are going to save the day, you can't say that VTS is going to save the day, and putting ARCO's focus on team training is probably as good as any. I hope that other shippers will too. In this business everybody has to compete to stay in except for the integrated companies. One of the reasons Jerry operates as he does is because he's part of an integrated company. A difference between ARCO and BP is that BP, being a foreign corporation, has to charter vessels.

G. STOCK:, I would like to echo a lot of what Jerry has said. We've heard in the last few hours that somewhere between 60 to 80% of all casualties are to some degree related to the human factor. The Coast Guard has shifted focus from the mechanical aspect to the personnel aspect of ship and vessel safety and in particular prevention of oil spills. We have some studies ongoing that deal with personnel issues, the human factor. Our people at the R&D center in Groton are working on a number of studies, and MIT is working on a study for us.

E. NALDER: I won't try to prioritize myself, because I'm a reporter not an editorialist. But it seems the people who have talked to me would rank building better ships and training as very important. Change the licensing and change the IMO, make it more responsive to port states. People also talk about better escort services. Let's have more uniform standards in ports.

In a conversation I had today with John Tracy, a television reporter here in Anchorage, he talked about the observers aboard fishing vessels. He said maybe we ought to have observers from the regulatory agencies go aboard merchant ships like our oil tankers randomly to see whether they're following the rules and see first-hand what's happening. I thought that was an interesting idea.

J. WILLS: I have a shopping list. My first item is bleepers. Bleepers have been used to trace loads of steel around American freeways and railroads for more than ten years. There's no technical reason why satellite bleepers

can't be on every tanker so we always know where they are. Once we know where they are, we can get things organized to help them when things go wrong.

I'm concentrating on existing proven technology. Bleepers are my first, followed by radar, particularly new ways of sending radar images down telephone lines more cheaply than has ever been possible before. Radar is no longer prohibitively expensive.

There's a desperate shortage of salvage tugs in Europe, and there are almost none on this side of the United States. I'm wondering what your contingency plan is for the broken down tanker off Middleton Island, and I'm wondering if you're going to get there in time and I'm telling you now you're not. So some sort of salvage tug capacity, which would have to be funded at least partly by the government. There are ways of doing that. In France they pay a salvage tug a retainer which pays for the running costs of the tug. If the tug saves anything under international law that's liable for a lot of money, it splits the salvage 50/50 or even 30/70 with the French government. The government can get up to 70% of the salvage. Great incentive to go and salvage things.

Harbor authorities should ban ships that don't meet international regulations when they're inspected. It's very easy to do in Valdez because the harbor's actually owned by the oil industry. If they're serious, they're going to want to ban tankers that don't meet the specifications. We do in Shetland with the oil industry's connivance and active support.

Let's double a lot of things: steam boilers on oil burning tankers, rudders, steering systems, and hulls.

You should keep the Jones Act, keep foreign shipping off your coasts, keep control of your own shipping. I wish we had managed to do the same but we're in the European federal system and we can't.

Finally, beware of the panacea syndrome. Whenever something new is suggested, it's resisted. When it's made mandatory it's put it on the boats or in the oil terminals and said to be innovative. When something like a tractor tug is suggested, it's called a panacea. But the people who say that have personal or corporate agendas. They exaggerate the benefits in order to underline the argument for the item.

**W. PARKER:** A world problem now is that the port states of the rich countries and the flag states are all dirt poor. Improvement is not going to come from the flag states. Eighty-five percent of the ships that call at U.S. ports now are foreign carriers. We're lucky in Alaska that the Jones Act protects us, but the rest of the country is at high risk.

K. STAHL-JOHNSON: I'm the City of Kodiak's representative to the Regional Citizens' Advisory Council. I'm glad we got back into vessel traffic systems.

Prince William Sound has heavy oil tanker traffic. Many types of cargo vessels besides tankers, a large domestic fleet of fishing vessels, and vessel traffic travel in Cook Inlet and through the passes north of Kodiak. I'd like to ask Mr. Parker and the Coast Guard why they said there are no plans for vessel traffic systems to be put in Cook Inlet when I heard that this has been studied and discussed. I'd also like to know more about the discussions going on now about escort vessels. We're talking about tractor tugs, and making a good system better in Prince William Sound, but we're not talking about the resistance to escort vessels in Cook Inlet mainly because there isn't as much money in Cook Inlet as there is from the North Slope pipeline. We haven't been able to get a serious escort proposal in place for Cook Inlet. We're talking about some great things going on in Prince William Sound, and we can always refine them and make them better; but there is also a very large potential for accidents in Cook Inlet. One of the vessels that goes into Cook Inlet comes from Prince William Sound. Why are we doing such a great job right around the corner of the Kenai Peninsula and we can't get some consensus on how to deal with a much more complex system that needs more attention in Cook Inlet?

G. STOCK: It is being looked at in Cook Inlet. Part of the problem is that the tanker traffic level is not as high in Cook Inlet as it is in Valdez. We realize there's a lot of container vessel traffic in and out of Cook Inlet and the port of Anchorage, but I think most people would agree the risks of a major oil spill are significantly less from a cargo vessel than from a tanker. There's not a lot of support to put in a VTS or to have an escort system in Cook Inlet. It's being looked at, but it's not an issue that is going to be quickly solved.

W. PARKER: Getting back to Jonathan's comment on the bleeper. If you've got a VTS on board, the ability to retransmit the signal to the vessel traffic control system is \$1,500 or so, and the vessel traffic control system for Cook Inlet in this day and age can just as easily be in the room at Valdez with the rest of the vessel traffic control. I think the evolution of VTS will make it just as easy to track traffic in Cook Inlet as Prince William Sound. Seeing it on radar is the only difference.

E. NALDER: You know, the tanker history in Cook Inlet's quite checkered. There have been a number of incidents there. Reading the accident

reports involving tankers in Cook Inlet is quite an eye-opener with the very strong currents and horrible weather conditions.

**K. STAHL-JOHNSON:** We may not have the traffic coming out of Cook Inlet that we have out of Prince William Sound, but last year there were three incidents in less than six weeks where tankers lost power due to ice in the cooling systems. We don't have anything in place that's comparable to what is in Prince William Sound.

**E. NALDER:** If you study the traffic and read the accident reports, Cook Inlet stands out as a place where something could easily happen.

**J. WILLS:** It depends what you mean by a serious oil spill. We lost 4,000 sea birds in the winter when there are hardly any birds around from one spill of fuel oil from a tanker. But, many large container ships are propelled by heavy fuel oil which is really nasty stuff. It doesn't evaporate much, it hangs around for years. Nearly 14 years later we still find it. It's part of the geology until we get a warm day and then it gets runny. In Cook Inlet, which is fairly shallow with high tides, there's a vast area where marine life is subject to any spill, and there is offshore drilling. I would have assumed that Cook Inlet had a vessel traffic systems, I'm surprised to hear it hasn't.

**L. HAMMOND:** I'm going to speak now in my role as chair of the COPE committee of the Cook Inlet Spill Prevention and Response Cooperative. We are going to have a prevention workshop this fall that's going to address prevention issues in the Cook Inlet area. I'd encourage those of you who are interested in those aspects to attend.

There are a number of factors that affect decision-making related to the vessel traffic control system in Cook Inlet. UNOCAL does run one tanker at a time to the Drift River terminal, and another tanker coming from Valdez to Tesoro, and their schedules are coordinated. There are a number of issues related to how fast the tides run in Cook Inlet that apparently make the vessel escort issue a very sticky one.

**R. FINEBERG:** The Valdez trade is economically unique. With at least six billion barrels left to go, the hard piping and the tractor tugs at Valdez would be less than \$0.03 per barrel gross. It would cost the companies after taxes less than two cents per barrel. To put that into context, the North Slope profits after taxes in 1993 were about \$2.96 per barrel. That's \$1.7 billion, which would be the equivalent of the seventh most profitable company on the Fortune 500 were the North Slope controlled by one



company instead of three. The difference being that if you're on the Fortune 500 and you have a bad year you drop off the Fortune 500, your stock goes from \$100 to \$60, you have no dividends for years on end, as occurred with both IBM and GM. What happened to Exxon when it incurred the costs of the *Exxon Valdez* is it went from number one to number four on the Fortune 500. It will probably be number one for 1993 although the reports are not out yet. Number one despite the fourth quarter.

The reason for that in part being its fourth quarter profits went up as oil prices declined. The reason, according to the Exxon newsletter to its stockholders, was that refinery profits went up due to the cheaper cost of crude oil. This means that the North Slope oil was even more valuable to its vertically integrated owner companies in low prices, "low" meaning 1.7 billion or number seven on the Fortune 500, as opposed to somewhere up higher in previous years. It was even more valuable overall at the lower prices.

To conclude, why are we having to wrangle to get a decent system?

D. LAWN: I have a quick question for Jerry Aspland. Does ARCO have any plans to revisit the big gulp concept in the new future?

J. ASPLAND: For those who don't know what big gulp is, big gulp was our idea to take a large ship and make a large skimmer out of it. Dan and I believe that the issue with picking up oil is the volume of liquid you can pick up. If you restrict the volume of liquid picked up either by the method used or the storage available, you're not getting total efficiency. The concept was that the bow would open and we'd bring the oil in. We could hold 500,000 barrels of liquid in the ship because we weren't worrying about separating it. I believe that in certain applications you've got to get the liquid up and forget about trying to separate it.

To be sure that we finished the cycle, we would have used natural separation to take the water off and then store the oil. I thought it was a good idea, but no one else did.

I would like to tell Mr. Fineberg I wish his numbers were correct because the board of directors and the stockholders of Atlantic Richfield would certainly thank him.



## Response Discussion

Moderator, Ernie Piper

144 E. 11th Avenue, Anchorage, AK 99501

E. PIPER: Let's go back for a minute not to March 24, 1989, but to the second week of May in Washington, D.C. I am with my good friend Dennis Kelso. He's preparing to go through a series of media presentations that are coming up, as well as talking to Congress, and here's where Denny came up with what I call the great white sound bite. He picked up the Alyeska Prince William Sound contingency plan and he dropped it on the table with a resounding thud and said, "This is the greatest piece of American maritime fiction since *Moby Dick*."

That quote has lived on, and I'll tell you why it's often been misunderstood. That's going to be the source of the first question I put to you. Here we are five years later and this is my question. Do contingency plans tell the truth? Or are they just modern modifications of *Moby Dick*?

D. LAWN: It takes great effort to make a contingency plan work. If everything is with you and nothing breaks down, and everybody does their job, and the weather is perfect, maybe you're going to get some of the oil. Maybe you'll get a lot more oil than has ever been collected before. Everything has to work right and it has to be there on time, which is almost impossible to do. That doesn't mean the people there aren't trying to make it work—it's just an almost impossible task.

E. PIPER: Does anybody in this room write contingency plans?

R. LEVINE: We write plans for the audience sitting in this room, but we don't write plans for the people who have to go out and do the work. If we wrote plans for the people who do the work, we'd have one- or two-page documents that describe their jobs and how to perform them. We write very long intricate documents that have thousands of pages on things like dispersants. It is the same information you can get from textbooks elsewhere.

E. PIPER: Why do we write only for the audience in this room? If anybody remembers, it was not necessarily the audience in this room that

had a driving effect on what was happening in Valdez, or in the rest of the Sound, throughout 1989. Where in those plans is the kind of communication that citizens need to have? How about the idea of triage as treatment?

K. STAHL-JOHNSON: Just as you recognize prevention is the key, we're going to have another spill. We're cutting down trees to write contingency plans that are very technical and take a lot of effort, but we're forgetting the most important key to what's going to happen after there is an uncontrolled major disaster in any area. It's the people who are going to be hit with the oil, and it's their lives and their livelihoods, and their futures that are not written into these plans in any way. We have the Coast Guard doing their damndest to fix a bureaucracy, and we have the Alaska Department of Environmental Conservation (ADEC) doing the same thing. We have all the agencies, industry, everybody trying to meet some kind of regulation standard. But the fishermen on the dock in the Kodiak, which is my reference point, are not included in those plans. Those are the guys who lost their entire livelihoods from the *Exxon Valdez* and who were never allowed to leave the dock until the oil completely surrounded the island. We are not planning for the people who are actually going to be impacted; the people are not in any of these plans. We're talking about the environment, but somehow the people aren't a part of that environment. That's what's so frustrating about this whole process.

R. KURTZ: The reason the plans were written for the people in this room is that they were the only ones who were directly involved either because of jurisdictional obligations or duties that they were assigned. Before 1989, everyone was complacent since there hadn't been a spill since the pipeline began in 1977, and it was assumed a spill would not occur. As we've all said, 1989 was a wake-up call.

What you have to do now is to prevent slipping back into that complacency. That's the only way you're going to keep the greater public involved. If you're going to write a plan, the secret is to involve individuals other than the folks in this room. You have to try to unlock that door.

E. PIPER: Do you really think you can do that? I'm a carpenter, and one of the biggest frustrations I've always had, particularly in remodeling, is when the owner hangs around while you're trying to do your work and asks, "Why are you putting that there?" "Because that's the way it's done. If I sit and explain it to you for the next two hours, you're gonna be running up a pretty big bill."

Do you think the general public needs to know or hang around? Are they going to be around when booms are being deployed and ask, "How come the fastener isn't going the right way?"

R. KURTZ: The public needs to know because once an incident occurs, they very much impact the decision-making process due to the politics involved.

E. PIPER: Oh, you've just said the P-word, which leads me to an article I saw in the *Anchorage Daily News*. They listed the biggest players in the spill who now, fortunately, are back to relative obscurity. The list included: Steve Cowper, Sam Skinner, Ernie Piper, Frank Iarossi, Dan Lawn, Rick Steiner, Admiral Yost, Chuck Hamill, Dennis Kelso, and Don Cornet.

What's wrong with this picture? These are the people who were making the decisions and I've just heard, as I've heard at many conferences, about how we're going to do some more planning. Who is really going to be there calling the shots when the hard decisions are made? Is it going to be the federal on-scene coordinator?

Hypothetically, we're in the Gulf of Maine where a lot of tanker traffic is coming in and going out of Casco Bay, and there's a big spill. It's washing up on the shore on the coast of Maine. This is a place where there are potatoes; they used to have fish, but they killed most of them. So this is a pretty dirt-poor state and tourism's about all they have. Now there's oil washing up all along the shore from Lubec down to Portland. One of the prevailing theories on cleanup, particularly on rocky shorelines exposed as these are, is to leave it alone. And the unified command, such as it is in the Gulf of Maine, even including Nova Scotia, sits down to work and they say, "Well, we're gonna do triage on a whole area of shoreline, particularly farther north where there aren't as many people and it's tougher to get to the shoreline." Do you think the governor of Maine is going to stand up and go along with that? Do you think the legislators in every coastal county are going to go along with that? What's going to happen when the story winds up on CNN that night and the unified command stands there with people throwing dead lobsters at them? How long is that strategy and the unified command going to last? Who's really going to call the shots? Is that theoretically possible?

N. LETHCOE: I feel that we need to undertake some type of education program on the importance of biological cleanup over esthetic cleanup. Unless that's done through the school system and through whatever means it can be done, we'll have exactly this situation. It's really difficult in the tourism industry, no matter how much we want to support biological cleanup. Every reporter that called me for an interview also wanted to know if we could get them out to an oil slick and show them some oil. Nobody wanted to see what's happened with the beaches that were oiled and now are not oiled, and that they are biologically recovering. Nobody's

interested in that. They all want disaster. We've got to start talking about biological cleanup, about biological recovery, and do something educational.

E. PIPER: Mr. Nance, you're the on-scene coordinator for the Gulf of Maine; how are you going to respond to that?

I. NANCE: You're going to have to deal with the situation at hand. I think that the reason we plan, and the reason we have the response equipment we do, is to avoid getting into a situation like that. I think the *Exxon Valdez* turned out to be an untenable situation for the people who had the assigned roles that we put into our plan. I don't think that anyone is going to be able to stand up to and withstand the political pressure of being in an untenable situation. The answer is that we just won't be able to sustain a response like that.

J. HARRALD: I think one thing we overlook is that a technological disaster, unlike a natural disaster, really elicits a lot of anger from people, a lot of emotion. There's someone to blame and we talk like there's going to be a rational aftermath. That emotion comes up as we saw in the *Exxon Valdez*. One thing our politicians and our corporate leaders learn very early is to survive; the first thing you do is deflect blame to someone else. Now you have a lot of deflecting the blame, and that's going to quickly tear apart the unified command. We've papered over the federal, state, and local things that were not resolved in the law and we pretend they're not going to be there. When the anger comes up and the emotion comes back at the organization, are people still going to stand together or are they going to deflect the blame to each other?

QUESTION: I think in your hypothetical situation in Maine that the people would take over, just like they did in Valdez and Cordova. Then it would be up to the command structure to start supporting them.

E. PIPER: Theoretically possible in Maine, too. Most of the lobstermen are armed these days.

W. PARKER: About the point on anger; people will get mad, but that doesn't mean that they'll do anything.

QUESTION: I think we're missing the real point, and that's the impact of the media, because they're the ones that give us the pictures of the birds and the sea otters and whatever else they think is important to that specific event. The public and the politicians, and maybe even some of the

technical people, are swayed by what the media puts on TV and in the newspapers. As far as I'm concerned, that's a critical situation.

**K. STAHL-JOHNSON:** My comment is in reference to what Mr. Parker said about angry people. If you recognize the people in the region are going to be even more outraged at the next incident, and they are kept out of the planning process, they're going to say, "To hell with you, this is my beach, this my life, I want to do something." All the planning's going to go up in smoke real fast. The answer to the inevitable question of what do you do when an oil spill's out of control is to manage the anger. You manage the anger by giving people something to do and not a bureaucracy to battle with.

**C. WEAVERLING:** As commodore of the Wildlife Rescue Group, I agree with the gentleman who spoke about the media. When I'd see the media, they would say, "Dead things, I want to see dead things, and I want to see them fast and I want to get back for my deadline." But, as far as triage goes, triage is a fact of life in a disaster. The definition of disaster is a certain problem to take care of and a certain amount of resources to deal with it. That irritates a lot of people, but basically that's the definition of disaster.

**R. KURTZ:** Regarding the point on human involvement, right after the *Exxon Valdez* spill, the Park Service brought in staff psychologists, and I did some work on the analysis with our in-house cultural anthropologist. We found that getting people involved, even if it's peripheral, is the first step in the healing process in this type of event. As previously said, a technological disaster is different from a natural disaster. We found that people don't have the coping skills for it like they do for a natural disaster. That's something to think about and include in planning for preparedness for a future event of this type.

**J. ASPLAND:** You really need to split the situation into two pieces, as I said earlier. You have the first 72 hours and then you have everything after that. The "after that" is where you can use some kind of an organization. Our experience is that in the first 72 hours you need an autocrat who has the authority and the responsibility to call out the forces. That person also has to have the pocketbook to go with it. The idea is that during the first 72 hours Bob Levine is the on-scene commander. He and Dan Lawn know each other so Bob could say to Dan, "You go down to the fish hatchery and stretch booms." Dan would say sure and not worry then about getting paid because the two of them had built a relationship. Dan may not have a thing to do with our plan, but he would do the job.

This is where we're missing the point, you can't organize quickly enough during the first 72 hours, and the public is going to be upset no matter what you do. It's very difficult to deal with all the issues at one time. I think that drills are all about establishing relationships, not worrying about who goes in what box. When you do worry about who goes in what box, you're in deep trouble.

E. PIPER: Let me just hold this for a second before we get too far afield on actual event management. Let's go back a little bit. Most of what I've heard are reactive statements. A good move bringing in the psychologist, but by then people were all screwed up, and they were uptight. The relationships are good; that means you guys can keep your heads together and keep them screwed on straight, but that doesn't quite mean that CNN is looking over your shoulder.

I have another question, is response planning truly interdisciplinary? There's the Alaska Department of Environmental Conservation (ADEC), the Coast Guard, the Alaska Department of Natural Resources (ADNR), and the Forest Service; all these agencies have statutory authority that only goes so far and there are many things such as risk assessment and communication that just don't fit into any agency's boxes. In the development of the contingency plan, has anybody honestly said what the real likelihood is if a couple hundred thousand barrels of oil are disgorged somewhere between Bligh Reef and Hinchinbrook? Do people really know? Is it written down? I think intuitively they know that when there's a spill it's all going to go to hell and that they're not going to pick up the oil. But CNN isn't going to buy into the blame deflecting. They still want their dead animals.

QUESTION: The trouble is the planning process as we now know it doesn't work. We have a small refinery. That refinery has one spill. I pull up the following plans: I have a DEC plan, I have a Coast Guard plan, an Environmental Protection Agency (EPA) plan, and a Mineral Management Service plan. Which plan is in control?

E. PIPER: For the sake of argument, let's assume that you need all those plans. How about things like geomorphological baselines and mapping? A lot of assumptions were made about what was going to happen, like the fate of oil on certain types of beaches based on literature searches. Some of the assumptions led to specific actions and they didn't necessarily turn out to be completely true. An example of that was how oil reacted on high energy shorelines in Prince William Sound. At least we have enough information to form a hypothesis that letting it sit on high energy shorelines didn't necessarily mean it was going to be quickly dispersed. We



have some information from last year that suggests that may not have been exactly the right thing to do. How about real agreement on cleanup approaches? You don't have to say what you're going to do at point "X" or point "Y," but how about a range of options given what you know? How about not basing your wildlife sensitivity work on a series of single species studies, but on an ecosystem-based approach? And how about subsistence ownership of parts of Alaska as opposed to just private land ownership? In a village like Chenega Bay or Port Graham, there's a sphere of subsistence influence, so to speak, that has almost nothing to do with land ownership. Would that better be included in the planning process? Any thoughts on making it more interdisciplinary, or would that turn your planning process into a mess?

R. LEVINE: At Port Angeles we had the same thing. It's not a 100,000 barrel spill, it's a 6,000 barrel spill. But what we found to be extremely effective is putting all the people who were concerned, all the different agencies, together. We wrote memoranda of understanding outlining the procedures that we would use on various beaches and for protection, and we signed them. They became, in effect, the contracts that said this is how things would work. Each time we strayed from that contract, someone would come back to let us know the contractor wasn't doing something according to the document.

The object is that unified command isn't the three people sitting at the top; unified command is the ability to get the committees together to make the decisions on each of the necessary activities. If you have to determine environmental sensitivities, the idea is to get all the environmentalists into a room. Let them beat each other up, and when they reach agreement, come out and tell the cleanup manager what the priorities are. Don't leave the decision-making up to the cleanup manager; however, he's going to have to do it if nobody else will.

That's where these contingency plans fall down. We assemble the data, but we don't provide guidelines on how to make the decision. Unified command is a great idea, it works very well. But unified command must be something other than the three people who stand up in front of press conferences twice a day and tell the story of what they've done for the day.

E. PIPER: Let's say I'm seeing legal counsel. I'm one of those interest groups just mentioned. Maybe I'm not agreeing, but I'm your client. I have an interest in the resources out there, and I come to you and say, "You won't believe what these people are doing; these industry people actually have a good idea. They want to get us all in a room together to set

some priorities, and then we're gonna sign 'em; it's gonna be just like a contract. Then if things go to hell, we're not gonna have to fight about this. Don't you think that's great?"

QUESTION: If you were my client, I would advise you of the up side and the down side. The up side, of course, is if you can mediate an agreement so that everyone wins and everyone feels great, then that is the preferable solution. If, however, things break down, either at that meeting or subsequent thereto, you've bound yourself to something that's going to come back to haunt you should you attempt to litigate.

R. LEVINE: We handled it by going in with the idea that the object was to clean up the spill and protect the environment. If we got sued later, so be it. But we stopped worrying about law suits. In Port Angeles, we did not have a single law suit filed. We went in with honest answers, we admitted where we were having problems, we didn't try to hide anything, and we brought the parties involved into the room and said, "We need to do this together; are we here to fight or are we here to clean up oil?"

N. LETHCOE: I believe that's an awfully important part, because I was part of the interagency shoreline assessment committee (ISEC) in Prince William Sound, and being part of the process and understanding why decisions were made in certain ways really reduced the interest in litigation.

T. LISCHINE: I ascribe to the quote: "If planning is everything, then maybe it's nothing." I'm speaking as an outsider because I'm not an Alaskan, and I'm not an agency person; I'm an academic. If you don't believe in planning, why do it? I don't understand why you persist. From my perspective, it's hard to recognize you've got the wrong objective, that you've got to change that objective, and do something else. Nancy Lethcoe mentioned being a member of the ISEC. I consider that the most interesting organizational phenomenon of the spill was ISEC versus the technical advisory group (TAG). They had the diametrically opposed approaches to decision-making, and I'd say the world has decided TAG wins, ISEC loses. I'm incredulous that the EPA got away with putting out a revised national contingency plan (NCP) that says planning is done by bureaucrats who may consult with ISEC types. The solution is within your grasp—why are you doing the planning? Let the citizens do the planning. Then the learning curve is on the part of the citizenry which is necessary so they recognize that when oil hits the beach, triage will have to occur and it will occur and they will accept it as the ISEC did while it was part of the process.

J. ASPLAND: Prior to all the new laws, we had an oil spill plan that was less than a quarter of an inch thick, and we used that in one major spill and one not-so-major spill. We used it all up and down the coast and around the world, and it worked. Now we have a plan that's about a foot thick. We have a plan for every different area that we travel in up and down the coast, but we have attempted to stick to our core plan and it's been very hard. A lot depends on who you select as your on-scene commander. It makes a difference. If you don't have strong individuals, forget about it.

A. DEKIN: Isn't the most important result of your foot-high plan the relationships you establish among the people who might be players? Are not the relationships between the various participants established during the construction of your plan the long-term benefit?

J. ASPLAND: I know when I come to Alaska that I am going to deal with a certain individual and that's the relationship I build. That shouldn't have anything to do with the length of my plan.

A. DEKIN: No, but it's the people you speak to in the development of your plan that establishes the relationships. The relationships are with people, not the paper.

R. LEVINE: No, the people we deal with when we submit a plan are not the people that we're going to deal with when the spill occurs. In the case of the OPA 90 plan, we developed it and sent it to a group of people in Washington, DC who are going to read it and review it. Those people have absolutely nothing to do with the people in Valdez. In fact, our OPA 90 plan was approved from Washington, but we're not required to send a copy of it to the U.S. Coast Guard in Valdez. They're getting one this week through ADEC when we submit the Prince William Sound plan.

C. WEAVERLING: Even though the people indicated in the plan might not be the ones you built a relationship with, the titles indicated on the plan will be the titles of the people you will be dealing with. Beyond that, whether we like the incident command system or not is a moot point because the incident command system is mandated by law.

E. PIPER: We've heard about several different approaches to a more interdisciplinary way to plan for response, and that's worthy of further consideration.

What we have to deal with in the case of a big event like this is that it usually takes an event to dislodge the political system. The people who make these laws in the political system generally assume static conditions,

"What I see today before the election is what's always going to be there, so let's pass a law that applies to it," and they also assume transitory attention spans and move on to the next item on their list.

Is there a need to periodically go back and review the current structure? Reserves in Prudhoe Bay are going down, those in Cook Inlet are beginning to disappear. Is there implicit understanding that changing economic viability, not just changing physical conditions, winds up being factored into the negotiations over response planning?

R. LEVINE: I haven't seen it happening yet. We're submitting the Prince William Sound spill plan for renewal and nowhere in the conversation did anybody talk about the decline in the field and the future of oil in Alaska.

E. PIPER: Does anybody know what kind of co-op is being put together, or what kind of equipment we are going to have in Cook Inlet? Does the economic viability of the enterprises in the area enter into the thinking?

Does it show up in the contingency plan in an explicit way? If we're sitting down and I'm the DEC and we're beginning to do some response planning for Cook Inlet and somebody says, "What we need are escorts like they have in Prince William Sound. We need escorts in dangerous water. Cook Inlet's a lot more dangerous, why don't we have them?" There are a lot of answers. But is one of the answers that a lot of water is being pumped out of the oil platforms and no one's making a lot of money in Cook Inlet, and if you do that, people are out of work. Does that enter into the planning at all?

D. LAWN: It enters into it from a political perspective. The rules are all in reaction to a grave event. We have some rules, but at the same time we have lobbying going on to reduce the rules, and agencies end up dealing with whatever the final rule is. I've heard a lot of really good comments here today, and some really good questions. But one of the things that's still driving the system is who's to blame? I submit that we are all to blame. The oil industry's to blame, the federal government's to blame, the state government's to blame, our legislative process is to blame, the regulators are to blame, the people are to blame.

I want to get beyond that stuff. I think we can solve the problems, but we also have to be honest about what the problems are. A zillion promises and commitments were made to allow the Trans Alaska Pipeline System to become a reality. The industry made some, and the government made some. They were made in response to people who said, "We don't want you to do this, but we'll let you do it if you promise us what we want to hear." I think we weren't really honest with ourselves. And we as

people, as citizens, didn't go back and make our legislators behave, make them do what they promised. Our legislators didn't fund the regulatory agencies to allow for sufficient oversight, and the industry really didn't do what they said they would do. We've got to stop looking for someone to blame, we've got to stop being reactionary and writing all these plans, and we've got to get a system that works. I think it's possible. There are some things that have been done by the industry that are good, there are a lot more pieces that need to be added. But somewhere along the line, we citizens have to accept that it can't all be picked up. A lot more effort has to be put into prevention. Sometimes, no matter what you do, even if you have the best system in the world, you're going to have a problem. But that's the cost of allowing it to happen.

I think the anger would diminish if people were really part of the process, if they understood the process and that you really can't do everything that you'd like to do. We need some political leader to say, "It's time to go to the moon. Quit the dialogue, get us there."

W. PARKER: After the 1964 Alaska earthquake President Johnson appointed a federal official in charge of earthquake relief who coordinated with the governor, and things went together pretty fast. Everybody keeps asking who's in charge and we're not doing a very good job of defining it.

I didn't hear any big outpouring after the *Huntington Beach* oil spill. What's the law suit situation on *Huntington Beach*?

J. ASPLAND: The *Huntington Beach* spill response, I think, was successful only because people stood up and took responsibility. The public was as mad as ever. With the *Huntington Beach* spill we were very lucky that the wind decided to blow onshore, it blew the oil on the beaches, it got scooped up, and that was the end of it. And this goes back to exactly what Walt Parker is talking about, and that is who's in charge. If you're not going to be in charge, you're not going to do very well. And I agree exactly with what Dan Lawn is talking about. That we need to get on with it and we need to think about what direction we're going to take.

QUESTION: I'm from the interior of Alaska and I came to this conference because I don't know a lot about oil issues and thought it was high time I learned. There's been a recurrent theme here which ignores the simple solutions. The *Huntington Beach*, as I understand it, went down on a rock; it was a single hull vessel. People are concerned about public relations. Imagine you're watching another oil spill disaster in Prince William Sound on CNN. You learn that it was a single hull vessel, and that a company like ARCO, which is a responsible oil company, has not yet converted one of

its ships to double hull. They have until 2015. Wouldn't you think that they would set out on an incremental system of converting the tankers? But, you find out that the reason for the accident was a storm of several days' duration, and there are insufficient storage tanks. We don't need more working groups to know that more storage tanks and double hull vessels will help. And yet there seems to be no plan for implementing these things that we know will work. Why? Who's accountable? Is Alyeska accountable? Who's accountable for starting?

J. SCOTT: I'm going to go back, Ernie, to when you were talking about the money, the cost. It looks to me like the money spent on the Prince William Sound spill has almost created a gridlock. The plan is too complicated, there're too many plans, all the money had to be spent within a certain time period, everybody's got a plan, there's gridlock. It sounds like there are plenty of plans for Cook Inlet. It sounds like some areas are way overfunded where they're almost in gridlock, while other areas have almost nothing. I'm sure that's why Jerry says he had a simple plan at one time and he could actually carry out that plan, and now there are so many that it looks like gridlock.

E. PIPER: Here we are five years later. We've all been to a number of conferences and congressional hearings, we've written legislation, we have citizens' advisory councils and OPA 90. We've done all kinds of things, we have a new division in DEC, we have a fund, and we still have the pipeline. Did we create any monsters? Anybody want to identify any of them lurking around out there?

J. SCOTT: In 1989, spill response in Alaska was pretty low. Today, we have the best spill response capability in the country, but our funding process is gridlock. I think we went backward in our planning process. I think we're really hurting ourselves with the planning process. We've gotten so far, but it's so complex, so bureaucratic, so legislative that it's virtually useless.

K. STAHL-JOHNSON: I think when push comes to shove, the books are going to go out the door. The people are going to do what their gut-level response tells them to just like Jim Scott says. He's got the simple road map through all of this, though the regulations are all there. We definitely have got to keep it simple. It isn't simple now, and if it isn't simple, it won't work.

N. LETHCOE: Back in 1989, when the oil hit the water Jacqui Michel said, "Everybody, we have a problem. We have to get together, we have to

work on this problem and we have to solve it." We did. I look at tourism in reviewing the contingency plans, and I think recreational tourism is in far worse shape now because of the contingency plans than we were in 1989, because we're not included in the plans. In 1989, nobody was included so we all developed a plan and went to work together. But now the contingency plans as they stand are a disaster for our industry.

R. FINEBERG: The fact is that we have too many plans and too much time goes into planning. People are going to take over because they're going to be outraged. There are a few of you in the planning process who are simply reflecting that in advance. That we don't have a clear workable plan for any or all contingencies, and we don't quite know what is going to occur, is a function of the fact that we don't have a crystal ball. The indications are that the plans are not yet adequate. Since we all believe that response is the tail end and prevention is the cure, we've got to make plans. If Kelley Weaverling wants to go out and save birds the next time, he's going to know that if Jim Scott says he'll help, he can count on Jim, and it's going to work.

Back to the economics. There is a triage situation. There is a health care meeting happening elsewhere on this floor today. One of their attendees was saying if they had half the intellect, the brain power, the energy of the people here working on silly oil spills, they could take care of people dying. Yet we're all concerned, and rightly so, about complacency. The social issues are always triage.

The way to prevent spills—back to prevention being the key—is to make sure it costs so much that it's much less likely to spill. That's an economic answer; and yes, they don't have the resources in Cook Inlet. Prudhoe Bay is unique and the economic answer in part gives us some comfort. The main point is the economic engine; we better charge a high price for oil spills so that we don't spill.

P. MEANS: I'm with the Coast Guard, and I think there's something resulting from OPA 90 that may be overlooked here. It's the area of contingency. It's intended to be a joint document that includes community involvement, industry involvement, and the federal and state agencies. All of the marine safety office (MSO) regions in Alaska now have area contingency plans, and they are going to be revised every year for the next five years. Environmental sensitivities are included in the plans. They're not prioritized but this is the most important site in this area. The Cook Inlet region was included with resources of major concern, moderate concern, and lesser concern. What you're asking resource agencies to do is essentially say that you can sacrifice my resource, and that's really hard to do. It's a positive step,

the plans obviously require a lot of work. If you want to be involved with the revisions and can bring something to the table, want to participate and contribute, I urge you to contact the MSO and volunteer to sit on one of their committees.



## **Oversight Discussion**

**Moderator, H.E. “Stan” Stanley**

*Prince William Sound Regional Citizens' Advisory Council  
750 W. Second Avenue #100, Anchorage, AK 99501-2168*

**S. STANLEY:** One of the things that struck me especially about today's session was its title “oversight.” I always have a problem with oversight because “overseeing” means so many different things to so many different people. In some people's minds it's that you're a policeman—a cop, you're keeping industry in check. In other people's minds you're merely observing, you're forming ideas, and you're trying to get industry to do something you think they should do. And there are probably a lot of gray areas in between.

There are a lot of people who think everything should be black and white, and thank God the world is colorful. There're all different shades and there is very little that's absolutely pure black and white. So to those who say oversight is one thing and those who say it's another; yes, you're right, that's what it is. It's all of that and probably more.

From my point of view, I think that we have oversight agencies who are tasked by law to provide regulatory oversight. We have federal agencies and we have state agencies and we have groups like our group, the RCAC, who have no legal authority to direct anyone to do anything, but we have a legal mandate to at least observe what's going on, to advise, and try to influence activities.

Does anyone have a specific question for any of the presenters that are sitting at the front table?

**QUESTION:** I have a question for Barbara Herman. When you're doing your risk screening of the vessels, do you have access to the Coast Guard database?

**B. HERMAN:** We have access to the Coast Guard MSIS information through the 13th District, and we have access to the new database, MSIX, which doesn't have much information yet but eventually it will.

**QUESTION:** Is there any provision in your plan to notify next port of call if you have an extremely high risk, or do you work with the Coast Guard.

B. HERMAN: We definitely work with the Coast Guard and before we even go out on inspections we'll call the captain of the port office for Seattle and coordinate so that we're not duplicating effort. We are very anxious to work with the other members of the States/BC task force and ultimately what I'd like to see is that we all have the same program and we cannot only alert each other if there's a problem with a vessel, whether it's been fixed while it's in Washington or it's headed on down to California or up to Alaska, but that we can also coordinate on the inspections, because everybody's got the same problem, there are not enough people to inspect vessels. I'd like to see an information highway where all the coastal states are sharing information and the responsibility to inspect vessels. Then we can all compare our information—we still have a way to go.

S. STANLEY: I'd like to hear from Jean Cameron on what the States/BC task force is doing in that direction, as far as trying to get other states to do an inspection of their own tankers or other vessels that are coming in.

J. CAMERON: Nobody else has taken the initiative that Washington has at this point, but we see that down the line. As I said earlier, the task force has stated that that's one of the things they want to look at. I don't think they included it blindly without recognizing that one of the things that will come out of the consistency review is the fact that California and Alaska do not regulate and require contingency plans from cargo and passenger vessels as do Washington and Oregon. The screening program Barbara has currently got in place, as she explained to you earlier, is for that class of vessels. There are some big pieces of the puzzle that need to be put into place to have exactly that program occurring up and down the coast. I believe there is a goal on the part of the task force to ultimately have a coastwide program in place, perhaps for tankers as well as cargo and passenger vessels.

B. HERMAN: I think we're closer on the tanker side. In fact, we've been in touch with California, where there is a fairly extensive inspection program and a better budget than anybody else. They're aware of what we're doing on the screening program and its application to tankers as well. So we might get there sooner on tankers with a state like California.

J. CAMERON: You mentioned that OMS is also providing a leverage for Oregon's Department of Environmental Quality to have a screening program on the Columbia River. Oregon and Washington have always cooperated on their rules pertaining to the Columbia because they're shared waters. And the Washington Legislature just funded extension of this field office program to the Columbia and DEQ will be cooperating

with it and providing office space. Barbara may want to elaborate, but that's another example of cooperation occurring between two of the states at this time.

QUESTION: I have a question on funding of this type of screening program. I understand it's authorized by the Washington State Legislature. What is the source of funding for your program, is it collected from just taxpayers or from shippers?

B. HERMAN: Right now funding is based on a five cent a barrel tax that's paid by the refinery, and it's similar to what I heard discussed yesterday that is being proposed here. The current breakdown of the five cents is three cents goes to fund all the programs, and two cents goes into a response fund. So we already have that division.

QUESTION: I have another question for Barbara. I was surprised by your presentation in that it seems like the actual history of the vessels was not scrutinized, it didn't seem to be nearly as important as the history of the personnel on board the vessels. Why is that?

B. HERMAN: It was a fairly important factor, casualty history and violation history, and I think it's not as important as the personnel history, understanding that personnel history includes casualty and violation history. Under the theory that whether it's 60%, 80%, or 90% of all oil spills and accidents are caused by human error as opposed to hardware problems, it makes sense to have your personnel information a higher priority or a higher risk than the hardware. I think that's the way the distinction was made.

W. PARKER: With a follow-on to that, someone yesterday made reference to the importance of the pilot, as in many cases the sole safety factor in the system. In the last three years I've looked at all 29 major ports in the U.S. and talked to all the pilot organizations and others who said that assumption was right. It's hard to say how much further we can go with this. Alaskans just don't realize how lucky we are in that almost all the ships that come in are of the domestic fleet and bound by domestic relations. At Europort when you go out to meet some ships, they have not just one pilot, but they take two pilots out initially. After you get to where you meet the pilot boat, they bring on board a whole line handling crew and as much additional crew as they feel necessary to take that ship safely on in. The cost of all that is, of course, put directly on the bill to the shipper. As the main entry port, it's the only way the Dutch have figured out to affordably operate Europort the way they want to since the crews coming in are so

dramatically different from each other. As I said, most U.S. ports are not facing that problem now, but most probably will to some degree in the future.

P. SLYMAN: I'm from Oregon DEQ. Maybe I'm cherry picking, but over the last couple of days we've talked about a lot of things that OPA 90 just brought about, but something seems to be missing from the discussion because it's only been given what I would deem lip service, and that's salvage requirements. And when the *Exxon Valdez* was up here on the rocks, Fred Devine sent the *Salvage Chief*, up from Oregon. It's one of the few vessels left in the United States with capabilities for lightering and bollard pull. I'm a little fearful that that whole industry is on the wane right now, and they're not well represented in any of these conferences or meetings. I don't know how we can best address the salvage industry. We seem to address quite well spill response companies and oil spill response organizations (OSROs), for which the Coast Guard has an elaborate classification, but there's nothing near so elaborate for salvage. Salvage is one aspect of the greater picture, because 80% of the *Exxon Valdez*'s cargo did not spill from the ship. You could say it's prevention or maybe a form of response. In any case, it's an industry that is not healthy right now.

S. STANLEY: Walt, did the Commission look at salvage? That was in your report, too, wasn't it?

W. PARKER: There was a little bit on salvage, but the marine board just set up a committee on the salvers which has been meeting for the last couple of years and their report should be out in a couple of months, I think. Essentially it's a dormant industry and there are a few salvers working in western Europe but not doing well financially. I don't think there's any salvage tugs, unless the Japanese have some, working in the North Pacific.

J. CAMERON: We've added it to our list of policies to look at, but it's my understanding that the Coast Guard is developing some salvage policies. California made some comments on the national contingency plan about the need to address it, that there was a sense of timing being off.

M. MILLER: It seems to me that the salvage interests congregate around those areas which have the propensity for accident. If you look at the history, salvers were active in New Orleans; on the Mississippi River there was an accident a day, if you will. The problem is enticing them economically to be available in areas other than those that have problems, and we haven't addressed that yet, I agree.

B. HERMAN: One initiative of the Office of Marine Safety is to get a dedicated rescue tug stationed somewhere near Neah Bay so that we can help vessels in distress for that area of the straits as well as the coast. One of the types of vessels that's being considered is a salvage vessel, but it might not quite have the horsepower of some of the others. That's our small contribution to the salvage industry in this country. We'd like to see a large, powerful vessel out there.

S. STANLEY: Bob Levine can correct me if I'm wrong, but I believe the salvage master who did phase one of the disabled tanker towing study recommended that we have a salvage tug at Hinchinbrook Entrance.

R. LEVINE: That's correct. The salvage master, Capt. Per Haar, worked with Smit Tak International, one of the two largest salvage companies in the world. He was master of the largest salvage tug in the world at one time. His experience says when you have a ship that is in open waters and high seas, you need very large ships to go out and rescue it. Large in this case is a vessel in the range of 15,000HP, 250 to 300-foot long. Due to fuel capacity, a typical Svendt salvage tug is capable of running about 13,000 miles without refueling.

S. STANLEY: Jonathan, did they bring a salvage tug to the *Braer*?

J. WILLS: Well, there happened to be a large downloaded tug in the main port; she didn't have a lot of gear on her afterdeck, she was being used as a supply ship at the time. So they called her out and she got there, but she got there half an hour after the crew of the tanker had been evacuated, so there was nobody to take a line in. You need a system where the Coast Guard can call out the tug. Our problem was that the Coast Guard didn't have authority to call out the tug without checking first who was going to pay for it. After the *Braer*, the British government told the local Coast Guard on-scene commander that now they have authority to order out a tug. As soon as you're worried about anything, you order a tug, don't worry about paying for it. So that's the new rule. Meanwhile the official inquiry criticizes the Coast Guard for operating under the old rule which says you have to get authority before you call a tug. What is your contingency plan if a large loaded tanker breaks down 20 miles off seal rocks in a storming gale? What is your contingency plan? I haven't heard it as yet. I think that's the most likely next scenario.

D. LAWN: Let me add a couple of comments to what Jonathan said. It's quite likely that had the Coast Guard been aware the *Braer* had broken down, maybe as many as six hours before she reported it to the Coast

Guard, there was time to get that tug of opportunity to the vessel had the vessel been equipped with a bleeper, as Jonathan likes to call them, or a GPS system with some kind of a transponder, the Coast Guard would've been aware that the ship had stopped and then they could have taken some action. Those are the kinds of things that we are fighting for around the world; those are the kinds of things that we need here in our own system. We just happen to be in the unique situation of requiring them on our TAPS vessels, and because they're a little bit different than the rest of the trade, we can do that if we want to. Certainly the Coast Guard's going to have that system inside Prince William Sound, but what happens off of Juneau, what happens off of British Columbia, what happens off of Washington, Oregon, California, Mexico, Panama? We're in the same position, we have to rely on the good graces of the vessel operator's crews on board to tell us they have a problem. We don't have the opportunity to protect ourselves, and that's where we need to move a little bit.

S. STANLEY: Max, as the captain of port for southwest Alaska, can you call a tug out without finding out who's going to pay for it and then what they're going to pay?

M. MILLER: Certainly I do. For example, in Dutch Harbor we had the potential of spilling the bunkers of a large processing vessel, a 300-foot processor. I spent \$1.6 million without having any oil in the water, just to prevent it from happening.

T. LAKOSH: I think you've noticed my question earlier. I've been trying my best for the last three days to illuminate a conspicuously deficient policy with regard to responding to a burning oil spill. In the last week we've had two burning ships. Mr. Banta informed me that there were two ships that exploded on their own. I would like Mr. Banta to elaborate on some of that information, and I'd like the rest of the panel, if there's any opinion or expertise, to analyze the present fire-fighting capacity and propose the proper equipment, which might fill the gap of this conspicuous deficiency in response.

J. BANTA: What I was telling you about I had gotten from some of the newsletters we get. Within the past month two tankers carrying crude oil in the Middle East, one of which at least was under heavy weather and I'm not sure about the second, caught fire. The report figured flexing of the hull contributed and something inside gave out a spark causing an explosion. In both instances the tankers that exploded were loaded, caught fire, and spilled. And I guess your question is what capability do we have in Alaska to address that type of problem?

T. LAKOSH: Yes, and what equipment would address the problem? I've ascertained from Alyeska and from Capt. Aspland yesterday that there's no fire boom on any of the Alyeska vessels or the Crowley tugs, and that Crowley tugs, although they have a small firefighting capacity, would probably not be capable of responding to a large tanker fire. The policy in responding to a burning spill is to try and contain the spill with nozzle pressure from water monitors or fire monitors. That has been proven to be totally and wholly ineffective in containing the Bosphorus Straits spill. What type of policy should be adopted to see that a burning tanker will not discharge all of its cargo without containment? The present boom that the Alyeska vessels have for surrounding a tanker is not fireproof, and it will not contain a burning spill. I would like to hear from the Coast Guard in particular what policy they feel should be adopted toward containing a burning spill?

M. MILLER: The current policy states that if you have a tanker and a spill, you secure the source of the spill, if possible, and stabilize the platform it's spilling from. You do not endanger the tanker or its crew by engulfing it with fire boom to allow the fire to stay there.

T. LAKOSH: Are you going to leave the crew on the ship? If the crew's gone, then booming the tanker isn't a safety problem.

M. MILLER: The idea is to stabilize the tanker and save the rest of the remaining product so you don't lose the whole ship.

T. LAKOSH: I don't understand how that conflicts with placing fire boom around it. Is it the policy not to boom the tanker at all, to promote stability and crew safety? Why is there boom; is it a policy to boom the tanker first of all, fire or not?

M. MILLER: The question is balance between what kind of product you have, how big the spill is, how much boom you have, and where the tanker is.

T. LAKOSH: Is there a written policy that says that the tanker must be boomed, is there policy that says the tanker must or must not be boomed when it is burning, and where are these policies written?

M. MILLER: I think it's a case by case basis, depending on the circumstance. I can't answer you specifically.

T. LAKOSH: So it's totally discretionary whether to boom a tanker?

M. MILLER: I'm just saying it's a case by case decision.

J. BANTA: I think the more interesting question really is what equipment is available to fight the fire, like fire monitors. Do we need better and more fire monitors for our region up here?

R. LEVINE: The two Crowley tugs that are equipped for firefighting are equipped as fire boats. They each have three monitors and they have foam capacity to go with the monitors. They are equipped to fight fires in accordance with normal firefighting practices. Each of the ships is also equipped with fire monitors in accordance with the Coast Guard rules. Most operators, to my knowledge, are also carrying extra foam beyond what they're required to have. There is also at CISPRI a system for firefighting which is high capacity, high pump and portable to the scene of a fire. The smaller tugs also have the capacity with small monitors, water only, in Valdez. You also have to look at the dock facility. The firefighting systems have just been replaced with high capacity, remote operated fire control systems. Right now, the firefighting capacity for tanker fires at Valdez is among the best in the United States.

T. LAKOSH: Alyeska said it's their policy not to respond to any fires seaward of the berth. They have a potential source of burning spills from the pipeline south of Thompson Pass, from the terminal, and from shippers which they're required to respond to and they have. Alyeska itself has no vessels with fire boom on them, or fire monitors, or fire foam above 50 gallons per vessel. Is Alyeska going to respond to a fire that is the result of a pipeline leak, at the tank farm, or from the vessels to which it's required to respond to the tune of 200,000 barrels of recovery in 72 hours? If it's burning, there is no way they can put it out or contain it. My question is, are they fulfilling their obligations under the contract, under the constitution, and under House Bill 567, the contingency plan requirement to respond to a spill if it is burning? Are they required to pick up that 200,000 barrels of stuff in 72 hours and what equipment do they have to do it with?

QUESTION: What's the benefit in not letting it burn if it's not going to get out of control?

T. LAKOSH: The idea is if you don't contain it, it will get out of control.

S. STANLEY: The only fire boom we have is for the purpose of corralling oil and burning it off.



S. STEPHENS: I think the area you're covering is very important, and the RCAC knows it has to look into fire both at the terminal and offshore. We don't have any answers for you today, but I can tell you it's an area that we intend to look at. We have had one drill that included a tanker on fire and we had a drill at the berths; both went fairly well. We know there are a lot of problems out there that we have to look into and we need to know what the capacity is. The questions you ask are good ones, but I don't think we have the answers for you at this time.

S. STANLEY: We can spend all afternoon talking about this one topic and still not come to closure. I'd like to shift a little bit. One of the things Walt Parker mentioned in his presentation was the best available technology. In the back of many people's minds are the promises that were made before the pipeline went in about having the best available technology. That means different things to different people. I'm finding that one of our biggest and most interesting problems is that everybody has a different interpretation of everything. From time to time industry has expressed the view that no matter what it buys, and buys, and buys, every time something new comes on the market there's a great hue and cry that we need that on board, too. Is that where we need to go, is that what we're talking about with best available technology?

QUESTION: I think one of the key issues in best available technology involves how to integrate that technology with the existing systems. And there are tendencies just to integrate gadgets, as Jerry Aspland mentioned several times earlier this week, without considering what the overall effects will be on the performance and system safety. I think one thing that's really lacking in maritime transportation is this approach, this systems level approach, that you find in aviation, nuclear, and other industries.

T. ROBERTSON: Another thing about best available technology is research and development. In order to develop best available technology, you need an ongoing consistent commitment to research and development. Many of you have probably heard about the OHMSETT facility in New Jersey, a tank built and designed to test oil spill equipment. It was originally built in the 1970s and fell into disrepair. By the time the *Exxon Valdez* came along, it was no longer in use; it had been mothballed. *Exxon Valdez* happened, and all of a sudden there's money for R&D again. They refurbished the facility, we visited it this fall, and they're again at the point where they have no funds. They can keep water in the tank but they have very limited funds to actually evaluate equipment. There's no gain to be

made if we can't test things. That's very important and it needs to be a consistent commitment from the industry and from funding agencies to allow these programs to go on and on and on. I wouldn't be surprised to see that facility closed in the next year or two based on the way it's going right now unless there's another big oil spill.

J. WILLS: Yes, BAT, that can mean best available technology, but how come it doesn't mean best affordable technology? Best affordable technology just refers to the economics, your main source of information on what's affordable is usually assurances by the oil industry, which by definition cannot be checked because of their confidential nature. So I think when a piece of new technology comes on scene, it's reasonable to argue with the industry about whether or not it's reasonable for risk benefit assessment. Say, for how many dollars will we get "X" percentage improvement in safety. That in fact can be argued.

What I find intolerable is that proven technology that's been around for years is still not being used. Take the example of the lifeboats on the ARCO ships, the open lifeboats on the ARCO ships that were mentioned in Eric Nalder's book. They still argue about whether a tanker should have an open lifeboat. This would be ludicrous if it weren't so sad and dangerous. Another example is the use of coastal radar linked by ordinary telephone lines to central control rooms and computer display screens. No technical problem anymore, no big financial problem. Not happening. The technology is there to keep an eye on those ships even before we put beepers on them. We also have salvage technology. Well, it's available but it isn't there, and that's a major problem. The technology to have rapid clip-on towing packages for even abandoned tankers is there. It's available, but it's not everywhere. And aerial surveillance is there to go and check that people are where they say they are. And we're just not using available technology to the best practical ends. I think on some of these decisions we're very soon going to have to ask the regulators to start discussing these with the industry and start issuing instructions. The industry, of course, will threaten to close down and go away, but they always do that. Don't worry.

S. STANLEY: Well, Max, do you want to issue a regulation or have somebody pass a law that directs you to issue a regulation that all the latest bells and whistles will be assessed to determine whether they should or should not be put on the vessel?

M. MILLER: Well, we've seen the process work to the benefit, I think, of the new regulations here with the regulatory process. I can't create new regulations on my own. The RCAC in Cook Inlet helped initiate a project

on the tug issue in Cook Inlet. That type of interaction is happening now. And perhaps a similar process will come out of this discussion.

**B. HERMAN:** In Washington State, one of the tasks the Legislature gave us was to establish regulations for the best achievable protection for the environment using the best available technology. This is a program that applies only to tank vessels. We started that program a year ago by asking all tank vessel owners and operators who enter Washington waters to file prevention plans with us. These are the prevention part of the contingency plans where we have all the information from every tank vessel on its operating procedures, its personnel procedures, its training and crew, and the technology it has to offer. We've just started the next phase of that program, we've reviewed the plans and we're now going to be working on regulations which we hope to have adopted within six months. But we hope at that point, after having reviewed the plans and had some hearings, to define what is the best achievable protection and what is the best available technology for tank vessels.

**W. PARKER:** The key word is available. It's not available if you don't know how to use it. So the other side of technology is that training programs have to be funded so everybody learns how to use the newest technology, if you choose to go that route. The high reliability organizations usually expend a good part of their budget in training. A carrier air group will expend probably 98% of its operating budget in training to maintain that high degree of reliability that gets you on and off a carrier deck. It's important that it not be a catchall, but that it be used, as was pointed out, as a continuing program. I tried to get that point across today. You have to have a continuing program that's always probing for a better way to do it. If the United States hadn't had the Bell Labs operating for the last century, we certainly wouldn't be where we are today in electronic technology.

One of the problems we have is that as a port state operating a very limited merchant fleet, we have very little research capability on the civil side in the marine area. In aviation we have a tremendous research capability. The Navy has a tremendous research capability, some of which gets transferred to the civil side. Essentially the big problem in R&D in civil shipping is that it's just a small industry. If the United States is going to continue to operate as a port state and protect itself, it's going to have to make the R&D investment to make them safer irrespective of how many of those ships are flying the stars and stripes.

**R. LEVINE:** If it makes you feel any better, I got an approval yesterday by the Alaska Department of Environmental Conservation (ADEC) that says

that it was conditional on some research that is being done and that the approval on the equipment will be subject to review and upgrade after the research is completed. So ADEC is definitely looking at its best available technology. They know it's in the regulations, and they're going after us real hard with the idea that it's up for evaluation.

S. STEPHENS: Technology, and the best available technology, depends on economics, not whether or not the technology is there. It depends on who's willing to spend the money. In the City of Valdez, the pipeline has been running some 17 years. It's one of the biggest emitters of hydrocarbons. Whether or not it's been affecting the health of the community, I don't know, but it's been affecting the way of life. Technology's available to solve that problem, but the regulators haven't seen fit so far to do the proper thing and enforce a regulation that requires Alyeska to put some kind of technology in place to either burn the vapors or capture them and turn them into product. They are, however, working on it now. If the regulations had been enforced or if the people in the City of Valdez had yelled loud enough, instead of being very quiet, Alyeska would have put something into effect earlier.

The problem is even if the technology is available, the industry's not going to use it or spend the money until they're forced to. When you're talking about best available technology, you have to look at the economics. It's too bad that that's the case, but people are secondary; profit is first.

J. WILLS: I've heard a very dispassionate and factual account of promises these people gave when they were given permission to operate the pipeline in federal and state lands and waters. They promised to use the best available technology to run it just so that it wouldn't spill oil. If those promises mean something, add them together with the state and federal laws, then surely the regulators can say, "Look, you promised this, don't get us involved in your technology arguments, just fix it. Here is the outcome we want and which you promised. Fix it, here's a deadline." It's the failure of your politicians to give the people in the Coast Guard and in the state and federal agencies the support to exercise powers which they already have, to enforce laws which have already been passed, and to insure that the oil industry meets promises which it gave. These weren't off the cuff remarks, these were carefully considered promises. Why are you getting so involved in all their technical problems? They love to do that to you, because that wastes time, you see. Why don't you just tell them, "this is the deal, fix it."

S. STANLEY: We've been leaning pretty heavily on the Coast Guard here. How about a State regulator?

W. PARKER: On that matter of promises, how about the west tank farm? It was the state who had the job of making sure the west tank farm was built, but the west tank farm was never built. Pipe to the west tank farm was supposed to be in place before the pipeline went past a million eight a day. But it never got built and that's the responsibility of the State of Alaska.

S. STANLEY: Dan, can DEC just go out there and say "you guys promised this and by golly you're going to do it?"

D. LAWN: Speaking as a private citizen, in past times DEC has said some of those things. As I recall, in 1988 after a rather long discussion about air quality, there was a commitment. DEC said "we want you to solve the problem, collect the vapors," there was some agreement to do that. We changed DEC people and politicians and we seem to be back to "we're going to study it some more." I agree completely with Jonathan. Politicians need to give the regulatory agencies the money and the independence to do the job. Also, they should quit appointing people who are politically correct and appoint people who are problem-solvers. At the same time, the industry needs to live up to their commitment and quit lobbying the politicians to reduce oversight. I mean, it's silly for us to be doing oversight anyway if the industry would just do what it said it'd do. We'd all be happy. That's what I was trying to say. Changing the system starts with us as individuals. You can't make it happen by paying attention every ten years when you have a major catastrophe. You've got to keep after it. Those of us who are parents know that if we just tell our kids to do something without a little bit of follow-up, it's likely not to get done unless they choose to do it. We, the citizens, have to be involved. I know there are a lot of dedicated, hard-working people trying to make the system better, but we ought to all start working together, including the regulators and the industry.

J. CAMERON: Personally, I think technology is being used here too much as a panacea or an excuse, and that in most cases the technology does exist. Take the problem with overfilling of tanks during bunkering operations, which is a very common problem. Why aren't there alarms, why aren't there mechanisms for that sort of operation similar to what you have when you put gas in the tank of your car? There's really no excuse. States and regulators shouldn't fall into the trap of constantly determining

what's the current best available technology. They should set performance standards and let the private sector develop the technology. As Dan said, it really is a matter of political will. Right now the political memory is dimming outside of the state of what happens when a large spill occurs. People are more focused on crime and people are certain that government regulators are just twiddling their thumbs and hanging around the coffee pots wasting their money anyway. Funds are being cut everywhere, not just here in Alaska. I agree completely that a concerted effort is needed and you can't reduce your vigilance at all whether you're a citizen, a regulator, or a concerned member of the industry.

QUESTION: It seems like one of the big problems that comes up again and again is economics. Alyeska makes the argument that they can't afford to invest in R&D because the system is winding down. To me the overall big problem is that we don't pay enough for oil. As Stan pointed out, we're all responsible. There's a problem with greed here, and as consumers we're all part of the problem. We're not paying enough for fuel and for the damage it's doing to our environment, not just the water but the atmosphere, too. There ought to be a carbon tax in this country for use of fuel.

The problem is that as consumers, we're not paying the price for shipping oil and for burning it. We need to change that in this country, and it needs to be everybody's responsibility. I don't know how we're going to fix it, it's a very big political problem, and I know Vice President Gore has been talking about something like that, and there's a lot of arguments for not doing a carbon tax because it's going to damage the poor. There's probably some way to get around that. Just a couple weeks ago, I paid \$4 or more a gallon for fuel in Norway. How come we're paying just a little over a dollar a gallon? That's ridiculous.

W. PARKER: That \$4 a gallon in Europe is mostly to take care of the old folks and the babies, that's what they spend it on. We don't believe in that in the United States anymore.

K. STAHL-JOHNSON: We put so much energy into exploration, development, transportation, oversight, all of this stuff so we don't spill oil, so we can continue our dependence on our oil-based economy. If the price of oil was even double, there would be competitive advantage. If you're talking about economics, it'd be a competitive advantage for alternative energy sources and the use of fossil fuels would decrease and the industry would lose money. There's not an incentive to increase prices, there's an incentive to have cheap gas so that we can all stay on this dependence. We will get off the dependency if the price of oil goes up.

J. CAMERON: There are a few other things that you can do, but they're not usually in the purview of the folks around this table. For instance, in Oregon they were looking, at a smog fee, based on mileage traveled between registrations multiplied by a factor determined by the emissions of your car. That would be a polluter-pays approach that would come right to us.

T. LAKOSH: On the issue of the best available technology, there is a review process. As a matter of fact, I just got a memo today from the Joint Pipeline Office that GAO is coming in next week starting Monday. I have a letter here from the Director of Natural Resources and Management Issues from the GAO, and they are here specifically to study if the Trans Alaska Pipeline System (TAPS) is operated in a safe manner. During these audits, there is a considerable window for people to ask for the best available technology whether they be a scientist who is exercising a professional responsibility, a government trustee performing his mandated duty of office, or a citizen seeking to have protection of his or her constitutional rights to freedom from pollution generated by state and federal leases. You have to ask. I went to Mr. Brossia about a month ago and asked him to consider these fire tractor tugs, and he responded appropriately. He wrote a letter directing Mr. Flint of ADEC to tie the three C plans from the pipeline, the terminal, and the shippers, together to consider the threat of fire and the use of a firefighting tractor tug. What I've done is petitioned Commissioner John Sandor, Commissioner Harry Noah, and the Governor, to generate attorney general opinions and issue a notice of deficiency to Alyeska to require them to have the best available technology, which is at this point a firefighting tractor tug carrying fire boom.

S. STANLEY: I'd like to throw out one other idea which you may or may not want to talk about, and that is there've been several things said today with regard to regulators working with industry. I alluded to the situation over in the Shetlands where they meet behind closed doors, discuss issues, make decisions, and marvelous things happen and the public doesn't know what's going on. We've got the opposite extreme where you can't meet behind a closed door with anybody. Recently Stan and I were meeting with the senior vice president of Alyeska at his request in an Alyeska office—with the door open—to discuss something that is very important to the community of Valdez, the impact of all the additional people that are coming into the town this summer and how they're going to deal with that. It really struck me later when a reporter came up and said he'd heard we had had a meeting with Alyeska. The tone and attitude of the reporter was, "How could you?" Well, you can't go stand in the middle of the intersection every time you want to talk to somebody from industry and invite all

the press to gather around and stop all the traffic. How much closed-door interface should there be between people who provide oversight, whether they're citizens' groups, regulators, or what have you, with industry? How open does that need to be?

D. LAWN: I agree that you need to have some sit-down quiet meetings where you're trying to work out some consensus. But I also understand the public's concern about wanting to know really what's going on because they don't trust any of us, and they have a right not to trust any of us. I suggest that if we do some real simple things which change the way we think about things, perhaps, we can bring that level of trust up. Let me give you an example.

There's been a big flap in the paper in Valdez for the last three months, there've been some hard feelings about a decision that was made to bring in one of ARCO's ships where the winds were higher than the established rules for normal transits would allow. I have several opinions about that, but where I'm really going with this is had the industry looked at the problem? We all knew the weather was going to get bad, it was probably going to be bad for several days. Had the industry really looked at what could be done to not get into a bind? We don't have enough tanks in Valdez, we don't want to move ships in bad weather, we don't have enough down in Puget Sound, so what can we do? Well, if they really had been thinking about that, they could've taken one or two of the ships anchored at Valdez waiting for their portion of oil that wasn't there yet. When the weather was still good they could have looked into the future and seen that it was going to turn to pretty nasty in a day or so. It would've been an easy process not to put the Coast Guard into a situation to violate their own normal rules and bring that ship in and get it loaded. That's a easy fix; that's a thought process.

It's a thought process to say "we think the weather's going to last for five days and we're probably not going to move any ships so instead of waiting 'til the fourth day we'll slow the pipeline down, slow it down a little bit on day one." The industry certainly could've done that. Had that been done, it's likely that the Coast Guard wouldn't have been put in the position to hope with their fingers crossed that everything would go right with that ship coming in, ARCO wouldn't have been put in that position, Stan wouldn't have had to write some letters, and we wouldn't have had a big flap. There're things that we can do right now just by working at it. I suggest that if the industry and the regulators would approach some of the things that way, then the public trust in us would elevate and then we could sit down at a table without the public getting irate that they aren't there listening to what we're saying.



R. FINEBERG: Aside from the all the case studies we have developed collectively, there is no question but that secret meetings erode fundamental processes of a public government just by definition. In terms of the quality of decisions that get made, it is crystal clear that in a closed room you are more vulnerable to log rolling and poor decisions. When there are only a few players in the room, it's easy to say "yeah, this is all you can do right now only because you didn't build the fourteen other tanks," or some other things people don't want to hear. It is crystal clear as a general proposition of public policy that more open is better. Jonathan has said that we are superior to the Shetlands in that regard. From our case studies, it's very clear we do much better with a more public process. Why would you want to have the decisions take place among a smaller number of people which makes it much more boring for other people because they can't play? People like Tom, who continue to play when no one is invited into closed meetings, are very rare and we need them. If we want to exclude the public and have complacency, let's go to closed meetings.

S. STEPHENS: I believe you need to have open meeting laws, that all meetings, if at all possible, should be open. We are advisors to Alyeska, and let's say that they have an item they want our advice on. They don't know which way it's going to go, they don't want it out in public until they've had a chance to ask our advice because it isn't a decision yet. Where do we go from there? We either have to honor the commitment to give them advice about it and not go public with it, or we can't give them advice because we have to be open and public. An industry should have some right to make decisions without everyone having to know about it, and the point is where do you draw the line?

J. WILLS: The difference between Shetland and here is that the Shetland Islands Council has executive power. RCAC is an advisor. But the principle I've always gone on is there really are only two things that ought to be discussed in private. One is staff matters, which should never be discussed in public, and the other is legitimately confidential commercial matters. Now, sometimes that's commercial confidence affecting the industry and other times it's affecting the public. As councilors we're also trustees of the permanent fund, the charitable trust in Shetland. We have a responsibility to protect that money. If we go to a negotiation with the oil industry as we do now, showing our hand to the oil industry and members of the public before the negotiations finish, then they're going to know what the backup to our bargaining ploy is. So I found myself in a strange position in supporting private negotiations with the oil industry, which are just starting for the next phase of our deal with them after the end of the

century, and having to say on local radio that I'm not going to tell people what's going on. Actually I don't know what's going on because the deal there is we give our negotiators instructions of the outcome we want, and they report back to us on what they can get.

However, when you get to the science which is carried on by the Shetland oil terminal environmental advisory group, then I really don't see the need for confidentiality at its meetings. It doesn't even publish agendas. It does a lot of good work and all of the industry associations and relevant members of the public are represented on it, but the representatives are expected to observe confidentiality, and their various recent reports on its workings showed up with some serious problems with peer review and respectability of the scientific results obtained. When this was set up, the argument was that chaps were more likely to speak frankly and candidly to other chaps in a closed meeting. That's just the argument the British establishment has always used to cover its tracks.

The ideal would be the regional citizens' advisory council to have the legal powers like the Shetland Islands Council's got, and you've gone halfway to it. Would it be a good idea for the public to own and control and direct the port of Valdez? We'll say the public does it already through the Coast Guard, but with all due respect they're not a local agency. Would you have more accountability if you had that kind of system?

R. LEVINE: From my point it'd be great as long as the public wants to take the liability with it. And that is probably the biggest issue. If the public wants to take all the liability and the responsibility with it, that's fine.

QUESTION: What about nationalizing the pipeline? What about turning it into a public utility? How would people like that idea and would that solve anything?

W. PARKER: I know of no organization which operates with more secrecy and more care to keep the public out of its decision making than the publicly owned Alaska Railroad.

T. LAKOSH: The reason why RCAC should not hold secret meetings is because oil transportation and production is an ultra-hazardous activity in which the public health, safety, and decency is imminently threatened. To withhold any negotiations or information which would allow the public to best protect its interests in a fiduciary relationship established by OPA 90 is criminal, fraudulent concealment.

K. STAHL-JOHNSON: Discussions, when you're dealing with oil spills, are what RCAC's responsibilities are. The fact that this grew out of a lack

of trust and fear, because fear drives lack of trust, the only way you can make the relationship comfortable is if you can get the public on board with the trust issue. RCAC is a group that's come together dedicated to a specific thing, They have to work intently on their relationship with the oil industry to create a consensus or understanding, agreeing to disagree. That's a relationship the public doesn't have, so you always have to work on the perception of independence and openness. In many ways, it's a matter of discretion and integrity within the organization. It's a trust-building process with both the public and the RCAC. It's a level playing field for everyone. That's the fair play that I think RCAC's really striving hard to meet for everyone's interests.

S. STANLEY: I have a hard time describing as a secret meeting going to someone's office to sit and have a conversation with them to acquire information to better assist in forming a position.

B. HERMAN: I don't think government has any business conducting its business behind closed doors. To me it's a very simple issue, but I also don't think you have to call a public meeting every time you pick up the telephone to find out facts or talk to somebody to do your job. If you did that, government would be at a standstill. However, when you're in deliberations and in a process where you're making decisions and answerable to the public, then the public ought to be involved and know what's going on. Sometimes it slows the work down and some people who come into meetings can be very disruptive so you wish they weren't there, but so what? We have an obligation to the public, that's why we're here.

K. STAHL-JOHNSON: But RCAC's not public.

S. STANLEY: Thank you.

B. HERMAN: Yes, I mean, I don't know enough about your situation.

QUESTION: I appreciate Stan's comments. Those of you in the upper ranks of RCAC might have almost daily communication with industry so where do you draw the line without seeing everything you say on the front page? I think the bottom line is probably in the definition of meetings.

J. WILLS: I'd like to clarify one thing. I wouldn't like to leave this country with people thinking I'm advocating nationalization; it doesn't work. What I advocate is small-scale local public enterprise working in partnership with large-scale private enterprise, like we have at the Sullom Voe Terminal. That works.



## **Oil Spill Prevention Measures Undertaken in the Wake of the *Exxon Valdez* Oil Spill**

Lcdr. Gary Stock

*U.S. Coast Guard, 17th U.S. Coast Guard District  
P.O. Box 25517, Juneau, AK 99802-5517*

This paper discusses oil spill prevention measures undertaken in the wake of the *Exxon Valdez* oil spill. The purpose is to give you some update and insight into where we are, relative to where we were in March of 1989, regarding preventing a major oil spill such as we saw with the grounding of the *Exxon Valdez*. I think you will see that we are much better off now than we were prior to March 1989. Are we where we need to be? We all have our own opinion on this issue. I'm sure if we polled everybody here today, we would have a wide difference of opinion as to how far we've come, and where we need to be. Again, my purpose is to update you on where we are now. You will have to draw your own conclusions, and develop your own opinions.

First, I'll talk about pollution prevention measures that have been mandated by federal law and regulation. Then I would like to discuss prevention measures that have been initiated voluntarily by the oil and product carrier industry here in Alaska.

What better place to start about where we are than to talk about law changes and regulatory mandates that resulted from the Oil Pollution Act of 1990 (OPA 90). OPA 90 was unanimously signed by Congress in the wake of the grounding of the *Exxon Valdez*, with the hopes of preventing another similar incident. This single piece of legislation had a large and far-reaching impact on the oil transportation industry in the United States, and in essence stated "that things need to change." This change was a mandate of the people. And change they did. Significant mandates that resulted from OPA 90 include the following:

- Review of alcohol and drug abuse and other matters in issuing licenses, Certificates of Registry, and Merchant Mariner's Documents. Requires merchant mariners to be tested for the use of dangerous drugs. This change also provides discretionary authority

to review the criminal record of each merchant mariner applicant, and requires applicants to make available information in the National Driver Register.

- Term of validities for Certificate of Registry and Merchant Mariners' Documents were established at five years. Allows for review of records and drug testing at time of renewal.
- Suspension and revocation of licenses, Certificates of Registry, and Merchant Mariners' Documents for alcohol and drug abuse. Provides for pre-employment, periodic, random, reasonable cause, and post-accident testing. Also allows the United States Coast Guard (USCG) to temporarily suspend and take possession of a license or document under certain circumstances.
- Removal of Master or Individual in Charge. Allows next two most senior licensed officers on a vessel who reasonably believe the master or person in charge is under the influence of alcohol or a dangerous drug, to relieve him/her and temporarily take command.
- Manning and crew standards for foreign tank vessels. Revises the requirements for evaluating manning and crew standards of foreign countries which operate in U.S. waters.
- Vessel Traffic Service systems. Provides for upgrade of VTS Valdez and establishes additional VTS systems around the country. Also allows the USCG to make participation in appropriate VTS mandatory.
- Periodic gauging of plating thickness. Establishes minimum plating thickness standards for tank vessels and requires periodic gauging of vessels over 30 years old.
- Critical area inspection plans. Program established by USCG to monitor Trans Alaska Pipeline Service (TAPS) vessels with history of fractures.
- Overfill devices. Requires devices and standards to warn of tank overfills on oil cargo vessels.
- Tank level or pressure monitoring devices. Requires tank level or pressure monitoring devices be used for leak detection.

- Study on tanker navigation safety standards. Requires the USCG to report on the adequacy of existing laws and regulations to ensure safe navigation of vessels transporting oil. The study is divided into 12 parts.
- Tank vessel manning. Mandates maximum working hours on board tankers in 24 and 72 hour periods.
- Autopilot, unattended engine room, and second licensed officer on the bridge. Establishes tanker navigation regulations which govern the use of autopilots and establishes minimum bridge manning levels.
- Establishment of double hull requirements. Requires phased in program of double hulled tank vessels based on age and size.
- Research in tanker grounding. Non-mandated USCG study being conducted at MIT to explore the behavior of tanker structures during grounding.
- Escorts for certain tankers. Designates certain U.S. waters (Prince William Sound [PWS], Rosario Strait, and Puget Sound) where at least two towing vessels must escort single hull tankers greater than 5000 GT.
- Revision of National Contingency Plan.
- Clean Water Act of 1977 (FWPCA) penalties. Increases penalties and creates new class of penalties.
- Terminal and tanker oversight and monitoring. Establishes Regional Citizens Advisory Councils (PWS and Cook Inlet).

As you can see, there are numerous preventive measures resulting from OPA 90. Now I would like to briefly talk about recent initiatives the oil industry here in Alaska has taken with the hope of preventing another major oil spill.

#### TAPS Vessel Owners/Operators Initiatives

- Providing an "ice scout vessel" for laden tankers in PWS when ice has been reported in the ship lanes.

- Laden TAPS tankers departing PWS will be escorted by Ship Escort and Response Vessels System (SERVS) vessels until they are clear of Seal Rocks.
- Laden TAPS tankers will not depart PWS if the prevailing weather conditions would prevent the SERVS escort vessels from rendering assistance near Seal Rocks.
- Feasible, cost effective recommendations from the Disabled Tanker Towing Study initiated in 1992 will be implemented.
- Once clear of Seal Rocks, laden tankers bound for the lower 48 will remain at least 100 miles offshore of the coastline of Southeast Alaska.

#### Nonpersistent Tank Barge Owners/Operators Initiatives

- Only twin screw tugs will tow member barges.
- Emergency tow lines present on all barges.
- Retrieval hooks on all coastwise tugs.
- Stricter tow wire maintenance and replacement standards.

As you can see, industry has instituted numerous voluntary initiatives that should assist in the prevention of a major oil spill, or in some instances mitigate its effects.

That covers my presentation today. I hope I have given some of you additional insight as to what has happened since the grounding of the *Exxon Valdez* relative to prevention. Have we come a long way? I think the answer is yes. Have we come far enough? That depends upon who you ask. I do know changes have been made, additional requirements are in the wings, and it is no longer business as usual. I think most people would agree that that is a good thing.



# The Significance of Human Factors in the Prevention of Oil Spills

Marc B. Wilson

*School of Aviation & Transportation  
Dowling College, Oakdale, NY 11769-1999*

## Abstract

The development of automated systems arises in part from widely held concern about high operating costs. Driven by new technology, owners have partially automated marine systems. There has not been a clearly defined allocation of functions. Operators, owners, and regulators have been slow to reengineer the marine industry. Expectations of new technology have yielded new solutions, but with new problems, e.g., a user-centered approach. There is little doubt that advancing technology can assist people in the performance of tasks, but the human-computer interaction is still uncertain.

This paper discusses human factors and organizational behavior as it relates to the marine and oil industries. The paper's theme is stress. Stress comes from job displacement, reengineering, work place design, and more. Stress can move a person in a positive or negative direction. This paper points out needed modifications in the quality of life at sea.

## Introduction

Not recognizing the applicability of human factors has tremendous consequences. The *Exxon Valdez* oil spill is only one example of such a consequence. The *Vincennes* and Three Mile Island are examples that "became the center of that uniquely American mega-event: a media blitz. Screaming headlines blared the worst oil spill in U.S. maritime history." Besides the environmental damage and destruction of catastrophic proportions, we cannot afford repeat performances (Peak 1990). With a company's image, reputation, and profits at stake, management in the oil industry cannot afford to ignore the importance and relationship of human factors in the prevention of oil spills.

Mastery and control of future events are more likely by applying human factors principles. Some principles are allocation of functions, human reliability analysis (HRA), job design or reengineering, perfor-

mance aids, workload or manning, proficiency, selection, training, and task analysis. For example, a person's situation awareness is needed for job performance. The marine industry has yet to consider situation awareness. Each of these principles, if gone unchecked, will yield a stressful environment.

Getting the oil to market as cheaply as possible is not the bottom line. Getting the oil to market with minimum risk of an accident, or a potentially catastrophic event, is the bottom line. This implies consideration of all the human factors caveats. Critical decisions are biased by any impediment. Psychological stress is "a particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being" (Lazarus 1989). This state of well-being has important consequences on the performance and productivity of an organization's members. Sutherland and Cooper explain that to an organization in the oil industry, "the costs are enormous...in terms of reduced physical and/or psychological well-being and increased accident potential" (Lazarus 1989). When an employee's well-being is at stake, an organization's ability to effectively conduct its mission is impaired. Excessive stress may cause erroneous interpretation of radar data, jeopardize the safety of the vessel, or go undetected. Industries can prevent excessive stress by applying human factors principles.

## Discussion

Management has recognized the value of teamwork or shipboard resource management (SRM). SRM is founded on a premise of value added and support where individuals work to a common goal. SRM is an allocation of functions. The allocation of functions designates who or what performs a task. Another example of function allocation is determining human-computer equivalency (HCE) aboard vessels with sophisticated automation. The human that operates and controls this technology cannot be ignored and must be in the hierarchy of control. Humans are preferred and needed, for human control cannot operate effectively without adequate communication or information of functions and performance. Humans are to remain in the loop. SRM and HCE will create a synergism that will yield both user acceptance and cost savings. The operation of today's and tomorrow's ships is different from yesterday's. Vessel safety has been a paramount concern. The anxiety about safety and risk will be alleviated when the marine environment realizes and implements the new paradigm, i.e., SRM and HCE.

Conditions are exacerbated by the perception of risk. The sea is perceived to be inherently risky and hazardous. Work with chemicals such as oil dispersants and related errors, such as oil spills, are hazardous and

call for caution. Sutherland and Cooper (1989) show that "awareness of the dangers and the consequences of making a mistake were significant predictors of depression." The solutions are in educating or training personnel in situation awareness (Wilson 1994). Sutherland and Cooper's studies show "accidents, media attention and the need for special training to deal with emergency routines heighten the level of risk awareness. . ." Situation awareness is training to cope with emergencies and will alleviate anxiety and stress. When organizations incorporate situation awareness and invest in reengineering, safety and risk perceptions will be reflected.

The at-sea or offshore environment requires working hours atypical to most other industries. These hours include long working shifts and night shift work that lead to fatigue, more specifically sleep deprivation. When the crew is tired, the skill to make decisions is impaired. Risk and safety issues are aroused and induce stress. The work, rest, sleep times (WRST) need to be determined. Workload analysis needs to be determined. More than a 70-hour work week is too much. Thompson elaborates that automation, "has allowed ship operators to reduce the size of the crew. But according to the Coast Guard's Report in October 1989, 'The effects [of automation] seem to be crew fatigue and neglected vessel maintenance due to reduced manning.'" (Thompson 1990). Currently, manning is set by laws pertaining to watch standing, enacted over 50 years ago. It seems proper that workload vs. human error be the catalyst as justification for determining the manning requirements.

Automation or technology is the primary reason human factors is more important than ever before in industries and can be most beneficial in the offshore and at-sea environment. The task analysis is the justification for what work an individual is to perform. The intelligent vehicle highway system (IVHS) is an excellent model for how to use human factors and is the most dramatic example of HCE. For example, what are the hand-eye motions to maneuver a car of the future? IVHS America is looking at a car that is still to be manufactured. The user perception of future technology has not been implemented by the Coast Guard nor the shipping industry. The Coast Guard has used equivalency before and will probably use it again. Industry must make the case. For example, since many vessels already have periodic unattended engine rooms, it makes sense to have main control in the wheelhouse, yet regulations still require main control to be located below the main deck. With the introduction of more sophisticated automation, personnel will be displaced for the watch-standing task, but not for maintenance or reliability. In order to have the benefits of technology, sophisticated automation needs to be user-centered. Management cannot downplay the risks of human error when automation is solely technology driven.

Another significant factor is profit pressure from management. In the effort to meet deadlines and profit goals, shortcuts are made or at least considered. This is where reengineering fits into job design. With crews operating at manpower minimums, many incentive programs support the quick fix or shortcut. Thompson states that, "the owners and managers of some ships have certainly stretched the envelope of safety—and common sense—to the breaking point. Some cost-cutting measures appear to cut too many corners. Among them: schedules that don't leave enough time for travel; maintenance or safety; hiring cheaper foreign crews that may have inadequate training or experience; registration of ships with 'flags of convenience' from countries that offer relaxed enforcement of safety and crew certification standards" (1990). It is not just organizations related to the merchant marine. It is management in general that has perpetuated this business practice. Managing a 9:00 am to 7:00 pm operation five days a week is different from managing a 24-hour-a-day, seven-day-a-week operation for 90 to 120 days at a time. Marine transportation management cannot operate with a financial management mentality without incurring increases in risk. Reengineering the shipping business has yet to occur.

Workspace affects personnel. The physical work environment on board vessels is traditional and needs to be redesigned. This is partly because of the old but current regulations that administer the merchant fleet. The unions and the private sector have met "the physical demands of the living arrangements . . . still on many ships berthing is in close proximity to the working areas. The sharing of confined spaces, lack of societal norms, or inadequate recreation—leisure facilities" can be counterproductive during long voyages. The confines of the ship dictate the relationships on board. Feeling "lonely in the company of other people" is often exacerbated by the conditions where social networks are confined too (Sutherland and Cooper 1989). Working relationships can be affected. Peers and management are forced to get along with each other. For many, these conditions are worsened by lengthy voyages, stays away from the support of friends and family. The feeling of isolation or sensory deprivation (Sutherland and Cooper 1989) is another significant factor and it is usually a dissatisfier. As the crew size decreases, the sensory deprivation increases. Workplace design is a job satisfier and can counter sensory deprivation. Physical well-being contributes to mental well-being. Facilities such as a workshop, fitness center including a swimming pool, and satellite television reception brings societal norms to the at-sea environment. Mental well-being is also important to an employee's state of mind. The information age will help to alleviate the mental stress. In any 24-hour society, the constant peer-to-peer and manager-to-labor relationships may not be smooth. Leadership, motivation, and productivity

are achievable, but the challenge is greater. Workspace design is more important than ever before. Redesigning the ship's workplace will have positive effects on behavior and performance (Sutherland and Cooper 1989). For improved productivity, the wheelhouse needs substantial redesign. All wheelhouses should be standardized like the cockpit of an aircraft. Aircraft standardization is by design not by chance.

### Measurements of Effectiveness

The relationship between the effects of human factors on organization behavior and the linkage to potentially harmful accidents has been examined. The costs of ignoring human factors are high. With such high stakes, management must be concerned with implementing human factors. The maritime environment has characteristics particular to itself (Wilson 1992). Therefore, a means of measurement can only be effective if it is maritized.

#### *Physiological Measurements*

Alcohol and drugs are a factor in the sequence of events that lead to an accident. Both are considered to be a strong indicator of stress experienced by people everywhere. Naturally, "excessive stress can lead to several health problems in the form of . . . abuse" (Schermerhorn 1994). Although a drink per day is recommended by the American Medical Association, incidents of excessive alcohol consumption interfere with performance, and are easily recognizable by coworkers or authorities. Sobriety tests are indeed a measure of fitness and readiness for duty.

Another measure of effectiveness is the medical examination. The Federal Aviation Administration requires all commercial pilots to be physically examined every six months. Healthy employees are more productive. Biological measures such as "blood pressure, heart rate, galvanic skin response, and respiration rate are some physiological indexes used to measure stress" (Lazarus 1989) and performance. It is in management's interest to not only monitor these indicators, but also to provide the resources for activities such as exercise and physical fitness. Access to a fitness center should be provided to employees.

Stress can improve or weaken performance. Therefore, the measurement of performance can be used as an indicator of the presence of stress. Performance tests "measure the after-effects of exposure to a stressor. If subjects show lowered ability to do certain tasks after having been exposed to such stressors as loud noise . . . then it may be assumed that the impaired performance was due to the stress . . . performance tests should not be used alone as an indicator of stress, but should be supplemented by other devices" (Lazarus 1989).

Another method used to measure performance is feedback reporting. As trips or tasks are completed, members can be solicited for feedback on their own performance and the performance of other team members. Review of these reports can alert management to potential problems. Data from these reports should be maintained for building profiles of human reliability. Changes in personnel or workload must be monitored over periods of time as the profiles give a historical perspective for analysis.

### *Psychological Measurements*

Except for drug and alcohol tests, there have been no quantifiable methods to test mental reasoning. Although these are widely accepted in the detection of stimulants and depressants that impair reaction time, the ability to test performance as a function of workload has only recently been explored. New computer software packages have been created to measure performance (McGinley 1992).

### **Predicting Performance**

A performance testing software package called Factor 1000, developed by Performance Factors, Inc., tests mental alertness and coordination of Domino's Pizza truck drivers, warehouse workers, and dough makers. The test is a simple video game that measures hand-to-eye coordination by having the user try to keep a swinging pointer centered on a computer screen. A Domino's employee who fails the test is simply assigned paperwork or other tasks that do not involve much stress or danger (McGinley 1992).

Delta, a more enhanced performance testing package from Essex Software, is being piloted by a Japanese nuclear power utility, a foreign navy, and a major U.S. oil company. This package combines the technology from Factor 1000 with 20 tests that measure perception, reasoning skill, and judgment. Jeffrey Lapidus, vice president of commercial products for Essex, claims that the software is not expensive (about \$1,000 per copy) in comparison with the liability and employee disability law suits stemming from preventable accidents. Since testing began, many private companies have reported a decrease of on-the-job accidents by 67% (McGinley 1992).

### **Oil Spill Prevention and Recommendations**

Since March 1989, life in the maritime industry has changed forever. If a single solution is chosen for oil spill prevention it must be human factors. Inasmuch as statutory reform is late or absent, training and education is the first step and is one aspect of human factors. Besides past

and current training, human factors principles must be taught. This will reduce or contain the by-products of stress, such as human error. As a marine inspector, I have inspected many ships and evaluated many mariners. Knowledge, skills, and abilities (KSA) ensure performance. "Training was almost always lacking, not so much on the part of the officers but with the rest of the crew. . . . Spills by oil tankers provide an object lesson in the costly failure of a technical-training system to keep itself updated . . . because an inadequate technical-training curriculum creates the illusion of competence, it virtually ensures the accident it is intended to prevent" (Thompson 1990). Management and industry must address this education issue or the regulator will. KSA will be the determinator for tomorrow's education and training. The feeling of personal mastery and control of a situation is desirable. Human errors are reduced by KSA. Risks are minimized by KSA. Job satisfaction increases with KSA. Users must control technology. It is time for a new paradigm (Wilson 1992).

Training can be accomplished in many ways. Oil spills provide empirical data that must be used. These historical reviews can be used for scenario analysis. An individual's response and decision-making skills can be sharpened through walk-throughs or mental modeling. Technology exists today, i.e., simulation and expert systems that will capture the expertise for different training scenarios in a knowledge base. Today's ship should not sail without simulation games for training and recreation.

The maritime schools are our educational centers of excellence. The simplest and most effective solution to oil spill prevention lies in the education of the maritime work force. The linkage to performance is clear: providing education and training results in a work crew that is able; esteem and morale improve; job satisfaction improves; stress is reduced; and productivity will increase. In a time where TQM (total quality management) means business, human factors means safe, reliable, and effective performance. Human factors is a part of business that a company cannot afford to do without.

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## **Development of a Computer-based Model to Estimate the Staffing Needs of Commercial Ships**

**John D. Lee and Thomas F. Sanquist**

*Battelle Seattle Research Center  
4000 NE 41st Street, Seattle, WA 98105*

**Martha Grabowski**

*Le Moyne College  
Syracuse, NY 13214*

### **Abstract**

Technological developments and economic pressures have led to a 50% reduction in crew requirements on commercial ships. The promise of a "one-man bridge" and other technological changes may make additional reductions possible. However, the effect of these reductions on overall ship safety is unknown. In the past, crew requirements have been based on an evolutionary approach that has slowly adapted the crew size to meet the demands of the ship operation. Rapid changes in technology and operating conditions may render this evolutionary approach unworkable. This paper addresses the problem of specifying crew requirements by describing the development of a model that will provide a formal, objective method for determining the crew complement required for merchant vessel operation. This model will combine the time and expertise requirements of individual shipboard functions to estimate the crew resources required for different ship, technology, and route configurations. The viability of a proposed crew complement will depend on whether the calculated work hours for any of the crew exceed predefined work-hour limits. The primary benefits of this model are the ability to provide consistent estimates of crew requirements, facilitate communication between industry and the Coast Guard, and identify how staffing changes influence the overall safety and efficiency of ship operation.

### **Introduction**

The issue of shipboard staffing is a complicated legal, economic, and human factors engineering question. The worldwide trend in shipboard staffing is toward increasingly smaller crew sizes—in the case of some Japanese ships, crews are composed of as few as 11 persons. Crews

of these sizes are made possible by advanced technologies permitting unmanned engine rooms and one-man bridge operation, as well as reductions of deck crew for cargo handling. A fundamental question that arises as a result of such crew reductions is the extent to which smaller crews compromise ship safety and the ability to respond in an emergency. This question has not been addressed satisfactorily, and there is a need for a systematic method of establishing safe crew levels that can be applied on an international basis. A number of authors share this opinion (Seitz 1981, Knudsen and Mathiesen 1987, Froese 1987, Joseph 1987, Gaffney 1987), and several approaches have been developed.

Although a variety of methods can be used to evaluate staffing requirements, the 1990 National Research Council (NRC) report illustrates the limitations of these techniques. For example, adjusting ship staffing and evaluating the rate of subsequent accidents could be catastrophically expensive. Furthermore, the many concurrent changes that might accompany crew reductions make it very difficult to identify a causal link between crew reductions and subsequent changes in accident rates. Computer-based models provide a safe, cost-effective alternative. A computer-based model that can predict the consequences of changes in manning levels on ship safety could enable ship owners and regulators to evaluate a wide range of potential staffing alternatives.

In the context of this paper, "model" refers to a simplified representation of a system that translates input variables, such as changes in manning, into output variables, such as changes in ship safety. In essence, a model provides a simplified, abstract representation of an actual system, to evaluate system effectiveness. Therefore, any model developed will have limitations that include the types of scenarios it accommodates, decision support capabilities, ease of use, and the detail with which it describes shipboard tasks. However, as technological and economic pressures combine to modify staffing structures, even limited models of the human element aboard ships will help evaluate the safety consequences of proposed changes.

The need for a model of ship staffing is driven by the need to understand how reduced or modified staffing influences ship safety. The general issue of ship safety involves several more specific concerns, such as the ability of the crew to operate the ship without exceeding work-hour limits, the effects of increased technology, emergency response effectiveness, and maintenance capabilities. In establishing safe crew levels, government and industry need to consider demands on the crew, each vessel's technology, type of service, crew skills, quality of management, and training programs. Evaluating how these and other issues affect ship safety provides a crucial step toward developing a technical basis for estimating the staffing needs of commercial ships.

One simple criterion of ship safety is work hours completed by the crew. If any crew member exceeds agreed-upon work-hour limits, then the ship requires more crew members to operate safely. Therefore, a basic requirement of a staffing model is the ability to test whether a proposed crew can operate a ship without exceeding work hour restrictions. The need to match crew qualifications to the task requirements complicates this simple requirement. Therefore, the model must incorporate information concerning both the time and skill requirements of each task. Developing a model that matches the time and expertise requirements of shipboard tasks with the proposed crew can help evaluate the effects of automation, the viability of maintenance plans, and emergency response capabilities.

Introducing advanced technology may automate many functions and offer opportunities to reduce crew size. However, it is not always obvious whether automation justifies crew reductions. Automation promises to reduce the physical and mental workload of ship personnel; however, the capability of automation to reduce workload in a way that promotes ship safety, especially in abnormal situations, is poorly understood. Research in the aviation and process control domains suggests that introducing automation often compromises system safety rather than enhancing it (Woods, Potter, Johannesen, and Holloway 1991, Wiener 1985). In many instances designers automate what is most easily automated, leading to a patchwork of systems that inhibit rather than support personnel. In addition, automation often operates smoothly during normal operations, but fails when the personnel need it most, during abnormal operations, leading to workload peaks greater than those experienced without automation (Wiener 1989). A model that matches task requirements to the proposed crew complement will identify workload peaks that might jeopardize ship safety. Therefore, the model will help avoid simplistic assumptions of workload reductions that might justify crew reductions. Thus, the model will help avoid unjustified crew reductions that may jeopardize ship safety.

Besides the problems associated with introducing new technology, emergency response capabilities represent an aspect of ship operations that may be especially sensitive to changes in staffing. Emergency response requires a coordinated effort of the crew, often in unfamiliar and adverse situations. Emergencies may require more people than normal operations, and the demands on these people may exceed those of routine activities. In addition, the ability of personnel to react efficiently to emergencies has immediate implications for the safety of the crew and for the integrity of the ship. Predicting the ability of a proposed crew complement to mitigate emergency situations would provide crucial information concerning how changes in staffing structure affect overall ship safety.

Like emergency response capabilities, the ability of a ship's crew to maintain the ship effectively may be particularly sensitive to changes in the staffing structure. Because ship safety is directly dependent on the quality of the maintenance, conditions which lead to inadequate maintenance require identification. Preventive and shore-based maintenance both act to alleviate unexpected maintenance demands. However, the effectiveness of these techniques, in conjunction with reduced staffing, has not received a detailed examination. A model can examine how different combinations of shore-based maintenance and modified staffing structures combine to affect ship maintenance.

In summary, to estimate the staffing requirements of a commercial ship a model must consider several issues. Most simply, a model that supports staffing decisions must consider whether the proposed crew can operate the ship without exceeding work-hour limits. This criterion can be used to address the impact of increasing complex technology, emergency response capabilities, and maintenance effectiveness. To evaluate the feasibility of producing such a model we examined past modeling efforts in the maritime and non-maritime domains. Past efforts show that no model currently exists that provides answers to these questions; however, previous efforts show that developing a model is feasible.

## Approach

### Identification of Desired Model Capabilities

To be most effective, the model developed during this project must include capabilities required by both the Coast Guard and industry. To ensure that the model includes these capabilities the views of labor representatives and ship operators will be solicited throughout the development process. At the beginning of the development process, a list of desired capabilities was generated through discussions with Coast Guard personnel, ship operators, and labor representatives. The interviews with ship operators ranged from oil tankers and container ships to research vessels and tug-barge combinations. Some capabilities were also identified from previous studies, such as Lee and Sanquist (1992), NRC (1990), and Grabowski and Hendrick (1993). Although we have tapped a range of sources, these capabilities represent an initial identification of what the model should be able to achieve. As development of the model progresses, additional capabilities are likely to be identified.

The model capabilities include the ability to examine the impact of automation, the emergency response capabilities, and the feasibility of maintenance programs. Specifically, the model will evaluate the effects of automation by adjusting or eliminating the time requirements of those

tasks affected by the automation. The model will then show how these changes influence the overall staffing requirements of the ship. The model will also evaluate the emergency response capabilities of a crew by examining whether sufficient crew members exist to perform all the tasks associated with a variety of common emergency response scenarios. To evaluate the viability of maintenance proposals the model will enable decision makers to evaluate whether sufficient crew and time are available to perform maintenance tasks when some are allocated to shoreside or riding crews.

### Rapid Prototyping Approach to Model Development

Potentially, the model could include a wide variety of capabilities. However, it is not clear how best these capabilities should be implemented. To ensure that a model meets the needs of the Coast Guard and industry, these capabilities will be developed in a series of prototypes. Comments from the Coast Guard and industry will guide the development of successive prototypes so that the capabilities of the model will meet the requirements of the users.

Based on comments from industry and the Coast Guard, each prototype iteration will generate a model that is more useful than the one before. For each prototype, three elements are considered in making a more useful model. Each element is critical and neglecting any one of the three would result in a model that would fail to meet the needs of the Coast Guard. The three elements include:

- Data manipulation capabilities
- User interface enhancements and documentation
- Model accuracy

Data manipulation capabilities concern the ability to combine task/function data with potential crew configurations in different ways to evaluate proposed changes. For example, adding the ability to evaluate the consequences of a variety of shipboard automation alternatives facilitates analysis of shipboard data in a different way. User interface enhancements and documentation do not change the data manipulation capabilities of the model; however, these changes make the model easier to use. These changes also make the output of the model more comprehensible. For example, enabling users to view the output of the model in different formats (graphs or tables) and save results in a convenient format will help them take advantage of the data manipulation capabilities. Enhanced model accuracy is a requirement if the results are to be trusted and used to set

policies. Model accuracy depends on how well the relationships within the model reflect reality. For instance, the first prototype will assume that the tasks occur independently with a fixed frequency. The accuracy of future models will increase as additional information will be used to define when and how frequently tasks occur. Each prototype will include enhancements to the data manipulation, user interface, and model accuracy.

The goal of this project is to develop a model of ship staffing that will help the Coast Guard and industry to determine minimum staffing requirements. One of the primary objectives in developing the model is to ensure that its capabilities reflect the needs of potential users. To achieve this objective, model development will consist of a series of prototypes. Each prototype will be evaluated by ship operators, Coast Guard personnel, labor representatives, and modeling experts. The modeling experts will guarantee model accuracy and the others will ensure that the model contains the requisite features and capabilities. Based on comments from these groups, the model will be revised and a new prototype will be developed (see Figure 1).

### Framework for Model Development

To arrive at an accurate estimate of crew size will require sophisticated data processing and modeling mechanisms. These mechanisms must be paired with an extremely flexible user interface that can deliver information in an easily comprehensible form. Furthermore, these requirements must be satisfied in the context of a limited budget and time.

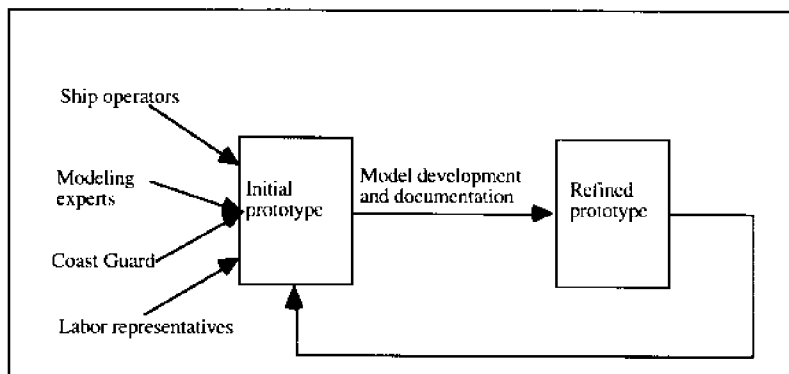


Figure 1. An illustration of the process used to create a model to estimate the staffing needs of commercial ships.

To satisfy these criteria, a customized user interface will be developed as a shell that surrounds a powerful computational engine. The primary benefits of this approach include:

- A user interface, free of computer jargon and simulation syntax, that eliminates the need for specialized modeling expertise
- Access to the power of task network simulation and a relational database
- A powerful, customized application that avoids the majority of software development costs

Figure 2 illustrates some of the main features associated with a custom tailored shell that surrounds task network simulation and relational database engines. The user interface manages the flow of information so that the user never needs to encounter the database or simulation engine. The left side of the figure shows several information flows into the model, and the right side shows several information flows leaving the model. For example, the model will enable users to enter a variety of emergency scenarios, such as engine room fire. The right side of the figure shows a variety of output information. One of the more important types of output are model diagnostics. These include assumptions, such as those that might accompany work-hour estimates and workload reductions associ-

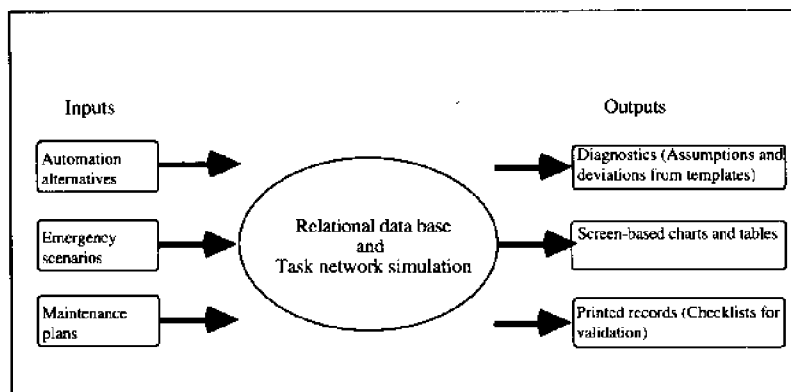


Figure 2. An illustration of how the user interface shell will work with the database and simulation engines to support users.

ated with various types of automation. The diagnostics, combined with screen-based charts and tables, clearly describe the implications of manning configurations on personnel work hours.

## Conclusion

The capabilities included in the model will provide an effective way to augment the intuitive heuristics that justify the current staffing levels of commercial ships. The model embeds a powerful task network simulation within a user interface that can be tailored to the specific needs of regulators, ship owners, and labor representatives. In this way, the model avoids burdening decision makers with the need to develop, execute, and analyze simulations. The model will support analysis of three critical aspects of ship operation: the effect of increased automation, the effectiveness of various maintenance programs, and emergency response capabilities. Because the model considers all phases of ship operation, the entire crew, and a variety of voyage scenarios, the model can provide a realistic analysis of these issues. This will help avoid indiscriminate crew reductions that might follow the introduction of automation and jeopardize safety.

Developing a series of prototype models will identify the potential scope, flexibility, and role of a computer based model in the decision making process associated with ship staffing. The rapid prototyping process outlined in this paper provides practical method for examining these issues. In this process, prototypes are developed and presented to the Coast Guard and industry. Based on comments from these groups, these prototypes can be refined and presented for further evaluation. The end product of this process will be a basic staffing model that provides a first step toward a technical basis for evaluating crew requirements. In addition, this process will identify the need for subsequent data collection and model development.

## Disclaimer

The views and conclusions contained in this document are those of the authors and should not necessarily be interpreted as representing the official policies, either expressed or implied, of the United States Coast Guard, Washington, D.C., or the U.S. Government.

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## The Grounding Resistance of Alternative Structural Systems for Tankers

Jerome P. Sikora and Donald P. Roseman

*Carderock Division, Naval Surface Warfare Center  
Code 66.1, Bethesda, MD 20084*

### Abstract

As a result of OPA 90, all single hull tankers in the coastal trade will be replaced by double hull ships by early in the next century. Comparative grounding analyses and oil outflow studies support this legislation.

Stranding tests were performed on quarter scale hull bottom models of the 32,000 dwt *Paul Buck* and an Advanced Double Hull alternative. These tests showed that in addition to the crushing of the bottom structure which occurred prior to inner shell rupture, plastic deflection lifted the innerbottom out of the rock's way.

Grounding analyses of single and double hull tankers were performed with these plastic deflection considerations. Since the quantity of steel in a hull is dictated by longitudinal strength requirements, the shell of a single hull tanker will be thicker than the outer shell of an equivalent size double hull tanker. Hence, for the statistically most likely shallow penetrations, the damaged length of a single hull tanker will be less than for the equivalent double hull tanker, although the double hull tanker will not have spilled any oil. When deeper penetrations involve the innerbottom, the damage length of the single and double hull ships is about the same.

### Introduction

The Oil Pollution Act of 1990, as adopted in the Code of Federal Regulations (1992) mandates that all tank vessels for which the building contract was awarded after 30 June 1990, must be of double hull configuration if it is intended to transport oil in the navigable waters of the United States, including the U.S. Exclusive Economic Zone. Major conversions of existing tank vessels are also included in this mandate in that they are treated as new construction.

Existing tank vessels built without double hulls, double bottoms, or double sides will not be permitted to operate in U.S. waters after reaching the specific age and date explicitly stated in the Act. This is illustrated in

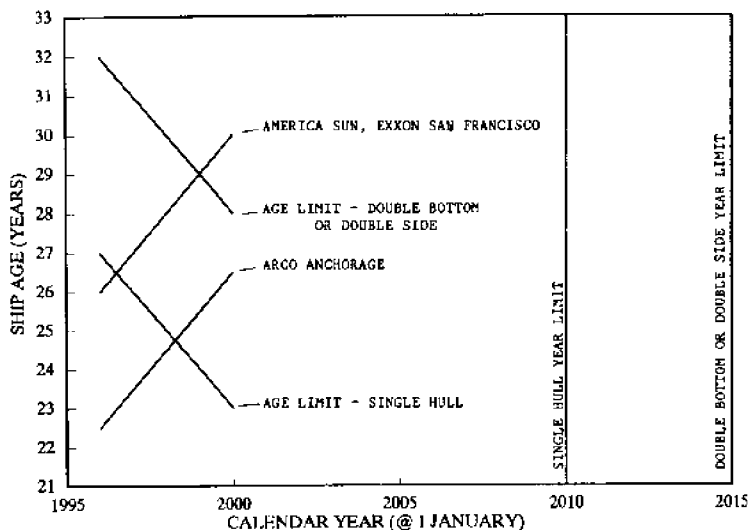


Figure 1. Age-date limits for single hull tanker operations.

Figure 1, derived from the age-date limit data in OPA 90. The age limit lines for existing single hull, double bottom, or double side configurations are plotted for vessels above 30,000 gross tons. The age-date line for the 120,000 dwt single hull *Arco Anchorage* intersects the age limit line at the year 1998, when the ship will be 25 years old. Similarly, the first ships of the 80,000 dwt *America Sun* class and the 75,000 dwt *Exxon San Francisco* class will become obsolete in 1996 when the ships become 26 years old. In no case can a single hull ship be operated in U.S. waters after 2010, or after 2015 for an existing ship with double bottom or double sides, regardless of the age of the vessel. From a brief review of the TAPS tanker listing in Table 1 derived from the USCG (1990) reference, it is evident that a major portion of the fleet will become obsolete well before these limiting dates.

During the interim period before an existing tanker reaches the limiting operating date, proposed new rules, as presented in the CFR (1993), will require certain structural and/or operational modifications to "provide as substantial protection to the environment as is economically and technologically feasible."

It should be noted here that double hull tank vessels did not originate with OPA 90. Double hulls were introduced many years ago as safety and antipollution measures for the transport of hazardous and toxic

Table 1. U.S. Flag Tankers in Alaska "TAPS" Trade

Tanker Identification	Gross Tonnage	Builder	Delivery Period
<i>America Sun</i> class 80,735 dwt	37,269	Sun	12/69 - 9/71
<i>Arco Anchorage</i> class 120,300 dwt	57,691	Bethlehem	6/73 - 8/74
<i>Atigun Pass</i> class 173,400 dwt	74,250	Avondale	11/77 - 6/79
<i>Chevron Oregon</i> class* 39,200 dwt	16,941	FMC Corp	12/75 - 12/77
<i>Exxon New Orleans</i> class 67,800 dwt	32,035	Newport News	4/65
<i>Exxon San Francisco</i> class 75,650 dwt	34,266	Avondale	12/69 - 6/70
<i>Exxon Long Beach</i> 211,500 dwt	94,999	NAASCO	4/87
<i>Massachusetts</i> class 262,400 dwt	117,515	Bethlehem	4/77 - 11/77
<i>San Diego</i> class** 188,000 dwt	83,650	NAASCO	3/78 - 7/80
<i>Sansinena</i> class 70,500 dwt	35,633	Bethlehem	8/71 - 10/72
Sun "TAPS" class* 122,000 dwt	60,384	Sun	12/75 - 1/79
<i>Mobil Arctic</i> 125,000 dwt	57,834	Sun	8/72
<i>Arco Texas</i> *** 89,950 dwt	5,935	Bethlehem Newport News	6/73
<i>Exxon Baytown</i> ** 57,720 dwt	32,204	Avondale	7/84

\* pre-OPA 90 double hull; \*\* double bottom; \*\*\* jumboized by N.N. 11/81

cargoes, including liquefied gasses. In some cases, double hull configurations were adopted to insure purity of high value liquid cargoes and to facilitate cargo tank cleaning.

The discussion in the following paragraphs is concerned with the design and construction of new double hull tankers conforming to the requirements of OPA 90. In particular, the grounding resistance of alternative double hull structural systems is compared with the grounding resistance of an existing single hull tanker, for tanker designs of approximately the same size. Interim results from an ongoing major double hull structural research program are used in the analysis.

### **Advanced Double Hull Research at CDNSWC**

Under sponsorship of the Office of Naval Research, the Carderock Division, Naval Surface Warfare Center (CDNSWC, formerly the David Taylor Research Center) has been engaged in a major research and development effort leading to practical application of advanced double hull structural design concepts to naval combatants and auxiliaries and commercial tank vessels. (The advanced double hull concept is a unidirectional structural configuration consisting of longitudinal web members connecting the inner and outer hulls. This cellular arrangement has such inherent strength that conventional transverse web frames are unnecessary.) The Advanced Double Hull (ADH) Technology Project has been designated a Congressional Interest Project and funds were appropriated for FY 92 and FY 93, with the period of performance extending through FY 94. Results of the research completed during the first year have been applied primarily to commercial tanker design.

Conventional single hull tanker structure consists of a complex grillage of longitudinal framing, widely spaced transverse web frames, and oil-tight longitudinal, and transverse bulkheads providing cargo subdivision. Conventionally framed double hull tanker structure includes a similar grillage of longitudinal and transverse framing. The ADH framing system which is the principal subject of the research program is an alternative concept with only longitudinal, unidirectional, framing. Advantages claimed for this concept are simplification of structure, improved resistance to collision and grounding, and reduced construction and maintenance costs. Examples of these structural systems are shown graphically in the following section of the paper.

The ADH program consists of 18 tasks in the general areas of structural integrity, affordability and survivability, as shown in the task summary, Table 2. The program includes major expenditures for structural model tests and correlating analytical studies, including large scale model

**Table 2. Advanced Double Hull Technology Project.**


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Structural Integrity
Collapse behavior
Fatigue life of cellular structures
Stress behavior
Foundation concepts
Grounding response
Internal deck options
Affordability
Automated fabrication
Corrosion protection
Outfitting of distributive systems
Hydrodynamic performance of new design concepts
Ship integration
Inspection, maintenance, and repair
Survivability
Resistance to underwater explosion holing damage
Resistance to underwater explosion whipping damage
Acoustic signature control
Damage control
Equipment shock response
Resistance to air explosions

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tests to investigate stranding and grounding response. Tests completed to date include collapse behavior of nine small-scale and five large-scale column models, loaded in axial compression to determine post-buckled residual strength. Also completed are stranding tests of one-fourth scale tanker double bottom models with conventional framing and advanced unidirectional framing systems. Future tests of particular relevance to this forum will include large-scale grounding tests of double bottom structures. Results of these tests will be published in reports to the ONR sponsor and will be presented before professional societies in future papers.

### Comparison of Three Tanker Designs

Two existing U.S. flag product tanker designs were selected for this study, the *Overseas Alice* and *Paul Buck* classes. The principal characteristics of the classes, as built, are summarized in Table 3. Product tankers of approximately this size are the most likely for near-term construction for U.S. flag coastal and intercoastal service in the protected Jones Act trades.

General arrangement sketches of the *Overseas Alice* class product tankers are shown in Figure 2. While the ships of the *Overseas Alice* class were delivered in 1968 and 1969, at least seven of this class are believed

**Table 3. Principal characteristics of representative 32,000-37,000 dwt product tankers.**

Ship Characteristic	<i>Overseas Alice</i> Class	<i>Paul Buck</i> Class
Length BP (feet)	630.0	587.5
Breadth, mld (feet)	90.0	90.0
Depth, mld (feet)	48.8	653.67
Draft, scantling (feet)	36.6	536.05
Displacement, total (1 ton)	46,243	41,584
Deadweight, total (1 ton)	37,814	32,446
Cargo Tank Arrangement	3 x 5	7 x 2
Number of Tanks, ex slops	15	14
Propulsion Machinery	Steam turbine	Low speed direct diesel
Power, max continuous (hp)	15,000	15,300
Service Speed (knots)	16	16
Hull Configuration	Single	Double
Builder	Bethlm Stl/Sparrows Pt.	Tampa&Avondale
Year Delivered	1968	1986

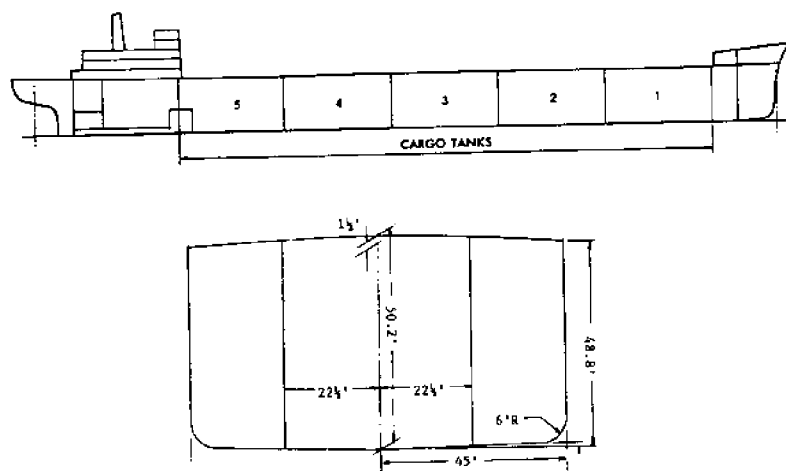


Figure 2. Sketch arrangement, 37,000 dwt *Overseas Alice*.



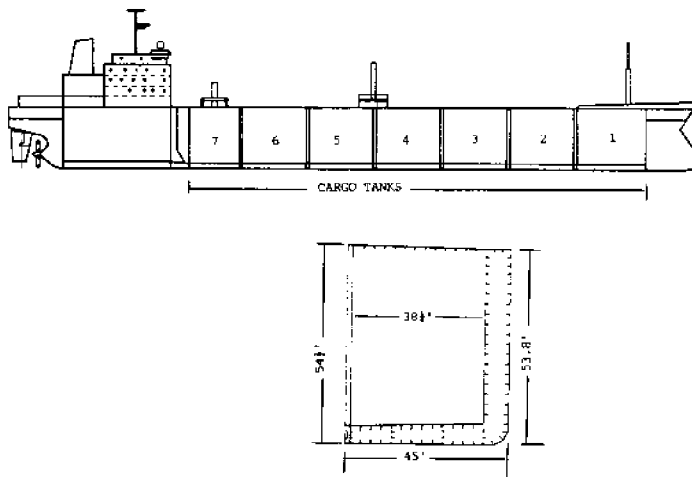


Figure 3. Sketch arrangement, 32,000 dwt Paul Buck.

to be in operation in U.S. flag service. These ships were conservatively built to a high standard and will probably remain in service until the mandated dates of obsolescence.

The general arrangements of the more recent *Paul Buck* class are shown in Figure 3. This class was built to commercial standards, specifically to carry petroleum products on commercial charters to the U.S. government. The tank arrangement is typical of modern double hull product tankers. The cargo tanks are generally shorter in length than the ships of the *Overseas Alice* class, but are arranged two-abreast rather than the older three-abreast configuration.

Structural midship sections of the two designs are shown in Figures 4 and 5. Both configurations have deep transverse web frames 11' 4" apart supporting longitudinal stiffeners every 34 inches. The bottom plating of the single hull *Overseas Alice* class is 23 mm thick whereas the highly optimized *Paul Buck* class has an outer shell plating thickness of 14.7 mm and an innerbottom, or inner shell, thickness of 13.7 mm.

The proposed ADH alternative, unidirectional framing system, for the *Paul Buck* will be referred to as the ADH T-5 and is shown in Figure 6. The reduced number of structural members and general simplification of the structure is evident in the comparisons with the two midship sections

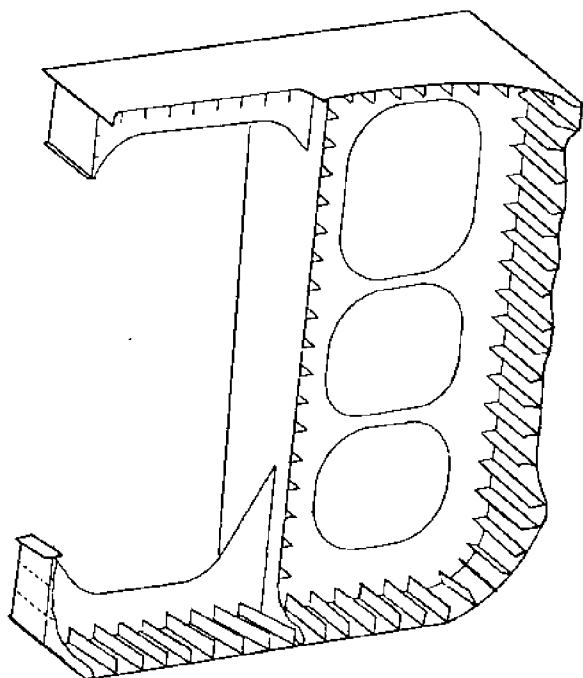


Figure 4. Midship section, Overseas Alice class.

in Figures 5 and 6. To minimize differences with the *Paul Buck*, the same external lines, internal tank geometries, innerbottom depths, etc. were maintained for the ADH T-5 design. Thus, the ADH T-5 was not optimized for either structural weight, producibility, or grounding resistance. The ADH T-5 was designed to the same ABS criteria and minimum scantlings as the *Paul Buck*. As a result, both variants have the same inner and outer shell thicknesses. The weight of the longitudinal web members of the innerbottom and side shell corresponded to the weight of the longitudinals and transverse frames on the *Paul Buck* such that the structural weights were within a half percent.

### Stranding Tests

Stranding occurs when a ship comes to rest on a rock, sandbar, reef, etc. with no forward speed. The rock counteracts part of the buoyancy thus imparting an upward vertical force on the bottom structure. Models of the

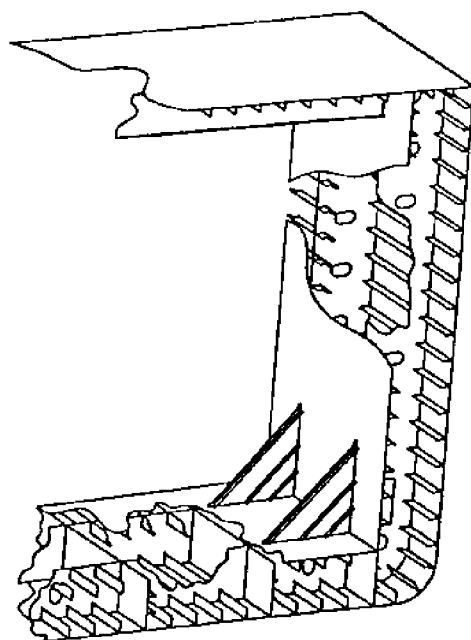


Figure 5. Midship section, Paul Buck class.

*Paul Buck* and the ADH T-5 variant were tested to determine the structural failure mechanisms under stranding. The portion of the ship modeled is the double bottom structure extending one tank length between transverse bulkheads, with a width nearly half the beam of the ship, i.e., from the centerline longitudinal bulkhead to the inner side shell. The indentation of the rock was centered in this bottom panel.

### Scaling Relationships

For experiments involving high elongation, ultimate strength, tearing, etc., a single set of simple scaling relationships does not accurately predict both the damage patterns and the loads needed to produce them. Jones and Wierzbicki (1983) present a number of experiments showing several scales of a similar structure which exhibit very different final deformed shapes. Tearing damage does not scale by a relationship compatible with the distortion from bending, buckling, and crushing. The discrepancies decrease as one approaches a scale factor of unity. Table 4

Table 4. Scaling relationships.

Parameter	Ratios	Scale Factor	Comments
Length	$1. L_p = \lambda L_m$	$\lambda = 4.25$	Length scale factor definition
Modulus of Elasticity	$E_p = E_m$	1 to 1	Ship and model are ordinary steel; OS
Section Area	$A_p = \lambda^2 A_m$	$\lambda^2 = 18.1$	(Length ratio) <sup>2</sup>
Deflection	$\delta_p = \lambda \delta_m$	$\lambda = 4.25$	For similar damage patterns
Strain	$\epsilon_p = \epsilon_m$	1 to 1	For similarity
Stress	$\sigma = \sigma_m$	1 to 1	Damage occurs at same stress levels
Force	$F_p = \lambda^2 F_m$	$\lambda^2 = 18.1$	Force = Stress x Area
Energy	$W_p = \lambda^3 W_m$	$\lambda^3 = 76.8$	Work = Force x Deflection
	p = prototype    m = model		

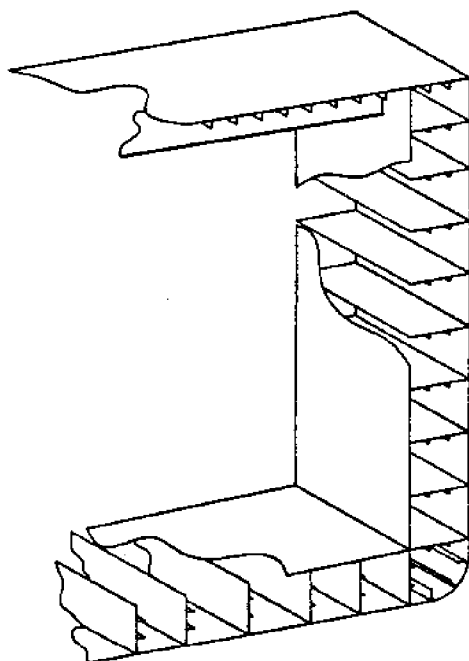


Figure 6. Midship section, ADH T-5 with alternative unidirectional framing system.

presents the scaling relationships used. They assume that the model is of the same material as the ship and, therefore, the models reach yield at the same stress.

### Model Design

Because of the scaling considerations, it was desired to have as large a scale for the models as possible. The limiting consideration was the 2,540 mm transverse clearance in the test machine. Therefore, the models were limited to a maximum scale factor of 4.25; corresponding to a length of 4,267 mm, a width of 2540 mm, and an innerbottom depth of 470 mm. Figures 7 and 8 show the model details. All material was ordinary (mild) steel with 4 mm shell plating and 3.2 mm longitudinal webs. Two longitudinal flat bars stiffened each longitudinal web member on each model. The transverse webs on the *Paul Buck* model were composed of 4 mm plating

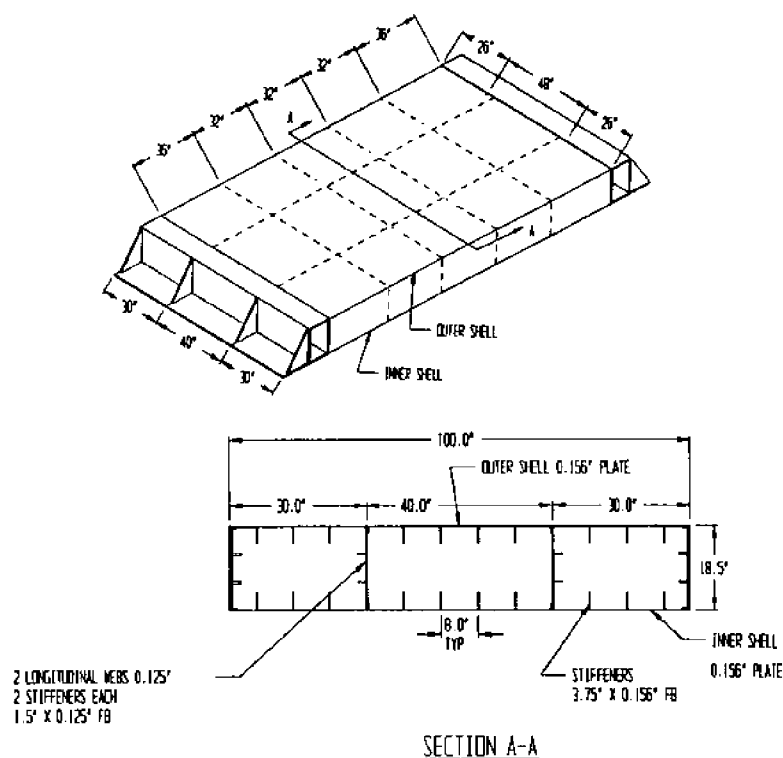


Figure 7. Quarter scale stranding model of Paul Buck.

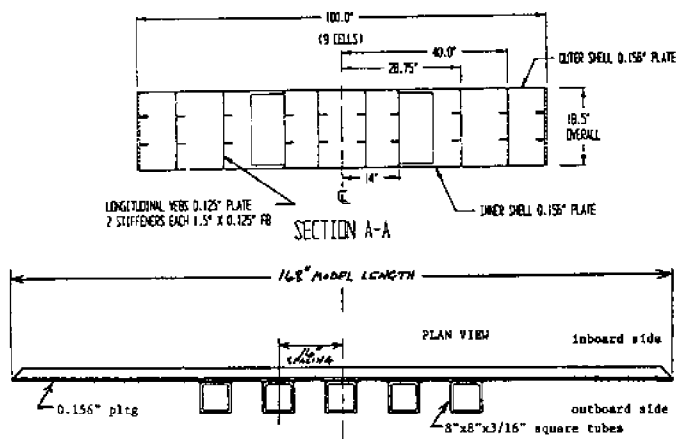


Figure 8. Quarter scale stranding model of ADH T-5.

with vertical flat bar stiffeners. Two of the ten longitudinal webs on the ADH T-5 model were vertically stiffened with square tubes (203 x 203 x 4.8 mm, 406 mm apart) to ensure a more global deformation pattern. Although it was necessary to weld many of the joints from only one side, TC-U4-S welds with backing bars and 100% fill were employed.

### Rock Geometry

The rock geometry selected for the stranding experiments was the result of the following rationale. Although a blunt rock shape is statistically the most likely to be encountered, the distorted shape of the models was not expected to be very different for the two innerbottom geometries. At the other extreme, it was assumed that a sharp pinnacle shape would cause the same zipper-like tearing of the inner and outer shells regardless of structural configuration, i.e., the rock would penetrate the inner shell without interacting with any of the longitudinal or transverse webs. Furthermore, a sharp pinnacle would likely break off or collect debris so that it would become more blunt after a short time.

Therefore, a shape between the above extremes would be the most useful in a comparative study. A 90 degree cone with a rounded tip was selected as a very severe, yet plausible rock shape. The radius of the model rock tip was 229 mm, resulting in the cone surfaces making contact with the longitudinal and transverse webs before the tip contacted the inner shell; see Figure 9. The base of the cone was 1,829 mm.

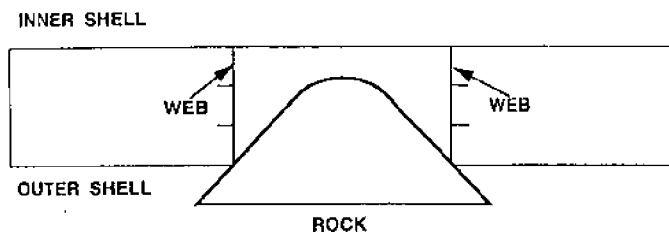


Figure 9. Intrusion of rock into double hull stranding model.

The rock tip was constructed from an 458 mm diameter hemisphere (HY80). The rest of the rock consisted of a heavy steel centerpost, 6.4 mm shell plating, and 25 mm thick internal webs. The void spaces were filled with high strength concrete.

### Experimental Setup

The 12 million pound universal test machine at the National Institute of Standards and Technology (NIST) was chosen as the test facility because it is the largest such machine in the world and has the most clearance in the test area. Rigid boxes were welded to the ends of the models to simulate the support of the transverse bulkheads. The end boxes were grouted and bolted to pedestals such that the models could deform globally (as fixed-fixed beams). Both the end boxes and pedestals were built of 25 mm thick plating. Each model was mounted in an inverted position (outer shell on top) and the rock lowered by the machine head to contact the outer shell; see Figure 10. The rock tip was centered between longitudinal webs, and—in the case of the *Paul Buck*—also centered between the transverse webs, to simulate the expected worst case scenario.

The models were instrumented with strain gages to record the loss of strength of critical members and deflection gages to record global bending. Video cameras recorded the progress of the rock through the innerbottom by viewing both the inner shell and outer shells. In addition, a small “pencil” camera was taken into the interior of the structure when the outer shell opening became large enough for access.

### Experimental Results

Following is the sequence of events during the stranding test of the *Paul Buck*, model measurements are given with scaled prototype values in parentheses. Figure 11 presents the load deflection plot:

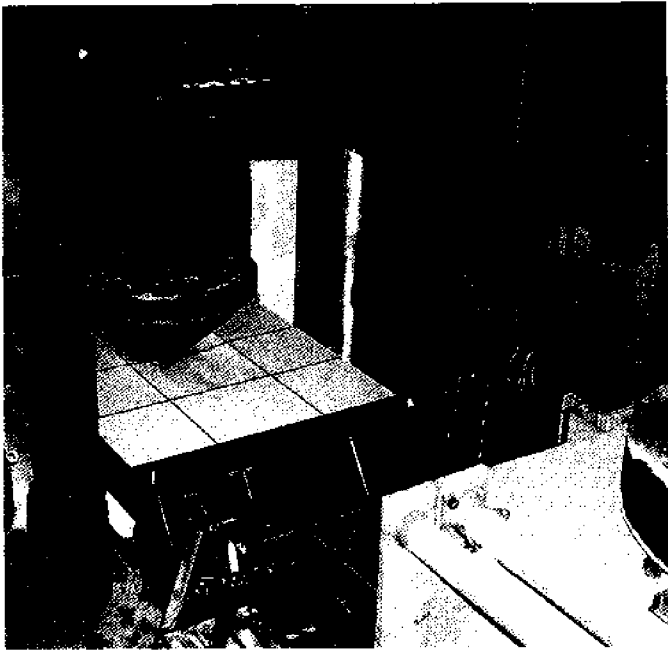


Figure 10. NIST experimental setup (Paul Buck model).

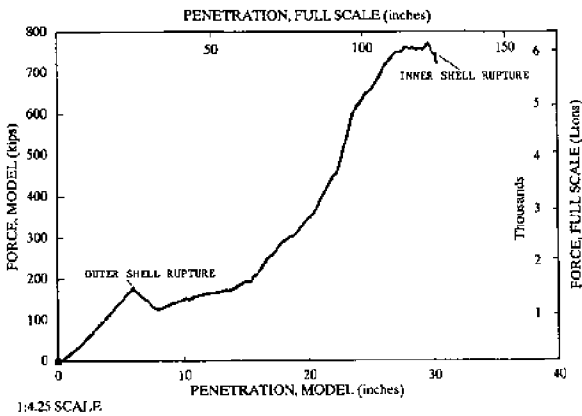


Figure 11. Load/penetration plot of Paul Buck in stranding.



- Outer shell rupture occurred at a load of 185,000 lbs (1,495 l tons) when the rock penetrated 6.2 inches (26 inches). Rupture occurred at the perimeter of the rock contact area and not at the rock center.
- The tear in the outer shell propagated longitudinally beyond the transverse webs at a load of 200,000 lbs (1,616 l tons) and a penetration of 15 inches (64 inches).
- As the rock surface neared the intersections of longitudinal and transverse webs, the slope of the load deflection plot increased. Rock contact with the intersections lifted the inner shell up and away from the rock tip, i.e. the model deflected in global bending as a beam.
- At a load of 400,000 lbs (3,232 l tons) and a penetration of 19.3 inches (82 inches) a bulge appeared on the inner shell where the rock made contact. Shell stiffeners were tripped and folded flat against the inner shell by the rock.
- The load penetration plot showed a gradual loss of stiffness above 600,000 lbs (4,850 l tons) indicating a crushing of the web intersections. Severe plate buckling occurred transversely in the outer shell indicating slipped material was being pushed laterally away from the rock surface.
- The inner shell rupture began as a longitudinal crack at the edge of the rock contact area, followed shortly by an abrupt change to the transverse direction. Figure 12 shows the final damage at the rupture site corresponding to a load of 750,000 lbs (6,060 l tons) and a penetration of 30 inches (127 inches).
- The energy dissipated was calculated from the load-penetration plot to be 776,000 ft-lbs (26,600 ft-l tons).

Following is the sequence of events during the stranding test of the Advanced Double Hull (ADH T-5) model. Measurements are given with scaled prototype values in parentheses. Figure 13 presents the load penetration plot:

- Outer shell rupture occurred at a load of 170,000 lbs (1,374 l tons) and a penetration of 6.2 inches (26 inches) with a longitudinal crack at the edge of the rock contact area.

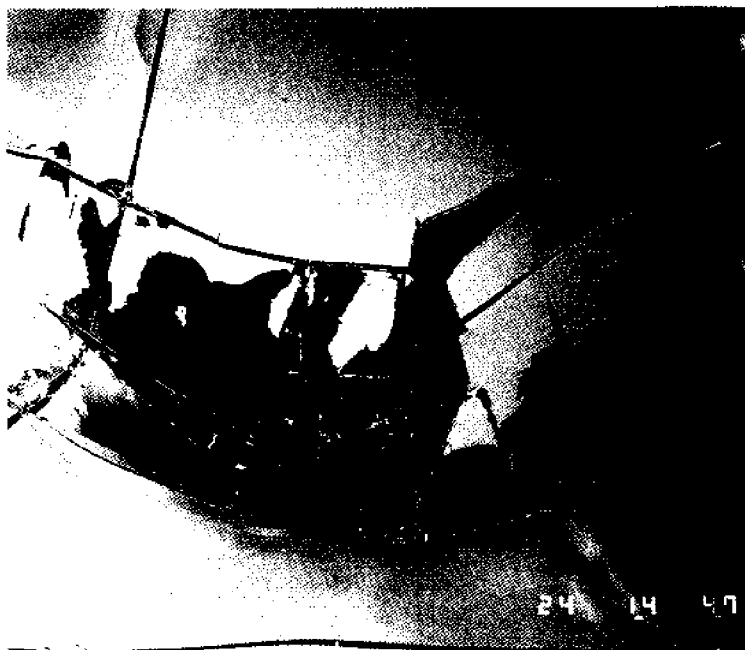


Figure 12. Paul Buck model at inner shell rupture.

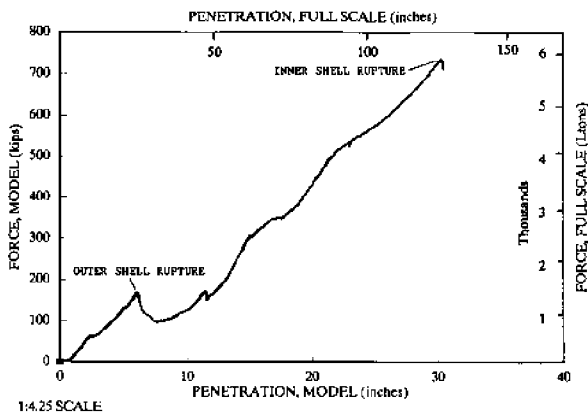


Figure 13. Load/penetration plot of ADH T-5 in stranding.

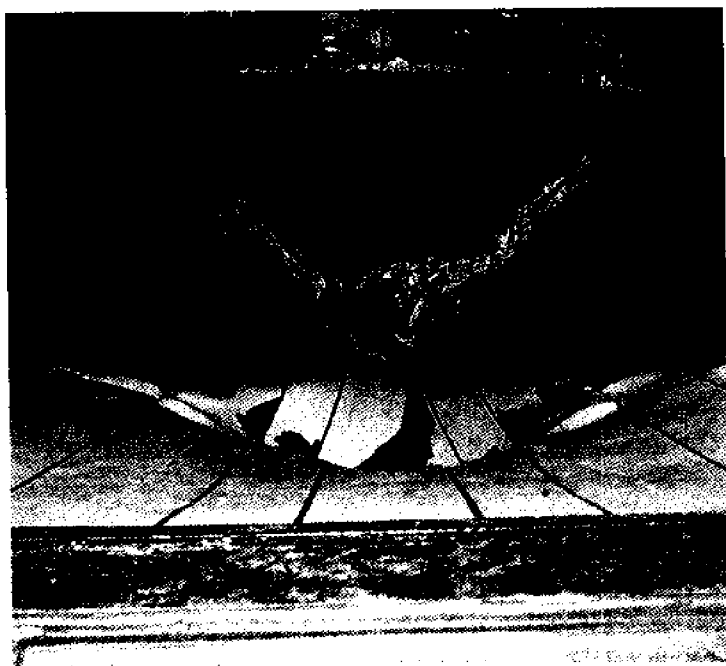


Figure 14. ADH T-5 model at inner shell rupture.

- Contact was made with the tube stiffened longitudinal webs at a load of 190,000 lbs (1,535 l tons) and a penetration of 13 inches (55 inches).
- The portion of the load-penetration plot between 200,000 and 700,000 lbs (1,600 to 5,600 l tons) shows the stiffness associated with the inner shell lifting out of the rock's way. The undulations in the slope correspond to the web components making contact with the rock and then crushing causing a loss of local stiffness.
- As the load approached 720,000 lbs (5,820 l tons), a vertical crack in the longitudinal web propagated to the inner shell. This initiated a longitudinal crack at the inner shell weld line. A maximum rock penetration of 31 inches (132 inches) was achieved. Figure 14 shows the final appearance of the damaged model.
- The energy dissipated was calculated from the load-penetration plot to be 807,000 ft-lbs (27,670 ft-l tons), 4% more than the *Paul Buck*.

## Grounding Damage

In a grounding incident, the kinetic energy of the moving ship is primarily dissipated through the crushing and tearing of the hull structure, i.e.:

$$\text{Kinetic Energy} = \text{Absorbed Energy}$$

where the kinetic energy is a function of the displacement of the ship and velocity at impact and the absorbed energy ( $W_s$ ) is a function of the cross-sectional material and the length of damage.

### Method

This analysis is based on the work done by Vaughan (1977) which is itself an extension of Minorsky's work. Vaughan's collision energy equation takes into account the energy due to tearing during a grounding, in addition to Minorsky's crushing energy.

$$W_s = 352 V_s + 126 A_s$$

where  $V_s$  and  $A_s$  are the total volume and area of displaced and torn material respectively. Vaughan derived the coefficients from Akita and Kitamura (1972).

The volume of crushed steel was calculated by multiplying the "effective thickness" by the stiffener spacing and damage length. The effective stiffness includes structure which supports the hull plating by "smearing" their areas into the hull thickness. Crushed bulkhead and web frame volumes are also included in the hull thickness, as functions of penetration depths. The following expansion of Vaughan's equation (DnV 1990) is for the total energy absorbed during a steady state grounding event.

$$W_s = L_d [352(B_{d1}t_{pe1} + B_{d2}t_{pe2}) + 126(t_{pa1} + t_{pa2})]$$

- where
- $L_d$  = longitudinal length of damage
  - $B_{d1}$  = breadth of damage on outer shell
  - $B_{d2}$  = breadth of damage on inner shell
  - $t_{pe1}$  = equivalent thickness of outer shell
  - $t_{pe2}$  = equivalent thickness of inner shell
  - $t_{pa1}$  = actual thickness of outer shell
  - $t_{pa2}$  = actual thickness of inner shell

The units of energy are 1 ton-knot<sup>2</sup>, lengths and breadths are in meters and thicknesses are in millimeters. The crushing volume and tearing area are obtained by superimposing the rock shape over the ship cross-section to determine the damaged structure.

As a result of the stranding tests in the last section, it is seen that the bottom structure is deflected out of the rock's path. Therefore, the above grounding damage method was modified in two ways. First, the volume of penetration was reduced by the global deformation of the innerbottom. The maximum penetration of the rock was reduced by one half until the following limits were realized:

<u>Ship Type</u>	<u>Deformation Limit</u>
Conventional Single Hull	Elastic Deformation Limit
Conventional Double Hull	1.6 x Innerbottom Depth
Advanced Double Hull	1.7 x Innerbottom Depth

Thereafter, global deformation has no additional effect. Second, the kinetic energy dissipated ( $E_k$ ) is equal to Vaughan's equation ( $W_s$ ) plus the work done in deforming the innerbottom up to the elastic deformation limit ( $W_{ed}$ ):

$$E_k = W_s + W_{ed}$$

At the yield stress ( $\sigma_y$ ), the force ( $F_y$ ) is given by

$$F_y = 8\sigma_y Z/L_t$$

and the maximum elastic deflection ( $\delta$ ) is given by

$$\delta = F_y L_t^3 / (192EI)$$

where  $Z$  is the section modulus of the innerbottom,  $L_t$  is the length of a tank,  $E$  is the modulus of elasticity, and  $I$  is the moment of inertia of the innerbottom. For the  $Z$  and  $I$  calculations,  $B_{d1}$  is assumed for the breadth of the sections. Converting the above expressions to consistent units with equation (1), the work in elastically deforming "N" cargo tank innerbottoms becomes:

$$W_{ed} = 204N\sigma_y Z\delta/L_t$$

where the units for  $W_{ed}$  are 1 ton knot<sup>2</sup>,  $s_y$  is psi,  $Z$  is meter<sup>3</sup>, and both  $d$  and  $L_t$  are in meters. (It is assumed that the energy which deforms the innerbottom to the maximum (plastic region) amount entails a crushing

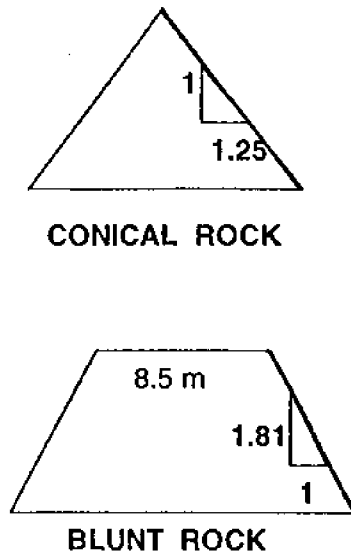


Figure 15. Sample rock geometries for grounding analysis.

[vertical] of structure which is already included to some extent in Vaughan's equation [longitudinal crushing].)

For very large rocks, e.g. penetrations of several times the innerbottom depth, neither of the above modifications is significant. However, for shallow rocks, the effects of innerbottom deflection can be significant in predicting inner shell rupture, with the elastic deformation energy modification less so.

### Rock Geometries

Two rock geometries were selected for grounding scenarios with several penetration depths studied as parameters, the idealized rocks are shown in Figure 15. The conical rock was claimed to be an IMO/MARPOL assumption in the DnV 1990 reference, but some authorities have questioned the slope value. In any event, the conical rock is quite similar to the rock used in the stranding tests and was used as one extreme in this study. The blunt shape in Figure 15 is an assumed idealization strictly for comparison purposes.

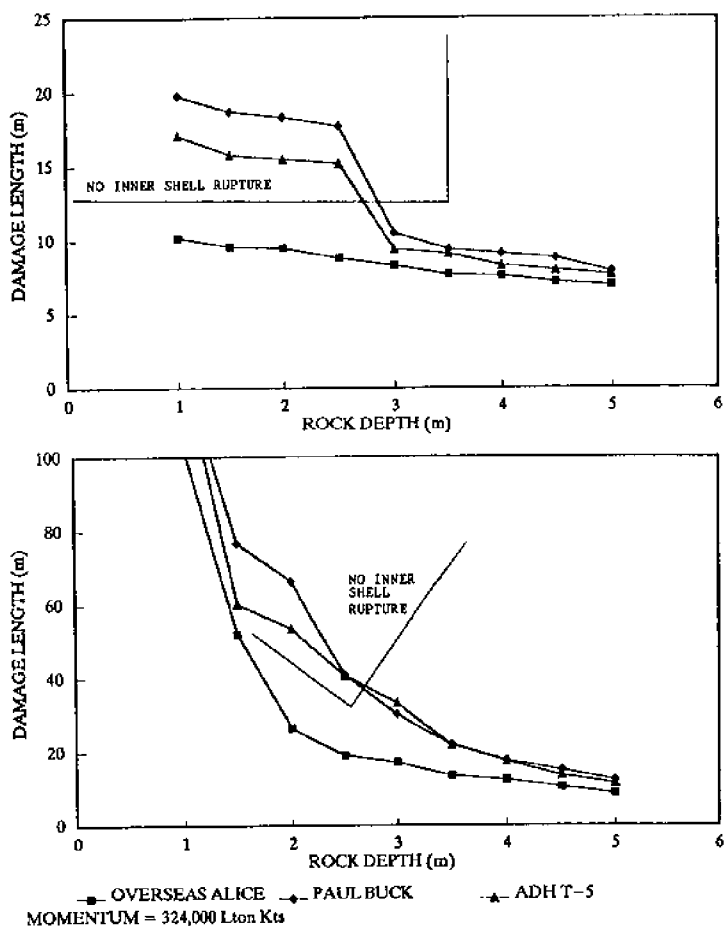


Figure 16. Grounding damage as function of rock depth.

## Analytical Results

The following results are based on the assumption that the midships scantlings extend the entire length of the damaged ship length. A comparison of the damages for the conical and blunt rocks as a function of rock depth is given in Figure 16. All of the results are at a constant momentum of 324,000 l ton knots (10 knots for the *Paul Buck* and ADH T-5 and 9.2 knots for the *Overseas Alice*).

The quantity and distribution of steel in the hull of a tanker is dictated by longitudinal hull girder strength and local strength

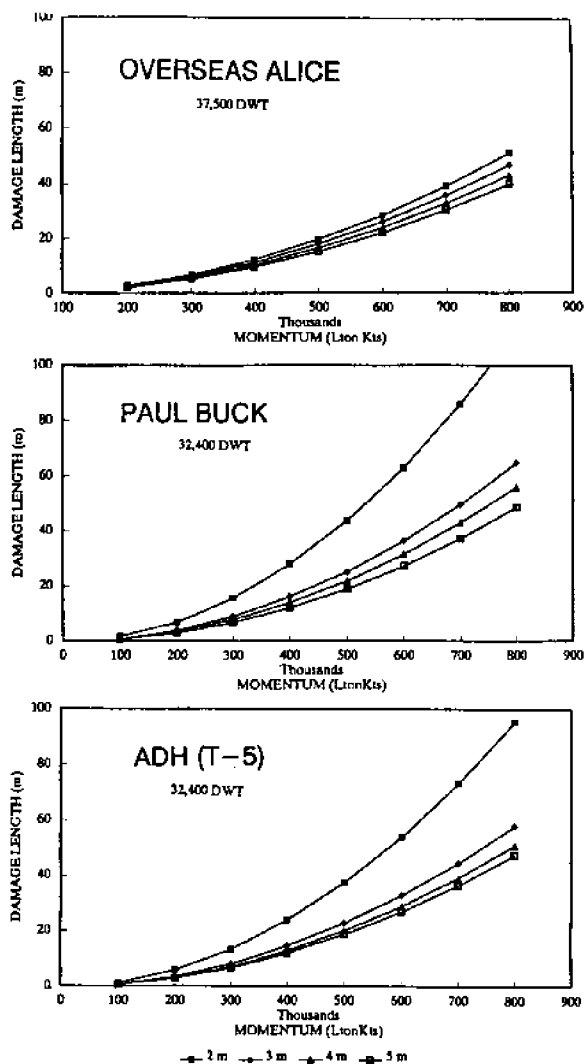


Figure 17. Predicted damage lengths in grounding.



requirements. Accordingly, for large ships the hull of a single hull tanker will be thicker than the outer shell of the equivalent double hull tanker for the same strength requirements. This occurs because the required hull girder steel is distributed between the inner bottom and outer shell of the double hull tanker. With this in mind, several observations are noteworthy:

- The conical rock acts more like a can opener and tears a much longer length of the ship than the blunt rock.
- The *Overseas Alice* has a shorter damage length than either of the double hull ships. When the rock depth is small (under 3 meters), the single hull ship has a shorter damage length because the rock has not penetrated the inner hull of the double hull ships (no oil has spilled) and does not have as much material to crush. When the rock depth is large, there is no significant difference in the damage length for the three ships.
- The advanced double hull, ADH T-5, has slightly more cross-sectional area than the conventional double hull, *Paul Buck*, and therefore has a slightly shorter damage length.

The lengths of the predicted grounding damage from the blunt rock are presented in Figure 17 for the *Overseas Alice*, the *Paul Buck*, and the advanced double hull version of the *Paul Buck* (ADH T-5). Momentum (1 ton-knots) was chosen as the common ordinate to compare these slightly different sized ships. The rock depths were varied at 2, 3, 4, and 5 meters above the baseline of each ship. Following are some observations from Figure 17:

- The larger rocks caused a shorter damage length than the smaller ones. This is because they have a wider base and therefore crush more of the structure per unit of travel. In the extremes, a can opener will tear open the entire length of a ship without dissipating much energy, whereas a tall, immovable object will cause a ship to stop immediately.
- There is a gap in the curves for the two double hull ships between the 2 and 3 meter rock depths. At the lower value, only the outer shell is crushed while at the larger values both the inner and outer shells absorb energy, thus reducing the longitudinal extent of damage.

From the above analytical predictions, there is little difference in the behavior of the two double hull variants. Future grounding tests are

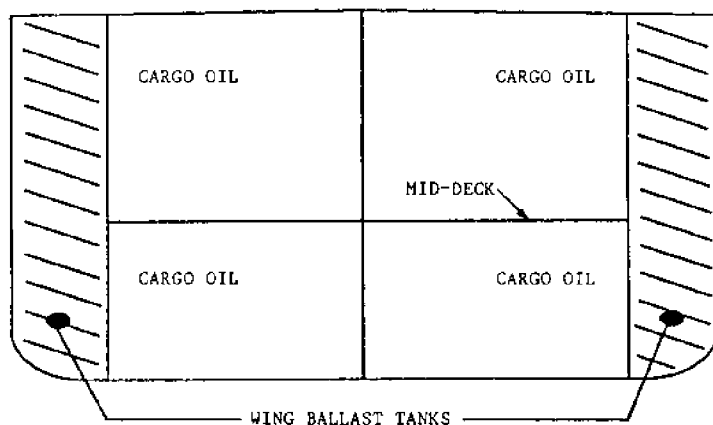


Figure 18. Mid-deck tanker.

planned during the ongoing advanced double hull research program. These tests of fifth scale models of the innerbottoms of the *Paul Buck* and ADH T-5 should shed more light on the grounding phenomenon.

### Oil Outflow from Grounding

At some time during the ADH research program, oil outflow calculations for alternative tanker structural arrangements will be conducted for representative scenarios. At this stage in the program such calculations are premature, pending outcome of the planned large scale grounding tests. However, it is appropriate to draw some general conclusions regarding oil outflow as related to double hull tanker geometry.

During the intense debates in international maritime forums, which accompanied the enactment of OPA 90, the U.S. decision to unilaterally require double hull tanker geometry was attacked by proponents of alternative systems and concepts. The primary structural alternative proposed was the Mitsubishi mid-deck concept, Figure 18, which relies on external hydrostatic pressure to prevent oil leakage in the event of a grounding. The most strongly proposed operational measures all involved hydrostatic balanced loading, which limits the oil level in cargo tanks to insure that outflow resulting from grounding is prevented by external hydrostatic pressure. The United States maintained its position with the enactment of OPA 90. Shortly thereafter, the International Maritime Organization (IMO) incorporated the double hull requirement as well as the "equivalent" mid-deck configuration (IMO Regulation 13F).

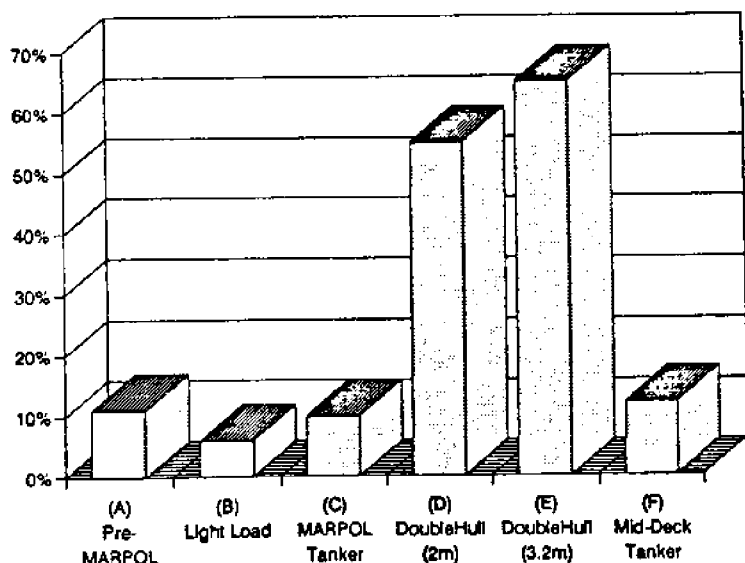


Figure 19. Probability of zero outflow (bottom damage only).

During the period of investigation and deliberation at the time of OPA 90 adoption, significant model test programs were conducted at the Tsukuba Institute in Japan and at the David Taylor Model Basin in the United States, to compare oil outflow characteristics of mid-deck and double hull tankers subject to grounding damage. The results were reported by Karafiath (1991). The oil outflow characteristics of each concept depend on a variety of environmental factors, including the nature and magnitude of the grounding damage and the existence of external currents.

In one respect, the performance of the double hull tanker model in high energy grounding was better than expected. When the innerbottom was ruptured, cargo oil tended to flow into the empty double hull spaces rather than out into the sea through the bottom shell opening. This is an important observation and should be the subject of further research. It is clear that the structural design of the inner hull void spaces should be such as to minimize obstructions to cargo oil flow into these spaces.

The authors recognize that any proposed design or operational concepts can be supported by its proponents with a hypothetical casualty scenario that demonstrate the merits of the concept. In this connection it should be emphasized that the nature of tanker casualties in U.S. waters

reflects the relatively shallow water depths at approaches to U.S. ports. Results of a recent casualty survey indicate that groundings total 45% of all casualties, collisions and ramblings 25%, fire and explosions 14%, and structural/operational failures 16% of the total. The majority of the groundings involve relatively low energy incidents where the innerbottom would not be breached. The merits of the double hull configuration in the prevention of oil spills are clearly supported by these statistics.

Further support for the double hull requirement is given by Michel and Tagg (1991) in their important probabilistic analysis of tanker oil outflow. Their studies show that to maximize the probability of zero outflow resulting from bottom damage, the double hull geometry is superior to all other alternatives, including the mid-deck tanker. Figure 19 (taken from their paper) shows the probability of zero outflow for casualties involving only grounding damage to the bottom. The probabilities in Figure 19 were developed by Michel and Tagg with the assumption that a rock depth equal to the innerbottom depth would cause rupture and oil outflow. In view of the stranding results presented in this paper, that is a conservative assumption. In fact, the probabilities of zero oil outflow presented for the 3.2 meter innerbottom would be appropriate for a 2 meter depth (1.6 plastic deformation x 2 meters) and the probabilities for a 3.2 meter innerbottom would be higher still.

## Conclusions

As a result of OPA 90, all single hull tankers in the coastal trade will be replaced by double hull ships by early in the next century. Comparative grounding analyses and oil outflow studies support this legislation.

Stranding tests were performed on quarter scale hull bottom models of the *Paul Buck* and the ADH T-5 at NIST. These tests showed that in addition to the crushing of the bottom structure that occurred, plastic deflection lifted the innerbottom out of the rock's way (60-70% of the innerbottom depth before inner shell rupture). Thus, the probabilities of zero oil outflow for double hull tankers shown in Figure 19 (from Michel and Tagg) are probably conservative.

Grounding analyses of single and double hull tankers were performed with considerations for the plastic deflection of the innerbottoms away from the rock. Since the quantity of steel in a hull is dictated by longitudinal strength requirements, the shell of a single hull tanker will be thicker than the outer shell of an equivalent size double hull tanker. Hence, for shallow penetrations (less than 1.6 times the innerbottom depth) the damaged length of a single hull tanker will be less than for the equivalent double hull tanker, keeping in mind that the double hull tanker will not

have spilled any oil. When deeper penetrations involve the innerbottom, the damage length of the single and double hull ships is about the same, all other considerations being equal.

### Acknowledgments

The authors gratefully recognize the work of our associates at CDNSWC: Mr. Robert W. Michaelson designed the advanced double hull version of the *Paul Buck*, the ADH T-5. Mr. James L. Rodd was the principal investigator of the stranding tests and was responsible for the design of the models, rock, and test fixtures in addition to providing an excellent explanation of the results. Mr. Erik Anderson of NIST ran the stranding tests and was most helpful in providing for our needs. Mr. Brian Snyder and Mr. David McAfee developed the analytical grounding tools of which this report is an extension. Special thanks are also offered to our sponsor at the Office of Naval Research, Mr. James Gagorik.

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## **The Prevention of Accidents and Oil Spills on the Outer Continental Shelf**

**James B. Regg, John Breitmeier, Rodney Smith,  
and Jeff Walker**

*Minerals Management Service, Alaska OCS Region  
949 E. 36th Avenue, #603, Anchorage, AK 99508-4302*

### **Abstract**

Prevention of accidents and oil spills is a key ingredient in assuring the continuation of safe operations on the outer continental shelf (OCS). The Minerals Management Service (MMS) regulatory program identifies special requirements for industry for the prevention of accidents which could threaten life, property, or the environment. The MMS prevention requirements will be discussed. The emphasis for the discussion will be on the exploration phase of offshore oil and gas activities on the Alaska OCS. A brief summary of the historical activities conducted on the Alaska OCS and a characterization of the challenges of the Alaskan offshore environment will serve as background information to the subject of prevention. Finally, the authors will briefly mention how prevention enters into the development phase of offshore operations.

### **Introduction**

The primary responsibilities of the Minerals Management Service (MMS) are to manage the mineral resources located on the nation's outer continental shelf (OCS), collect revenues from the federal OCS, and distribute those revenues. The Offshore Minerals Management Program administers the OCS competitive leasing program and oversees the safe and environmentally sound exploration and production of our nation's offshore natural gas, oil, and other mineral resources. Meeting the challenges of operating on Alaska's vast OCS through technology and the prevention of accidents and oil spills is the main theme of this presentation. Although the primary focus for this discussion is on exploratory operations, a summary of production safety systems is included to emphasize the comprehensive MMS pollution prevention effort.

Offshore drilling and production in United States OCS waters have not been a significant source of pollution. We believe there are good

reasons for the excellent OCS safety record, not the least of which are continued improvements in technology, a commitment by the oil industry to operate in an environmentally responsible manner, and a prevention effort which has evolved over many years of offshore operations.

Prevention is a key component in assuring the continuation of safe operations on the OCS. The MMS regulatory program identifies special requirements of industry for the prevention of accidents which could threaten life, property, or the environment.

### **Challenges**

Offshore oil exploration and development must be conducted in a manner which is compatible with the other uses of the OCS, and which protects the region's valuable resources.

There are a number of special challenges which must be met by the Alaska OCS operators. These include: dynamic weather conditions, intense storms, remoteness and the general lack of infrastructure which pose resupply and logistics difficulties, seismic activity, and subfreezing temperatures and associated conditions (including superstructure icing and seasonal ice) requiring the use of special procedures for the protection of men and equipment. These harsh natural conditions coupled with the stringent regulatory constraints developed to ensure protection of the environment add to the challenges of technology, planning, and execution of exploration in these remote areas. The challenges of operating in the Alaska OCS can and have been met and should not be viewed as unmanageable issues.

### **Summary of Offshore Alaskan Exploration**

Operating experience relevant to Alaska's offshore comes from industry exploration and production activities throughout the United States offshore, the North Sea, and other areas with similar environmental conditions. Offshore drilling in Alaska has been ongoing in Cook Inlet since 1959 and on the Alaska OCS since 1975. The Alaska OCS wells are listed by sale area in Table 1. The wells were drilled from floating drilling units such as semisubmersibles, drillships, and a conical drilling unit; and bottom-founded structures such as jackups, gravel and ice islands, and unique concrete and steel gravity caisson-type units.

### **Prevention**

Prevention of accidents and oil spills is primarily the responsibility of the lessee drilling a well. The MMS also has responsibilities regarding



**Table 1. Alaska OCS Wells by Sale Area (3/94)**

Lease Sale/Area	Sale Date	Number of Wells		
		Lease	DST	Total
Sale 39/Gulf of Alaska	April 1976	11	1	12
Sale CI/Cook Inlet	October 1977	10	1	11
Sale BF/Ceaufort Sea	December 1979	7	0	7
Sale 55/E. Gulf of Alaska	October 1980	1	0	1
Reoffering Sale/Gulf of Alaska	June 1980	0	0	0
Sale 60/Cook Inlet	September 1981	3	0	3
Sale 71/Beaufort Sea	October 1982	8	0	8
Sale 57/Norton Sound	March 1983	6	2	8
Sale 70/St. George Basin	April 1983	10	2	12
Sale 83/Navarin Basin	April 1984	8	1	9
Sale 87/Beaufort Sea	August 1984	10	0	10
Sale 97/Beaufort Sea	March 1988	2	0	2
Sale 109/Chukchi Sea	May 1988	4	0	4
Sale 92/North Aleutian Basin	October 1988	0	0	0
Sale 124/Beaufort Sea	June 1991	1	0	1
Sale 126/Chukchi Sea	August 1991	0	0	0
North Aleutian Shelf			1	1
Kodiak Shelf			6	6
Total		81	14	95

prevention, and MMS regulations (30 CFR Part 250) establish performance standards with which the lessee must comply when conducting OCS operations. These regulations include requirements for specific equipment, redundant safety systems, testing of safety systems, and training. Separate from, but complementing the prevention requirements, are preparedness and planning requirements. The MMS Alaska OCS Region has strict requirements for contingency planning and oil-spill-response drills to ensure that a lessee is prepared to respond to, and clean up, any spill which might result from drilling operations.

The MMS exercises review and approval authority over a lessee's operation by requiring the submission of detailed plans and permit applications, including an exploration plan, an oil spill contingency plan, and an application for permit to drill. The MMS Alaska OCS Region employs a multidisciplined staff involved in environmental assessment, permitting, and inspections of OCS activities. The staff includes engineers and inspectors, geologists, geophysicists, marine biologists, environmental scientists, and other appropriate professional disciplines with experience relevant to the Alaska offshore environmental challenges. Reviews conducted by the MMS staff are designed to ensure that sound technical

and environmental protection practices are employed for all OCS activities.

It is important to recognize that the Alaska OCS is in an exploration phase. Development and production activities will require additional and extensive MMS and public reviews and, most likely, an environmental impact statement based on site-specific information. A development and production plan would require specific information on the type, timing, and sequence of activities; the structure to be used; operating procedures; the hydrocarbon transportation strategy; and other similar criteria. Those activities will be governed by another stringent set of safety and pollution prevention (and planning) requirements. Some of the specific requirements included in the MMS production regulations are highlighted later in this paper.

The following systems, related components, and procedures are the key mechanisms used by industry and the MMS to meet the challenges of operating on the OCS, and are important for accident and oil spill prevention. Detailed explanations of equipment, procedures, and systems are beyond the scope of this paper. The reader is encouraged to examine the publications included in the references section to learn more about equipment, offshore activities, and safety systems.

- **Shallow hazards surveys:** High-resolution geophysical surveys are run to detect any seafloor or shallow geological conditions which might pose a hazard to drilling, such as shallow gas, over-pressured zones, faulting, soil stability, and other potential seabed hazards. These surveys are completed and analyzed in advance of proposed drilling. Hazards surveys are sometimes combined with archaeological, biological, and geotechnical evaluations.
- **Geotechnical evaluations:** Shallow core samples and evaluations of the soil conditions at a proposed drill site are conducted when a bottom-founded drilling unit or a platform will be utilized. An evaluation will indicate the ability of the soils at the drilling location to support the structure. The ability of the soil and the structure to withstand the environmental forces, and the identification of any limitations, are important to ensure safe operations.
- **Well planning:** Well planning includes the appropriate wellbore casing and cementing designs. Well design takes into account the proposed well depth and geological conditions, the type of casing and cement, and maximum anticipated pressures. Other well design considerations include offset well data and the potential for gas and

overpressures. Preestablished test frequencies of the casing, cement, and formations are required by MMS as part of the well design. Well planning and tests are reviewed by the MMS to confirm the adequacy and integrity of a wellbore design.

- **Drilling mud:** Properly designed drilling-mud systems are critical for ensuring wellbore stability and temperature and pressure controls. A mud system is developed by the lessee based on expected downhole conditions and is reviewed by MMS as part of the well plan. Adequate mud supplies must be on the rig or readily available to ensure the ability to maintain well control. A ready-mixed heavyweight mud system, called kill mud, must always be available in reserve as a contingency for unexpected downhole conditions.
- **Mud logging and measurement while drilling:** Improved equipment and technology contributes to real-time information on downhole conditions and to increased safety. Improved accuracy and sophistication of equipment for monitoring wellbore and drill string parameters provides an early warning of abnormal downhole conditions which could cause possible well control problems.
- **Drilling unit fitness:** Approval of the drilling unit is part of the drilling-permit review and approval process. The lessee must provide information and any supporting evidence to the MMS that the drilling rig and equipment are capable of performing the proposed activity at the proposed drilling location under all anticipated environmental conditions. The fitness is verified through MMS analyses and inspection of the safety systems and drilling-unit design certifications. In some cases, the MMS requires third-party review and certification, especially for new or untried technology. For mobile offshore drilling units such as semisubmersibles and arctic caissons, the lessee is required to obtain a U.S. Coast Guard (USCG) Letter of Compliance and Certificate of Inspection as proof of the operating capability of the unit.
- **Blowout prevention (BOP) systems:** The BOP systems are designed and installed to ensure well control and are tested weekly to prove that they are properly operating. Redundancy within the BOP system is required by the MMS to ensure safety and reliability. Multiple pipe rams and a shear ram capable of cutting drill pipe, an annular preventer(s), redundant controls (including

multiple remote control panels), and redundant choke/kill lines are required. In some instances, completely redundant BOP stacks are kept in the proximity of the drilling location. Specially designed BOP operating fluids or the use of nonfreezing fluids are necessary for protection of the system from freezing.

- **Drilling personnel training:** Training requirements are outlined in the MMS regulations for all personnel associated with the drilling operation. The MMS requires training in safety and well control, in the marine safety requirements, and in health and safety rules administered by the USCG.

The MMS has been certifying well control personnel for 15 years through a program that focuses on basic and periodic refresher training. The drilling personnel training must be completed prior to working on the OCS. The training requirements involve hands-on and written testing designed to ensure that drilling personnel are capable of operating safety systems and implementing well control procedures.

A worldwide blowout database, compiled and analyzed by well control specialists Neil Adams Firefighting Incorporated (NAFI), indicates that there has been a sharp reduction in blowouts beginning in 1978 (Adams and Kuhlman 1993). The trend can be attributed to the MMS well control training requirements, according to the NAFI study. The reduction in blowout frequency occurred at a time of increased drilling activity offshore. A similar decline in well workover and completion blowouts is expected to follow the 1988 promulgation of MMS regulations covering training for those activities, but no data have yet been analyzed.

- **Well control drills:** Weekly well control drills with variations of personnel and situations are required. These drills ensure the preparedness of the rig crews to deal with a well control emergency, and these are in addition to other safety training and drills (fire, oil spill, hydrogen sulfide, abandon ship, etc.).
- **Special operations contingency plans:** The Alaska OCS Region requires the submittal of a special contingency plan for curtailing operations, referred to as a critical operations and curtailment plan (COCP). A COCP details the criteria and structured procedures for suspending operations and ultimately securing the wellbore prior to environmental conditions which could exceed the operating

limitations of the drilling unit. For floating drilling units, the COCP further details the conditions and procedures for disconnecting and moving the unit off location after the well has been secured, should the environmental conditions exceed the floating drilling unit's capability to maintain station.

Curtailment of operations consists of various stages of alerts indicating the deterioration of meteorological, oceanographic, or wellbore conditions (Figure 1). Higher alert levels require increased monitoring, the curtailment of lengthy wellbore operations, and, if conditions warrant, the eventual securing of the well. If conditions improve, operations could resume based on the limitations established in the COCP or by the district supervisor for the known environmental conditions.

A COCP relies on a combination of factors, including the monitoring and forecasting of meteorological and oceanographic conditions, the well status, and the type and mechanics of wellbore operations. These factors are analyzed on site through a decision-making process outlined in the COCP. The emphasis is on making real-time, situation-specific decisions based on available information. Ensuring adequate time to safely and efficiently suspend operations, secure the well, and if appropriate, move off location is a key component of the COCP. Time requirements are reviewed and analyzed as environmental conditions and the types

Alert Level	Meaning	Drilling Response	Support Response
↓ Increasing Alert	↓ <i>Deteriorating env. or well conditions; Decreasing time available to secure well in advance of hazard condition.</i>	↓ <i>Increasing restrictions on wellbore activities</i>	↓ <i>Increasing: Surveillance Monitoring Forecasting Ice breaking</i>
↓	↓	↓	↓

Figure 1. Alert level table.

of wellbore operations change. Extensive monitoring of the environmental conditions is conducted to ensure early warning of potential and impending hazardous situations.

The organization and responsibilities of the drilling unit and support vessel staffs are detailed in the COCP. Clearly defined responsibilities for the drilling contractor, marine support, and operator staffs are part of the successful implementation of the COCP.

The COCP describes emergency suspension and securing procedures in addition to the orderly and structured procedures established for normal operations. These emergency provisions are necessary because of the unpredictable downhole and environmental conditions which could be encountered.

- **New technology:** There are many recent technical advances which have improved the safety of drilling operations. Some of these are directly related to drilling and drill rig safety, including computer application and automation of safety sensing devices and equipment. Such things as abnormal pressure prediction or detection through seismic data analysis or drilling measurements, automated drill pipe handling equipment, and top drive or improved rotary swivel equipment are examples. Improved technology applies to every aspect of drilling, and these developments contribute directly or indirectly to safer operations. A high level of ongoing research and development is expected to contribute significantly to increased safety in the future. Efforts following major accidents also improve safety through investigative evaluations and hazards analysis involving all sectors of the work force.
- **Inspection:** The Alaska OCS Region conducts on-site inspections to ensure that operations are in compliance with MMS regulations, stipulations, and approvals. Drill rig and equipment inspections prior to commencement of operations and periodic visits to the facility to conduct planned and unplanned evaluations make up the inspection program. The inspection program involves checking safety equipment, witnessing activities, and reviewing records for periodic testing and actuation to ensure that the various types of equipment are in proper working condition.

The MMS also actively audits approved training facilities with both announced and unannounced inspections. Periodic audits help ensure the adequacy of training facilities and programs.

- **Safety and environmental management program (SEMP):** The MMS has begun looking into comprehensive safety management through the SEMP (Bartholomew 1993). The purpose of the SEMP approach is to reemphasize that OCS lessees are responsible for ensuring the safety of their operations and facilities. The SEMP documents a company's management system for ensuring that operations are conducted in a safe and environmentally sound manner.

The MMS has decided not to publish SEMP as regulation at this time. Industry, through the American Petroleum Institute, has published Recommended Practice (RP) 75, "Recommended Practices for Development of a Safety and Environmental Management Program for Outer Continental Shelf Operations and Facilities" for voluntary implementation. One provision of both RP 75 and SEMP is a systematic training program. The program goes beyond current required training, much of which is device oriented and should be designed to educate employees about potential hazards, safe work practices, emergency response, and the like. The MMS intends to monitor the acceptance and success of RP 75 to determine whether voluntary compliance meets the goals of SEMP.

- **Production safety systems:** Surface and subsurface safety valves must be installed in all wells capable of production (whether they are producing or not), injection wells, and pipelines. These valves are among the most significant production related equipment responsible for oil spill prevention. Safety valves are designed to shut in wells or pipelines as appropriate when abnormal conditions occur which could lead to an oil spill. Special provisions apply to the design and installation of safety systems in the arctic. Periodic testing, inspection, and maintenance of safety valves are required by MMS regulation.

The MMS prevention regulations specify requirements for emergency shutdown devices, leak detection, pressure-sensing equipment, and other platform safety systems. Basic and refresher training courses in production safety systems are also specified for personnel involved in the installation, maintenance, testing, and repair of OCS safety systems. The goal is to improve safety and pollution prevention through visual and hands-on instruction.

The MMS incorporates by reference several quality assurance programs for safety devices installed in wells and on platforms. The purpose is to ensure pollution prevention equipment is properly manufactured, installed, and maintained.

### Summary

The MMS continually assesses its regulatory program, emphasizing accident and oil spill prevention and planning requirements. Technical constraints, difficult operating conditions, and unique environmental issues and concerns associated with Alaska OCS operations are challenging; however, more than three decades of Alaskan exploration and production activities have demonstrated that these challenges are not unmanageable problems. Continued emphasis on prevention by the MMS and the hydrocarbon industry will ensure that future operations are conducted in a safe and environmentally sound manner.

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# The Development of an Oil Spill Contingency Planning Evaluation Model

Faisal H. Abordaif

7621 Virginia Lane, Falls Church, VA 22034

John R. Harrald

The George Washington University  
2130 H Street NW, #632, Washington, DC 20052

## Abstract

The initial response to an oil spill can in itself determine the effectiveness and success of the entire response effort. The development of a contingency plan prepares an organization to quickly mobilize, organize, and control the response.

Most organizations use contingency plans to prepare for emergencies. In the oil industry, for example, contingency planning is called for by government regulations contained in the Oil Pollution Act of 1990 (OPA 90). However, it has been commonly observed that during an actual response there is inevitably a shift away from the organizational forms and actions delineated in the established contingency plan. This deviation from stated procedures is often so dramatic that the original plan becomes of limited use.

The purpose of this research is twofold: (1) to develop a decision-making model that can be used to evaluate contingency plans; and (2) to identify, categorize, and synthesize the critical factors that lead to the shift from the original contingency plan during an actual response.

Using the results of the pilot test elements of the oil spill response process, we identified and categorized a hierarchical structure. The model was tested by the response to the *Exxon Valdez* oil spill, as a case study, and the four main contingency plans that were in effect. These plans were measured against a hypothetical "adequate plan" which was predefined. The Analytical Hierarchy Process (AHP) represented an ideal tool for this purpose. Expert Choice software was used to build a hierarchy that employed the pairwise comparison technique. The input of field experts was used to calculate and establish priorities and weights of different factors affecting the success of an actual contingency plan.

Findings included ranking of the contingency plans that were activated during the *Exxon Valdez* oil spill. Furthermore, the factors influencing the success of these plans were synthesized, and their relative importance to each of the plans was obtained.

## Introduction

Disasters, both technological and natural, have inflicted great agonies upon the world, claiming thousands of lives and causing billions of dollars in damage. A combination of human error and hazardous technology led to the 1984 disaster in Bhopal, India, where more than 2,000 people were killed and 200,000 more were left horribly injured. Other notable man-made disasters of the last decade include the 1989 wreck of the tanker *Exxon Valdez* in Alaska's Prince William Sound and the 1991 spilling of many millions of gallons of oil into the Arabian Gulf. More recently, catastrophic natural disasters such as hurricane Andrew's devastation of Florida in 1991 and the earthquake and aftershocks that shook southern California in early 1994 still loom large in our memories.

As the level and scope of technology grows, the potential for more frequent and even greater disasters also increases. This increasing vulnerability to catastrophic events requires that a closer look be taken at the probability and possible effects of their occurrence, however complicated this task may be. A natural disaster may in turn lead to a technological disaster or disasters, making an already challenging situation even worse. A natural disaster such as an earthquake, for example, might cause major ruptures in natural gas lines; a hurricane might lead to an oil spill.

## Statement of the Problem

The process of managing disaster or crisis situations is a complex field involving all sorts of different conditions from political upheavals to airplane crashes. Disaster management, a subarea of crisis management, is a complex field involving a broad array of types of disasters and many layers of participants of varying expertise and backgrounds.

The initial response to a disaster can, in itself, determine the effectiveness and success of the entire response effort. In crisis management, the initial response involves three overall functions: (1) mobilization, (2) forming the response organization, and (3) directing the initial response actions (Harrald 1993). The development of a contingency plan prepares an organization to quickly pass through these three stages.

Most organizations use contingency plans to prepare for emergencies. In the oil industry, for example, contingency planning is called for by government regulations such as the U.S. Oil Pollution Act of 1990. However, many observers agree that during an actual response effort there is always a shift away from the organizational structures and actions outlined in established contingency plans; this, in turn, causes a deviation from the original plan which is often so dramatic that the plan becomes of limited use.

Government requirements for contingency planning should be coupled with directions for better planning. It would seem an almost pointless and costly exercise to spend valuable time and resources to develop contingency plans that cannot be evaluated for effectiveness before an actual emergency.

Following the responses mobilized to deal with the aftermath of hurricane Andrew and the *Exxon Valdez* oil spill, much criticism was directed at the effectiveness of the national and regional contingency plans that were in place, which were supposedly constructed with "worst-case scenarios" in mind. In particular, the organization and tactics organized to deal with these events differed greatly from those outlined in preconceived contingency plans (Cohn et al. 1991, Harrald et al. 1990, Harrald et al. 1992, Carley and Harrald 1993).

### Purpose of the Study

This research set out to develop a decision-making model capable of evaluating contingency plans and, furthermore, to identify, categorize, and synthesize the factors that lead to deviation from established contingency plans.

The researcher attempted to answer the following questions in this study:

- Can the critical factors that contribute the most to the failure of a contingency plan be identified?
- Can a model be developed to prioritize these critical factors?
- Can this model be used to evaluate oil spill contingency plans?

### Methodology

#### Overview

As discussed earlier, the researcher undertook a descriptive, historical, and experimental study of the 1989 *Exxon Valdez* oil spill. Because of the relatively small number of books and monographs written on this topic, excluding some in the general area of crisis management, the author relied mainly on original source documents, secondary source documents, interviews, and the results of questionnaires. The use of documents such as the actual contingency plans used during the 1989 spill provided a unique and valuable source of information. In general, this study benefited from several excellent sources of information, including the Oil Spill Public Information Center in Alaska. This Center provided access to special

collections and primary sources such as final reports, contingency plans, and newspaper clippings. Other sources of information used in this research include the reference library of the American Petroleum Institute, and resources available at the Environmental Protection Agency (EPA) and the U.S. Department of Transportation (DOT). Both EPA and DOT provided many of the references needed for this study. In addition, by meeting with experts in the field at conferences and conducting personal interviews with them, the researcher was able to make use of firsthand knowledge and experience in the area of inquiry. In all these ways, the author was able to establish a network of references and contacts which would be difficult to duplicate. The term "experts" in this study refers to persons from the sectors of government, industry, and academia who are well known and active in the area of oil spill management.

### Identification of Critical Factors

Factors leading to deviation from established contingency plans were identified after careful study of reports written about the 1989 *Exxon Valdez* incident and by conducting interviews with informed sources. What follows below is a discussion of these factors, which were grouped under three general areas: internal factors, external factors, and spill specific factors.

#### *Internal Factors*

Internal factors are defined as those factors which influence response efforts but are specific to the response organization. (The response organization is the entity handling the response, e.g., Exxon, United States Coast Guard (USCG), etc.) The response organization can control such factors. Internal factors are grouped under the following four subcategories: resources, planning, mobilization, and organization and leadership.

#### *External Factors*

External factors include the following: media, politics, and stakeholders. They can influence the response efforts, but the response organization cannot control them.

#### *Spill Specific Factors*

Spill specific factors include location, magnitude, and environment specific to a particular spill that influence the response efforts. It is very difficult to control or mitigate these factors.

## The Experiment

### Analytical Hierarchy Process

As discussed earlier, the basic components of an initial response to an oil spill were grouped in a hierarchical structure. The Analytic Hierarchy Process (AHP), a multi-criteria decision making process, makes dealing with both tangible and intangible factors possible. AHP involves a relatively simple and intuitive approach and can be used to handle a wide variety of elaborate problems.

AHP operates in a way comparable to the method of the human mind by sorting the elements of a complex situation into like groups, which are considered for their common properties and arranged into levels in a hierarchical system. Higher levels may be obtained by repetition of this process until a single highest element is distinguished as the goal of the decision-making mechanism. In order to identify the influence of individual elements at the lowest levels of the hierarchy on the highest level, the elements or factors are prioritized through a sequence of pairwise comparisons, which lie at the core of AHP (Saaty 1988).

There are four steps involved in using AHP. First, a decision hierarchy must be constructed by identifying and grouping among interrelated decision elements. The second step calls for collecting input data by pairwise comparisons of decision elements. Third, the "eigenvalue" method is used to estimate the relative weights of decision elements. Finally, the relative weights of decision elements are aggregated to derive a set of ratings for the decision alternatives (Zahedi 1986).

There are three major concepts behind AHP: analytic, hierarchy, and process.

#### *Analytic*

In general, AHP uses a quantitative approach to arrive at a decision (whereas holistic decision making does not use numbers, a choice is simply made among several alternatives). Using mathematics to understand and/or describe to others the basis of a choice has advantages (Harker 1988).

#### *Hierarchy*

The problem is broken down into levels corresponding to different parts of the situation: goals, criteria, sub-criteria, and alternatives. Although complicated, the hierarchical evaluation process is useful when the goal is not only to isolate the primary factor which led to the failure of the plan, but also to compare the plan with other plans. The uppermost level

of the model contains the goal node. In this case, the goal entails prioritizing the factors that lead to failure of contingency plans. Factors such as scenarios are represented at an intermediate level. In this case, this level depicts the categories or grouping of the factors. The lower level of the model includes the alternatives, which, in this case, constitute the five main contingency plans activated during the 1989 *Exxon Valdez* oil spill. Data must be organized in a logical, hierarchical structure.

### *Process*

In general, major decisions require more than a single meeting to be resolved. The AHP, despite its advantages, must work within the basic limitations inherent in group decision making. People need time to think about a decision, gather information, discuss consequences, etc. Thus, actual decision making is a complex process involving learning, negotiating, and compromise (Harker 1988).

### Expert Choice

Expert Choice is a software package developed by Ernest Forman to implement AHP. It makes it possible to look at the elements of a problem in isolation using pairwise comparison where one element is compared against another with respect to a single criterion. This feature was used in this application to evaluate the relative importance of the factors. Expert Choice helps structure the problem, prompts the user with options, and synthesizes or combines all judgements into a unified whole in which the alternatives are clearly prioritized from high to low.

### Model Building

Model developing is more an art than a science. The credibility of any given model is derived from the credibility of the model developer. The role of AHP (Expert Choice) is to act as a "guiding-hand" for model developers (Harrald 1988). The identified factors were analyzed to form a hierarchical model (see Figure 1). A decision tree model developed by the four-step-process recommended by AHP was used. The four steps are described as follows.

### *Gathering Information*

Quantitative information can be obtained from primary and secondary sources. Subjective information, on the other hand, is derived from subjects' interpretations of quantitative information and from the model developer's views regarding the given problem. In situations where the model developer will try to validate his model based on an expert's views,

the issue of subjectivity can arise if the developer is unable to adequately describe the process to the decision makers. Such problems can be addressed by seeking the involvement of the users (experts) in the actual development of the model.

### *Hierarchy Development*

The aim here is to break the problem down into its major components in a manner that enables the decision maker to address specific portions of the problem. The model used in this study, for example, was aimed at evaluating contingency plans by ranking them; thus, the goal was placed at the top level of the hierarchy.

The main factors (or criteria) for evaluating a contingency plan are: internal factors, external factors, and spill specific factors. These categories are placed in the second level of the hierarchy. Sub-factors are placed in the lower levels of the hierarchy, and so on. For example, internal factors may be separated into four sub-criteria: resources, planning, mobilization, and organization. Each of these factors will further be broken down into sub-criteria. The fourth level of the internal factors comprises the elements from which that area is formed. Finally at the bottom level of the hierarchy (alternatives) are the four contingency plans under discussion, i.e., the Exxon, Alyeska, USCG, and Alaska Department of Environmental Conservation (ADEC) contingency plans. A fifth plan, "adequate," was added so that participants would have a unified plan against which to make comparisons. Experts define an "adequate" plan as one which can facilitate an initial response which restricts the spilled oil to a pre-decided area. In the 1989 *Exxon Valdez* oil spill, this area was determined by the experts to cover an area described by a 10 to 15 mile radius of the spill site.

### *Pairwise Comparisons*

Objective as well as subjective comparisons between any two elements in a given hierarchy are allowed. Three modes of comparison are available: the importance of one element over another, the likelihood of occurrence of one element over another, and the preference of one element over another. Going back to the model constructed for this study, the factors in the second level of the hierarchy can be compared according to their importance. For example, one might feel that the internal factors are three times as important as the external factors. After making all comparisons, a final ranking of the factors can be obtained.

AHP provides a scale of 9 as a basis for comparisons between any two elements:

- 1 Indicates equal importance of two elements
- 3 Indicates weak importance of one over the other
- 5 Indicates strong importance of one over the other
- 7 Indicates demonstrated importance of one over the other
- 9 Indicates absolute importance of one over the other
- 2,4,6,8 Indicate intermediate values between two adjacent judgments.

### Synthesizing

The use of Expert Choice sidesteps the mathematical approach of synthesizing. In brief, synthesis involves the incorporation of the elements of a given hierarchical level into a matrix, the comparison of its elements, and the derivation of a single number indicating the priority of each element in relation to the factor at hand.

### The Questionnaire

Based on the results of a pilot test and use of Expert Choice, the questionnaire was redesigned and divided into two parts. The first part,

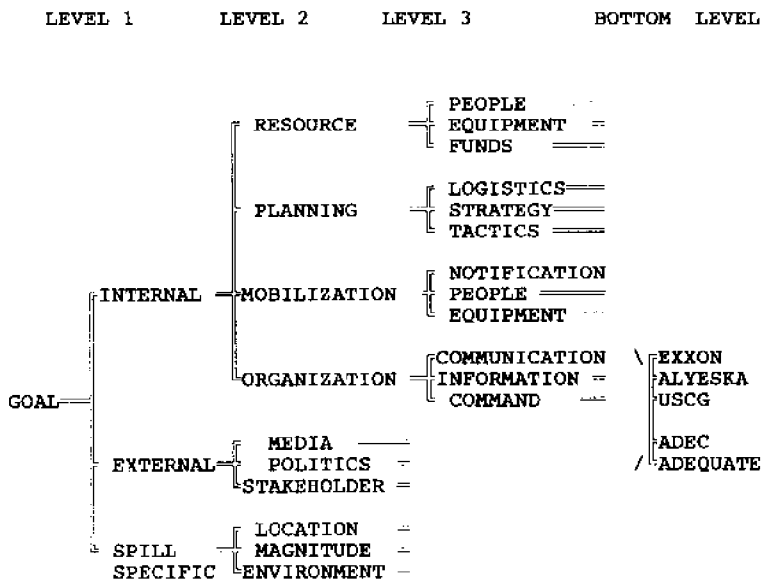


Figure 1. A graphic representation of the model (condensed). The goal: prioritizing critical factors and evaluating oil spill contingency plans at the bottom level.



questions 1 through 8, covered elements common to contingency plans. As discussed earlier, the elements or the factors were grouped into a hierarchy; then, by generating pairwise comparisons, tables were generated to solicit expert opinions on the importance of these factors with relation to each other. The second part, questions 9 through 26, dealt specifically with the four main contingency plans that were in effect during the *Exxon Valdez* oil spill: Exxon, Alyeska, ADEC, and USCG. Each of these plans was compared with respect to one area of planning (for example, resources) and measured against a bench mark "adequate plan." Experts have defined the "adequate" plan as one which can carry out an initial response restricting the spilled oil to a designated diameter area around the spill source. After the *Exxon Valdez* accident, the U.S. Coast Guard commissioned many studies on the status of contingency planning. In a recent USCG report, the guidelines for an adequate plan were described as being based on a worst-case scenario. Other items in the report are:

- Evaluators should be at the scene within two to three hours.
- Mount a fully operational clean-up effort within 48 hours of the spill.
- Mobilizing needed equipment should be pre-decided.
- Pre-identify sensitive areas and protection methods (Epler 1991).

Each table has an introduction, question, table of comparisons, and definitions of terms used. The participants were asked to read each question and then select a number on a scale that would best represent the level of importance of one side of the comparison over the other. If both sides are equally important, the number 1 is selected, which is in the middle and represents an equal weight of each side of the comparison.

The questionnaire was refined with regard to the *Exxon Valdez* oil spill. During a visit to the U.S. Coast Guard's National Strike Force Coordination Center in Elizabeth City, North Carolina, the researcher, in addition to making arrangements to participate in the upcoming drill and a workshop sponsored by the Marine Safety Office in Anchorage, Alaska, September 23-24, 1993, conducted a number of interviews to support the basic assumptions and methodology. The workshop provided an excellent opportunity for this study because it was conducted in the same state where the *Exxon Valdez* oil spill happened. Furthermore, most of the participants in the workshop were involved in either the development of some of the contingency plans that were in effect during the *Exxon Valdez* oil spill, or were involved in the response efforts. Their input was very

enriching to the research. Firsthand interviews with people that were actually there during the first few hours of the spill were important. With the help of the university, the researcher attended this important drill and workshop.

### Data Collection

Data were collected from planners, implementers, and observers from government and industry who, for the most part, were involved with the 1989 *Exxon Valdez* oil spill in Alaska's Prince William Sound. Another set of questionnaires was mailed to key participants in the *Exxon Valdez* oil spill response who had relocated away from Alaska. The researcher compiled a mailing list of the participants based on research and referrals.

The final questionnaire was distributed during a workshop sponsored by the USCG Marine Safety Office in Anchorage, Alaska, on September 23-24, 1993. Most of the persons attending the workshop belonged to organizations that participated in either the drafting of some of the contingency plans that were in effect during the *Exxon Valdez* oil spill, or were involved in the response efforts. The input of the workshop participants greatly enriched the outcome of this research. Interviews with people that were actually on hand during the first few hours of the massive spill provided important details.

A scenario closely resembling real conditions was constructed, and each participating agency took part in the response effort as if it were an actual emergency. This setting allowed the researcher to follow the minute-by-minute progress of response efforts and also gave the opportunity to ask questions of the participants about various actions taken and decisions made during the response.

### Sample Size and Response

The targeted population was made up of persons who took part in the response efforts for the *Exxon Valdez* oil spill either as planners, implementers, or observers. To ensure that all relevant organizations were represented and a high proportion of decision makers were sampled, a group of about 100 expert participants covering most of the participating agencies and organizations was deemed adequate. Thirty responses to the final questionnaire were collected by the researcher, which amounted to over 50%. As in any questionnaire, getting people to respond was not easily accomplished. The questionnaire consisted of tables of pairwise comparisons which require the participants to think of two elements at a time in isolation of other factors. The comparisons were constructed based on the hierarchy of all the factors and the plans in question. The hierarchy

had three levels, and every level had number of elements as described earlier.

## Data Analysis

Analysis of the data was divided into two parts. In the first part, the factors will be discussed by running different syntheses to show the factor's behavior with respect to different comparisons. A summary page of the factors is also provided. In the second part the four contingency plans are discussed with analysis of the overall evaluations of the plans compared to the adequate plan, and also to other node comparisons as well. For example, plans were evaluated with respect to the internal factors only. A formula to calculate relative performance is also given in the first part along with a summary table listing the relative performance of the internal factors for each plan.

### Analysis of Critical Factors

#### *Mobilization (0.165)*

The model in Figure 1 and also in Figures 2a and 2b depicts a hierarchy of all the factors and their weights. As is apparent in the graph, mobilization, which was defined as the ability to deploy resources to the spill site within predetermined time constraints, ranks first in importance (0.165). Mobilization includes three elements: mobilizing response equipment, notification, and mobilizing of response personnel. In the case of the *Exxon Valdez* spill, 10 hours passed after the spill before the first piece of response equipment arrived on the scene. Notification, the process of notifying the response organization, should be clearly recognized and identified as time should never be wasted in a response situation. Mobilizing response personnel must also be done on a timely basis.

#### *Organization (0.152)*

The second most important group of factors was the organizational factors (0.152). These factors were defined as the design of the overall management structure of the response participants and effectiveness of the response and includes communication, information, and command. Communication is defined as the ability of the command units to communicate efficiently and effectively with other units of the various response forces. During the early days of the *Exxon Valdez* oil spill, communications channels proved inadequate. Various response teams thus were forced to use the same frequencies—which resulted in poor communication and confusion—until an integrated system was put in place. Informa-

DISTRIBUTIVE MODE			
LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
INTERNAL =0.553			
.	MOBILIZATION =0.165		
.	.	EQUIPMENT =0.063	ADEQUATE =0.031
.	.	.	USCG =0.010
.	.	.	EXXON =0.009
.	.	.	ALYESKA =0.007
.	.	.	ADEC =0.005
.	.	NOTIFICATION =0.056	
.	.	.	ADEQUATE =0.023
.	.	.	USCG =0.013
.	.	.	ADEC =0.008
.	.	.	EXXON =0.007
.	.	.	ALYESKA =0.006
.	.	PEOPLE =0.046	
.	.	.	ADEQUATE =0.023
.	.	.	USCG =0.007
.	.	.	EXXON =0.006
.	.	.	ADEC =0.005
.	.	.	ALYESKA =0.005
.	ORGANIZATION =0.152		
.	.	COMMAND =0.064	
.	.	.	ADEQUATE =0.033
.	.	.	USCG =0.012
.	.	.	EXXON =0.007
.	.	.	ADEC =0.007
.	.	.	ALYESKA =0.006
.	.	COMMUNICATION =0.056	
.	.	.	ADEQUATE =0.026
.	.	.	USCG =0.012
.	.	.	EXXON =0.006
.	.	.	ADEC =0.006
.	.	.	ALYESKA =0.006
.	.	INFORMATION =0.032	
.	.	.	ADEQUATE =0.015
.	.	.	USCG =0.007
.	.	.	ADEC =0.004
.	.	.	EXXON =0.004
.	.	.	ALYESKA =0.002
.	RESOURCES =0.134		
.	.	EQUIPMENT =0.052	
.	.	.	ADEQUATE =0.017
.	.	.	EXXON =0.014
.	.	.	USCG =0.009
.	.	.	ALYESKA =0.008
.	.	.	ADEC =0.005
.	.	PEOPLE/R =0.051	
.	.	.	ADEQUATE =0.021
.	.	.	EXXON =0.010
.	.	.	USCG =0.009
.	.	.	ALYESKA =0.006
.	.	.	ADEC =0.006
.	.	FUNDS =0.031	
.	.	.	ADEQUATE =0.012
.	.	.	EXXON =0.008
.	.	.	USCG =0.005
.	.	.	ALYESKA =0.004
.	.	.	ADEC =0.002

Figure 2a. Plan success. Sorted details for synthesis of leaf nodes with respect to goal.

tion, the ability to collect, process, and distribute information and data to response forces in a timely fashion, is another organization element that ranks high in importance. The command factor is defined as the ability to deploy and effectively manage the response organization by following a preset chain of commands, policies, and procedures. The command structure was not clearly defined during the initial response to the *Exxon Valdez* oil spill.

## DISTRIBUTIVE MODE

LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
.....	PLANNING =0.102	LOGISTICS =0.049	ADEQUATE =0.024
.....	.....	.....	EXXON =0.008
.....	.....	.....	USCG =0.007
.....	.....	.....	ALYESKA =0.005
.....	.....	.....	ADEC =0.005
.....	.....	STRATEGY =0.029	ADEQUATE =0.013
.....	.....	.....	USCG =0.005
.....	.....	.....	EXXON =0.004
.....	.....	.....	ADEC =0.004
.....	.....	.....	ALYESKA =0.003
.....	.....	TACTICS =0.023	ADEQUATE =0.011
.....	.....	.....	USCG =0.004
.....	.....	.....	EXXON =0.003
.....	.....	.....	ALYESKA =0.003
.....	.....	.....	ADEC =0.002
SPILL SPECIFIC =0.312	ENVIRONMENT =0.129	ADEQUATE =0.070	
.....	.....	ADEC =0.021	
.....	.....	USCG =0.017	
.....	.....	ALYESKA =0.013	
.....	.....	EXXON =0.008	
.....	LOCATION =0.106	ADEQUATE =0.050	
.....	.....	USCG =0.017	
.....	.....	ADEC =0.017	
.....	.....	ALYESKA =0.011	
.....	.....	EXXON =0.010	
.....	MAGNITUDE =0.076	ADEQUATE =0.042	
.....	.....	USCG =0.010	
.....	.....	EXXON =0.008	
.....	.....	ADEC =0.008	
.....	.....	ALYESKA =0.006	
EXTERNAL =0.136	MEDIA =0.055	ADEQUATE =0.031	
.....	.....	USCG =0.007	
.....	.....	EXXON =0.007	
.....	.....	ADEC =0.006	
.....	.....	ALYESKA =0.005	
.....	STAKEHOLDERS =0.047	ADEQUATE =0.025	
.....	.....	ADEC =0.008	
.....	.....	USCG =0.006	
.....	.....	EXXON =0.004	
.....	.....	ALYESKA =0.004	
.....	POLITICS =0.034	ADEQUATE =0.019	
.....	.....	USCG =0.005	
.....	.....	ADEC =0.004	
.....	.....	EXXON =0.003	
.....	.....	ALYESKA =0.003	

Figure 2b. Plan success. Sorted details for synthesis of leaf nodes with respect to goal.

### Resources (0.134)

Resources represent the main component of crisis management and include all the equipment that is physically needed to carry out a response effort, such as computers, communications systems, hardware, etc. Resources also include personnel such as managers, supervisors, operators, technicians, laborers, and other staff. All of the mentioned resources cannot be provided without proper financial support; thus, proper financial

arrangements are of the utmost importance in carrying out an effective response. However, in this analysis, resources ranked third with 0.134. The argument can be made that a resource decreases in importance if it cannot be mobilized in a timely fashion. Yet, some might argue that without resources there would be nothing to mobilize, which is also a valid argument. It is important to reiterate that this study focused on one specific oil spill—the *Exxon Valdez*. Based on numerous reports, the initial mobilization was a main contributing factor to the failure of the response.

#### *Environment (0.129)*

Environment, which was defined as weather conditions, wind speed, status of the sea, and sea currents, are crucial elements that must be factored into response design and tactics. If weather conditions are too severe, the response operation might have to be interrupted. Environment ranked fourth (0.129) just after resources. During the *Exxon Valdez* spill, the use of chemical dispersants was approved just before adverse weather moved in. After a few days, mixing caused by wave action and wind turned the oil into mousse which was difficult to remove but less toxic to the environment. Had calm weather continued for a few more days at that time, a lot of the spilled oil would not have reached the shoreline and, thus, the damage from the spill would have been reduced.

#### *Location (0.106)*

Fifth position was occupied by location (0.106), which was defined as the spill's longitude and latitude, and the spill site's proximity to supporting infrastructure facilities such as airports, telephone lines, accommodations, etc. The *Exxon Valdez* oil spill occurred in a remote location near Prince William Sound—the nearest town had only 4000 residents and one small airstrip. The nearest large airport was located in Anchorage, which was a nine-hour drive away. Proximity to environmentally sensitive areas such as wildlife habitats and fisheries is also an important location factor. The *Exxon Valdez* oil spill occurred in an area very rich in assemblages of seabirds, marine mammals, fish, and other wildlife. In some places of the 700 miles of shoreline damaged by the spill, oil was found to have accumulated to levels three to four feet deep. Moreover, parts of the shoreline were made up of gravel and cobble, which allow maximum penetration of oil.

#### *Planning (0.102)*

Planning (0.102) followed location by a narrow difference. Planning included long-term strategies and short-term tactics and procedures. Planning also included logistics to utilize response resources.

### *Magnitude (0.076)*

Magnitude came next with (0.076). Magnitude was defined as the amount and type of oil spilled and possibly yet to be spilled and constituted a major factor in deciding the size and type of response personnel and equipment needed. Because different types of oil behave differently with water, information concerning characteristics like spreading, evaporation, emulsification, dispersion, dissolution, oxidation, and movement must be considered in the design of an appropriate strategy for combating a spill. The oil spilled from the *Exxon Valdez* was Prudhoe Bay crude oil, which has a high evaporation rate and is known to be rich in the most toxic components of oil, i.e., volatile hydrocarbons such as benzene and toluene. This spill covered over 1000 square miles and reached 90 miles from the wrecked tanker. The contingency plans that were active at the time of the spill did not consider such spill size. New regulations require contingency plans to be based on a worst-case scenario, which is normally described by a full cargo on a larger vessel in unfavorable weather.

### *Media (0.055)*

Media reaction to the spill can influence the response efforts (0.055). Information about the impact of the spill and response efforts must be communicated to the media in a timely and accurate manner. During the *Exxon Valdez* crisis, the reporting in the media did not accurately reflect what really took place. For example, some reporters relied on unauthorized sources and used exaggerated statements like "worst disaster in history." It is useful to note that this factor is not under the control of the response organization, yet proper public relations and accurate information sharing will always help the media to be more precise in its reporting of events. Having officials available for interviews minimizes the appearance of inaccurate statements in the media.

### *Stakeholders (0.047)*

Stakeholders include organizations and individuals, such as land owners and people affected by the spill, who have an interest or "stake" in the results of the spill response. They frequently want to take part in the response and may voice opinions on some of the cleaning methods and some other critical decisions. Their involvement in the decision-making process should be taken into consideration as part of the contingency plan (0.047). Decisions like the use of dispersants or oil burning could very much be disrupted by stakeholders rendering a response interruption.

### Politics (0.034)

The influence of politicians on the response has the potential to be very damaging (0.034). Media attention, stakeholders, and public concern may bring about a high level of involvement on the part of elected officials. Politicians' reactions to the spill affects and the response efforts need to be accounted for in the contingency plan. In brief, as one observer put it, "Oil and politics don't mix." Politicians are not known to follow set contingency plans, and their involvement is better described as imperative.

### Contingency Plan Analysis

In this part, performance of the contingency plans is evaluated with respect to the adequate plan. It will be called the relative performance rate ( $R$ ), which can be calculated by dividing the priority rate of the plan in question over the priority rate of the adequate plan.

The relative performance rate can be given by the following formula:

$$R_i = \frac{P_i}{A}, 0 \leq R_i \leq 1$$

- $R_i$  = relative performance of the  $i^{\text{th}}$  plan
- $P_i$  = priority of the  $i^{\text{th}}$  plan
- $A$  = adequate plan
- $i$  = US (USCG),  
EX (EXXON),  
AD (ADEC),  
AL (ALYESKA).

Another way of looking at the evaluation scale is the inadequacy ratio ( $D$ ). The inadequacy ratio could be given by the following formula:

$$D_i = 1 - R_i, 0 \leq D_i \leq 1$$

- $D_i$  = inadequacy ratio of the  $i^{\text{th}}$  plan

Figure 3 presents a graphical representation of the contingency plans under discussion with respect to the goal. The goal is the evaluation of the plan's overall performance. The adequate plan had the highest priority rate (0.486) which was expected not only at the overall comparison but also in level to level comparisons.



USCG Captain of the Port of Prince William Sound came in second with priority ratio of (0.161). According to the data collected, this plan was the closest to the adequate plan with a relative performance of  $R_{CS} = 33\%$  in the overall rating. Another way of expressing the performance is by the inadequacy rate, which is  $D_{US} = 67\%$ . What follows explains how these percentages were derived.

The USCG plan had the highest relative performance ratio in 18 criteria; it also displayed about average relative performance in the rest of the criteria.

Both the Exxon and ADEC contingency plans fell into second position with overall evaluations of (0.128) and (0.122), respectively, and  $R_{EX} = 26\%$  and  $R_{AD} = 25\%$  with one point difference. However, as mentioned earlier, the ranking differed according to the level at which the comparisons were performed (see Table 1). However, the Exxon contingency plan had the highest relative performance rate in five criteria. These criteria were resources, response people, response equipment, funds, and logistics. At the same time, Exxon's plan also had the lowest relative performance in four other criteria: environment, location, spill specific, and politics. For the rest of the criteria, Exxon was about average.

ADEQUATE

0.486

---

USCG

0.161

---

EXXON

0.128

---

ADEC

0.122

---

ALYESKA

0.104

---

Figure 3. Plan success. Synthesis of leaf nodes with respect to goal. Distributive mode. Overall inconsistency index = 0.02.

Table 1. Relative performance ratio table.

	USCG	EXXON	ADEC	ALYESKA
GOAL	0.33	0.26	0.25	0.21
Internal	0.40	0.35	0.23	0.25
Resources	0.45	0.65	0.26	0.37
People	0.42	0.48	0.28	0.30
Equipment	0.53	0.81	0.28	0.48
Funds	0.39	0.71	0.18	0.32
Planning	0.33	0.31	0.23	0.23
Strategy	0.38	0.31	0.28	0.28
Tactics	0.31	0.28	0.21	0.24
Logistics	0.31	0.32	0.21	0.22
Mobilization	0.39	0.29	0.23	0.24
People	0.32	0.28	0.21	0.20
Equipment	0.32	0.29	0.16	0.23
Notification	0.56	0.32	0.34	0.28
Organization	0.41	0.23	0.22	0.19
Communication	0.46	0.24	0.22	0.22
Information	0.44	0.26	0.28	0.16
Command	0.36	0.20	0.20	0.18
External	0.25	0.19	0.23	0.16
Media	0.24	0.22	0.18	0.16
Politics	0.25	0.17	0.20	0.17
Stakeholders	0.25	0.18	0.31	0.17
Spill Specific	0.27	0.17	0.29	0.19
Location	0.35	0.21	0.34	0.23
Magnitude	0.25	0.20	0.20	0.15
Environment	0.24	0.12	0.30	0.18

The ADEC contingency plan had the highest relative performance ratio in three criteria only. These criteria were spill specific, stakeholders, and environment. This plan had the lowest relative performance in 12 other criteria, and was about average in 11 criteria.

Finally, the Alyeska Pipeline Service Company contingency plan received a value (0.104), with  $R_{AL}=21\%$ . The Alyeska contingency plan ranked average in 12 criteria, with the lowest relative performance rate in the remaining 14 criteria. It is important to remember that all of these rates

are based on the sample population, for one specific incident, and were measured against an "adequate plan," which was defined as the plan that restricts the oil spill to a pre-decided area from the spill source.

## Results

This research addressed the following three major questions:

- Can the critical factors that contribute the most to the failure of a contingency plan be identified?
- Can a model be developed to prioritize these critical factors?
- Can this model be used to evaluate oil spill contingency plans?

With respect to the first question, the factors were identified based on the literature review, interviews, questionnaires, and a case study of the *Exxon Valdez* oil spill. These factors are listed in Table 2. These factors were analyzed and grouped and then were used to form the hierarchical evaluation model.

With respect to the second question, a hierarchical model was developed and structured. Using a pairwise comparison questionnaire, a group of experts helped in comparing the factors against each other. The questionnaire results were analyzed using Expert Choice. Table 2 is a summary of the relative importance rates for each factor. The table also indicates the priorities of these factors resulting from the analysis.

This research has concluded that these factors were the most important factors contributing to the success or failure of the contingency plans. It should be emphasized that this research was based on a case study of the *Exxon Valdez* oil spill, and that the particular conditions surrounding other spills might differ. Further research could be conducted on the evaluation of the relative performance ratios, and whether or not acceptable standards using these ratios can be developed.

In addressing question three, the model was tested by evaluating the four main contingency plans that were in effect during the response to the *Exxon Valdez* oil spill. These plans are the USCG Captain of the Port of Prince William Sound contingency plan (USCG), Alaska Department of Environmental Conservation contingency plan (ADEC), Exxon Company contingency plan (Exxon), and Alyeska Pipeline Service Company contingency plan (Alyeska). To further investigate the adequacy of the plans, simple formulas were derived to calculate relative performance.

A summary of the overall relative performance follows:

33%	USCG
26%	Exxon
25%	ADEC
21%	Alyeska

These evaluations were based on pairwise comparison of each plan against a hypothetical plan named "adequate," which was predefined as the plan that ensures the restriction of the oil spilled to a pre-decided area around the spill source.

Furthermore, the model can be used for pre-evaluation of contingency plans as well. The following steps describe how this can be accomplished. First, an adequate plan must be defined in order to compare against. The second step is to identify the factors or the elements based on

**Table 2. List of factors contributing to the success of oil spill contingency plans (prioritized).**

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Mobilization (0.165)
Equipment (0.063)
Notification (0.056)
People (0.046)
Organization (0.152)
Command (0.064)
Communications (0.056)
Information (0.032)
Resources (0.134)
Response Equipment (0.052)
Response People (0.051)
Funds (0.031)
Environment (0.129)
Location (0.106)
Planning (0.102)
Logistics (0.049)
Strategy (0.029)
Tactics (0.023)
Magnitude (0.076)
Media (0.055)
Stakeholders (0.047)
Politics (0.034)

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which the plan is evaluated. If these elements or factors are similar to the factors in this research, then the same hierarchy could be used. Otherwise the model is modified to accommodate the new factors. Third, using Expert Choice, tables of comparisons are generated. Fourth, the comparisons are rated by planners (or people who know the plan very well). Finally, the geometric means of the ratings are inferred into Expert Choice, then by the synthesis function priority ratios could be generated. For further analysis the formulas developed in chapter five can be used to calculate the relative performance and the inadequacy rates.

## Summary

As the threat to the environment from oil spill disasters increases, government requirements to develop contingency plans also increase. Various sectors within the oil industry, such as production facilities, oil terminals, oil transporting companies, etc., are complying or trying to comply with these requirements. However, no established method exists for evaluating these contingency plans. The critical need for developing an evaluation method has been substantiated by the encouragement given this research from within the oil industry and, in particular, by the financial support extended by the Marine Spill Response Corporation (MSRC). The model developed by this study provides a method for evaluating oil spill contingency plans which was not only based on sound methodology, but was also tested by evaluating real oil spill contingency plans. The plans that were evaluated were the four main plans that were in effect during the 1989 *Exxon Valdez* oil spill off the coast of Alaska.

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## **Oil Spill Response in the Wake of the *Exxon Valdez* Oil Spill**

**Capt. Don Bodron**

*U.S. Coast Guard*

*P.O. Box 25517, Juneau, AK 99802-5517*

I'm very glad to be here today to discuss with you oil spill response and pollution preparedness, how we see it today as compared with how we were configured five years ago. There have been a lot of changes. We know that we are much more prepared to take on an oil spill of the size of the *Exxon Valdez* today than we were five years ago. We have to be. We are required by law—by the Oil Pollution Act of 1990 (OPA 90).

I've taken a quick look through OPA 90 and will point out some of the main features of the law which are directly related to improved spill response. First listed in OPA 90 are the increases in the limits of liability in the water pollution financial responsibility requirements. This requires that vessels and facilities have greater insurance coverage than they carried five years ago so that there is more money available for a company to pay for cleanup. There are also provisions in OPA 90 for state access to the Oil Spill Liability Trust Fund. The governor of a state may request access to the fund in the amount of \$250,000.00 for removal costs consistent with the National Contingency Plan.

There is authority within OPA 90 for the President, delegated to the Commandant of the Coast Guard and redelegated to the federal on-scene coordinator, to direct all federal, state, and private actions to remove a discharge. This authority to direct a response can be used even if there is a responsible party who is performing the cleanup.

OPA 90 directed the formation of Coast Guard District response groups which consist of all of the Coast Guard forces within a particular Coast Guard District which are to be made available for response in the event of an oil spill. The law directed the pre-positioning of Coast Guard owned pollution response equipment and the formation of District Response Advisory Teams (DRATs) in all 10 Coast Guard Districts.

In Alaska we have OPA 90-funded pollution response equipment pre-staged in Anchorage with our vessel of opportunity skimming system.

We also have staged small amounts of harbor boom, sorbents, skimmers, and pumps in Ketchikan, Petersburg, Sitka, Juneau, Cordova, Valdez, Seward, Homer, Kodiak, and Dutch Harbor. We are in the process of siting some equipment in the Pribilof Islands in the Bering Sea. All of this equipment is staged in an area where there is a Coast Guard presence—a buoy tender, a 110-foot patrol boat, an air station, or a Marine Safety Office. In the event of a spill in the immediate neighborhood, if commercial resources are unable to respond appropriately, this equipment can be rolled out and utilized either by Coast Guard or by contracted personnel. We think this pre-positioning of equipment makes a lot of sense and allows us to be in a better position to respond to more spills in a more timely manner than ever before.

OPA 90 discussed and required area drills and area contingency plans to be prepared. OPA 90 created the two Regional Citizens Advisory Councils in Cook Inlet and in Prince William Sound. One of the purposes of the RCACs is to observe pollution response preparedness and drills and to make recommendations regarding improvements to better respond to spills and other marine incidents. As part of this responsibility the RCACs review vessel and facility response plans and make recommendations concerning their provisions to enhance preparedness. In Prince William Sound, OPA 90 made some specific requirements such as prepositioned oil spill containment and removal equipment at strategic locations within Prince William Sound, escort vessels with skimming capability, barges to receive recovered oil, and pumping, transferring, and lightering equipment. OPA 90 also specifically required practice exercises not less than twice a year in Prince William Sound to ensure that the equipment and the people who operate it are ready and capable of responding when called upon. The things I have mentioned are only what was required by OPA 90 to enhance pollution response preparedness. Locally other things have been put in motion which have enhanced our preparation to deal with a large oil spill.

In the areas covered by the four major oil spill response organizations in Alaska, we have adopted the principles embodied in the incident command system (ICS). We have practiced extensively with a unified command system (UCS) which brings together the responsible party, the federal on-scene coordinator, the state on-scene coordinator, and an organization ready made to deal with operations, logistics, finances, and planning issues vital and necessary to the efficient handling of a large marine spill incident.

One of the biggest confusion factors and major deficiencies of the *Exxon Valdez* spill response was the perception that there was nobody in charge or that the wrong people were in charge. Through the UCS, the



National Contingency Plan remains alive and well with no doubt that the Coast Guard is in charge of a coastal spill and that the other agencies and responsible party, rather than operating from separate camps, will be operating out of the same room in close cooperation and concert, instead of in competition, with each other. Those of us who lived through most of the *Exxon Valdez* spill response know what a tremendous advantage this gives us. Simply stated, we are able to concentrate on fighting the spill rather than fighting with each other. That's got to be a real advantage. Industry has made some improvements in contractual arrangements with air cargo companies who are capable of flying the air deployable dispersant spray systems so that these companies are on six-hour standby to be available to take advantage of the pre-approved dispersant zones in Cook Inlet and Prince William Sound if dispersant use is considered desirable by the federal on-scene coordinator. In this regard, the Coast Guard made some rather historic progress this past summer in flying the dispersant spray pack system in one of our own C-130s. Since we normally have six or seven of these aircraft, based out of Kodiak, in use somewhere in the state, it only made sense that we commence a training and familiarization process for our own pilots and air crews in the use of this equipment. As usual, there should be no concern that the Coast Guard is going into the air cargo business and is trying to compete with private enterprise in the carriage of this equipment. If it ever becomes necessary, the C-130s would only be used as a stopgap measure until the commercial response and commercial aircraft could come online.

I want to return to the discussion of vessel response plans I mentioned previously. OPA 90 required the preparation and submission for approval of vessel response plans by all tank vessels. The deadline date for the submission of these plans was February 18, 1993, and the deadline date for compliance with the plans was August 18, 1993. The guidance for preparing these plans was extensive. Among other things, it did require that a tank ship's contingency plan would include general information about the vessel, notification procedures, shipboard spill mitigation procedures, and shore-based response activities. For the first time, there is a requirement that these shipping companies have thought through in advance what they are going to do in the event of a spill. Many times I have been with the master on a ship which has spilled oil. The master has said to me, "Yes. That is our oil in the water. We spilled it. What do you want me to do now?" When I have told him to hire a contractor to clean it up, the response has been, "I'll be happy to hire someone, but I don't know who to call." We should be way beyond these conversations now thanks to the requirements of OPA 90 for these vessel contingency plans. In the event of a spill, the plans are required to specify by name a "quali-

fied individual" who is empowered to act on behalf of the vessel as the responsible party's on scene commander. There is also a requirement to have identified the oil spill removal organizations with which the owners have contracts to respond to the actual discharge. These contractors are required to be able to respond to a worst-case discharge to the maximum extent practicable or to any other spill event of a lesser magnitude. There is also a scheme for mobilizing response resources on a time-phased deployment schedule called tiers with differing amounts of skimming and storage capacity which should be arriving on scene within 12, 36, and 60 hours of a spill. And there is also a method for determining an effective daily recovery capacity for oil recovery devices; and it goes on and on. The arrangements specified in these contingency plans put us miles and miles ahead of where we were on March 24, 1989.

In preparation, we are orders of magnitude ahead of where we were. But, we should remember that even with all of our new equipment, our carefully calculated skimming and storage capacity, our ability to quickly boom off pre-planned areas, our unified command system and excellent coordination and cooperation and authority to direct efforts, and our ability to tap response funds with millions of dollars, and even with the highest levels of training that we can possibly achieve, once that oil is on the water, our system has failed. Once we uncork that bottle and let the genie out, it's really very difficult to get him stuffed back in there where he belongs. If we wind up with a large volume of oil in the water again, we're going to need every bit of the equipment on hand. We're going to need every tool in that tool box and that includes mechanical, burning and dispersing agents. We're going to need all of it. We must remember that even the highest levels of preparation just may not be enough. We have to keep in mind that while spill response preparedness is good, prevention works much better. Let's keep that oil out of the water in the first place.

## **The *Braer* and the *Exxon Valdez*— Cleanup Comparisons**

Jonathan W.G. Wills

*Shetland Islands Council*

*Sundside, Bressay, Shetland ZE2 9ER, Scotland*

Shetland and Alaska had been in touch, now and again, before the *Exxon Valdez* but, in the 45 months between your spill and the wreck of the tanker *Braer* on our coastline in January 1993, the contacts became regular and frequent. The reasons were serious and professional, but as a result we have become close friends who know, among other things, how important it is to be able to party in the midst of despair.

The visitors' book in my home on the little island of Bressay is littered with the signatures of well-known Alaska citizens. At times it seemed we had Alaskans in the attic the way some folks have mice. I have lost count of the Alaskans who have been to Shetland since 1989, and of the Shetlanders who have made the return journey along the 60th parallel—just 4,000 miles across the pole as the jumbo flies but 7,000 (alas) now that we have to go via Seattle. I blame the Russians opening their airspace for that but I must take some of the blame for this unexpected and mutually beneficial new market in airline tickets from ANC to LSI—Lerwick, Shetland Islands.

It took me a month to get to Prince William Sound after the spill. I had to persuade a New York magazine to pay the fare. The fools never printed my story, which was that the spill wouldn't have happened if the oil companies in Alaska had insisted on the tanker safety scheme which they had enforced in the Shetland Islands for the previous 10 years. They missed a scoop, or so I like to think.

I was in Cordova on Prince William Sound Day in April 1989. It was a very moving experience. The oil was still moving west. The cleanup was well under way, but had not yet reached its peak. None of us suspected that it would go on for three years and more, or that it would recover so little oil after such a vast expenditure of treasure.

The scale of the social and economic disruption was only beginning to dawn on Alaska, although the environmental damage was already

apparent and extremely alarming. What I saw was enough to convince me that Shetland was ill-prepared for such a major incident. For a small spill in the harbor we were well-equipped. But we were still trusting to prevention, not response, to deal with our "big one," if and when it came.

I made that comparison between the prevention and response systems in place in Alaska and Shetland. Shetland came out better on prevention and not so well on response. I wrote about it in my book *A Place in the Sun* and spoke about it in my TV documentary *Slick Operators* so I won't detain you with the details here. My purpose today is to speak about response, not prevention (much as I prefer prevention).

My new-found friends Rick Steiner and David Grimes were the first Alaskans to visit Shetland after *Exxon Valdez*, at my personal invitation. Their trip in the summer of 1989 began a process which continues today—a regular exchange of information and ideas which has been enormously helpful to both communities. The subsequent visits by Dan Lawn, Riki Ott, Governor Cowper, Chris Gates, Marge Tillion, Marilyn Leland, Stan Stephens, Vince Kelly, and Leann Ferry were particularly significant. (And, as is always the case when Alaskans and Shetlanders get together, memorably merry.)

Long before the *Braer* hit the rocks on Tuesday, January 5, last year, Shetland Islands Council and the British government had drastically overhauled their pollution response plans. Alaska may have learned something from our experience with preventing at least six *Exxon Valdez* scenarios in Shetland waters, but by golly we had learned from the delays, blunders, gung-ho attitudes and hyped-up technology which had added to the problems in Prince William Sound.

When the alarm was raised at 5:13 am on that horrible morning in January 1993, a rather splendid spill response system went into action immediately. Long before the *Braer* went aground, and even before she was abandoned by her crew, emergency control rooms in London and Shetland were up and running; stocks of dispersant, booms, skimmers, and all the rest of the paraphernalia were loaded on planes, trucks, and boats and headed for the scene from all over Europe. It was, perhaps, the best organized, best equipped, and fastest oil spill response in history.

I have been over the details again and again and I cannot seriously fault it. There was indeed a brief argument about who was in control, the British federal government or the Shetland local government. The conflict was quickly resolved when astonished London officials landed in Shetland and found that the locals already had everything in hand and were receiving the fullest cooperation and assistance from BP, the operators of our Sullom Voe oil terminal—to say nothing of the terrific efforts by various shipping companies, airlines, helicopter operators, airports, police authori-

ties, coast guards, and thousands of individuals and volunteers in official and unofficial organizations in Shetland and on the mainland of Britain 100 miles away.

BP, operators of the Sullom Voe oil terminal, in particular deserve full credit for their contribution to the *Braer* spill response. It was quick, comprehensive, committed, efficient, and magnificent, even if there was some criticism of their public relations and a few quibbles about who paid some bills. They threw everything they had at the problem. Very different from the fumbled initial response from Alyeska, the company which I still can't help thinking of as a BP subsidiary in all but name.

This was just as well, for the owner of our tanker was not a multinational like BP or Exxon but a relatively small-time outfit called Bergvall & Hudner (B&H) based in Stamford, Connecticut. The ship was registered in Liberia for the expressed purpose of avoiding American and Liberian taxes. No way did they have the resources to respond to a spill.

Above all, BP, the British government, and Shetland Islands Council had learned the main organizational lesson of the *Exxon Valdez* response—at all costs avoid confusion in the chain of command. The only thing that was fouled up was the use of dispersants and I'll come to that in a moment.

There was just one problem: there was no way they could keep the planes in the air or the kit in the water. The *Braer* got into trouble during a gale. Soon after she had grounded and begun to leak twice as much oil as the *Exxon Valdez* had done, the gale became a screaming hurricane. With one or two lulls down to 30 knots or so, it remained at 70 knots or more during most of the following 11 days. Often it nudged 100 knots. And, most wonderful of all, it stayed in the same direction, corralling the oil.

Mother Nature cleared away the *Braer* oil. Some folks still think it was a miracle. Even pagans like me tend to speak in suspiciously theological terms when we remember it. The *Braer* Wind, as it came to be known, was unprecedented even in Shetland, where our winter climate resembles that of Middleton Island in the Gulf of Alaska. It has been said, in jest but with great truth, that Shetland has nine months of winter and three months of bad weather. We call fine spells "days atween wadders"—dialect for "days between weathers."

The deepest atmospheric depression ever recorded in the northeast Atlantic (909 millibars) swept in soon after the grounding. Usually, depressions roar over Shetland and only slow down when they hit the mountainous coastline of Norway, 200 miles east of us and strikingly similar to the southern seaboard of Alaska. But this baby got stuck on the edge of a high—the high pressure zone which often lays down a hard, calm frost over Scandinavia while we islanders are cowering indoors.

The British government flew a few dispersant spraying missions low and slow over the slicks with some elderly DC3s. They had some effect but the dispersant spray kept blowing over farmland and houses just inland from the wreck. This raised serious public health worries, and even today not everyone accepts the official reassurances which have since been issued. Outdated dispersants were used in uncontrolled mixes which may yet have long-term health effects. There was hell to pay when we were told that the chemical composition of the dispersants was "commercially confidential." But what really stopped the spraying was not the protests from local residents (who threatened to lie down on the runways), but the weather. It simply became too dangerous to fly.

Booms were put in the water in vain attempts to protect salmon pen farms. The booms blew away or sank. So did some of the farms. A few skimmers were tried. They were swamped. Sturdy trawlers and work boats had to give up because it was becoming too dangerous for their crews. Some fuel oil and oiled debris from the wreck was scooped up and bagged by hand. But the fact is that, by the time the weather moderated enough for what you and I would recognize as a containment and recovery operation, most of the oil had gone away. And most of the huge depots of containment and cleanup gear were never used.

Thank God, some of us say, thinking of the anger and recrimination there would have been if the kit had been deployed and if, as usual, it had failed to come up to specification. It was bad news for the hundreds of loonies, inventors, and entrepreneurs who phoned us from all over the world, and sometimes became indignant when we politely declined their offers of Australian sheep's wool pillows, Welsh straw mats, Irish peat dust, and revolutionary Hoover-skimmers invented in disused South African hay barns. But, as it turned out, technology's irrelevance was good news for us.

So how can 85,000 tons of crude oil disappear? It was a question Dan Lawn asked me on that day of utter despair when the *Braer* broke up and we finally had to accept that the spill was running wild.

Oil spills usually stay on the surface for several weeks, if not months. Eventually, of course, all the oil we use, whether we spill it or not, ends up in the sea in one form or another, through the normal cycle of exchange between atmosphere, land, and water. Oil spills may be cleared away but they are never cleaned up, they just take on another form, whether you burn them, use dispersants, or landfill what you manage to recover. As University of Alaska Professor Don Button and others have demonstrated, it takes a very long time indeed for some hydrocarbon molecules to be recycled into their component atoms.

But this one was different from the conventional picture which we all have of an oil spill. It is estimated that about a third of the oil evapo-

rated, maybe more because this was the lightest of light North Sea crudes, not like your heavier North Slope stuff. Perhaps a fifth of the oil was sprayed by the hurricane onto the land, mixed with the salt spray which formed a cloud 200 feet high. You can still find traces of it here and there, if you dig down to the bedrock a few feet below the surface, but the fact is that excellent crops of potatoes, swedes, carrots, and cabbage were grown in the sandy soils of polluted southern Shetland during the following summer. Good enough to eat, I can tell you. I have a healthy appetite.

But where did the rest go? The answer is astonishing and highly unusual. It went under the sea. Some of the *Exxon Valdez* oil did the same—forming those pancakes which were reported lurking on the seabed in Prince William Sound.

What happened in Shetland was that the hurricane turned the two sandy bays next to the *Braer* wreck into a sort of gigantic food mixer. Waves 20 to 40 feet high slammed into bays from 20 to 100 feet deep, for the best part of two weeks. As soon as a slick formed, it was churned into an oily froth. Some oil got out around the edges of the bays—and that was what caused the damage to salmon farms and fishing grounds in the southwestern corner of the islands. But most of it became suspended in the sea. Only the fuel oil created recognizable heavy pollution.

By the morning of the second day the sea around the wreck had turned a strange, pale brown color. That was the color of the water from top to bottom, not just on the surface. There was no mousse. Only the fuel oil created recognizable heavy pollution. Oiled seabirds merely looked soaked, not coated in chocolate. And only 1,500 seabirds died.

Suspended in the sea, the oil began to move. Not with the wind but with the tides and the prevailing ocean current. As it spread under water, it was massively diluted. The 400 square mile exclusion zone around the southern tip of Shetland, where fishing was banned for four months and shellfishing is still banned as a precaution, contains about 18 cubic miles of seawater. Even in that volume, 85,000 tons of oil would be diluted to a few parts per million. And remember that maybe half of the oil had evaporated or was sprayed on the land.

Within two months, hydrocarbon levels near the wreck had returned to background levels. In patches on the seabed up to 60 miles from the islands, surveys have found concentrations of oil in the sand, 300 feet below the waves. Some of it is as oily as 30 parts per million. Here and there a little more. But no Alaskan pancakes. And that, incredibly, is it.

Ladies and Gentlemen, we have at last discovered how to respond to and disperse an oil spill. All you have to do is arrange for your tanker to break up in a semi-circular bay about 100 feet deep; then you throw a two-week hurricane at it.

Fourteen months after the *Braer*, there is no sign of the oil. We are still worried about what those seabed patches of oily water may do to the herring spawning grounds. We still avoid eating lobsters and crabs from the exclusion zone (although I've had a few good feeds of uncontaminated shellfish caught a hundred yards north of the zone).

What we are left with, after the containment and recovery operation that never had a chance to get going, is a different form of pollution. Our image is contaminated, as yours was. Our director of tourism has called it, perhaps a little unfairly, "media pollution." He estimates that we endured some \$900 million worth of global bad publicity during the so-called *Braer* disaster. Around 1,300 journalists from all over the world had filed their copy from Shetland in the first three months of 1993. Some people in Japan, Germany, and maybe even the good ol' US of A still think Shetland is massively polluted and the Shetlanders all evacuated. The insurers of the *Braer* still haven't paid the piffling \$600,000 we asked for, to mount a publicity campaign to win back customers for our seafood and wildlife holidays.

Seafood which used to earn a 15% premium because our seas were so clean, now sells for low prices, even though our seas are clean again. Last year was the best seabird breeding season I'd seen in 10 years, but tourist numbers were 11% down. This year looks to be just as bad. But I don't need to tell you folks about that kind of thing. You know better than we do. That's why we can't afford another spill, even a little one. It will finish off the markets for our clean food and fresh-air holidays. We are just 22,500 people trying to earn a living on 567 square miles of rocky islands in the middle of the ocean. When the offshore oil fields dry up, as they will in the 2020s, and the brief spasm of the Hydrocarbon Age is over, the sea and the land will once again be all we have.

That's why I can't really get excited about oil spill response technology, necessary and well-meaning as its earnest and ingenious practitioners may be. Outside sheltered harbors, it doesn't yet work well enough to be taken seriously. My main interest is still in stopping the next one.

It's good to know that in this global endeavor we Shetlanders have so many good friends here in Alaska. We'll never forget your kindness during our mercifully brief period of crisis last year. You held our hand in the dark, and for that we will always be grateful. We'll keep in touch, having trans-polar fax communication when we can't afford phone calls.

But what a pity it is that our friendship could only begin because of these two totally avoidable calamities.



# **Identifying the Strengths and Weaknesses of Local Area Spill Response Preparedness**

**James Gynther**

*U.S. Coast Guard Research and Development Center  
1082 Shennecossett Road, Groton, CT 06340-6096*

## **Abstract**

As a result of the Oil Pollution Act of 1990, the U.S. Coast Guard has been upgrading its capabilities for evaluating local and national marine spill response "preparedness." One component of this upgrading effort is a comprehensive exercise program, which is presently being finalized. This program is called the National Preparedness for Response Exercise Program (PREP). This paper focuses on the important "area exercises" within the PREP program, which can be either "government-led" or "industry-led" exercises. It describes these critical exercises and outlines the U.S. Coast Guard Research and Development Center's present efforts to develop improved "tools" to enhance the conduct and evaluation of these types of exercises.

## **Introduction**

### **Background**

The U.S. Coast Guard (USCG), in cooperation with the Environmental Protection Agency (EPA), the Research and Special Programs Administration (RSPA), and the Minerals Management Service (MMS), has undertaken the establishment of a national exercise program in order to assist local, predesignated, federal on-scene coordinators (FOSCs) in identifying the strengths and weaknesses of spill response "preparedness" within their assigned geographic areas. This national exercise program is being called the National Preparedness for Response Exercise Program (PREP). It is presently envisioned to consist of a comprehensive mix of "internal plan holder" and "external plan holder" exercises, which will be conducted over a three-year cycle (Draft PREP Guidelines dated 1 October 1993).

All types of exercises, within the PREP exercise mix, are important elements of the program. This paper, however, focuses on just the area exercises within the "external plan holder" category of exercises. Specifi-

cally, it focuses on the U.S. Coast Guard Research and Development Center's efforts to develop appropriate "tools," which will allow the USCG (and other groups who choose to use them), to significantly upgrade the conduct and evaluation of area exercises, above the minimum requirements set forth within the present PREP guidelines.

### Area Exercises

The PREP program's area exercises, will strive to involve all elements of the local, multi-organizational, spill response organization in a comprehensive, simulated response effort. Exercise play by the participants will occur as it would during an actual spill response. The Unified Command Post staff will assemble within the actual spaces in which they would normally assemble. There will be no large audience as in the earlier, USCG-conducted, on-scene coordinator/regional response team exercise format. This is to increase exercise realism and minimize exercise cost. An exercise control team-selected subset of local response resources, including both personnel and equipment, will be activated and field deployed in a manner similar to that of an actual response.

These area exercises will be planned by a multi-organizational, "exercise design team," consisting of federal, state, and responsible party (RP) representatives. When they are conducted, the exercises will be controlled by a multi-organizational staff of "exercise controllers," who will be located in: (a) a dedicated exercise control space, (b) actual command post spaces, and (c) selected field locations. The exercise will be evaluated by a "joint evaluation team" consisting of representatives, who are knowledgeable in spill response operations from the federal government, state and local governments, and the responsible party.

The evaluation of these PREP exercises will, at least initially, be based on the subjective assessments made by the joint evaluation team. While such an evaluation process can yield substantial insights into the strengths and weaknesses of the local spill response preparedness, it is well established that often important, available feedback information is overlooked by this personality-driven process (Hammell et al., 1979; Gynther et al., 1981). As a result, the USCG is exploring the feasibility of moving the evaluation of these exercises onto a more objective-based foundation, while still recognizing the value of subjective analysis, particularly with regard to the interpretation of objectively derived observations and results. This paper identifies and discusses the U.S. Coast Guard Research and Development Center's present vision for the area exercise evaluation process. This vision is consistent with the U.S. Coast Guard's present internal total quality management (TQM) efforts, which are striving to systematically upgrade services provided to various

customers via more objective performance measurement techniques (USCG Planning Manual 1994).

## **Evaluation Process Vision**

### **Goal**

The goal of the area exercise evaluation process is to systematically identify, in a clear, concise, non-biased manner, the operationally relevant strengths and weaknesses of local spill response preparedness, in order to alert the cognizant area committee, of the specific risks which should be associated with the current spill response preparations within its particular geographic area.

### **Pre-Exercise Planning**

Once an area exercise has been scheduled for a particular geographic area, an exercise director will be assigned. For USCG-led exercises, this will be a USCG officer. The exercise director has the job of assembling the multi-organization's exercise design team in order to plan the details of the exercise. Such details include establishing specific exercise objectives, selecting the responsible party (RP), defining spill event parameters, preparing the exercise script, etc.

An important aspect of the pre-exercise planning process is the designation of the joint evaluation team leader. It is extremely important to the eventual success of the exercise evaluation that this individual actively participate in all the critical steps within the exercise planning process. The joint evaluation team leader also has the responsibility of selecting, preparing, and leading the multi-organizational joint evaluation team during the exercise evaluation process, which is summarized within this paper. For USCG-led exercises, this will usually be a U.S. Coast Guard officer.

### **Exercise Conduct**

During the actual exercise, the joint evaluation team members (evaluators) will be stationed within the exercise control space, within the various command post spaces, and aboard key field units, in order to collect two distinct types of data. First, they will be documenting (as assigned by the joint evaluation team leader) their subjective assessment of the effectiveness and workability of the "area contingency plan" and associated "vessel and facility response plans." Second, they will be collecting (as assigned by the joint evaluation team leader) specific observable data, usually the time of some key response team decision or

action. The subsequent utilization of this data will be discussed later in this paper.

Another element important to the successful conduct and evaluation of these exercises is the maintenance of "exercise truth" within exercise control. The term "exercise truth" is being used here to mean an accurate picture of where the spill is located, and the specific status of all response resources at any point in time. In addition, exercise control has the responsibility for ensuring that appropriate deployment time delays are entered into the exercise for those resources which are not actually deployed. It should be noted here that the picture of the spill within the command post is not necessarily exercise truth; it is the command post's perception of truth based on its data-gathering and data-processing capabilities. The maintenance of exercise truth within exercise control is an extremely important, but very difficult, labor-intensive task, particularly during the initial turbulent hours of even a simulated response effort. Recognizing this, the U.S. Coast Guard is presently investigating the use of U.S. Navy simulator-based training technology to reduce the difficulty and labor-intensiveness of maintaining exercise truth within exercise control (see the discussion of the PISCES project later in this paper).

### Post-Exercise Joint Evaluation Team Meeting

During the hours shortly after the completion of the exercise, the members of the joint evaluation team will meet to: (a) analyze the local spill response actions, which were observed during the exercise, and (b) prepare materials for the post-exercise debriefing session, which will be conducted for exercise participants the next morning. An important step of the joint evaluation team, in the future vision, will be to review and interpret the objective performance data available from the exercise. The primary intent is not to pass or fail individual participants, but to identify and recommend appropriate system improvements. Generally, this type of data can be grouped into two categories: (a) tactical performance measures, and (b) diagnostic performance measures.

#### *Tactical Performance Measures*

The overall "tactical" effectiveness of the response effort can usually be investigated by establishing whether or not the observed response achieved the desired tactical results. For example, if one response objective were to protectively boom specific, high priority, environmentally (or economically) sensitive areas, were these areas, in fact, protectively boomed prior to the joint evaluation team's best estimate of the arrival time of the oil (or prior to a particular clock time established by the FOSC)?

This information will be presented to the joint evaluation team on a large, classroom-sized screen, through the use of two types of displays, both of which rely on data from the historical exercise truth record that is maintained within exercise control. The first of these displays will be a geographic plot depicting the status of the spill coverage area and the status of the response resources at any point in time (Figure 1). This type of display will have the capability to be manipulated for analysis purposes in order to obtain the joint evaluation team's best estimate regarding the time and distance, from the leading edge of the oil to the sensitive area, at the time when each protection boom installation is completed. Such safety margins are just two tactical measures that can be used, in certain circumstances, to begin to paint a portrait of local spill response preparedness. In other circumstances, similar measures may identify the safety margins involved when the actual (or anticipated) delivery times of critical response resources to specific geographic areas are compared against time goals established by the FOSC/command section during the exercise.

If response equipment is actually mobilized, loading, transit, and installation times will be recorded and used: (a) directly in the analysis as

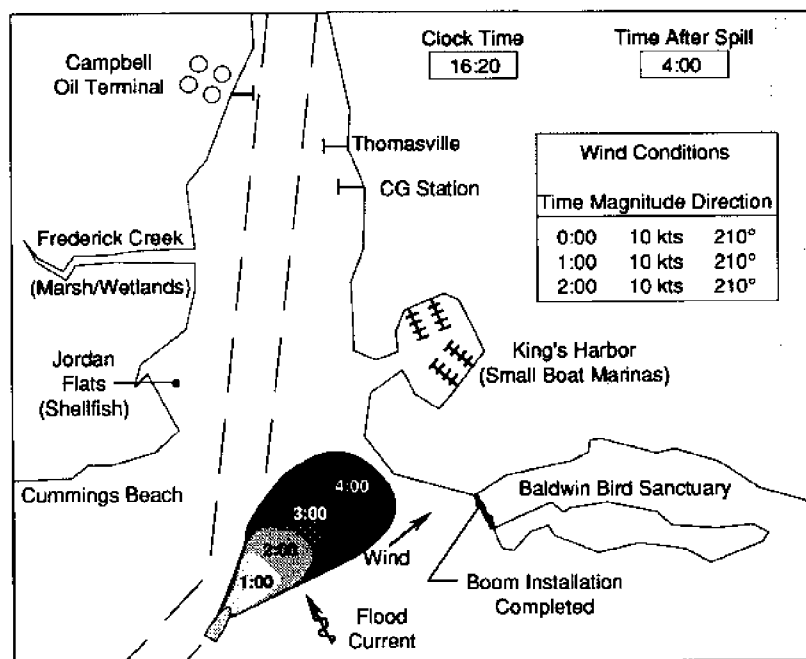


Figure 1. Interactive geographic display.

a means of establishing the time when each delivery/deployment is completed, and (b) entered into an appropriate USCG database for further processing and utilization. If the response equipment is not mobilized, then rational estimates of loading, transit, and installation times will be developed by the joint evaluation team members based on available database information and personal experience. In all cases, the intent of the envisioned interactive, computer-based tool is to provide the joint evaluation team with the capability to look at the impact of different assumptions regarding spill arrival times, boom installation times, etc., on overall tactical performance.

The vision is to capture the results of this Figure 1-type manipulation, and the associated joint evaluation team analysis, in tabular form on a pertinent, data collection spreadsheet (see Figure 2). Once tabulated, this data will be automatically transferred onto a more graphic summary display, which depicts the anticipated risk profile for this simulated spill response effort (see Figure 3 for one display presently under consideration). It is anticipated that careful scrutiny of this type of information will be most helpful to local decision makers, as they attempt to establish whether or not additional resources should be invested to upgrade local response preparedness.

### *Diagnostic Performance Measures*

If the tactical performance measures indicate that the local response organization will have difficulty installing appropriate booms to protect high priority areas in a timely manner, it is important that the joint

Sensitive Areas	Time Boom Installed	Spill Range (nm)	Spill CPA	Time CPA	Time Safety Margin
Baldwin Bird Sanctuary	4:00	1.5	0	4:30	+0:30
King's Harbor	4:15	2.5	0	5:30	+1:15
Frederick Creek	5:20	1.0	0	6:20	+1:00
Jordan Flats	12:10	0	0	8:40	-3:30
Cummings Beach	15:20	1.5	1.5	9:10	-6:10

Figure 2. Interactive spreadsheet display.

## Timeliness: Protection Boom Installations

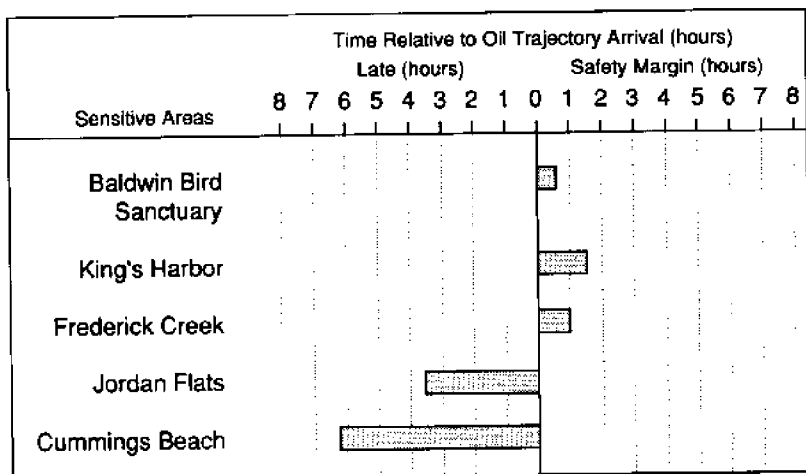


Figure 3. Risk indicator profile display.

evaluation team dig deeper in order to provide some insight into the specific problem areas which may be the source of the weak performance. Once again, this can be done subjectively. However, objectively based, diagnostic performance measures can provide an important basis for a more effective and efficient identification of such problem areas (Hammell et al. 1979, Gynther et al. 1981).

As some individuals may be aware, there are a variety of more objectively based, diagnostic, performance evaluation techniques, which appear to have potential for successful adaptation to the spill response problem. However, only one potential technique will be discussed within this brief paper as an example of such techniques. It involves the development and use of a timeline of relevant protective booming events/milestones (see Figure 4). Such timelines allow the evaluators and the participants to graphically analyze which events are absorbing the greatest amount of the critical time resource. If the potential exists that the observed safety margin(s) is unacceptable, there may be one particular event that is absorbing an abnormally high amount of time, or there may not be any one apparent villain. The observation of either condition may be very relevant information to be provided to both exercise participants (from a training feedback perspective) and to the FOSC/area committee (from a local preparedness assessment perspective). The interpretation and use of such data is a joint evaluation team responsibility.

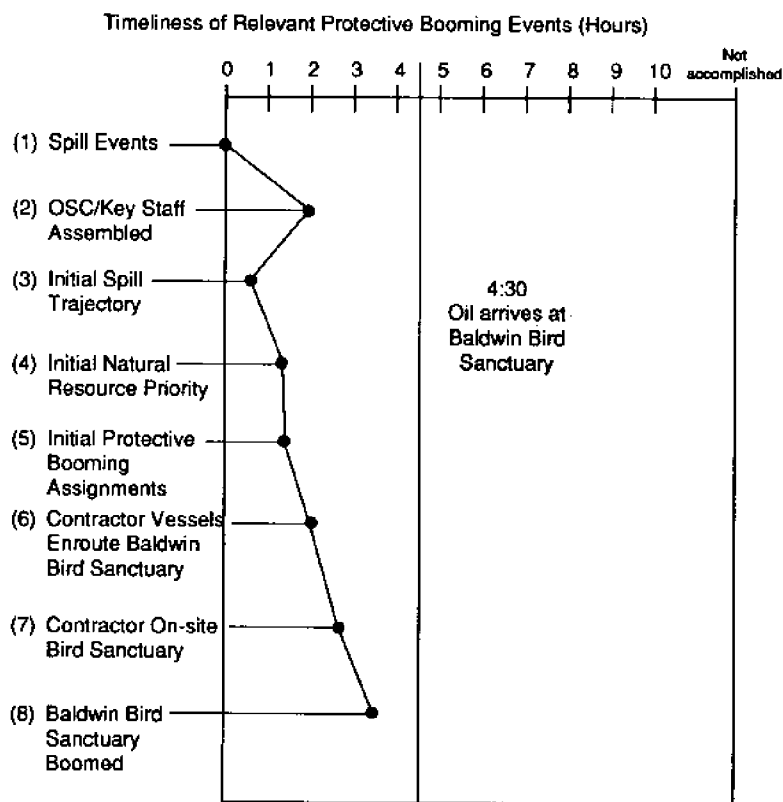


Figure 4. Sample diagnostic display.

It should also be noted here that comparison of such timelines, from one area exercise within a specific geographic area, with those of earlier area exercises in the same area, or with those from area exercises in other similar geographic areas, may provide the joint evaluation team with critical, additional insight into the identification of potentially troublesome problem areas. The relevancy of such information, as with all such performance measure information, can vary from scenario to scenario. However, it should be noted that such information can serve as an important point of departure for the joint evaluation team's subsequent discussions and analysis of local marine spill response preparedness. The use of such objectively collected data to rapidly focus diverse evaluation groups, and increase their depth of analysis, is an established concept (Smith et al. 1985, Thomas 1987).



## Exercise Debriefing Session

As a general rule, the area exercises will not be designed for real-time presentation to large audiences. Likewise, the debriefing session(s) will be for selected participants only. It is anticipated that the debriefing session(s) will be limited to no more than 25 people per session. Multiple sessions for key organizational units, such as command, planning, operations, etc., may be appropriate.

The joint evaluation team leader will use a large classroom display system with appropriate computer-generated color graphics to present the results of the evaluation process. Specifically, these computer-generated graphics will be designed to communicate the tactical and diagnostic performance measure information, previously discussed, to the debriefing audience in a clear, readily understandable manner. Hard copies of these displays will subsequently be used during the development of the exercise evaluation report.

## Exercise Evaluation Report

In the days after an area exercise within a particular geographic area, the joint evaluation team leader will utilize the objective tactical and diagnostic performance data, along with the collective joint evaluation team's interpretation of this data, to develop an exercise evaluation report. This report will be forwarded, via the exercise director, to the predesignated federal on-scene coordinator within the area. The FOSC will review the report and then forward it to exercise participants for comment. Exercise participant comments received by the FOSC will be attached as an appendix to the report, which will then be forwarded to the area committee for use as an important data point in its ongoing review of the Area Contingency Plan.

Although the joint evaluation team provides an important service by identifying and analyzing the risks that should be associated with local response preparedness, the acceptability (or unacceptability) of such risks—as well as what corrective action(s) to take if the risks are indeed unacceptable—are local decisions. To phrase it another way, while the identification of spill response risks, via the area exercise and its evaluation process, is a joint evaluation team responsibility, the management of these identified risks is a local responsibility. This concept is particularly important because it is a well-recognized fact that levels of acceptable risk can vary substantially from one local area to another (Ruckelshaus 1983, Smith et al. 1985).

## Implementation

As mentioned earlier in this paper, the U.S. Coast Guard is presently investigating the adaptation of U.S. Navy simulator-based training technology to improve the effectiveness and efficiency of the conduct and evaluation of the area exercises. More specifically, the U.S. Coast Guard Research and Development Center, located in Groton, Connecticut, has teamed with the U.S. Naval Air Warfare Center- Training Systems Division, located in Orlando, Florida, on a project to develop a cost-effective, prototype computer-based system which will: (a) reduce the difficulty and labor-intensiveness of maintaining exercise truth within exercise control, and (b) provide the joint evaluation team with critical, objectively based, performance data for consideration within its analysis of local spill response preparedness. This prototype system has been named the Pollution Incident Simulation Control and Evaluation System (PISCES). It is expected to be ready for trial use by the U.S. Coast Guard during 1996.

## Note

The views expressed within this paper are the author's alone, and should not be construed to reflect the views of the U. S. Coast Guard, the Department of Transportation, or any other government entity.

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## **Prince William Sound Community College and Fishing Vessel Oil Spill Response Training**

Dennis A. Ulvestad

*Prince William Sound Community College  
P.O. Box 97, Valdez, AK 99686*

### **Abstract**

During the *Exxon Valdez* oil spill cleanup, it became obvious that fishing vessels were a valuable asset. They have become an integral part of Alaska's oil spill response capability. The Prince William Sound Response Plan and the Nearshore Response Plan both require a trained group of oil spill technicians to operate a fleet of small boats. Fishing vessels are in an ideal position to fulfill this function. Fishing vessels are already located in Prince William Sound and can be quickly and easily converted into oil spill response vessels. Their captains and crews have the local knowledge and small boat operating skills necessary for maximum effectiveness.

Prince William Sound Community College (PWSCC) is in the second year of a fishing vessel crew training program. The three major goals of this training are: (1) to teach vessel crews to safely operate the equipment they will employ to contain and cleanup a spill, (2) to provide general health and safety training, and (3) to give participants an insight into their responsibilities during an oil spill response. The training is modular in nature. The first year provides basic instruction. Each subsequent year reviews the first year and presents new material. The classes are structured to include both classroom and on-the-water training utilizing the fishing vessels. This paper will describe the development of the training curriculum and the training program in its current form.

### **Development of the Fishing Vessel Training Program**

Prior to the development of this program, no precedent existed for an oil spill response training program intended for nonprofessional oil spill technicians. The model for oil spill response training in the rest of the country was to train a small nucleus of professional responders to serve as leaders in the event of an incident, and to train nonprofessionals as needed after the incident occurred. The fishing vessel program required the training of a large group of nonprofessional oil spill personnel and the

continuation of that training so that responders maintain a high preparedness level. This training represents a new concept in oil spill training.

In the fall of 1992, Prince William Sound Community College began the development and delivery of a multiyear training program for fishing vessel crews involved in oil spill response operations. At the time PWSCC did not have the staff or resources to develop the training unaided. UAA's Mining and Petroleum Training Service (MAPTS), headquartered in Soldotna, was brought into the course development process. MAPTS has a long history of teaching oil industry safety courses. A crew of experts assembled by MAPTS was given the critical task of creating a training manual. After an intensive effort by PWSCC, industry, and MAPTS during January and February of 1993, they developed a two-day course that is the basis for the present Level I course. Oil industry personnel played a major role in the course and manual development. In March and April of 1993, 263 crew members received the training in Kodiak, Homer, Seward, and Whittier.

### **The Current Program for Oil Spill Training of Fishing Vessels**

Oil spill technicians trained to operate a fleet of small boats will be required in the event of an oil spill. The fishing vessels are in an ideal position to fulfill this function. Fishing vessels are already in Prince William Sound and can be quickly converted into oil spill vessels. The three major goals of this oil spill training are: (1) to teach the fishermen how to safely operate the oil spill equipment located in their response areas, (2) to provide health and safety training, and (3) to give them an insight into the importance of organization in oil spill response and the role they play within that organization.

A modular training concept has been developed for fishing vessel training. The basic training course for all fishing vessel crew members enrolled is the Level I course. The course consists of one day of classroom training and one day of equipment demonstrations and drills on the water. The topics covered during the classroom portion include: the role of fishing vessels in oil spill response, the incident command system, the fate and behavior of spilled oil, spill response strategies, containment and recovery, seamanship and boating safety, containment boom construction, booming techniques, and hatchery protection. The on-the-water day includes incident command system (ICS) call out procedures, boom deployment, and booming techniques.

Crew members who have been through Level I training in the first year of the sequence are given a Level II course in the second year. Level

II for the 1993-1994 training season includes a review of Level I, a Hazardous Waste Operations and Emergency Response (HAZWOPER) refresher, safety and U.S. Coast Guard vessel examination requirements, the Nearshore Plan, skimmer and powerpack operation, and portable barge towing. Level II classes will change from year to year and new equipment will be presented.

The 1993-1994 training year has 16 Level II classes and four Level I classes scheduled. Training will be held in Valdez, Cordova, Whittier, Kodiak, Homer, and Seward. The first day is spent in the classroom. The second day of class is spent on the water with hands-on training. The *Oil Spill Response Fishing Vessel Training Manual* is the text for the class. *Oil Spill Response Fishing Vessel Training Manual Level II* is used for Level II classes.

### Level I—Day I

The emergency response organization is the first topic of instruction. Fishermen need to know the location and equipment of community response centers and their role as emergency responders.

In section two, fishermen learn the basic structure and function of the ICS. They also learn where and how they fit into the emergency response system. There is a detailed ICS check-in procedure for fishermen to follow, which is necessary for the ICS system to function properly. The ICS position titles that fishing vessel operators must contact in sequence during a response are: the fishing vessel administrator, the staging area manager, and the task force leader. The fishermen must understand the duties of each one of these ICS position titles.

The next three presentations cover health and safety issues, which are key elements of the training program. They are marine safety, fishing vessel safety requirements, and HAZWOPER training.

Marine safety includes the following topics: boating safety, deck safety, lines, knots, and towing. It is important to understand that human safety is the number one priority. Crew members are expected to work safely and need to know how to work safely.

The U.S. Coast Guard fishing vessel safety exam is discussed by a guest speaker from the U.S. Coast Guard. This presentation usually involves some brisk discussion. This presentation centers around the requirements of the Coast Guard fishing vessel safety inspection program.

Spilled oil is considered a hazardous material and oil spill training has to include training specified by Federal Occupational Health and Safety Administration (OHSA) and Alaska state regulations. This training is now provided by a separate 24-hour training course that is independently scheduled.

As part of the oil spill response team, the fishermen need training in the operational aspects of oil spill response. The direct supervision of each phase of an oil spill response may not always be possible. Therefore, the fishermen/oil spill technicians need to have a basic knowledge of fate and behavior of spilled oil. They need to have the ability to understand what to expect from spilled oil, and how it changes and moves, in order to plan their work properly. The fate and effects section provides this information. It includes the physical and chemical properties of oil, spreading and transport of oil, the weathering and dispersion of oil, and the influence of cold regions on these processes.

Oil spill response options and objectives need to be understood by the fisherman. All members of the response team need to understand how strategy decisions are made and the parameters that are considered to arrive at these decisions. The first step in selecting a strategy is to establish response priorities. Oil spill response priorities are: human safety, control of the spill source, containment and recovery or elimination, and minimization of impact on sensitive areas, in that order. Another important point in this section is to understand the decision-making process involved when choosing a response option. Those options are containment and recovery, in-situ burning, chemical dispersant application, monitor and wait, shoreline protection and cleanup. Fishermen involved in some of these options, such as in-situ burning, require specialized training not included in this class. It is the objective of this training to understand the advantages and disadvantages and the equipment and training required for all response options.

The primary tool of containment on the open water is the oil boom. Oil spill technicians need to know how oil boom is constructed so that they can prevent boom failure during deployment, anchoring, and towing of the boom. They also need to know how design type dictates the boom function and application as well as boom deployment techniques such as containment, exclusion, and diversion booming. The second half of the containment and recovery training provides an overview of skimmer devices.

The hatchery protection plan is the final topic included in the classroom portion of Level I. Hatcheries have an oil spill protection plan complete with pre-staged equipment and boom anchoring buoys. The fishermen need to know how to implement these plans and carry out field operations in the event of an oil spill.

Day I concludes with a briefing on the activities planned for the second day of training. A class evaluation is completed by the fishermen for this portion of the training. This evaluation is critical for continued course development. The fishermen's candid comments have proven to be a valuable resource in the evolution of this training.



## Level I—Day II

### *Objectives*

- The implementation of health and safety concepts during oil spill operations.
- The deployment and retrieval of CSI or harbor boom and Ro boom 1100.
- Booming techniques. Containment for the Ro boom and diversion for the CSI boom.
- The implementation of the ICS system and procedures.

Day II begins with a call out that initiates contact with the ICS system. Vessel operators are instructed to contact the staging area manager. The staging area manager gives them a HAZWOPER briefing and assigns them to one of three instructors who simulate task force leaders. All communications and radio frequencies follow a predetermined communications plan. The fishermen are divided into three groups:

Group 1. Boom deployment.

Group 2. Containment booming using the Ro boom 1100.

Group 3. Diversion booming using the CSI boom.

Half the boats join Group 1 and will deploy both the CSI and Ro boom. Group 1 boards the nearshore landing craft and receives instruction on the deployment of Ro boom. Ro boom is a very robust boom that can be used in nearshore and open water applications. The fishermen deploy the Ro boom from reels aboard the landing craft. The boom must be inflated during deployment. Each reel contains 200 meters of boom. The Ro boom is a significant component of the Prince William Sound boom inventory and fishermen need to be able to deploy and inflate this boom without assistance. The CSI harbor boom is a nearshore boom with solid flotation. It is deployed either from the landing craft or from land-based storage vans. If the storage vans are land based, Group 1 must assist in the deployment from land. After all the boom is deployed, the fishermen are then given a tour of the oil spill equipment that is aboard the nearshore landing craft and staged in the area.

The other two groups and the other half of the boats receive instruction in boom handling and strategy implementation. Group 2 tows the Ro

boom in a containment configuration; group 3 deploys the CSI boom in a diversionary tactic. When completed, Groups 2 and 3 change places, group 3 tows the Ro boom and Group 2 tows the CSI boom.

The second half of the day Group 1 becomes Groups 2 and 3 and receives instruction on boom handling and strategies. Groups 2 and 3 become Group 1 and puts the boom away at the end of the day. This change of groups is accomplished through the ICS system.

At the conclusion of the day, the groups assemble and go through a debriefing and class evaluation process.

## Level II—Day I

The first day of the level II class starts with a review of the operations portion of the level I class. The fishing vessel fleet has received or is in the process of receiving a 24-hour HAZWOPER class as a part of their training package. This is the same class received by professional oil spill technicians. Oil spill training by nature includes many of the elements required for instruction in the federal health and safety regulations, such as ICS, safety, spill containment, and emergency response plan training. In addition to the oil spill training manual, a HAZWOPER supplement is used to provide training in those elements of health and safety required by law, but not covered in the operations or safety portions of the class. HAZWOPER instruction in conjunction with hands-on training works well and provides an excellent opportunity to demonstrate health and safety/HAZWOPER concepts and how they apply to ICS and the operations part of an emergency response. The fishermen receive a HAZWOPER refresher card for this training.

In the afternoon of the first day, the operations portion is presented. This training is designed to give the fishermen/oil spill technicians detailed instruction on nearshore response techniques and the operation of some of the oil spill equipment that they will be expected to operate during an oil spill. The lecture on the Nearshore Plan describes the methods of oil collection contained in the plan. The procedures for diversion booming, passive collection, cold water deluge, entrapment, nearshore trapping, and in situ burning are covered in class.

The balance of the day is spent teaching the purpose and characteristics of the recovery equipment that will be used during the second day on-water portion of the class. The principles of powerpacks, hydraulic pumps used to power oil spill skimmers and equipment, are described. The principles involved in the operation of the Desmi 250 skimmer and the Seamop 4090 rope mop are outlined in preparation for the hands-on portion of the class. The construction and operation of the Pollutank 100, a portable oil storage barge, is the final topic of the day. At the conclusion of

the first day of this training the fishermen will have a working knowledge of the equipment used during the second day of training.

Oil spill training for fishing vessels is designed to give fishermen operational, organizational, and safety training. Each course is evaluated by the students, and the content of the those evaluations are used to make the class more relevant to the fishermen.

## Level II—Day II

The fishing vessels go through the same call out and ICS check-in process they go through in Level I. The fishing vessels are divided into two groups. These groups change duties at mid day.

### *Fishing Vessel Level II*

#### Group I Objectives

- Secure the Pollutank (portable barge) to the fishing vessel to reduce surging between the two vessels.
- Safely position the fishing vessel to skim from the teardrop formed in the boom apex.
- Explain the difference in handling between a Pollutank that is empty, half full, and loaded.
- Safely rotate all vessels through towing boom and handling the Pollutank.

This session will last about three hours and will involve half of the total number of vessels in the class. This group will deploy two reels of Ro boom 1100 towed in a U formation as a target for the barge vessels to simulate skimming.

One vessel from the group will be hipped up to the Pollutank approximately half full. The lead vessels in the U boom formation will form a teardrop, turn to go behind the other U formation, and coordinate with the skimming vessel to allow the vessel to move into a skimming position. The boom towing vessels will fall into place behind the leading U boom while the skimming vessel is still skimming. After the boom has been skimmed empty, the skimming vessel will break loose from the barge and pass it to another vessel. The vessels that had the barge will take the position of one of the boom towing vessels. The vessel that picked up the Pollutank will practice maneuvering the barge for about 15 to 20 minutes and will then move into a position to skim from the boom of the next

group of boom towing vessels which have already formed a teardrop and are running behind the lead boom in the formation.

### Group 2 Objectives

- List the proper pre-start checks for the West Coast powerpack.
- Start the powerpack.
- Show how to connect the skimmer and compressor properly to the powerpack.
- Show how to set the system flow and pressure settings.
- Describe the powerpack automatic shutdown systems.
- Describe how the Desmi 250 skimmer deals with debris, cutting blade, and debris screen.
- Explain how to adjust the weir with air for different oil layers.
- Re-package the equipment properly according to the inventory list.
- Explain the operation of the Rope Mop 4090.

This session will involve the balance of the class. The vessels will raft up to the landing craft and the crews will board the vessel. The class will be given operating instructions for the West Coast powerpack and a demonstration on assembling the Desmi 250 skimmer. This group will be given an orientation on the use of the fishing vessel's hydraulic systems to operate skimming systems. After learning how to operate the powerpack and skimmer, the fishermen will be expected to operate the skimmer and compressor by themselves. They will be expected to adjust the weir and explain how the skimmer deals with debris, and how the pump works. The skimmer will be deployed by the group and operated. At the completion of these tasks, they will be expected to put the skimmer away in the packaging order it was received. This group will also be given a demonstration of the Rope Mop 4090.

### Summary

Fishing vessels are an important component of oil spill response plans. The crews must receive organizational, safety, and operational training. This program combines classroom and fishing vessel-based

exercises to achieve this goal. The progress that has been made and continues to be made in developing this training will set a new standard for oil spill response readiness.

### **References**

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## **Preparing for Success: A Systems Approach to Oil Spill Response**

**John R. Harrald**

*The George Washington University  
2130 H Street NW, #632, Washington, DC 20052*

### **Abstract**

This paper explores the difficult organizational task of preparing for a successful response to a significant pollution incident. A dual approach to the concept of preparedness is presented: the first is derived from an organizational theory perspective and the second is developed from expert judgment obtained from a series of exercises conducted with oil spill response experts. Implications for successful response preparedness are developed using three different theoretical views: (1) the organization as a purposeful system, (2) the organization as a dynamic system of interrelationships, and (3) the organization as a high performing system. The critical success factors and critical issues for response success are then developed from the expert judgment expressed in the scenario exercises. The framework provided by organizational theory, when coupled with the system issues identified by the experts, provides a useful model of response system preparedness.

### **Introduction**

Preparedness is a more important and complicated concept than that addressed by contingency planning. Preparedness is a state of a system; a plan is a document. The systems approach to preparedness is intended to re-focus the process from the structural and procedural dimensions of planning to the central systems attributes of goals, information, feedback, and relationships. The pollution response preparedness system and the subsystem that is created to respond to a unique pollution event are complex organizational systems. In order for such systems to reach their goal, an operational definition of the goal and a method of measuring the effectiveness of progress toward that goal are required. Success can only be defined in a systems context and must be defined by response experts, not by contingency plan writers. Creation of structural, cultural, and learning systems to support success are important aspects of preparedness.

How and when success is measured, and who participates in determining success have been overlooked aspects of preparing for spill response.

## Background

A major maritime oil spill is a low probability, high impact event resulting from the failure of a complex technological and economic system. The critical function of preparedness is the creation of a response system capable of effectively responding to such a relatively rare and complex event. The design and implementation of a response system goes far beyond the specification of organization, responsibilities, resource requirements, and tactics found in the typical contingency plan. Oil spill contingency planners have focused on the resource and technology dimensions of response and have produced plans that are often compendiums of available resources backed by relatively simplistic organizational definitions. Until recently, few plans were based on realistic scenarios and even fewer specified response organizations that effectively integrated even the major players in an oil spill response—the Coast Guard, the state, and the responsible party. The focus on technology and resources (and the lack of focus on organizational and other “soft” planning issues) can be seen from a cursory review of the biennial Oil Spill Conference Proceedings articles published during the 1970s and 1980s.

The response to the *Exxon Valdez* spill made it painfully obvious that government and industry contingency plans failed to provide a basis for the organization and execution of the required response (Harrald et al. 1990). The Oil Pollution Act of 1990 (OPA 90), a direct result of the *Exxon Valdez*, required for the first time that U.S. contingency plans be based on “worst case” scenarios and backed by adequate resources. OPA 90 also redefined the federal government/responsible party relationship, directed the formation of local area planning committees to ensure state and local participation in the planning process, and directed that the National Contingency Plan be revised to create a workable response organization. Coast Guard regulations have precisely defined scenario requirements and established guidelines for local area plans.

The Coast Guard has, at the national and local levels, invested a significant amount of energy into defining the response organization for the next “spill of national significance.” The Coast Guard, many state agencies, response organizations (e.g. the Marine Spill Response Corporation), and oil companies seem to be converging on the incident command system (ICS) as the organizational framework for a pollution response. The ICS structure has not been directed by law or regulation, but these organizations recognize that some uniformity in the organizational



approach to spill response is required. Ad hoc response by committee has not worked and will not work. The ICS has proven effective in many emergency situations and is being widely adopted for oil spill response. (Hunter 1993). However, concern has been expressed by some experts that OPA 90 does not facilitate the integrated organization required for an effective ICS, and that all stakeholders (responsible parties, states, and localities) will really delegate their interests to an organization controlled by the Coast Guard (Ott et al. 1993). Other more significant concerns have been voiced by disaster researchers that the coordination, cooperation, and communications required for a multi-agency response to a major disaster may actually be impeded by the command and control focus of the ICS (Wenger et al. 1990, Dynes 1990)

### The Systems View

The specification of spill scenarios, the rationalization of the response organization, and the specification of mobilization and tactical actions are necessary, but not sufficient, conditions for a successful response. The creation of a response system is far more complex, and the performance of this system is very dependent upon the turbulent and event drive environment in which that system is expected to function.

Three views of organizations as systems provide useful perspectives for analysis of the pollution response problem. Schoderbeck and Schoderbeck (1985) view organizations as purposeful systems that can be modeled in terms of goals, inputs, processes, outputs, and feedback as

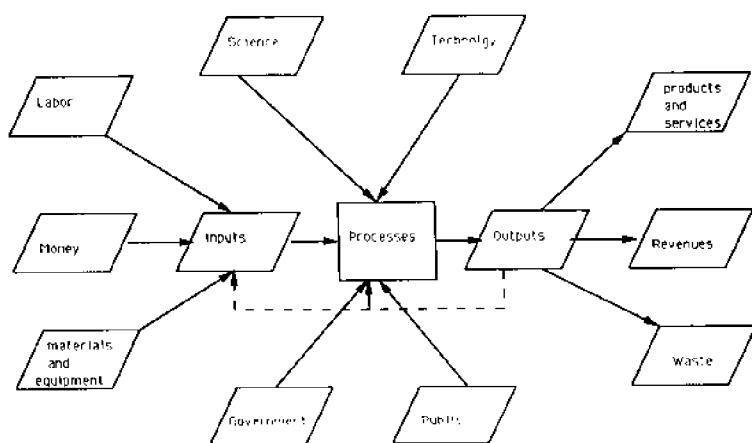


Figure 1. A systems view of an organization. Source: Schoderbek.

shown in Figure 1. An interaction view of the organization is furnished by Leavitt (1972) and by Michael S. Scott Morton (1993). Leavitt described an organization in terms of its task, technology, structure, and people and the interactions between these four elements. Scott Morton has broadened this model to include the components of strategy and managerial process and to incorporate the influences of the external socioeconomic and technological environment. His model, which served as the basis for the MIT study of the corporation of the 1990s, is shown in Figure 2. A third and still evolving view of organizational systems is provided by P. Vaill (1982), T.R. LaPorte (1988), Karlene Roberts (11989, 1990) and others in their studies of high performing and high reliability organizations. They have described the features of these exceptional organizational systems and attempted to determine how sustained, high reliability is achieved.

Schoderbeck's emphasis on the purposeful nature of a system implies that the successful response system must be goal directed; a clear, shared, and accepted concept of success must exist. A second implication of the system view of the organization is that control of the system requires comparison of some system characteristics against standards or expectations. This means that measures must be developed that will enable organizations to evaluate their performance and will enable them to adjust

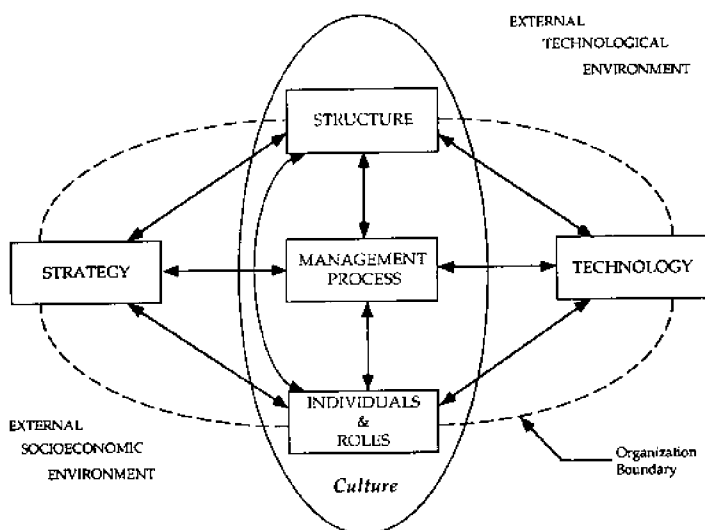


Figure 2. The organization as a set of relationships in equilibrium. Source: M.S. Scott Morton.

their processes (strategy, tactics, and procedures). The feedback loops are required in order to control the system. The collection and transmission of information is central to the process. Most contingency planning does not define success, let alone attempt to ensure that the definition is accepted by all stakeholders, or attempt to develop measures of effectiveness. The failure to establish feedback of critical control information prior to the event seriously impairs the organizational system's ability to adapt or even to survive. The pre-defined response organizations for both the *Exxon Valdez* and hurricane Andrew response did not survive the first week (Harrald et al. 1990, Carley and Harrald 1993).

In general, large complex systems are difficult to comprehend or to manage as a whole. Often it is advantageous to decouple subsystems in order to minimize the essential interactions. Large tightly coupled systems can exhibit physical problems associated with resource movement coordination, as well as problems of communication. Large systems may also run down or decay (the process of entropy, or the tendency toward disorder). Tight coupling can magnify the impact of system failures (Perrow 1984). Decoupling tightly coupled systems, which reduces the need for communication and allows subsystems to communicate with each other on an exception basis, has a number of benefits but also some costs. For instance, there are costs associated with maintaining decoupling mechanisms (i.e., buffers); further, each subsystem may operate in a manner not optimal for the organization as a whole (suboptimization). The current emphasis on a unified command for spill response, and use of the incident command system to ensure command and control, may be seen in this context as a choice to make the organization that responds to a significant event into a tightly coupled system. The potential adverse impacts of this policy choice have not been adequately examined.

Leavitt's and Scott Morton's view of the organizational system emphasizes the dynamic equilibrium between forces and interrelationships rather than processes. The inter-relationships between organizational structure, organizational culture, and technology are the key to understanding organizational performance and organizational change. Changes or initiatives intended to influence one element will affect all other elements. As stated by Leavitt (1975), "we must never forget that when we tamper with any one of these variables, we are likely to have significant effects on the others." Most contingency planning efforts ignore this view and treat structure and technology as independent, task and structure as synonymous, and culture as irrelevant.

The relational view of the organizational system implies that attempts to define organization without considering culture and technol-

ogy may be dysfunctional. For example, the imposition of a centralized (unified), hierarchical organizational structure such as the incident command system should work well when the organizations that are subsumed in the structure are themselves relatively structured or hierarchical (e.g. fire departments, military units, large corporations) but may not work as well when some of the organizations involved are less formal or less structured organizations (e.g. small companies and environmental groups). Interrelationships and organizational culture are critical, unavoidable elements of organization. Unanticipated cultural clashes and failed organizational relationships can doom a response, yet little attempt has been made to anticipate the compatibility (or impacts of non-compatibility) of organizations thrown together in a response organization.

Peter Vaill, in a 1982 article, described the phenomenon of high performing systems: those human systems that perform at levels of excellence far beyond those of comparable systems. He found that such systems have clear objectives and strong commitment to purpose. Leadership is strong and clear and integrated, team action is the norm. High performing systems are, however, fertile sources of creativity. LaPorte and Consolini (1988) examined high reliability systems where system errors can lead to catastrophic consequences. These systems, the air traffic control systems, and aircraft carrier operations, exhibit many of the same features of Vaill's high performing organizations. Dr. Karlene Roberts (1990) has expanded on the work of Vaill and LaPorte and has investigated "high reliability organizations"; large scale organizations with complex technical, human, organizational, and cultural components which necessitate the development and proliferation of high degrees of organizational reliability and safety. These organizations avoid major errors even though their exposure to situations where catastrophic failures are possible is high. The organizational system features discussed by these authors are important to the survival and success of the pollution preparedness and response organizations. Roberts found that the high performing systems she examined had the following features in common:

- They avoid unanticipated "baffling interactions" between organization subsystems and ensure that subsystems are not called upon to serve incompatible functions.
- They minimize indirect communications between subsystems.
- They minimize the impact of tight coupling through redundancy and by adhering to high standards of responsibility and accountability.

- They ensure that goals are clearly stated and universally understood.

The three views of organizations as systems presented in this section provides the context for the discussion of pollution response systems. Further insight into the system's view of pollution response can be gained from describing how the response preparedness system creates the organizational subsystem that must respond to a specific event. This subsystem is formed and adapts; it either succeeds in achieving its goal, or it fails.

### **The Creation and Evolution of a Response System**

The pollution response preparedness system is composed of the organizations and stakeholders with responsibility for or significant stake in the results of a pollution response. The National Contingency Plan and regional, local, and industry contingency plans provide a framework for the creation of a subsystem (the response organization) that must respond to a event that causes or may cause a maritime spill. In the United States, this subsystem is coordinated by the pre-designated on scene coordinator. During the initial hours after a spill, the on scene coordinator is faced with three critical functions: (1) mobilizing resources, (2) forming the response organization, and (3) directing the initial response actions. If he or she is successful, the response quickly passes through three stages: the mobilization and initial response phase, the integration phase, and the production phase. The transition between these phases is, as represented in Figure 3, often marked by a regression in organizational output and effectiveness.

The mobilization and initial response phase is marked by the execution of tasks that are pre-defined by the contingency plan. The success or failure of the mobilization effort depends upon the adequacy of the plan and the ability of the unit to immediately execute the plan. In order for a plan to be an effective basis for notification and mobilization, the response scenarios must be based on realistic vulnerability assessments, and must determine the appropriate response resources required for each scenario. The organizational system uses the feedback from the external environment (initial assessment) to estimate the resources required. These resources must be accessed and mobilized within the time constraints imposed by the external event. The feedback mechanisms must be in place prior to the spill event in order for the response organization to enable the evaluation of the effectiveness of this critical phase.

The second stage of a crisis response, the integration phase, is the period required for the responding forces to arrive on scene and to form an

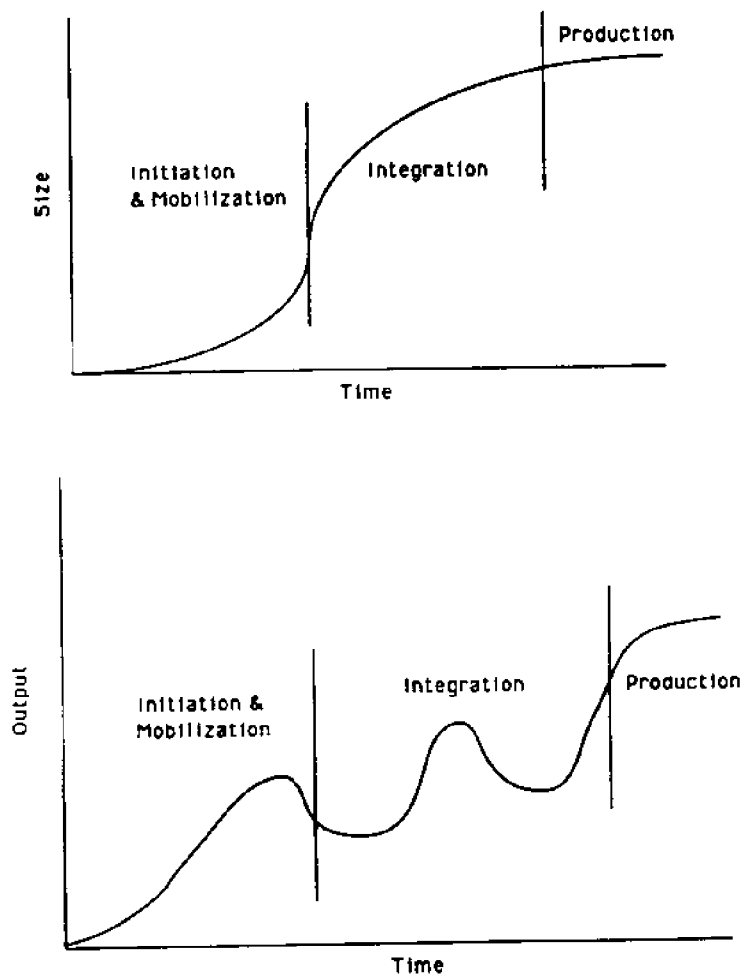


Figure 3. Stages of a disaster response.

effective operating system. Bruce Tuckman (1965) has pointed out that all groups go through the stages that may be categorized as orientation, internal problem solving, growth, and productivity and control. He termed these stages as "forming," "storming," "norming," and "performing." During the *Exxon Valdez* response, the integration phase lasted for almost a week (Carley and Harrald 1992). A similar delay caused by the need for organizational integration impeded the federal response to hurricane Andrew (Carley and Harrald 1993). The goal of the response subsystem should be to get through the integration phase and into the production phase as quickly as possible through preplanning, training, and exercises that include all critical stakeholders.

Specification of a desired organizational outcome does not ensure that this integration will take place. Following Leavitt's organizational taxonomy, three issues can be identified that may prevent effective integration:

### Task Complexity

The tasks facing the organization cannot be centrally coordinated during the timeframe available due to lack of resources or capability. This may lead to the emergence of ad hoc organizational groups engaged in problem solving behavior (Dynes and Quarantelli 1968). A maritime casualty may involve multiple and diverse tasks such as rescue, salvage, firefighting, and pollution response. The response system must be able to integrate all facets or it will be unable to make resource trade offs and avoid conflicts. A critical weakness of the U.S. system is that the expertise for these tasks resides in different formal organizations and must be integrated during emergency conditions. The Coast Guard has responsibility for rescue and pollution response, but salvage is a private sector problem, and maritime fire fighting is a shared local/state/federal responsibility. This task complexity is incident dependent and can prevent overall coordination. For example, salvage was the major issue immediately following the *Exxon Valdez* grounding: a factor better understood by Exxon shipping and the Coast Guard than it was by state and private environmental organizations. During the *Mega Borg* response, the lack of adequate fire fighting and salvage resources, and the location and control of these resources, became public issues.

### Organizational Incompatibility

The organizations that must operate as a unified entity in the response subsystem may be incompatible along one or more dimensions. They may be culturally incompatible, geographically incompatible (e.g.

land based or maritime based), and/or functionally incompatible (having conflicting functional responsibilities). During the hurricane Andrew response, for example, the author observed that "uniforms dealt with uniforms". Military organizations quickly and easily established relationships with each other and with state and local uniformed agencies (police, fire, fish and game). Establishing and maintaining relationships with critical civilian organizations (Red Cross, social service agencies) happened slowly, if at all. This is not a new problem. Stephens (1993) discusses what he terms the land/marine incompatibility of the organizations responding to the 1947 Texas City disaster. Many of his observations could be applied to the *Exxon Valdez* response.

### Political Incompatibility

Organizations may not rely on the same processes or same criteria to make decisions. In the extreme case, decision authority may be withheld from the members assigned to the response organization by the parent organization. A more typical example of this incompatibility would be a conflict between organizations used to centralized autocratic decision making and organizations accustomed to decentralized or group decision making processes. Spill response organizations may have to integrate very diverse organizations. For example, the organization created to respond to the spill produced by the sinking of the *Tenyo Maru* at the entrance to the Straits of Juan de Fuca explicitly included the Makah Indian tribe in the decision-making process due to the impact of the spill on tribal lands. The tribe's decision criteria and decision process were both significantly different from those used by the federal and state response teams (USCG 1991).

The relationship focus is essential to understanding the challenges of the integration phase of a response effort. The relative importance of the factors is event driven, reinforcing the need for effective feedback.

The production stage of a pollution response is reached when the response organization stabilizes and attains the capability of operating in a routine manner (e.g. the production and execution of daily tactical plans). At this point, the response is far from over, but the system, the task environment, and information flows have stabilized. A successful outcome is possible, but not assured. In order to be perceived as successful at this point in the response, the dimensions of success and the measures of effectiveness must be defined and broadly accepted by participants and observers. This implies that a very critical element of preparedness and response is influencing the process of defining success. During the *Exxon Valdez* and hurricane Andrew responses, for example, the definition of



success was abdicated to the media. Success was a moving target and responders could do nothing to counter the perception of failure that resulted. Neither of these response organizations reached a stage of routine operations for weeks after the crisis occurred, and early opportunities for effective action were missed.

### **Defining a Successful Response**

The preceding discussion shows that the organizational system must exhibit goal-directed behavior and possess the information gathering and handling capabilities required to measure and control its performance. Goals that are not clearly defined and are not measurable, are rarely achieved. In the disaster response area, however, responders must deal with vague and changing definitions of success. Too often, response organizations take as their measure of success the ability to execute the procedures defined in their contingency plan. Often, however, they then discover that the public and media are more interested in the effect of their response on the external environment impacted by the disaster than they are in the agency's mobilization and organizational progress. During the response to hurricane Andrew, for example, FEMA spent the first three days implementing the organizational and procedural steps required by the new Federal Response Plan. Unfortunately, FEMA was reacting to grossly underestimated damage assessments. The media and political pressure to respond prompted President Bush to establish a presidential task force to coordinate the federal response and to send in approximately 30,000 military personnel. FEMA's plan was dead on arrival (Carley and Harrald 1993 p. 13.)

The definition of success is a non-trivial exercise. It involves establishing criteria for actual achievement and recognizing that external perceptions are a critical element of success. One approach to defining success is to identify those factors that must be achieved in order for success to be realized. The critical success factor approach was developed by Jack Rockart at MIT as a strategic planning tool (1981). In order to determine the critical success factors for a pollution response, a methodology had to be developed for extracting and structuring expert opinion. A scenario based "hindcasting" technique was developed by the author to focus response experts on the factors critical to success and the problems that must be resolved in order to achieve these factors.

Hindcasting is an innovative technique that can be used to facilitate the creation of a comprehensive scenario from the chain of inherently low probability events that describe a technological or natural disaster or disaster response. In this technique, the end of the scenario is described to

a group of experts and they are challenged to work backwards in time, creating possible sequences of events, decisions, and actions which could have produced the specified end result. It has been shown by Starbuck (1989) that experts are more likely to envision a sequence of low probability events once they assume that the sequence has already occurred and when their task is to collaboratively deduce a rational, causal explanation.

This section describes the consolidated results of five separate hindcasting exercises. The first three exercises were conducted as tabletop exercises with groups of experts assembled by the U.S. Coast Guard. There were approximately 20 experts in each group representing federal agencies (Coast Guard, Environmental Protection Agency), state agencies, and industry. In one of these exercises the participants were the senior organizational members of the federal, state, and local agencies represented on a major U.S. port's local area planning committee. The other two exercises were conducted in an electronic meeting room facilitated by a system of networked computers and group support software. (This type of technology has been termed a group decision support system or GDSS. The use of GDSS to support the contingency planning process is described in detail in Belardo and Harrauld 1992.) One of these exercises was conducted with managers from the Marine Spill Response Corporation (MSRC), a national pollution response organization in the United States funded by the major transporters of petroleum products. The final exercise was conducted with a group of experts assembled by the Texas General Land Office. A sample hindcasting scenario is shown in Appendix A.

The objective of each hindcasting exercise was to use a scenario-based exercise to identify the issues and problems that must be resolved to successfully execute a spill response operation. In each case, the group of oil spill response experts was presented with a newspaper description of a response to a major oil spill. The front page article asserts a public verdict of failure (as proclaimed by members of Congress, the press, and the U.S. General Accounting Office). The scenario used for each of the exercises was based on a historical maritime casualty.

During each hindcasting experiment, experts were given the end point of an operation (a failed pollution response) and challenged to determine *what* went wrong, and *why* these failures occurred. The results of the exercise were then used to develop planning and problem solving strategies. Since the *what* and *why* of success are the inverse of the *what* and *why* of failure, the exercise enables the definition of the factors critical to the success of an oil spill response, and identification of priority problem solving activities.

When asked to determine what went wrong (before or during the spill response) that created the public perception of failure, the experts in

each exercise identified approximately 100 failures that could be grouped into five general categories. The unresolved problems and system states that they identified as the reasons why these failures occurred provide the basis for describing a causal chain. The participants identified approximately 80-100 causal factors that led to the failure to achieve one or more of the critical success factors. These causal factors were also grouped into six statements that represent problems that had to be solved before or during the response operations.

The results of the five exercises were remarkably similar, indicating an important convergence of expert opinion. These experts from different organizations, participating in different group exercises, arrived at almost identical definitions of a successful response (critical success factors) and barriers to success (problems to be resolved).

### Critical Success Factors

The oil spill experts identified six critical success factors (CSF), or things that must go right if the response operation is to succeed and to be perceived as a success:

*1. The salvage operation for a vessel spill, or emergency response operation at a facility, must effectively stop spillage of oil and must not interfere with pollution response operations.* The best way to minimize the environmental impact of a maritime casualty is to minimize the amount of the pollutant that escapes into the environment. However, the event that caused the polluting incident must be resolved in a manner that does not impede the pollution response. This implies the close coordination of salvage, rescue, and response operations.

*2. The immediate response by the responsible party and the Coast Guard must mobilize enough appropriate response resources (people and equipment) to contain the oil at or near the source and to protect sensitive areas.* The second most obvious way to minimize environmental impacts is to prevent the pollutant from reaching sensitive areas. This can be done only if appropriate response resources can be effectively brought to bear by the responsible party and or the Coast Guard to contain, deflect, disperse, or remove the oil before it comes ashore. This factor is obviously dependent upon the location of the casualty and the forces of wind and weather. In many cases, achievement of this CSF may be physically impossible.

*3. The response organization must be able to communicate and manage information internally and externally.* Accurate and timely information

must be provided to the media and public, and feedback on the effectiveness of strategy and tactics must be provided to decision makers if the response system is to adapt its strategy and tactics and remain goal directed. Information must be transmitted effectively within the response organization and between the response organization and the media and public. Only if this communication is timely and accurate will the public's expectations be anywhere near realistic.

*4. Federal, state, and local organizational coordination must be preplanned, must account for stakeholder interests, and must ensure a response organization that will be cohesive and effective.* The response organization must work effectively during the immediate initiation and mobilization phase and must support the rapid expansion of the integration phase without losing organizational effectiveness. Integration must be achieved without public conflict. Preplanning must identify and account for stakeholder interests and resolve potential organizational conflicts.

*5. The response organization must be capable of sustained effective operations.* Equipment must work as designed and must be properly used. The OSC must lead the response and must be able to recognize when the response strategy is inappropriate and be able to quickly adjust strategy to the actual situation. Adequate personnel and equipment strengths must be maintained.

*6. The public's expectations for pollution response must be realistic and achievable.* If the public and the media have established and accepted a pre-event definition of success that cannot be achieved, such as zero environmental impact or immediate and effective response under all weather conditions, the response will be perceived as a failure regardless of how it is conducted.

### **Causal Problems and Issues**

The experts identified seven problems or issues that could prevent attaining one or more of the critical success factors. The statements of problems that must be solved or capabilities that must be created furnish a pre-spill agenda for the response preparedness system.

*1. The Coast Guard pre-designated on scene coordinator must have credibility, knowledge, and experience in order to function as leader of the multi-agency operation.* Individual leadership is critically important during a crisis event. The leader must have the ability to function under stress and to ascertain essential feedback from overwhelming information

flows. He or she must have the authority and ability to adjust strategy and tactics and have the personal and professional standing that will lead to the acceptance by others of these actions. The U.S. Coast Guard is attempting to address these issues in its On Scene Commander's crisis management course.

*2. The response organization must establish an information handling capability able to support a large, distributed organization and quickly and accurately distribute and display large volumes of information. The capability of communicating accurate, timely, and consistent information to the media, public, and other responders during a response must be created prior to a spill event. Communication networks that support inter and intra organizational information transfer must pre-exist, and the identification of information to be gathered and distributed must be made. Needed computer based data and decision systems must exist in a deployable state. Capabilities and limitations of response organizations and equipment must be communicated to stakeholders, media, and public prior to and during a spill response. Public information strategies and media access sites must be pre-defined or they will not be implemented.*

*3. Scenario based response actions must be developed and drilled to accomplish constrained mobilization of resources. Initial response and mobilization effectiveness are determined by scenario based time constraints. Drills and exercises are necessary to ensure that the response system can react with appropriate notification and mobilization within these constraints. Local contingency plans and vessel response plans that do not consider scenario based time constraints will not ensure a viable response.*

*4. Preparedness activities must focus on identifying stakeholder interests, resolving conflicts, and establishing a response organization that will be implemented and followed. The response organization specified in the plan must work in practice to integrate all responsible organizations in a way that ensures the ability to make decisions and take action. Key jurisdictional authorities and stakeholders must participate in the planning process; inter-organizational issues must be resolved prior to a spill event in order to ensure ownership of the product by all response system members.*

*5. The capability to deal with multiple, simultaneous, emergencies must be developed. The Coast Guard, the United States pre-designated on scene coordinator, does not have the ability or authority to control simultaneous maritime crisis operations such as fire, salvage, or multiple spills that*

occur as part of a natural disaster. This capability must be created and exercised as a key element in local area planning.

6. *The technology for open water containment and removal must be improved.* Current technology for containing and removing oil from open water will not be adequate in the sea state and current conditions that will occur during many highly probable spill scenarios. In the United States, it is unlikely that dispersant use will be permitted in nearshore areas. It is in these areas that response is most time constrained and environmental resources are most at risk. The effectiveness of current technology must improve before success in these areas can be assured.

7. *Response organizations must communicate with and educate the public about vulnerability, risk, and realistic outcomes.* The management of expectations prior to a response event is a key issue. Unfortunately, most response organizations stress and downplay their limitations. The failure to educate the public as to the limitations of existing technologies and constraints that are imposed by weather and sea conditions has led to a perception that the great increase in investment in pollution response equipment and personnel guarantees a successful response to the next major spill.

### **System Evaluation and Adaptation**

Two important inferences may be extracted from the preceding system oriented description of preparedness and response. The first is that success is a multi-dimensional concept and that a methodology for preparedness planning and assessment based on this concept can be developed. The second is that the response system must enhance its ability to be an adaptive system, both at, during, and after a pollution response.

Figure 4 is an influence diagram based on the analysis of the hindcasting exercises described in the preceding sections. This figure shows the relationship between the objectives of a pollution response (the avoidance of impacts and the perception of success), the factors critical for this success, and the problems and issues that must be resolved in order to achieve the critical success factors.

Influence diagrams have become popular for model building and decision analysis. An influence diagram is a compact visual portrayal of a scenario or system. As defined by Shachter (1988), an influence diagram is a network representation of probabilistic and deterministic variables and decisions. It can be used to identify key expert inputs such as likelihood of occurrence of and dependencies between events. Howard (1989) terms this use of influence diagrams as the construction of knowledge maps. These

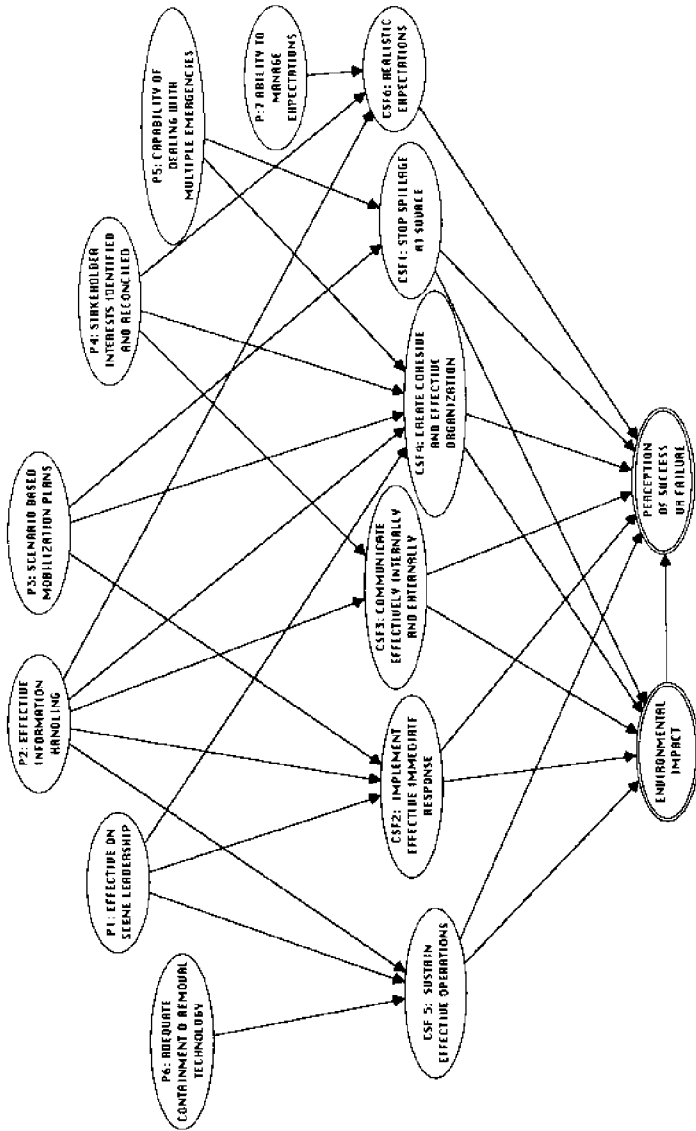


Figure 4. Influence diagram showing factors critical to a successful pollution response.

knowledge maps can be used to assess the readiness of the response preparedness system in a specific area. Each problem or issue variable in the knowledge map can be assigned a probability distribution representing the likelihood that it will/will not occur. The probability of achieving each of the critical success factors can be calculated and the overall chance of success can be inferred from the status of the critical success factors (Harrald and Mazzuci 1993).

In order to achieve and sustain high levels of performance in low probability, high consequence environments, response preparedness, and response organizations must become adaptive systems. This means that response organizations must be able to adapt and adjust during a crisis event and be able to assess lessons learned from each event. These lessons must be transmitted to and institutionalized by the response preparedness organizational system. Systems that fail to attempt to learn may not have established goal directed behavior, created essential feedback loops, or developed metrics for success and effectiveness.

## Conclusions

The national pollution response preparedness system and the subsystem that is created to respond to a unique pollution event are complex organizational systems. The task domain of these systems is the difficult problem of responding to a low probability, high consequence event. This paper has developed the argument that more attention must be paid to the facets of these systems that are essential to their success. Goal directed behavior, measures of effectiveness, feedback, information handling, and adaptive behavior all are attributes demonstrated by effective systems. Expert opinion can be used to develop the critical success factors that will help define goal directed behavior during a pollution response, to determine the actions required to achieve these factors, and to specify the information needed to monitor the response system's progress. If the response preparedness and response systems are to succeed, they must capitalize on the knowledge of experts who have experienced similar events.

The relationships and the interconnections between task, technology, organization, and culture are important elements in the ability of preparedness and response systems to succeed. Organizational and technological solutions that are currently being implemented in the United States and elsewhere do not adequately consider these interactions, and the failure to resolve organizational and cultural issues could have a significant effect on the outcome of a major pollution response effort. A unified command specified by a plan, for example, cannot become a reality unless the



organizational and cultural issues have been recognized and resolved prior to a spill event.

In order to continue to improve their performance, the preparedness and response systems must become adaptive systems and exhibit the ability to learn from their successes and failures. Effective information gathering and distribution, organizational flexibility, and strong leadership are attributes that will enable these systems to adapt and to succeed. These systems are critical to our society; every effort should be made to ensure that they become high performance and high reliability systems.

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## Appendix A

### *Event Scenario*

The Norwegian bulk carrier *Lutefisk* sailed at 2:00 am on August 19, 1994 from the port of Corpus Christi bound for the Panama Canal in heavy rain and restricted visibility. The *Lutefisk* was fully loaded with a cargo of grain and a deck cargo of containers. At 3:00 am the *Lutefisk* collided with the tanker *Universal Peace*, a Bahamian flag tanker that was anchored three miles southeast of Corpus Christi waiting for a lightering vessel to offload its cargo of Venezuelan crude oil for a Corpus Christi refinery. The momentum of the collision caused the *Universal Peace's* anchor to break free and the two ships, locked together, drifted with the tide and current.

The crews of both vessels abandoned ship due to the potential fire hazard on the *Universal Peace* and the fear that containers of hazardous cargoes carried on the deck of the *Lutefisk* may have been ruptured or lost overboard during the collision. An estimated 9,000,000 gallons of crude oil from *Universal Peace* escaped from four ruptured cargo tanks and an additional 100,000 gallons of fuel oil was released from the bunkers of the *Lutefisk*.

#### Description of Vessels Involved in Collision:

##### *Universal Peace*

- 165,000 dwt, single hull tanker
- Built in 1979 in Pusan, Korea
- Bahamian Flag, classed by Croatian Classification Society
- Owned by Maple Leaf Inc., a Canadian investment group
- Managed and operated by Li Operating Co. Ltd., a Hong Kong ship management company
- Manned by Indian officers, Filipino crew

##### *Lutefisk*

- 35,567 Gross ton bulk carrier (reinforced for deck carriage of containers)
- Built in 1978 in Gdansk, Poland
- Norwegian Flag (NIS Registry), classed by Det Norske Veritas
- Owned and operated by Harald Shipping, a Norwegian family shipping company

August 24, 1994

Special to the Houston Chronicle

**Oil Spill Clean Up System "Failed Miserably" in Texas Congressman Claims.** Congressman Peter Miller (D-Texas), chairman of the House Environment Committee announced today that his committee would hold hearings to determine why last week's oil spill caused by a collision between a tanker and a cargo vessel off of the Texas coast has resulted in such extensive contamination of environmentally sensitive areas. Miller declared at a press briefing at Corpus Christi airport after visiting the spill scene that, "Nothing has changed since the *Exxon Valdez* fiasco. The Coast Guard and the oil industry have been promising a lot to the Congress and to the public for the last four years, but when the chips were down, they failed just as miserably as they did the last time." Congressman Miller asserted that the contamination of the shoreline of Padre, San Jose, and Matagorda islands is clear evidence of the "incompetence of the oil and shipping industries and the Coast Guard; and that the inept response, one full year after all requirements of the Oil Pollution Act of 1990 were to be met to the taxpayers of Texas and the nation."

One of the most damaging oil spills in the history of the Gulf Coast occurred in heavy rain and restricted visibility at 3 am, August 19. The Norwegian cargo vessel *Lutefisk* was outbound from Corpus Christi when it collided with the tanker *Universal Peace*. The large Bahamian flag tanker was anchored and waiting for a lightering vessel to offload its cargo of Venezuelan crude oil for a Corpus Christi refinery. The *Lutefisk* was fully loaded with a cargo of grain and a deck cargo of containers. The momentum of the collision caused the *Universal Peace's* anchor to break free and the two ships, locked together, drifted with the current while the *Universal Peace's* cargo of crude oil gushed into the coastal waters. The Coast Guard ordered the crews of both vessels to abandon ship due to the potential fire hazard on the *Universal Peace* and the fear that containers of hazardous cargoes carried on the deck of the *Lutefisk* may have been ruptured or lost overboard during the collision. An estimated 9,000,000 gallons of crude oil from *Universal Peace* escaped from four ruptured cargo tanks, and an additional 100,000 gallons of fuel oil was released from the bunkers of the *Lutefisk*. Fishing vessels and Coast Guard Cutters rescued all 35 crewmen from both vessels and commercial tugs retrieved five containers from the water. Observers said, however, that the initial response to the oil spill was "uncoordinated and confused." Prevailing southeasterly winds and currents have pushed the oil up the Texas Coast for the last five days and oil has entered Corpus Christi Bay, Aransas Bay, and Matagorda Bay.

The Coast Guard captain of the Port for Corpus Christ, Captain Mark Wheatley, presided over a hostile press conference held at the Corpus Christi Coast Guard base today. Wheatley said that he wanted to "ensure the public that federal, state, and local forces were working well together and that reports of dissention and organizational confusion were unfounded." The Coast Guard and the tanker owner had mobilized all the resources he needed to combat the spill, Wheatley stated, in response to allegations that the oil industry's Marine Spill Response Corporation's multi million dollar stockpile of equipment in the Gulf of Mexico was not immediately used. "The owners of the *Universal Peace* employed a local clean up contractor as specified in their approved vessel contingency plan," said Wheatley, MSRC and other resources were called in when it became apparent that the spill was beyond the local contractor's capability." Bill Merlin, the Regional General Manager of the Marine

Spill Response Corporation said that responders were impeded by the rain and poor visibility on scene, but that the performance of the company's new response vessel, the *Texas Responder*, had met expectations. However, according to observers, by the time the vessel arrived on scene much of the oil was either ashore or had been carried by the wind and current to shallow areas close to shore. "Clean up in these areas is a slow process," admitted Wheatley. The *Chronicle* has learned that the tanker owners are a group of Canadian investors and, although their local representative was at Captain Wheatley's side during today's press conference, the owners have not made themselves available to the press. In spite of repeated attempts, the *Chronicle* could only reach a voice mail message at the corporate headquarters in Toronto. Observers said that uncertainty over the vessel owner's actions, friction between federal, state, and local officials, and the initial focus on the safety threat posed by the drifting vessels hampered early response efforts. Press conferences have been scheduled for tomorrow by the State of Texas General Land Office, by the Friends of the Gulf environmental coalition, and by Mayor Brown of Corpus Christi. Mayor Brown stated in an interview last night with Channel 7 News, that he "was not pleased with the progress of the clean up and had serious questions about the Coast Guard, State, and City oil spill plans."



# **Oil-Spill-Response Preparedness: OCS Oil and Gas Operations**

**Tom Murrell and Jerry Jeschke**

*Minerals Management Service, Alaska OCS Region  
949 E. 36th Avenue, Anchorage, AK 99508-4302*

## **Abstract**

Minerals Management Service (MMS) regulations require each lessee to submit an oil spill contingency plan (OSCP) to MMS for approval with, or prior to, the submission of an exploration plan or development and production plan before conducting exploratory drilling or production operations on the Outer Continental Shelf (OCS). The OSCP is developed for site-specific operations, based on the type, timing, and location of the proposed activities. The OSCP must satisfy the content requirements and provisions identified in the Code of Federal Regulations, Title 30, Part 250.42 30 and the "Planning Guidelines For Approval of Oil Spill Contingency Plans," developed jointly by the MMS and U.S. Coast Guard. In addition, operators are required to conduct oil spill response drills to demonstrate their preparedness to implement an approved OSCP. These exercises include equipment deployment drills and tabletop exercises.

Historically, offshore exploration and development activities account for a very small percentage of spilled oil, and large catastrophic spill events are rare from such operations. Even so, operators must be prepared to respond to large spills. The amount of oil that can be recovered or burned in situ varies greatly depending upon the amount and type of oil spilled, the ability of industry to respond to the spill before it has had a chance to spread over a wide area, and the oceanographic conditions during the spill response effort. Technology currently exists that is capable of containing, recovering, and disposing of oil spilled from offshore facilities. Strong winds, high sea states, dynamic ice conditions, and emulsification of oil can greatly reduce spill response effectiveness. Industry and government are working together to improve spill response capabilities and to better understand existing technology.

## **Oil Spill Response Preparedness**

### **Oil Spill Contingency Plan Requirements**

Before conducting exploratory drilling or production operations on the Outer Continental Shelf (OCS), Minerals Management Service (MMS)

regulations require each lessee to submit an oil spill contingency plan (OSCP) to the MMS Regional Supervisor, Field Operations for approval with, or prior to, the submission of an exploration plan or development and production plan. The OSCP is developed for site-specific operations, based on the type, timing, and location of the proposed activities. The OSCP must satisfy the content requirements and provisions identified in the Code of Federal Regulations, Title 30, Part 250.42, and the "Planning Guidelines For Approval of Oil Spill Contingency Plans," developed jointly by the MMS and U.S. Coast Guard (USCG) (herein called Guidelines). Each OSCP is required by the regulations and Guidelines to include:

- A summary of all oil spill trajectory analyses which are specific to the area of operations. The summary must identify environmentally sensitive areas and biological resources, including birds and marine mammals, commercial fisheries, and subsistence resources which may be impacted by the spilled oil, and the strategies to be used for their protection. The Guidelines also require a risk analysis which indicates the number and size of spills that could occur during the proposed operation.
- An identification of response equipment which is committed and available (on-site, locally, and regionally) and the associated response times, together with materials, support vessels, and procedures to be employed in responding to both continuous discharges and spills of short duration and limited maximum volume. The response equipment and strategies must be suitable for anticipated environmental conditions in the area of operations. The Guidelines establish that equipment should be capable of operating in 8- to 10-foot seas and 20-knot winds, with deployment in the 5- to 6-foot range. The Guidelines also establish that the quantity and capability of the equipment should be related to the risk analysis. A recovery rate of at least 5,000 barrels of oil per day is considered appropriate for exploratory operations on the Alaskan OCS. The response times established by the Guidelines are 6 to 12 hours for initial recovery actions, with pre-staged equipment, depending upon location and weather. If the risk analysis indicates shoreline contact sooner than 6 to 12 hours, response times must be adjusted accordingly. For extraordinary spills, the Guidelines establish that additional equipment shall be available within 48 hours.



- A dispersant use plan includes an inventory of the dispersants which might be proposed for use, a summary of toxicity data for each dispersant, a description of the types of oil on which each dispersant is effective, a description of application equipment and procedures, and an outline of the procedures to be followed for obtaining approval for dispersant use. The Guidelines establish that the types and quantities of dispersants proposed for use must be related to the risk analysis, taking into account toxicity, expected oil composition, and water temperature. A target response of 24 hours or less from the time the spill occurs is established by the Guidelines.
- A plan for inspecting and maintaining response equipment.
- Establishment of procedures for early detection and timely notification of an oil spill including a current list of names, telephone numbers, and addresses of the responsible persons and alternates who are to receive notification of an oil spill, and the names, telephone numbers, and addresses of regulatory organizations and agencies to be notified when an oil spill is discovered.
- Well-defined and specific actions to be taken after the discovery of an oil spill including:
  - Designation by name or position of an oil spill response operating team composed of trained personnel available within a specified response time, and a description of the training such personnel will receive.
  - Designation by name or position of a trained oil spill response coordinator who is charged with the responsibility, and is delegated commensurate authority, for directing and coordinating response operations.
  - A planned location for an oil spill response operations center and a reliable communications system for directing the coordinated overall response operations.
- Provisions for the disposal of recovered oil, oil-contaminated material, and other oily wastes. This section must describe both the interim storage of such oil and material, and the ultimate disposal options available.

- Provisions for monitoring and predicting spill movement. The Guidelines also require that, if electronic or mechanical instrumentation is used, threshold detection sensitivities and limitations of equipment must also be provided.
- Provisions for ignition of an uncontrollable oil spill and the guidelines to be followed in making the decision to ignite. The Guidelines also require the identification of an operator's representative who has the authority to order the ignition of an uncontrollable well causing a massive spill event.
- Identification of the location where inspection, training, and response drill records will be kept.

All plans are reviewed by federal and state agencies, local government, and the public to ensure that each plan is appropriate for the type and scope of activities proposed, the environmental conditions of the area, and the biological resources at risk. The OSCP plan must be updated at least annually.

### Training and Drills

The MMS requires that operators conduct oil spill response drills to demonstrate their preparedness to implement an approved OSCP. The exercises include equipment deployment drills and tabletop exercises. The drills are observed by the MMS, and representatives of the USCG, State of Alaska, and local governments often participate in these drills.

### Response Capabilities

Historically, offshore exploration and development activities account for a very small percentage of oil that has been spilled, and large catastrophic spill events are rare from such operations. Even so, the MMS requires that operators be prepared to respond to large spills. The amount of oil that can be recovered or burned in situ varies greatly depending upon the amount and type of oil spilled, the ability of industry to respond to the spill before it has had a chance to spread over a wide area, and the oceanographic conditions during the spill-response effort. Technology currently exists that is capable of containing, recovering, and disposing of oil spilled from offshore facilities. Strong winds, high sea states, dynamic ice conditions, and emulsification of oil can greatly reduce spill-response effectiveness. Industry and government are working together to improve spill-response capabilities and to better understand existing technology.

# **Wildlife Protection Strategies: How Prepared Is Alaska in March 1994 to Deal with Oiled or Potentially Oiled Wildlife?**

**Pamela Bergmann**

*U.S. Department of the Interior  
Office of Environmental Policy and Compliance  
1689 C Street, #119, Anchorage, AK 99501-5126*

## **Abstract**

Following the *T/V Exxon Valdez* oil spill, the federal and state governments, including the State of Alaska, passed legislation that emphasized oil spill prevention, contingency planning, and response capabilities. At the same time, the oil industry reevaluated its preparedness in each of these areas. As a result, progress has been made in Alaska by federal and state agencies and the oil industry in their respective abilities to deal with wildlife that are contaminated, or are at risk of being contaminated, as a result of an oil spill.

## **Federal and State Agencies**

First, federal legislation (i.e., Section 4201(b) of the Oil Pollution Act of 1990) and state regulations (18 Alaska Administrative Code 75.425(e)(1)(F)(xi)) were enacted that address requirements for the inclusion of wildlife protection in contingency plans. Second, in February 1991, the Alaska Regional Response Team's Wildlife Protection Guidelines for Alaska were revised to incorporate relevant information based on lessons learned from their use during the March 24, 1989, *T/V Exxon Valdez* and the February 27, 1989, *M/V Swallow* oil spills. The guidelines were revised again in December 1993. Third, federal and state trustee resource agencies have continued developing and refining agency plans that complement the guidelines for dealing with wildlife following an oil spill. Fourth, work has been initiated by federal and state trustee resource agencies to complete a comprehensive inventory of wildlife resources at risk and what response actions may be taken to protect those resources.

## **Oil Industry**

First, increased attention has been given to all aspects of wildlife protection including hazing, capture, stabilization, and treatment. Second, additional attention has been given to steps that are necessary to implement a capture and treatment

program for species other than birds. Third, oil spill exercises have included various components of wildlife protection strategies. Fourth, plans have been developed for providing logistical support to wildlife capture efforts. Fifth, wildlife protection components of oil spill contingency plans for oil spill cooperatives have been upgraded to reflect the industry's increased preparedness.

In addition, representatives of the oil industry and federal and state trustee resource agencies have participated in joint industry/agency task forces, workshops, and oil spill exercises designed to ensure that complementary wildlife protection strategies are developed and understood.

## Conclusion

While federal and state agencies and oil companies operating in Alaska have made important progress in wildlife protection preparedness in the five years since the T/V *Exxon Valdez* oil spill, additional work remains. In general, federal and state agencies need to: (1) continue upgrading their respective agency response plans, (2) finalize guidance to industry on basic levels of wildlife preparedness, and (3) develop additional information on sensitive resource areas for area contingency plans. In addition, the oil industry needs to: (1) complete the acquisition of wildlife hazing, capture, and rehabilitation equipment and materials, (2) complete planned wildlife stabilization and rehabilitation facilities, (3) institutionalize wildlife protection training programs, and (4) annually exercise the wildlife protection component of their oil spill contingency plan. Once a basic level of preparedness is in place for the principal areas of concern in Alaska, additional attention needs to be focused on the other areas of the state.

## Introduction

The State of Alaska encompasses over one-half of the total U.S. coastline. This coastline and its offshore areas provide important habitat for large numbers of birds and terrestrial and marine mammals.

Since 1987, federal and state agencies have been working cooperatively, primarily through the Alaska Regional Response Team's (RRT) Wildlife Protection Working Group, to identify and institutionalize wildlife protection strategies for use in oil spill contingency planning and oil spill events in Alaska. These agencies have been assisted by representatives of the oil industry, Native community, and environmental community, who also serve as members of the Wildlife Protection Working Group. In December 1988, the Alaska RRT adopted the Wildlife Protection Guidelines for Alaska. These guidelines, which were prepared by the Wildlife Protection Working Group, provide federal on-scene coordinators with information on how to protect birds and marine mammals following an oil spill.

On March 24, 1989, the T/V *Exxon Valdez* ran aground in Prince William Sound and spilled approximately 11 million gallons of crude oil. This spill dramatically demonstrated the lethal effects of crude oil on birds

and sea otters. Images of the oil spill, particularly those of oiled birds and sea otters, dominated the national and international media for several weeks. Oil spill response activities included extensive wildlife capture and rehabilitation efforts. Those efforts, which focused on birds and—for the first time in history—sea otters, became the largest and most complex wildlife capture and rehabilitation program ever undertaken.

Following the T/V *Exxon Valdez* oil spill, the federal and a number of state governments, including Alaska's, passed legislation that required increased levels of oil spill prevention, contingency planning, and response capabilities, including wildlife protection. At the same time, the oil industry also evaluated and improved its preparedness in each of these areas. As a result, since March 1989, federal and state agencies and the oil industry in Alaska have made progress in their respective abilities to deal with wildlife that are contaminated, or at risk of being contaminated, as a result of an oil spill. The following discussion summarizes that progress and identifies areas that require additional work.

## **Federal and State Agencies**

### **New Laws and Regulations that Address Wildlife Protection**

Following the T/V *Exxon Valdez* oil spill, federal legislation (i.e., the Oil Pollution Act of 1990) was passed. Among its many provisions, Section 4201(b) of the Act requires that federal and state agencies prepare:

A fish and wildlife response plan, developed in consultation with the Fish and Wildlife Service and the National Oceanic and Atmospheric Administration, and other interested parties (including state fish and wildlife conservation officials) for the immediate and effective protection, rescue, and rehabilitation of, and the minimization of risk of damage to, fish and wildlife resources and their habitat that are harmed or that may be jeopardized by a discharge.

As of March 1994, this plan—which addresses fish and wildlife planning and response at a national level—was in final draft form. It is anticipated that the Alaska RRT's Wildlife Protection Guidelines for Alaska will fulfill the majority of the plan's requirements at the state level.

Section 4202(a) of the Oil Pollution Act of 1990 requires the establishment of area committees and the development of area contingency plans to facilitate and include procedures for "protection of sensitive environmental areas, and protection, rescue, and rehabilitation of fisheries and wildlife." As of March 1994, seven area committees had

been formed by the U.S. Coast Guard (USCG); namely, Southeast Alaska, Prince William Sound, Cook Inlet, Kodiak Island, Aleutian Islands, North Slope, and Western Alaska; and preliminary area contingency plans had been drafted for each of these areas. The U.S. Environmental Protection Agency (EPA) had not yet formed an area committee for Interior Alaska.

Federal and state agencies with statutory responsibilities for wildlife, and other appropriate federal and state agencies (i.e., the USCG, EPA, and Alaska Department of Environmental Conservation [ADEC]), met in January 1993 to develop an overall approach for developing appropriate wildlife-related information for area contingency plans. The Department of the Interior's (DOI) Office of Environmental Policy and Compliance (OEPC) took the lead in coordinating, while the Fish and Wildlife Service (FWS) and the Alaska Department of Fish and Game (ADF&G) developed information on sensitive areas, including wildlife concentration and critical habitat areas for the draft Southeast Alaska, Prince William Sound, Cook Inlet, Kodiak Island, Aleutian Islands, and North Slope Area Contingency Plans. In addition, work had begun on developing information on sensitive areas for the Western Alaska Area Contingency Plan and for Interior Alaska. Furthermore, resource agencies developed indices for prioritizing protection of critical habitats and wildlife resources in Southeast Alaska and Cook Inlet, and are working on indices for Prince William Sound and the North Slope.

In May 1992, new and more stringent oil and hazardous substance pollution regulations went into effect for the State of Alaska. Included in the provisions—which address facilities such as terminals, pipelines, oil production platforms, and tank farms—is the requirement that contingency plan holders address wildlife protection (18 Alaska Administrative Code 75.425(e)(1)(F)(xi)). Specifically, oil spill contingency plans are to include strategies for the protection, recovery, disposal, rehabilitation, and release of potentially affected wildlife including: minimizing wildlife contamination through hazing or other means, when appropriate; the recovery of oiled carcasses to preclude secondary contamination of scavengers; and the capture, cleaning, rehabilitation, and release of oiled wildlife, when appropriate.

The state regulations were prepared in conjunction with the federal agencies responsible for protecting wildlife who are members of the Alaska RRT's Wildlife Protection Working Group. As a result, the wildlife protection requirements contained in these regulations are consistent with those outlined in the Wildlife Protection Guidelines for Alaska.

The State of Alaska's new pollution regulations provide an important mechanism for requiring petroleum operators to upgrade their wildlife response preparedness capabilities. Review agencies, such as the ADF&G,

may recommend that the ADEC disapprove an oil spill contingency plan if the wildlife response section is inadequate.

As of March 1994, the ADF&G was preparing draft guidelines designed to determine the appropriate response capability for various facilities and operations. The guidelines are intended to provide a standard and equitable approach, while being flexible enough to reflect differences in the potential risk that various operations pose to wildlife resources. The guidelines are based on: (1) state spill response planning standards established in statute and regulation, (2) information on resources at risk in the area of operations, and (3) capture and treatment data from the T/V *Exxon Valdez* oil spill. Depending on the circumstances, the guidelines support a range of response options from hazing to a complete capture and treatment program. Moreover, the guidelines provide a methodology for calculating the number of migratory birds and/or sea otters that operators should be prepared to handle.

### Revisions to Wildlife Protection Guidelines for Alaska

The Alaska RRT's Wildlife Protection Guidelines for Alaska were revised in February 1991 to incorporate relevant wildlife protection information based on lessons learned from the use of the guidelines during the March 24, 1989 T/V *Exxon Valdez* and the February 27, 1989, M/V *Swallow* oil spills. The guidelines were revised again in December 1993. The most significant changes focused on the:

- Identification of federal and state agency roles during a responsible-party response.
- Inclusion of a checklist to help determine when to end a wildlife rescue program.
- Identification of potential oil related impacts on terrestrial wildlife and potential response strategies.
- Identification of wildlife protection considerations during response activities (e.g., prevention of unnecessary or illegal disturbance to sensitive species and habitats, and prevention of wildlife contacts with shoreline treatment chemicals).
- Inclusion of a list of equipment and materials suggested for a migratory bird hazing kit and a migratory bird capture and stabilization kit.

- Addition of checklists used by a party responding to a spill to request permission to conduct wildlife hazing and/or capture and treatment programs.

### Improvements in Agency Wildlife Protection Plans

Following the T/V *Exxon Valdez* oil spill, the FWS in Alaska elected to begin updating its own agency plan for protecting fish, wildlife, and sensitive resources. The FWS's Alaska-specific plan builds on information contained in the Wildlife Protection Guidelines for Alaska. As of March 1994, the FWS's plan was in draft form. In addition, the OEPC in conjunction with bureaus such as the FWS is developing a database of DOI bureau staff who have wildlife protection and other spill response training and experience.

### Agency Participation in Educational Endeavors

Between March 1989 and March 1994, federal and state agencies with responsibility for managing and protecting wildlife in Alaska sponsored and/or participated in a variety of educational endeavors related to wildlife protection:

- An April 1990 Sea Otter Symposium (and subsequent proceedings) sponsored by the FWS to evaluate the sea otter response effort following the T/V *Exxon Valdez* oil spill.
- Training videos on the capture and treatment of sea otters produced by the FWS.
- Alaska RRT May 1992 Outreach Workshop—targeted to industry personnel who would be involved in response activities following an oil spill—that included sessions on the Wildlife Protection Guidelines for Alaska presented by federal and state agency members of the Wildlife Protection Working Group.
- Sponsorship by the Minerals Management Service of the publication of a book titled *Emergency Care and Rehabilitation of Oiled Sea Otters: A Guide for Oil Spills Involving Fur-Bearing Marine Mammals* (Williams and Davis, in press).
- Participation by federal and state Wildlife Protection Working Group members in a February 1992 workshop sponsored by an oil industry cooperative that included information on wildlife protection and response.



- Participation by federal Wildlife Protection Working Group members in a May 1992 Texas A&M University Oiled Wildlife Response Program.

### **T/V Exxon Valdez Oil Spill Research**

Natural resource damage assessment and restoration studies that were conducted following the T/V *Exxon Valdez* oil spill have provided federal and state agencies responsible for managing and protecting wildlife with additional information on the effects of oil on birds and marine mammals, and on their food sources and habitat. In addition, those studies have also provided detailed information on sensitive wildlife areas within Prince William Sound and the Gulf of Alaska.

### **Oil Industry**

Since the T/V *Exxon Valdez* oil spill, several oil companies operating in Alaska have increased funding for various aspects of wildlife protection including hazing, capture, stabilization, and treatment. This funding has been channeled primarily into the three oil industry cooperatives responsible for taking initial response actions following a spill in the primary areas of concern in Alaska: the North Slope, the Trans-Alaska Pipeline System corridor, Prince William Sound, and Cook Inlet. In addition, the Southeast Alaska oil spill cooperative has begun funding wildlife protection planning and preparedness activities in Southeast Alaska. The following discussion focuses on progress made in the wildlife protection areas by the oil industry cooperatives since March 1989.<sup>1</sup>

### **Upgraded Training Programs**

In general, training programs related to wildlife response have been upgraded since 1989. For example, the North Slope oil industry cooperative funded the development of a one-day training class on hazing birds by a leading hazing expert. The class includes hands-on experience with hazing equipment. Prior to the development of this course, oil industry cooperatives typically listed a small number of bird hazing devices (such as propane cannons and shotgun cracker shells) in their oil spill response inventories. However, there was no program to ensure that any oil industry cooperative personnel were trained to properly use the hazing equipment.

A one-day bird capture and stabilization training program offered in Alaska prior to the T/V *Exxon Valdez* oil spill was also upgraded following the oil spill. The new course includes 20 hours of instruction on capture, evaluation, treatment, blood sampling, stabilization, and cleaning and husbandry of oiled birds. In addition, the Prince William Sound oil

industry cooperative has developed a 2-day wildlife capture course for birds and sea otters (offered in Valdez in December 1994 as a pilot course, but not yet approved by the FWS or ADF&G), and plans to complete development of a marine bird hazing course by December 1994, which will also be taught in Valdez. The Southeast Alaska oil spill cooperative has plans to begin an outreach program that will include training on bird capture and stabilization for veterinarians in communities throughout Southeast Alaska.

### **Expanded Equipment and Materials Inventories**

Additional equipment and materials (such as pyrotechnic equipment, active and passive scare devices, and electric fencing) have been acquired by oil industry cooperatives for hazing birds, bears, musk oxen, and caribou, and for bird capture and sea otter stabilization and treatment.

### **Additional Stabilization and Rehabilitation Facilities**

In July 1991, the North Slope oil industry cooperative designed, constructed, and emplaced two self-contained, air-transportable modules for stabilization and emergency treatment inside a warehouse at Prudhoe Bay. The facility, known as the Wildlife Emergency Treatment Center, is capable of handling up to 150 small birds, 200 geese, and 10 small terrestrial mammals at one time.

In summer 1991, a wildlife response center was established in Anchorage to provide the North Slope and Prince William Sound oil industry cooperatives with a centralized, long-term rehabilitation center for birds and sea otters. As of March 1994, the facility had the capability to simultaneously treat several hundred birds and 10 sea otters.

In March 1994, the Prince William Sound oil industry cooperative was completing construction of one bird stabilization module for Pump Station No. 8 (located south of Fairbanks) which could handle approximately 150 large birds, and two stabilization modules for Valdez (one each for birds and sea otters). The modules, which can provide stabilization for up to 10 sea otters, will serve as a "pass-through" facility for birds. In addition, the cooperative is currently reviewing bids for a sea otter treatment center in Valdez, to be completed by December 1994, to treat up to 100 sea otters (a maximum of 20 sea otters per day).

As of March 1994, stabilization and treatment facilities for birds were in place in Homer for the Cook Inlet oil spill cooperative. Planning continued for sea otter stabilization and treatment facilities, scheduled to be in place on the Kenai Peninsula by December 1994. In addition, the Southeast Alaska oil spill cooperative has initiated discussions with the

Alaska Raptor Rehabilitation Center to upgrade its facility in Sitka to handle oiled wildlife, principally birds.

### Attention Given to Species Other Than Birds

Since 1989, the oil industry cooperatives have given additional attention to the steps necessary to implement a capture and treatment program for species other than birds, i.e., sea otters, polar bears, and terrestrial mammals. Therefore, the cooperatives were better prepared in March 1994 than they were in 1989, when the wildlife protection component of their contingency plans consisted primarily of the name and telephone number of a bird rehabilitation contractor.

### Improved Planning for Wildlife Capture Logistical Support

Plans have been developed to improve the provision of logistical support for wildlife capture efforts. For example, by March 1994, agreements were in place with Prince William Sound vessel owners to provide logistical support for wildlife capture efforts following an oil spill in that area. In addition, the Prince William Sound and Prudhoe Bay cooperatives designated helicopters for logistical support for wildlife response actions in their respective response areas.

### Upgraded Wildlife Protection Components of Oil Spill Contingency Plans

As stated above, prior to the T/V *Exxon Valdez* oil spill, the wildlife protection section of the cooperatives' oil spill contingency plans consisted of the name and telephone number of a bird rehabilitation contractor and, in some cases, a partial list of equipment and materials necessary for bird treatment as part of an overall list of response equipment. Following the adoption in December 1988 of the Wildlife Protection Guidelines for Alaska, the cooperatives included the guidelines as an appendix to their contingency plans without identifying what actions they would take to protect wildlife resources following an oil spill.

In 1990, the North Slope oil industry cooperative formed a joint industry/federal and state agency task force to review its wildlife contingency plan and provide recommendations on how wildlife response capabilities should be upgraded. As of March 1994, each of the oil industry cooperatives were continuing to work on upgrading the wildlife protection components of their oil spill contingency plans to reflect their overall increased preparedness and to delineate their specific wildlife response plans.

## Expanded Oil Spill Exercises

Since 1989, the number and complexity of oil spill exercises has increased. Several included field components that exercised specific wildlife protection strategies:

- In August 1991, a mock bird hazing operation was mounted as part of a full scale North Slope exercise, and the Wildlife Emergency Treatment Center was mobilized.
- In March 1992, as part of a full scale oil spill exercise in Prince William Sound, crews were deployed by boat to "capture" stuffed toy sea otters and birds placed on beaches in Prince William Sound and return them to a stabilization center where wildlife were "walked through" stabilization procedures.
- In March 1992, as part of an unannounced drill for mobilizing the Wildlife Emergency Treatment Center in Prudhoe Bay, the wildlife modules were prepared for transport, moved 34 miles from a Prudhoe Bay warehouse to a Kuparuk Field warehouse, unloaded, and set up in a heated building.

In addition, other exercises have been held (e.g., one centered in Prince William Sound in August and October 1993) that have addressed wildlife-related issues without containing a field component.

## Conclusion

While federal and state agencies and oil companies operating in Alaska have made important progress in wildlife protection preparedness in the five years since the *T/V Exxon Valdez* oil spill, additional work remains. In general, federal and state agencies need to: (1) continue upgrading their respective agency response plans, (2) finalize guidance to industry on basic levels of wildlife preparedness, and (3) develop additional information on sensitive resource areas for Area Contingency Plans. In addition, the oil industry needs to: (1) complete the acquisition of wildlife hazing, capture, and rehabilitation equipment and materials, (2) complete planned wildlife stabilization and rehabilitation facilities, (3) institutionalize wildlife protection training programs, and (4) annually exercise the wildlife protection component of their oil spill contingency plan. Once a basic level of preparedness is in place for the principal areas of concern in Alaska, additional attention needs to be focused on the remaining areas of the state.

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## **Endnote**

<sup>1</sup> In addition to the cooperatives described above, there are several hundred individual operators that are required to complete oil spill contingency plans that include wildlife protection components. No attempt is made to summarize the activities of individual operators, or to discuss the preparedness of contractors that may provide wildlife response services to either individual operators or oil industry cooperatives.

## **Reference**

Williams, T.M. and R.W. Davis (Eds.). In press. *Emergency Care and Rehabilitation of Oiled Sea Otters: A Guide for Oil Spills Involving Fur-Bearing Marine Mammals*. University of Alaska Press, Fairbanks.



## **Sea Otter Oil Spill Contingency Planning**

**Randall W. Davis, Terrie M. Williams,  
and Pamela Tuomi**

*International Wildlife Research  
2661 Concord Circle, League City, TX 77573*

### **Abstract**

The Alaska Regional Response Team's Wildlife Protection Guidelines specify the response strategy for marine mammals, migratory birds, and terrestrial mammals that are threatened as a result of an oil spill. The response strategy is divided into three parts. The primary response emphasizes controlling the release and spread of spilled oil at the source to prevent or reduce contamination of potentially affected species and/or their habitat. The secondary response strategy emphasizes keeping potentially affected wildlife away from oiled areas through the use of deterrent techniques. Preemptive capture and relocation of sea otters may be feasible if only a small number are in danger of being oiled. The tertiary response involves the capture and rehabilitation of oiled animals. Tertiary response is initiated only when primary and secondary response activities fail and the trustee agency (i.e., USFWS in conjunction with ADF&G) deem that it is appropriate to capture and rehabilitate oiled sea otters. Any secondary or tertiary response activities must have the approval of appropriate federal and state wildlife trustee agency representatives.

If a decision for tertiary response is made, the key to saving the maximum number of oiled sea otters is through preparedness and rapid response. The most critical time for saving oiled otters is during the first two weeks of a spill. This is true for both preemptive capture and for otters that have become oiled. If contingency plans are inadequate and the first few weeks are spent assembling a response effort (as was the case in 1989), then the number of otters saved will be greatly reduced. At this time, our understanding of how to rehabilitate oiled otters will not be the factor which limits survivorship. The limiting factors will be the time involved to mobilize the capture effort, build appropriate rehabilitation facilities, and train rehabilitators. To be most effective, a rescue effort must be able to respond within six hours. This is only possible if the capture boats are pre-identified and under contract, the rehabilitation facilities are already built, and the staff has been trained before the spill occurs. Unfortunately, the State of Alaska and the oil industry have yet to invest the amount of money needed to build a regional rehabilitation center that will enable a rapid response. Ironically, investing in a rehabilitation center, response equipment, and training programs before a spill occurs will actually reduce the cost of caring for oiled sea otters by

50% to 80%. Given that the public will demand a sincere and conscientious attempt to save oiled sea otters, preparedness and a rapid response will not only save more otters, it will save money too.

## Introduction

At the time of the *Exxon Valdez* oil spill, there was little published information about the effect of oil on sea otters. A handful of scientific studies (Costa and Kooyman 1982, Williams et al. 1988, Davis et al. 1988) had identified sea otters as the marine mammal most vulnerable to the detrimental effects of oil. However, the existing literature wholly underestimated the severity of the clinical effects of oil contamination and the logistical problems of rehabilitating large numbers of oiled sea otters. The problem was compounded by the lack of realistic oil spill contingency plans for sea otters. When the *Exxon Valdez* oil spill occurred, a sea otter rehabilitation program was initiated with little advance organization or preparation (Williams and Davis 1988). During the six months that followed, 357 sea otters were treated at three response centers in Alaska and at seaquariums in San Diego, Tacoma, and Vancouver. It would be an understatement to say that the animal care specialists and veterinarians who treated the oiled sea otters were unprepared for the wide variety of medical problems and initial high mortality. With so little information on the systemic effects of petroleum hydrocarbons, the rehabilitation program was severally handicapped. Despite these difficulties, 225 sea otters were rehabilitated and either released or placed in seaquariums. Although the 64% rehabilitation rate was considered good by the standards of the rehabilitation community, it could have been better had the response organization and the facilities been in place prior to the spill.

A positive result of the sea otter rehabilitation program was the tremendous amount of new information that was obtained. This information, which will be invaluable in preparing for and responding to future spills, will be published in a new book edited by Terrie Williams and Randall Davis entitled *Emergency Care and Rehabilitation of Oiled Sea Otters: A Guide For Large and Small Oil Spills Involving Fur Bearing Marine Mammals*. This multi-authored book, which covers all aspects of the effects of oil on sea otters, their care, and the organization of rehabilitation programs, will be published by the University of Alaska Press in 1994. The purpose of this article is to review our current understanding of oil spill contingency planning for sea otters in order to mitigate the detrimental effects of oil and enhance survivorship.



## **The Alaska Response Strategy**

The Alaska Regional Response Team's Wildlife Protection Guidelines specify the response strategy for marine mammals, migratory birds, and terrestrial mammals that are threatened as a result of an oil spill. The response strategy is divided into three parts. The primary response emphasizes controlling the release and spread of spilled oil at the source to prevent or reduce contamination of potentially affected species and/or their habitat. The secondary response strategy emphasizes keeping potentially affected wildlife away from oiled areas through the use of deterrent techniques. Preemptive capture and relocation of sea otters may be feasible if only a small number are in danger of being oiled. The tertiary response involves the capture and rehabilitation of oiled animals. Tertiary response is initiated only when primary and secondary response activities fail and the trustee agency (i.e., USFWS in conjunction with ADF&G) deem that it is appropriate to capture and rehabilitate oiled sea otters. Any secondary or tertiary response activities must have the approval of appropriate federal and state wildlife trustee agency representatives.

### **Pre-Spill Planning**

In the waters under United States jurisdiction, the U.S. Fish and Wildlife Service (USFWS), under authority of the Marine Mammal Protection Act, has lead management responsibility for sea otters. To quickly and efficiently implement a secondary or tertiary response, pre-spill planning should include: (1) an agency approved response plan, (2) formation of a task force to review and update response plan strategies, (3) trained capture personnel, (4) identification of capture boats and crews, (5) the assembly of equipment and supplies, (6) the construction of regional rehabilitation facilities, and (7) the training of rehabilitators.

Obviously the best way to prevent the death of sea otters during an oil spill is to prevent them from contacting the spreading oil and to prevent it from damaging their habitat. The containment of an oil spill is the responsibility of the spiller and/or the U.S. Coast Guard. For the most part, it does not involve wildlife responders. However, in parallel with attempts to contain spreading oil, a secondary response may involve keeping threatened animals from becoming oiled. Attempts to herd sea otters away from an oil spill have never been successfully demonstrated and the available literature indicates that they are unlikely to be successful (Davis et al. 1988). There is no established method to move otters away from an oil spill using boats or other external stimuli such as cracker shells or

sound makers. At this time, we do not recommend the investment of time and resources in such attempts, as they are unlikely to save sea otters unless the spill is very small and is contained within a small harbor or bay. Under these circumstances, booming-off the spill and attempting to keep otters from entering this area with boats may be useful. However, under open water situations involving a large spill and many sea otters, attempts to herd sea otters are unlikely to be successful.

If there is enough time to identify the trajectory of a spill, a preemptive capture operation to remove otters from areas at risk is a viable secondary response option. Because the spill may spread rapidly, a preemptive capture operation is most likely to succeed if boats and capture personnel are pre-identified, trained, and ready to enter the field within 6-12 hours. For areas inhabited by sea otters, a preemptive capture strategy should be prepared for geographical regions considered to be at high risk from a spill. The plan should incorporate information on the seasonal abundance and distribution of sea otters, coastal geography, port and harbor facilities, and seasonal weather and sea conditions. In addition, facilities must be available to hold sea otters until the oil is removed from their environment. Alternatively, sea otters captured preemptively may be translocated to another area, although this may involve legal and political delays which prevent the rapid actions needed during a crisis.

In order to care for more than 50 oiled sea otters at one time, a rehabilitation facility should be designed to move animals efficiently through the various stages of rehabilitation (Davis and Davis in press). Depending on the level of exposure, an oiled otter may require a few days to several months to complete the rehabilitation process. Once the otters have recovered their health and the water repellency of their fur, they should be moved immediately to a pre-release facility to regain muscular strength and stamina. By designing the rehabilitation facility as a flow-through system, the number of otters that can be treated during an oil spill is much greater than the holding capacity of its pens and pools.

The most efficient and cost effective way of caring for large numbers of oiled sea otters is to concentrate resources and expertise in regional rehabilitation centers. These regional centers should be strategically located in areas where sea otters are abundant and at risk from an oil spill. By using a helicopter to transport oiled otters from the capture boats to the rehabilitation facility, each regional center can service an area within a 500-mile radius (i.e., within a 5-hour helicopter flight). This is analogous to using a "life flight" helicopter to bring patients to a regional hospital that has specialized facilities and personnel. Beyond the 500-mile radius, trained personnel and mobile facilities may be required to medically stabilize the newly captured otters before they are flown to a regional

center. When choosing a location for a regional center, the site should have all-weather access by road and aircraft, good telephone communications, a source of sea water, and easy access to commercial suppliers of frozen seafood, medical supplies, building hardware, electronics, and mechanical appliances.

Caring for large numbers of oiled sea otters requires facilities that are properly designed and constructed (Davis and Davis in press). Because of the specialized space requirements and the need for large pools and filtered sea water, a regional rehabilitation facility for sea otters should be a permanent structure. Even with detailed construction plans and the pre-identification of sites with essential amenities, it may take several weeks to build even a temporary rehabilitation facility. Because the first two to three weeks of a spill pose the greatest risk to otters, rehabilitation facilities should be built and maintained on a permanent basis to enable the prompt capture and care of otters as soon as a spill occurs. The space requirements and conceptual design of a regional sea otter rehabilitation facility have been described (Davis and Davis in press). A facility for 200 otters will require 16,294 sq. ft. of indoor space and 40,329 sq. ft. of outdoor space. A facility of this size should be adequate for most moderate to large spills in areas with a large sea otter population. As oiled otters are rehabilitated and moved to a pre-release facility, space is made for new arrivals.

During the Valdez spill, about two weeks were required to rehabilitate an oiled sea otter, although the duration may be longer for animals with serious health problems (Williams et al. in press). Rehabilitated otters should be moved from a regional rehabilitation center to sea water pens in a pre-release facility as soon as their fur is water repellent and they have no health disorders. Because of the many factors that may influence the timing of release, pre-release facilities may be needed to hold sea otters up to six months. As part of pre-spill contingency planning, possible sites for pre-release facilities should be pre-identified.

Holding pens in the pre-release facility should be large enough for otters to swim and dive and have good sea water circulation. Additional space requirements for the pre-release facility include accessibility of the site by road, a helicopter pad, and a boat dock for the delivery of sea otters, staff, and provisions. Security is essential to prevent visitors and pets from entering the facility, and for disease control. If a large capture is planned after a spill, quick access to sea water pens in a pre-release facility is vital.

## Remote Facilities

Transporting sea otters over long distances is stressful. For otters that have been exposed to oil, this stress can cause death or seriously complicate medical conditions. Mobile triage units are beneficial in certain cases because they allow staff to stabilize the animals medically before they are flown long distances to the regional rehabilitation center. Mortality can be reduced significantly if mobile units are employed when large numbers of otters must be captured more than 500 miles from the regional center (Davis and Davis in press). These mobile units, by necessity, are self contained and transportable by truck, ship, large helicopter, or fixed wing aircraft. A mobile facility should consist of a trailer that is divided into sections for triage, veterinary care, and food preparation.

## Facility Management and Personnel

The role of management is to ensure that the rehabilitation program is properly implemented. The management structure should be organized before an oil spill and executed by experienced professionals. Although the management style should be interactive and encourage the free exchange of information and ideas, staff members should understand the chain of command, rules of employment, and their job responsibilities. Management and staff requirements for a 200 sea otter rehabilitation facility may total over 200 persons (Davis et al. in press). For spills involving fewer than 50 otters, the number of personnel can be reduced as appropriate by assigning more than one job to each staff member.

After an oil spill, there is a large response by the volunteer community to help with sea otter rescue and rehabilitation. The availability of experienced veterinarians, animal health technicians, and animal husbandry staff is often inadequate to care for the large number of otters that may become oiled during a major spill. Volunteers can be a valuable supplement to the professional staff if they are trained and supervised (Davis et al. in press). They can assist with sea otter husbandry, cage and pool cleaning, food preparation, ground transportation, communications, facility maintenance, and secretarial duties. During the *Exxon Valdez* oil spill, approximately 200 volunteers were used in the rehabilitation centers. With proper training and supervision, the animals will benefit and the volunteers will find both their time and effort rewarded.

A training program for volunteers with a yearly refresher course should be an integral part of the facility. This insures that a group of knowledgeable and motivated volunteers are immediately available if an emergency arises. Instruction should include animal care and occupational safety. Personnel health and safety should be the first priority during the

capture and rehabilitation of oiled sea otters. The capture, triage, and rehabilitation program should comply with safety regulations established by the Occupational Health and Safety Administration.

### **Release**

Finally, a strategy for the release of rehabilitated otters must be in place before an oil spill occurs (DeGange et al. in press). This will insure the most rapid return of these animals to the wild if that is deemed the appropriate course of action by the USFWS. Because of the political considerations involving release, especially in areas actively used by commercial fisheries, appropriate release strategies must be planned in advance. Release options include no release, release at capture site, release in the general vicinity of capture, relocation to an area inhabited by other sea otters, and relocation to an area not inhabited by other sea otters. The release strategy selected following an oil spill will depend on the: (1) geographic location, (2) severity of the spill, and (3) overall risk to the population. Populations of otters, such as those in Alaska and California, should be kept distinct and not intermingled. Other considerations in planning a release strategy include disease transmission from released sea otters to the wild population, minimizing the time the animals are held in captivity, the composition of the receiving population once release begins, and monitoring released sea otters to look at their survivorship.

### **Conclusions**

What lessons have we learned from the Valdez spill? First, and not surprisingly, the best way to protect sea otters is through spill prevention. Nevertheless, preventive efforts are never perfect, and we must face the prospect that oil spills will continue to occur in the foreseeable future. The key to saving the maximum number of oiled sea otters is through preparedness and rapid response. We now know that the most critical time for saving otters is during the first two weeks of the spill. This is true both for the capture of unoiled otters and for the rehabilitation of otters that have become oiled. If contingency plans are inadequate and the first few weeks are spent assembling a response effort (as was the case in Valdez), then the number of otters saved will be greatly reduced. At this time, our understanding of how to rehabilitate oiled otters will not be the factor which limits survivorship. The limiting factors will be the time involved to mobilize the capture boats, build appropriate rehabilitation facilities, and train rehabilitators. To be most effective, a rescue effort must be able to respond within six hours. This is only possible if the capture boats are pre-identified and under contract, the rehabilitation facilities are already built,

and the staff has been trained before the spill occurs. In Alaska, which does not have state funding for sea otter oil spill preparedness, progress has been slow. The State of Alaska and the oil companies have been reluctant to invest the money needed to institute an appropriate sea otter rehabilitation program. Ironically, investing in facilities and training programs before a spill occurs will actually reduce the cost of caring for oiled otters by 50% to 80%, especially when the facility costs are amortized over the 30 year life of a regional rehabilitation facility. Given that the public will demand a sincere and conscientious attempt to save oiled sea otters, preparedness and a rapid response will not only save more otters, it will save money too.

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## **Cultural Resources and Oil Spills— Lessons in Preparedness from the *Exxon Valdez***

Albert A. Dekin, Jr.

*Binghamton University, State University of New York*

*Department of Anthropology*

*P.O. Box 6000, Binghamton, NY 13902*

### **Abstract**

My review of the protective measures for cultural resources during the oil spill cleanup identified four essential decisions that proved crucial to the ultimate success of the mitigative effort. These decisions established principles that now need to be maintained and held in organizational readiness in the event that another emergency response is required. Foremost among these is the need for continued inventory of shoreline cultural resources and for maintenance of appropriate coordinating organizations so that oversight and compliance are a seamless process, in place, "in case of emergency."

### **Introduction**

The *Exxon Valdez* oil spill led to an unprecedented Exxon/multi-agency/landowner response to identify and protect cultural resources that might be threatened by the oil spill and related cleanup activities. As Exxon and public agencies organized the spill assessment and cleanup, a number of important decisions were made that set the organizational context for the subsequent shoreline assessment and protection. First was the decision to coordinate federal, state, and private oversight of Exxon's cultural resource program through a single committee, with communications channeled through the State Historic Preservation Officer, using the Alaska Heritage Resources Survey. Second was the decision to regard all historic properties discovered in the oil spill area as "eligible for the National Register of Historic Places," regardless of their actual research or cultural significance, hence providing them with a full measure of protection without delay from further federal review and consultation. Third was the decision to place an archaeologist on the Shoreline Cleanup Assessment Team. Fourth was the decision to restrict spill cleanup personnel to

the shoreline cleanup area and to keep them off the uplands. These decisions provided an important framework for consultation and cooperation as the spill cleanup progressed.

I have reviewed the measures of protection provided cultural resources during the oil spill and related cleanup in two ways. First, I directed the *Exxon Valdez* Oil Spill Archaeological Damage Assessment Project at Binghamton University, under contract to the U.S. Department of Agriculture, Forest Service. This multiyear study consisted of field investigations in August and September of 1991, testing 10 archaeological sites, examining 26 historic properties, and resurveying 60 shoreline segments within the oil spill area. This was followed by analyses of archaeological and soil samples by Monteverde Environmental Consultants and geographic information systems studies and projective site distribution models by Ebert and Associates. The results of these studies were presented summarily at an oil spill symposium in Anchorage in February of 1993 (Dekin 1993) and more completely in the final report to the Forest Service the following September (Dekin et al. 1993).

Second, I have more recently reviewed extensive files, field notes, maps, photographs, reports (Mobley et al. 1990, Haggarty et al. 1991), and other records of Exxon's cultural resource program and of Chugach Alaska Corporation's Oil Spill Response Team, as a consultant to Exxon Company, U.S.A.. In this paper, I will restrict my comments to matters of public policy and preparedness as they are lessons from the *Exxon Valdez* oil spill, as preparations for future oil spill management, whether in Alaska or elsewhere.

## Background

Prior to March 1989, responsibility for protecting cultural resources within the spill area was divided among the landowners, which included Native corporations, various agencies of the federal and state governments, and other private entities. These responsibilities were codified in various ways, from Chugach Alaska Corporation's cultural resource program focusing on oral tradition and historic land use to the more formal site files of the Alaska Heritage Resources Survey (AHRS), the latter maintained by the Alaska Office of History and Archaeology, Division of Parks and Outdoor Recreation, Department of Natural Resources. Federal and state agencies used the AHRS as a central file to coordinate the collection and dissemination of site location and content information among professional archaeologists and cultural resource managers working in the region. The daunting task of inventorying significant cultural resources and evaluating their eligibility for the National Register

of Historic Places was required for federal agencies by Executive Order 11593 in 1971 and reaffirmed by the survey planning requirement included in the 1988 Amendments to the Archaeological Resource Protection Act. However, sufficient funds had not been made available to federal cultural resource managers and most of their shoreline and upland properties had not been systematically surveyed. Thus, knowledge of the nature and distribution of cultural resources within what was to be the oil spill area was spotty, at best. Additionally, the tectonic subsidence associated with the 1964 earthquake had damaged shoreline archaeological sites and subjected them to long-term erosion. In spite of the alarming evaluative surveys conducted by Don Clark and Bill Workman (Clark 1965) that clearly indicated the level of destruction that had begun, there did not seem to be any widespread landowner response to mitigate the damage from this "act of God," and archaeological resources continued to erode into the sea.

Cooperation among archaeologists and agencies working in the area had been quite good, with a number of significant studies contributing to our understanding of the prehistory of the Alaska Peninsula, the Kenai Peninsula, and the Kodiak archipelago, and the first archaeological excavations in Prince William Sound since Frederica de Laguna (1956, Yarborough and Yarborough 1991).

In brief, at the time of the spill in 1989, there had been little systematic inventory work done within the area of the spill, although some was proceeding and the oral history studies were continuing in the Chugach area. There were no procedures in place to support a coordinated response to the spill and there was no mechanism to insure compliance by whomever might be responsible for protecting cultural resources from oiling or from cleanup.

## **Review and Implications**

There are several important dimensions to the protection of cultural resources afforded by the coordinated effort among landowners and state and federal oversight agencies and the work of Exxon's cultural resource program.

### **Cultural Technical Advisory Group (CTAG)**

This committee of representatives from the Coast Guard, Chugach Alaska Corporation, the Alaska Office of History and Archaeology, and the Forest Service, the Fish and Wildlife Service, the National Park Service, and the Bureau of Indian Affairs proved to be the coordinating workhorse to guide efforts to protect cultural resources during the cleanup.

Here strategies were discussed, technical solutions prescribed, and concerns expressed. The group effectively allowed the common interests of many landowners to be expressed to Exxon through coordinated oversight and expedited compliance review by permitting organizations and by the State Historic Preservation Officer (SHPO). The creation of CTAG in 1990 (following the Interagency Shoreline Cleanup Committee in 1989) allowed an agreed-upon process to govern recommendations, review, and compliance procedures. They endorsed Exxon's "standardized constraint system" which simplified and standardized archaeological constraints on cleanup procedures and improved communications and compliance of Exxon's cleanup supervisors.

### National Register Eligible

Without this streamlining mechanism, there would have been additional delay in determining resource protection protocols requiring formal review procedures—the so-called Section 106 review, using regulations in 36 CFR 800, based on the National Historic Preservation Act of 1966, as amended. These would require extensive and lengthy consultation, involving the landowner, the SHPO and the Advisory Council on Historic Preservation. By treating every identified historic property as if it were eligible for the National Register of Historic Places, and by executing a programmatic Memorandum of Agreement, such properties were protected and review was expedited. This practice resulted in protection for some cultural resources that might not have been required if more comprehensive and time-consuming site examinations and a full-fledged determination of eligibility for the National Register had been done. Thus, some properties that might not meet the significance criteria for eligibility were protected.

### Shoreline Cleanup Assessment Team (SCAT) Archaeologist

The inclusion of an archaeologist on the shoreline cleanup assessment team meant that immediate consideration could be given to cultural resource matters in the first level of assessment of what needed to be done for cleaning and what protective measures needed to be required. This was especially important where oiling extended along the shoreline where archaeological deposits were eroding from the uplands or where relict deposits occurred in the beach (as a result of subsidence from the 1964 earthquake). These factors contributed to perception of a risk to archaeological deposits and to eroded artifacts that the SCAT archaeologist could address. Their responsive recommendations included restricting cleanup techniques and technicians, requiring archaeological monitors during cleanup, requiring further study or secondary review, and restricting

cleanup activities on the beach and adjacent areas. Without this first level of response, it seems likely that incidents of threats to cultural resources would have been far more frequent.

### Restricting Workers to the Beach

Large construction projects, such as the Alyeska pipeline construction in 1975-1976, brought large numbers of workers into areas of public and private land, some of whom traveled as widely as their means of transportation allowed. Restricting cleanup personnel to the beach, though an unusual restriction for laborers and perhaps especially supervisory personnel, nonetheless limited access to cultural resources and the amount of non-work time people could spend on or adjacent to archaeological sites. The policy was unusual, given the traditional public access granted in these areas. For some locations, this policy was an important means of protecting archaeological resources.

### Recommendations

As a result of this review, I suggest we focus our policy attention on three major areas.

#### Inventory

There is a compelling need to know the cultural resources that are there, to know their locations and character, and to know that they are vulnerable. A field-tested, baseline database is knowable and should be shared and maintained in Geographic Information Systems (GIS) files and hard copy. A regional focus is essential so that ownership differences do not impair the ability to maintain the data effectively and to manipulate the information in support of management needs for inventories, damage assessments, etc. A geological component is essential to understand the ongoing tectonic and erosional processes insofar as they affect the integrity and exposure of shoreline deposits. The cooperative establishment of such a baseline database, using the content of the AHRS and the technical capabilities of federal and state agencies, should be an important, ongoing historic preservation priority. This would require agreement on field and recording protocols to insure compatible data and provide information on where surveys found no sites, as well as the site-based information itself. Perhaps the National Park Service's National Archeological Survey Initiative "to conduct systematic, scientific research to locate, evaluate, and document archeological resources under NPS stewardship" (Rogers 1992:i) can provide the leadership to coordinate such an effort for Alaska.

## Procedures

There is a compelling need to have a mechanism already in place wherein the varying interests of different public and private land managing agencies can be represented in a task force by cultural resource professionals working together in common cause to approve mitigation plans, expedite reviews of injury assessment, and prioritize treatment plans. The fact that such a group has already functioned can provide contingency planning and rapid response guidance to those responsible for cleanup to insure proper concern for identifying the nature of oil injuries and preventing further injury from oversight and cleanup activities. Such a group could model itself on the Advisory Council on Historic Preservation, as a policy making reviewer of mitigation plans prepared by other, and constituent, agencies. It is absolutely essential that such a group include Alaska Native and local community representatives.

## Compliance

Once mechanisms exist to establish what needs to be done, translating these needs into actions requires cooperative oversight and effective communications to insure compliance with required stipulations and procedures. Clear lines of authority and responsibility are helpful in constraining land operations where preventing injury is a major concern. It would perhaps be best if the CTAG group where protocols were developed and prescribed was kept separate and distinct from the compliance oversight function. The difference between policy and procedure provides a clear model so that the same entity is not trying simultaneously to develop and evaluate policy and then to carry it out.

If we are to be prepared to respond effectively to another shoreline oiling, we need to maintain these proven elements of the coordinated response that contributed significantly to the effectiveness of measures to protect cultural resources. I hope that those with responsibilities for oversight will themselves be prepared to take these lessons and apply them in the protection of Alaska's significant cultural heritage.

## Acknowledgments

My understanding of the policy response and oversight has benefited considerably from the insights provided by the archaeologists involved, most particularly those who served on CTAG and on the archaeological steering committee, the latter providing helpful guidance to our Forest Service contract. In particular, the advice of Gerry Clark and Ted Birkedal were most helpful. Additionally, John Johnson provided a helpful perspective that I might not otherwise have seen. I am most indebted to Jim

Haggarty and Chris Wooley for their knowledge and for contributing to the recommendations section. More particularly, I am indebted to the perceptions and efforts of Mark Cassell and Mike Yarborough and the research of Doug Reger and Dave MacMahan. The support of the USDA Forest Service, the Research Foundation of State University of New York, Binghamton University, and of Exxon Company, U.S.A. is gratefully acknowledged—all are absolved from any responsibility for the opinions expressed herein.

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## **Cultural Resources Protection: How Prepared Are Federal and State Agencies in 1994 to Deal with Potential Impacts to Cultural Resources During a Spill Response?**

**Pamela Bergmann**

*U.S. Department of the Interior*

*Office of Environmental Policy and Compliance*

*1689 C Street, #119, Anchorage, AK 99501-5126*

### **Abstract**

Alaska's coastline and its interior contain important archaeological and historic heritage sites. At the same time, oil exploration, development, production, and transportation (via pipeline) occur both onshore and offshore. Furthermore, offshore waters serve as passageways for oil tankers and other ocean vessels, which carry petroleum products and/or hazardous substances. Marine or inland spills of those substances, and associated response activities, may result in injury to archaeological and historical resources.

Since 1988, the U.S. Department of the Interior has worked with Alaska Regional Response Team members and on-scene coordinators to help ensure that the protection of cultural resources is considered following oil spills and hazardous substance releases. As a result, since 1988, the Alaska Regional Response Team and on-scene coordinators have begun to recognize that: (1) oil spills and hazardous substance releases may impact cultural resources, and (2) they have a statutory responsibility to ensure that appropriate actions are taken to protect those resources following a spill. Because of this groundwork, steps were taken following the T/V *Exxon Valdez* oil spill to minimize injury to cultural resources during the 4-year response effort.

In July 1992, the Alaska Regional Response Team established the Cultural Resources Working Group to develop written guidelines for federal and state on-scene coordinators to use to ensure that archaeological and historical resources are taken into account following oil spills and hazardous substance releases. Members of the Cultural Resources Working Group include representatives from two state and five federal entities and one interest group: Alaska Department of Natural Resources; Alaska Department of Environmental Conservation (whose representative cochairs the Working Group); U.S. Forest Service; U.S. Department of

Commerce, National Oceanic and Atmospheric Administration; U.S. Coast Guard; U.S. Environmental Protection Agency; U.S. Department of the Interior, Office of Environmental Policy and Compliance (whose representative cochairs the Working Group), and National Park Service; and the oil industry.

The resulting draft Cultural Resources Protection Guidelines for Alaska, prepared by the Cultural Resources Working Group, include the following information: (1) summary of federal and state statutory requirements to protect cultural resources, (2) definition of cultural resources, (3) identification of potential direct and indirect impacts to cultural resources, (4) definition of emergency and remedial actions, (5) identification of notification procedures and information required by cultural resources specialists, (6) identification of response procedures, (7) identification of cultural resources specialists contact procedures, (8) discussion of qualifications and training, and (9) discussion of funding. Following adoption by the Alaska Regional Response Team in late 1994, these guidelines will serve as a valuable reference and response guide to federal and state on-scene coordinators. As a result, they will help increase the protection afforded to cultural resources in Alaska.

## Introduction

While most people are aware that the State of Alaska and its offshore waters provide important habitat for large numbers of birds and terrestrial and marine mammals, many people do not realize that Alaska's coastline and its interior also contain important archaeological and historic heritage sites. To date, over 15,000 archaeological and historic sites have been entered into the Alaska Office of History and Archaeology's state-wide inventory of cultural resources. It is estimated that thousands of additional sites have yet to be identified.

Alaska is well known for exploration, development, production, and transportation of petroleum products. Spills of those products, as well as other hazardous substances, and associated response activities may result in injury to a variety of resources, including archaeological and historical resources.

## Cultural Resources Protection Awareness

The U.S. Department of the Interior (DOI) began focusing on the importance of including the protection of cultural resources in spill responses as a result of DOI's participation on a design team for a U.S./USSR spill exercise held in Anchorage in 1988. The DOI recognized at that time that agencies responsible for managing and protecting public resources needed to ensure that cultural resources—and not just biological resources—were included in response planning activities and response actions. As a result, the spill's potential impacts to cultural resources were interjected into the exercise as an issue.

Following the exercise, the DOI held meetings with state and federal Alaska Regional Response Team (RRT) representatives to ascertain whether cultural resources were being taken into account during spill responses. As a result of these meetings, it was determined that while agency biologists were routinely included in decisions regarding spill response, agency cultural resources specialists were not included.

In response to these findings, the Alaska RRT fiscal year 1989 work plan included the following task: "Provide outreach to federal and state agencies on the role of cultural resources during response efforts".<sup>1</sup> The DOI held subsequent meetings with selected Alaska RRT agency representatives and their cultural resources protection specialists to discuss this issue.

In fiscal years 1990 and 1991, the Alaska RRT work plan included development of an annex to the Regional Contingency Plan that would include the following<sup>1</sup>:

- Definition of cultural resources to be protected.
- Identification of laws protecting those resources.
- Identification of agencies with mandated responsibilities to protect cultural resources.
- Identification of lead archaeologists and other cultural resources personnel within those agencies.
- Development of procedures for determining how and when cultural resources should be considered as part of spill response.
- Identification of differences in cultural resources protection measures taken during emergency actions vs. remedial actions.

Unfortunately, the March 1989 grounding of the T/V *Exxon Valdez* and subsequent T/V *Exxon Valdez* oil spill related activities delayed work on the annex until 1992.

Nevertheless, the groundwork had been laid, and a heightened awareness had been achieved within the federal and state response communities regarding appropriate cultural resource related actions and responsibilities. As a result, since 1988, the Alaska RRT and federal and state on-scene coordinators (OSC) have begun to recognize that: (1) oil spills and hazardous substance releases may impact cultural resources, and (2) they have a statutory responsibility to ensure that appropriate actions are taken to protect those resources following a spill. In addition, federal

and state agencies with responsibilities to protect cultural resources have begun working with federal and state OSCs to ensure that cultural resources are appropriately considered following a spill. Because of this groundwork, steps were taken following the T/V *Exxon Valdez* oil spill to minimize injury to cultural resources during the 4-year response effort.

### **Establishment of Cultural Resources Working Group**

In July 1992, the Alaska RRT established the Cultural Resources Working Group (CRWG) to develop written guidelines for federal and state OSCs to ensure that archaeological and historical resources are taken into account following hazardous substance releases and oil spills.

The CRWG originally was composed of eight representatives from two state and five federal agencies:

- Alaska Department of Environmental Conservation (Cochair)
- Alaska Department of Natural Resources
- U.S. Department of the Interior  
Office of Environmental Policy and Compliance (Cochair)  
National Park Service
- U.S. Department of Agriculture  
Forest Service
- U.S. Environmental Protection Agency
- U.S. Coast Guard
- U.S. Department of Commerce  
National Oceanic and Atmospheric Administration

All of these agencies are represented, directly or indirectly, on the Alaska RRT, and any or all may be involved in cultural resources protection following a spill.

In 1993, steps were taken to expand the CRWG to include representatives of two interest groups: the Native community and the oil industry. As a result, a representative from the oil industry was added. While the Native community was not able to identify a representative to participate in the CRWG, Native community representatives are being provided the opportunity to review the CRWG's draft documents.

## Draft Cultural Resources Protection Guidelines

The resulting draft Cultural Resources Protection Guidelines for Alaska (Guidelines), which are being prepared by the CRWG, include the following major components:

- *Summary of Federal and State Statutory Requirements to Protect Cultural Resources*—Brief summary of the principal federal and state acts that set out statutory provisions for protecting cultural resources: (1) National Historic Preservation Act, (2) Archaeological Resources Protection Act, (3) Alaska Historic Preservation Act, and (4) Native American Graves Protection and Repatriation Act.
- *Definition of Cultural Resources*—Explanation of what is covered by the phrase “cultural resources.” As used in the Guidelines, “cultural resources” refers to “deposits, structures, ruins, sites, buildings, graves, artifacts, fossils, and/or objects that provide information pertaining to history or prehistory.”
- *Identification of Potential Direct and Indirect Impacts to Cultural Resource*—Description of the types of injury that can occur to cultural resources as a result of a spill; namely, direct and indirect impacts. For example, direct impacts may occur when a spilled substance contacts an artifact and prevents its identification in the field. Indirect impacts may occur as a result of ground-disturbing containment and/or cleanup activities as well as from vandalism and/or theft due to increased activity in an area and/or increased knowledge of cultural resources site locations.
- *Definition of Emergency and Remedial Actions*—Definition of emergency actions (i.e., actions taken during the early stage of an incident when a spill is uncontained and spreading) and remedial actions (i.e., actions taken during the later stages of an incident when a spill is no longer spreading).
- *Identification of Notification Procedures and Information Required by Cultural Resources Specialists*—Reassertion that following a spill, notification of cultural resources specialists follows the established federal/state notification process.
- *Identification of Response Procedures*—Description of the responsibilities of federal and state agencies and responsible parties during three types of spill responses: (1) federally funded, (2) state

funded, and (3) responsible-party funded. For each of those response types, the Guidelines outline cultural resources protection actions that need to be taken during emergency responses and remedial responses.

- *Identification of Cultural Resources Specialists Contact Procedures*—List of federal and state contacts who can identify appropriate cultural resources specialists who could assist a federal lead agency in ensuring that cultural resources are given adequate and appropriate consideration following a spill.
- *Discussion of Qualifications and Training*—List of task descriptions for cultural resources specialists who would serve as part of the federal OSCs planning and/or operations staffs.

Discussion of participation in annual Alaska RRT Outreach Workshops (to provide pre-spill training to appropriate public- and private-sector representatives on policies contained in the Guidelines) and the development of appropriate materials to be used to provide response related personnel with a short training course on cultural resources awareness and protection.

- *Discussion of Funding*—Description of the appropriate use of the Oil Spill Liability Trust Fund by agencies for reimbursing the incremental costs of agency personnel who provide cultural resources related assistance to federal OSCs.

As of March 1994, the draft Guidelines were undergoing review by the CRWG, Native community representatives, and the Advisory Council on Historic Preservation. The CRWG will meet in April 1994 to discuss substantive comments received and to develop an action plan for ensuring that a draft final version of the Guidelines will be submitted to the Alaska RRT for approval prior to the end of 1994. Once adopted, the Guidelines will serve as a valuable reference and response guide to federal and state OSCs. As a result, they will help increase the protection afforded to cultural resources in Alaska.

### **Cultural Resources Working Group**

Cultural Resources Working Group members include the following: Larry Dietrick, Alaska Department of Environmental Conservation (Cochair); Pamela Bergmann, U.S. Department of the Interior, Office of Environmental Policy and Compliance (Cochair); Judy Bittner, Alaska

Department of Natural Resources, Office of History and Archaeology; Gerry Clark, U.S. Department of Agriculture, Forest Service; Ted Birkedal, U.S. Department of the Interior, National Park Service; Matt Carr, U.S. Environmental Protection Agency; Phil Means, U.S. Coast Guard; John Whitney, U.S. Department of Commerce, National Oceanic and Atmospheric Administration; and Chris Wooley, oil industry representative. In addition, the following individuals have made important contributions to the Cultural Resources Working Group: Bob Shaw, Alaska Department of Natural Resources, Office of History and Archaeology; Chuck Deters, U.S. Department of the Interior, Fish and Wildlife Service; and Bob King, U.S. Department of the Interior, Bureau of Land Management.

### **Endnote**

<sup>1</sup>The DOI was assigned lead responsibility for this task.





## Spill Planning, Preparedness, and Response Capabilities for Public Land Managers

Rick S. Kurtz

National Park Service

2525 Gambell Street, #107, Anchorage, AK 99503

### Abstract

In 1991, two years after the *Exxon Valdez* ran aground on Bligh Reef, the National Park Service (NPS) set out to answer the question, "What, if any lessons could the bureau learn from this tragedy?" This article presents a synthesis of the author's findings in answer to that question. The paper approaches the issue of spill response from the perspective of a public land management agency using the NPS *Exxon Valdez* response as a case study. Public land management oversight priorities and their influence upon spill response decision-making and preparedness are examined. The implications for resource protection, threat mitigation, and interagency cooperation are likewise discussed.

NPS successes and failures are identified in hope that they will enhance the general capabilities of public land managers charged with oil spill policy and planning obligations. The paper concludes with a discussion of present day response innovations in light of the *Exxon Valdez* disaster and their application to the future protection of public lands.

When the Tanker Vessel *Exxon Valdez* ran aground on Bligh Reef most National Park Service (NPS) decision makers in Alaska shared a commonly voiced opinion that the spill, though a terrible tragedy, was limited to Prince William Sound. They were thankful that the spill had not occurred along NPS shorelines and felt safe in the knowledge that the nearest national park unit, Kenai Fjords National Park, was over 100 miles away. This complacency quickly evaporated once it was realized the oil could not be contained within the Sound. Ultimately, the oil struck three national park units—Kenai Fjords National Park, Katmai National Park and Preserve, and Aniakchak National Monument and Preserve—impacting resources along some 400 miles of NPS coastline.

This paper addresses oil spill response from the perspective of a public land management agency. The paper begins with a brief discussion

of public land management priorities followed by an overview of NPS decision making during the aftermath of the *Exxon Valdez* spill. Policy implications for resource protection, threat mitigation, and interagency cooperation are identified and discussed. The application of these lessons to present day spill response planning and preparedness on public lands is also examined. The paper will focus on enhancing the general capabilities of public land managers charged with oil spill policy and planning obligations.

### **Land Management Priorities**

More than 80 federal departments and agencies have some type of responsibilities in environmental affairs. Each has its own distinct traditions and values. These traditions and values, in conjunction with basic statutory mandates, define the collective conception of what a land management agency perceives as its resource protection obligations. These concepts play an integral part in the agency decision-making process, helping to shape, define, and assign urgency and importance to the various challenges federal land managers encounter.

Most environmental calamities cross jurisdictional lines of state, local, and private sector concerns as well. Getting things done when facing an environmental crisis requires unity of action among these various groups. Politics, competing agency missions, and strict adherence to lines of responsibility during an environmental tragedy all serve to prevent unity of action. Often this failure to cooperate at an interagency level will cause agencies to act from their own narrow value orientations. When this occurs, hidden agendas and self interests replace the consensual participation required to effectively meet an environmental crisis (Henning and Mangun 1989). NPS and other agencies' adherence to their own priorities manifesting from these orientations and mandates became a point of repeated contention during *Exxon Valdez* response operations.

### **The NPS Response**

On March 24, 1989, at 12:04 am the 987-foot T/V *Exxon Valdez* ran aground on Bligh Reef, 25 miles outbound from Valdez on a heading for Long Beach, California. The impact tore open eight of the ship's 11 cargo tanks and spewed out 10.8 million gallons (over 257,000 barrels) of North Slope crude into Prince William Sound. By April 1 it had become apparent to NPS Alaska Region officials that oil would exit the Sound and impact park units in the Gulf of Alaska. A decision was made to mobilize a park service response.

The park service was poorly prepared to combat the oncoming spill. NPS had been in the process of finalizing a spill response plan for small-scale incidents at Kenai Fjords when the tanker ran aground. The process of formulating spill response plans for the two other impacted parks, Katmai and Aniakchak, had not yet begun. Few NPS employees had any prior hands-on training in spill response management. The park service likewise suffered because it did not know the full extent and value of coastal resources at the soon to be impacted park units (Lawrence 1989, U.S. Congress House 1989). This made resource protection decisions and efforts exceedingly difficult.

NPS decision makers at the Alaska Regional Office (ARO) and at the threatened park units initiated the NPS response effort. The actual management of the spill response was likewise handled at the regional level. The region decided to attack the spill as if it were a fire or similar resource threat. The first step was to request support through the Incident Command System (ICS). The ICS is a nationally recognized crisis management system which was first developed for wildland fire fighting in California. Separate Incident Command Teams (ICTs) provided administrative support to the superintendents in charge of the threatened parks. An ICT area command was created at the ARO. The area command was tasked with managing the NPS spill response, thereby relieving ARO of this administrative burden. Plans were made to conduct a pre-inventory sampling of resources prior to spill impact. Additional plans called for the placement of defensive boom in critical habitat areas and the mustering of park rangers to facilitate cleanup operations on park beaches. The final step in the NPS response called for a post-spill investigation of injuries to resources at the impacted park units.

### **Resource Protection**

The protection of natural and cultural resources was of prime concern to NPS decision makers. Steps taken to implement this process were threefold. They included pre-inventorying, defensive booming, and cleanup restrictions.

Pre-inventorying involved sending out small scientific teams to select sites along Kenai Fjords and Katmai coasts, prior to spill impact, to conduct natural and cultural resource site surveys. This information provided baseline data on park resources for gauging spill impact, and gave park personnel an idea of the resources lying in the spill's path. The need for conducting a hurried pre-inventory of resources for the threatened park units illustrated a glaring shortcoming. The park service had limited knowledge about the coastline of the stricken parks prior to the spill. This

was partially the result of the bureau's traditional reluctance to embrace science and research specialists within the park service ranks. The threatened parks were also relatively new. Kenai Fjords and Aniakchak units were established under provisions of the 1980 Alaska National Interest Lands Conservation Act. Katmai was greatly expanded through this legislation. The ARO, to its credit, had made prior attempts to secure funding for baseline data gathering. These attempts largely failed to clear the federal budgetary process (Everhart 1983, Bane 1989, Haertel 1989, Steering Committee 1992). A good pre-spill baseline inventory would have served as a useful tool in determining special cleanup requirements for the oiled beaches. It would have also helped the NPS more quickly target sensitive sites which were favorably disposed to defensive booming and freed up critical resources to focus on other tasks.

The park service had not originally planned to involve itself in defensive booming. Exxon and the Coast Guard were supposed to direct this operation. However, when the Seward-Kenai Fjords coastal region was first threatened, neither Exxon nor the Coast Guard was on scene. NPS, in conjunction with community leaders, decided to organize a cooperative response. The local community leaders and Senator Ted Stevens helped to assure ARO decision makers that NPS should get involved in directing the placement of defensive boom (Ames 1989, Castellina 1989).

The effectiveness of these booming activities can best be described as mixed. For those individuals who "wanted to get a lot of boom out there and stop oil from hitting anything," booming was gauged a miserable failure (Ames 1989). Oil moving out of Prince William Sound was impossible to contain. For those who gauged booming in terms of finite deflection opportunities and protection of select habitat areas, booming was more successful. The ad hoc Seward Multi-Agency Coordination Group (MAC Group) was able to identify and effectively boom salmon streams and other sensitive habitat. Still, the opportunities for effective defensive booming were limited. There simply was not enough boom to protect all targeted sites. Likewise, many critical habitat areas consisted of wide bays, rocky headlands, and other areas exposed to the full force of the weather. Booming was simply not practical under these conditions.

The failure to contain and deflect most oil away from critical resources had other implications as well. It meant there would have to be an extensive cleanup effort. To facilitate the cleanup effort the park service implemented the use of resource protection officers (RPOs). RPOs were responsible for preventing negative impact to resources from cleanup workers, preventing encounters between workers and wildlife, and enforcing NPS cleanup restrictions. RPOs also served as the eyes and ears

of decision makers at the NPS headquarters. The official Interior Department *Exxon Valdez* spill report submitted to Congress credited RPOs with preventing unnecessary damage to park resources, limiting encounters with bears, and ensuring compliance with special permitting requirements.

The actual cleanup operation carried two basic costs: direct and indirect. The direct costs included the labor, equipment, and other resources mobilized to combat the spill. The indirect costs associated with the spill included the detrimental impact the cleanup had on resources, and the subsequent implications for restoration (Dunford and others 1991).

Oil spill cleanup has been described as a continuum. In this continuum, natural cleansing is considered the least destructive means of cleanup. Next comes the less intrusive "type A" methods which include cold water washing, the extensive use of hand tools to remove oil, and bioremediation (chemical application to enhance the presence of oil-eating microbes). At the far end of the scale are the more intrusive "type B" cleanup methods such as hot water washing, the use of heavy mechanized equipment to remove oil, and the application of harsh chemicals to break down the oil. In addition, resource damage and disturbance from heavy foot traffic and spill worker transport contribute to the indirect costs of cleanup. Eventually there comes a point where the costs of implementing further cleanup outweigh the net benefits derived. Going beyond this point means greater overall resource restoration costs.

The NPS deemed the spill cleanup threshold level to be very low for impacted park resources. NPS decision makers felt that in a majority of cases intrusive cleanup measures, accompanied by uncontrolled mechanized transport and foot traffic, constituted a greater threat to park resources than did the oil (Evison 1993). In retrospect, the park service's conservative approach to cleanup appears to have been a wise decision for resources. Scientific findings presented at the 1993 *Exxon Valdez* Oil Spill Symposium in Anchorage suggested that high-pressure hot water washing and harsher chemical treatments often had a more detrimental effect on oiled shorelines than simply leaving impacted beaches to the forces of nature. Scientists found that many of the more intrusive treatments, particularly high-pressure hot water washing, caused severe reductions in the intertidal biota. In areas where less intrusive methods were employed or only natural cleansing occurred, biota recovery was significantly faster than in heavily treated zones.

Regarding cultural resources, evidence has shown that direct oiling had no measurable impact on coastal artifacts. However, inadvertent destruction through hot water washing and other removal activities occurred despite Exxon's extensive efforts to minimize such damage. Cleanup activities also had the unintended effect of making known the

whereabouts of previously undisclosed archeological sites, thereby placing these sites at risk to future looting and vandalism (Pers. comm., Martin McAllister, Archeological Resource Investigations, Duluth, MN 55804, June 1992).

### **Threat Mitigation**

Throughout the course of the spill response, the NPS cited its 1916 "organic act" and subsequent enabling legislation as justification for many of the restrictions it was placing on spill cleanup. However, the NPS generally failed to convince other spill participants of the legitimacy of NPS resource protection priorities. The park service had to repeatedly reassert to the Coast Guard the uniqueness of resource protection values contained in the NPS mandate. The perceived degree of impact, severity of oiling, and park service cleanup restrictions all became heated issues because of misunderstandings over park service resource values. Former ARO Regional Director Boyd Evison acknowledged the difficulty he encountered in trying to make the Coast Guard understand NPS resource protection values. The Coast Guard, in Evison's opinion, understood the scenery aspect of park values. They failed, however, to grasp the concepts of resource preservation as defined in the NPS mandate. This caused the Coast Guard to pursue a policy of oil removal by any means, in the mistaken belief that restoring the scenic view was the only goal of cleanup in the stricken parks (Evison 1993).

The park service's inability to successfully convey its resource protection mission to the Coast Guard was a reflection of a larger NPS predicament. For too long, park unit managers had tended to focus their attention on what was happening within the confines of their park (Steering Committee 1992). The implications of activities outside park boundaries and the potential impact these activities could have upon park unit resources were ignored. One clear lesson of the spill has been the need for land managers to look beyond their respective boundaries. Effective threat mitigation, be it for an *Exxon Valdez* or a host of other external threats which jeopardize resource integrity, precludes insular thinking. Many of the issues and threats which NPS and other public land managers face today cross jurisdictional boundaries. A preoccupation with internal matters does not work ecologically nor does it work politically in today's interdependent world (Cochrane 1994).

### **Interagency Cooperation**

Taking steps to mitigate external threats can be difficult. Other federal agencies with multiple use mandates, state and local governments

in search of tax dollars, and private developers do not have the same priorities as agencies charged with resource protection. Such conflicting use values can result in political confrontations. Success depends, in part, upon the ability to identify common interests. During *Exxon Valdez* the park service initiated some positive steps in this direction. NPS participation in the Seward MAC Group and Kodiak Emergency Council proved that a great deal could be accomplished when groups joined together in a concerted effort. These ad hoc groups had sufficient political clout to overcome obstacles and get the response process moving forward in their respective regions. It is doubtful if any one member of these intergovernmental groups would have had the ability to do so had it acted alone.

The ability of NPS and other land managers to protect resources under their jurisdiction, however, will depend upon more than the ability to form ad hoc cooperatives in the face of impending disaster. Proactive steps must be taken to protect resources against environmental calamities. NPS participation in prior spill planning efforts at the national, regional, and local level was inadequate. Contributing factors to this failing were twofold. First, there was the previously mentioned dilemma associated with the park service's insular management style. Second, compounding this difficulty was the problem of what has come to be known as "risk politics." Risk politics is peculiar to low probability, high consequence technological events in which people generally assume that the risk of an accident is so remote it will never happen. They therefore fail to formulate adequate plans and develop the expertise needed to combat the disaster should it ever occur. Consequently, once the disaster strikes, respondents must fashion from scratch an organization sufficient to meet the needs of the technological disaster (Harrald, Marcus, and Wallace 1990). This latter scenario sums up the state of preparedness for all respondents prior to the *Exxon Valdez* spill.

The *Exxon Valdez* spill emphasized, in glaring fashion, the need for improved spill planning and preparedness. Critics have offered several solutions to alleviate many of the problems NPS and other land managers experienced during the spill's aftermath. First, there is acknowledgment of the need to implement comprehensive contingency planning prior to an incident. Land managers must develop local plans and integrate these plans into broader area plans. Agency personnel charged with planning and response roles must understand the National Response System and their agency's role within this spill management system (Donahue and Hoogland 1991). Agencies must actively participate in all relevant spill exercises. This hones professional skills and offers the opportunity to foster positive working relationships with counterparts from other agencies. This is particularly important for the NPS and other land managers

charged with resource protection missions which may not otherwise be readily apparent to the on-scene coordinator. It provides an opportunity to educate other participants about the unique missions a given land manager is charged to uphold. Without this involvement, land managers will be only minimally effective in their attempts to prevent and mitigate spill incidents.

### Spill Preparedness Today

NPS participation in spill planning and response has been expanded nationwide since the *Exxon Valdez* incident. The park service currently holds spill response and contingency planning courses on a regular basis. NPS personnel attending these courses receive training in oil and hazardous spill planning and response. This training will enhance NPS spill preparedness capabilities. The NPS has been participating in the development of a computer generated oil spill decision support system. Respondents can use this system to aid spill incident contingency planning. The system should prove a valuable aid for spill planning and response in high risk regions.

NPS has augmented these efforts through the creation of two national all risk Incident Management Teams (IMTs) (Mabery and Malpais 1992, Pers. comm., Steve Holder, NPS-ARO 99503, June 1993). The IMTs are made up of experienced park service ICS personnel. Team members are trained to manage a variety of non-fire catastrophes and events. The system thus far has proven to be extremely successful. Park service IMTs have been used for managing situations as diverse as the 1991 observance of the 50th anniversary of the bombing of Pearl Harbor to Hurricane Andrew relief efforts in Florida.

### Final Remarks

Post-spill assessments of the *Exxon Valdez* spill have verified the tremendous magnitude of the incident and lent credence to speculation that spill respondents were in general poorly prepared to react adequately to the event (State of Alaska 1989; Harrald, Marcus, and Wallace 1990). It has also been recognized that should another spill the magnitude of *Exxon Valdez* occur, total containment—even under ideal circumstances—is simply not possible with today's technology. However, the impact from direct oiling and cleanup in a spill of this size can be lessened through comprehensive pre-planning coupled with adequate levels of training. Furthermore, the reality is that most spills are not of an *Exxon Valdez* magnitude. Small-scale incidents can often be fully contained or deflected away from critical resources. The adoption of comprehensive planning and



preparedness strategies should not be ignored. Ignoring threats will not make them go away. Proactive threat mitigation will ultimately result in fewer incidents, lower cleanup costs, less direct impact to resources, and a more timely restoration of injured resources.

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# Protecting Ecotourism and Recreation Resources in the Event of an Oil Spill

Nancy R. Lethcoe

*Alaska Wilderness Recreation and Tourism Association  
P.O. Box 1313, Valdez, AK 99686*

## Abstract

Ecotourism businesses and recreational users dependent on natural resources were virtually excluded from the *Exxon Valdez* oil spill (EVOS) response, cleanup, and restoration process. Both were denied legal standing for their claims for loss of use of natural resource and economic losses resulting from loss of clients. Recreational users and the ecotourism industry learned a number of lessons through trying to cope with EVOS. The Oil Pollution Act of 1990 (OPA 90) made changes which may help to provide better recognition, protection, and restoration of tourism resources in the future. However, an examination of contingency plans for the Prince William Sound area written since EVOS reveal that many of the lessons learned have not been incorporated into the contingency planning process. Recreation and ecotourism sites remain unidentified and unprotected. The paper identifies and suggests some possible solutions to remaining problem areas. OPA 90 intended to overturn the *Robins Dry Dock* rule making it possible for businesses to recover damages. However, whether businesses will be able to meet the requirements for proving a claim will probably take years of court tests that may be beyond the means of small businesses.

## Introduction

Oil spills may be hardly noticeable or catastrophic events that involve economic, environmental, and social disasters. Little attention has been paid to these effects on recreation and tourism. Major spills usually result in a loss of outdoor recreation and ecotourism resources. However, even small spills that heavily impact a highly used beach for which there is no alternative site may have a significant affect on a business. A tourism businesses' resources include its guests, employees, the supporting infrastructure, its image, and the natural resources it uses and markets. A company's management of these various resources affects its profits. When a large or catastrophic spill occurs, the ability to manage some of these resources is made difficult, at best, and impossible, at worst. For

example, employees may suddenly quit to take higher paying jobs in the spill response; hotels, bed and breakfasts, and air transporters may cancel reservations to take on contracts from spill responders; and the federal on-scene coordinator (FOOSC) may legally prohibit a company from cleaning up an area it uses, while not providing an alternative means of cleaning up the site. If the spill is small, the losses may be only temporary; but if it is large and has national and international attention, then some of the losses, such as natural resources, image, and clients, may continue for years. This paper begins with a brief description of the tourism industry in Prince William Sound, discusses some of the lessons learned by the ecotourism portion of the industry from EVOS, identifies some of the remaining problems, proposes some solutions, and identifies possible opportunities for the ecotourism industry involvement in pre-spill planning and response. Although the paper focuses on ecotourism, most of the topics covered also apply to recreation.

### **Types of Recreation and Tourism in the Prince William Sound Area**

This paper defines recreation as "the direct use of natural resources by individuals for purposes of enjoyment or relaxation." Tourism is defined as a "commercial service oriented toward the provision of income or profit for a private party that involves the use of natural resources for the purpose of providing clients with enjoyment or relaxation." These definitions are derived from the NOAA Proposed Rule on Natural Resource Damage Assessment (*Federal Register* 1994).

Typical recreational activities in the Prince William Sound region include sport fishing, hunting, walking, hiking, kayaking, boating, sailing, beachcombing, birdwatching, wildlife watching, exploring intertidal zones and other ecological communities, looking at the area's geological features, camping, staying in cabins, and gathering subsistence foods. For many recreational users the Sound's wilderness qualities and undeveloped recreational opportunities—such as anchoring rather than tying to a mooring buoy, and camping rather than staying in cabins—are part of the area's unique recreational appeal. Since recreation and ecotourism companies generally use the same natural resources in Prince William Sound, most of the discussion of ecotourism also applies to outdoor recreation.

Prince William Sound supports three types of tourism: urban tourism, large scale nature tourism, and ecotourism. Urban tourism includes hotels, restaurants, gift shops, bed and breakfast establishments, and other urban-centered tourism activities. Urban tourism is only indirectly based on natural resources. Large scale nature tourism is

represented by cruise ships, tour boats, and tour buses. It depends more than urban tourism on natural resources such as spectacular scenery and wildlife viewing. However, guests generally view natural areas from a distance. By contrast, ecotourism not only uses the same panorama and wildlife resources, it also makes direct use of the land and water. Tourists boat, kayak, sail, anchor, walk, hike, picnic, camp, hunt, sportfish, birdwatch, explore the intertidal zone, photograph, stay in remote cabins or lodges, and engage in a variety of other activities on the water, nearshore, or onshore. Trip participants seek a wilderness-quality experience—remoteness, solitude, and quiet in an area untouched by the hand of man. The opportunity to observe and study wildlife unobtrusively for extended periods is important. Wildlife viewing and sportfishing are major reasons tourists visit Prince William Sound. Protecting sensitive wildlife and sportfishing resources must continue to be a priority.

However, many recreation and ecotourism opportunities depend even more on the services provided by beaches. According to the Alaska Wilderness Recreation and Tourism Association's database (1993), approximately 150 ecotourism businesses operate in Prince William Sound. Some beaches generate hundreds of thousands of dollars annually (Twardock 1992). Hunting and kayaking trips are among the most popular and profitable types of ecotourism trips. Both are dependent on campsites. Because of the Sound's rugged, glacially scoured shoreline, campsites with safe landings, fresh water, opportunities for solitude and quiet, suitable wildlife watching or hunting opportunities may be limited and miles apart. Charterboat operators directly use beaches for dropping off recreational users, taking tourists for nature walks, and indirectly for observing wildlife, such as bears feeding, from a boat.

Large spills impact ecotourism companies far more than urban and large-volume nature tours. The less dependent a tourism company is on the resources damaged by the spill, the less the economic impact. In this case, the converse is unfortunately also true: the more dependent a company is on resources damaged by a spill, the greater its economic losses and the longer the time it will take to recover its market position. The successful recovery of large-scale nature tour operators as indicated by an increase in tourists cannot be used to determine the recovery of the tourism industry. Ecotourism operators may still be suffering from significant declines in clients.

### **Lessons Learned from the Response to EVOS**

Each spill will have a different list of impacts where the spill response either damages natural resources on which ecotourism depends or adversely affects a tour operator's ability to offer safe, quality vacation

experiences. The following list describes a few of the memorable problems from the EVOS response. It is offered as a means of stimulating thought about the types of major and relatively minor problems which might occur in future spills for ecotourism businesses and for evaluating the effectiveness of contingency plans to avert these problems.

### Lesson 1

Unbalanced media coverage has an adverse economic impact on both large-scale nature tourism and ecotourism by discouraging people from visiting an area. Reporters tend to focus on the "bad and the terrible." When archived photographs of dead and dying birds, oiled beaches, and massive cleanup operations are reused, they refocus attention on the need to prevent oil spills, but they also remind people that Prince William Sound was oiled. When this is coupled with the selective use of photographs of areas still oiled in the Sound, the image is conveyed that the Sound is still severely oiled.

For ecotourism companies the presence of oil on beaches poses a special problem. On the one hand, ecotour operators may philosophically support cleanup designed to help ecological communities recover faster over aggressive aesthetic cleanup techniques which may produce oil-free but sterile beaches. On the other hand, ecotourism companies recognize that leaving oil on the beach for the media and others to exploit results in lost inquiries, bookings, and profits for which there is no compensation.

*1994 Update:* This remains a problem. Unless the agencies, oil industry, environmental community, tourism industry, and others can work together to educate the public and media on the importance of biologically responsible cleanup, ecotourism companies may lobby for expanded aesthetic cleanup for financial reasons.

### Lesson 2

Tourism companies in the spill-impacted area were encouraged to continue operating, but were barred from voluntarily manually cleaning lightly oiled beaches. This is disturbing since no priority is placed on protecting and cleaning beaches important to ecotourism. Immediately after the spill, Holland-American/Westours canceled advance bookings at its Westmark Inn in Valdez and for its tour boat, the *Glacier Queen*, so they could be leased to Exxon. Charter fishing boats also canceled their seasons to work for Exxon. The National Outdoor Leadership School relocated most of its trips to Southeast Alaska. The media covered these events. Consequently, a number of agency officials and administrators

from the state government encouraged other tour operators not to cancel their seasons. They argued that it would increase the public's impression that all of Prince William Sound was destroyed, would hurt other Alaskan tourism businesses, and would take longer for the tourism industry to recover. Businesses which continued to operate in 1989 did so because they thought they could conduct their businesses successfully or felt a commitment to clients who had already booked.

Although letters were sent informing the FOSC that some heavily used recreational and tourism beaches on the western side of the Sound were oiled and needed cleaning, these beaches were never scheduled for official cleanup. Until August, when the summer season was almost over, tour operators and recreational users were prohibited from performing manual cleanup of lightly oiled beaches that they used. In August, some volunteer cleanup work using manual methods with hand-tools was permitted, but volunteers had to meet certain requirements and be pre-approved by the FOSC. At this time, one tour operator received permission to manually clean one of its most highly used anchorages.

*1994 Update:* Since 1989, oil has been classified as a hazardous substance. Before a person can cleanup oil, he/she must take HAZMAT training. This will make it even more difficult for tour operators to legally cleanup the beaches they use. Because ecotourism resources have not been entered into the Coastal Resources Database or federal/state Sensitive Areas Lists, they might never be scheduled for cleanup and would not have priority. Agencies and responsible parties in conjunction with tour operators should inventory and prioritize recreation and ecotourism resources so that HAZMAT-trained cleanup workers can clean them.

### Lesson 3

Lightly oiled beaches important to recreation and tourism may not be mapped as oiled and hence never cleaned. Initial beach surveys were made by low altitude aerial surveys. If the oil was not visible from the air, the beach was mapped unoiled. Some lightly oiled beaches important to recreation and tourism were not classified as oiled during the initial response. Other oiled beaches were never mapped as oiled. Lightly oiled beaches are often the easiest to cleanup manually to aesthetic levels with little or no biological damage. Placing a priority on cleaning these beaches would restore their use for recreation and ecotourism businesses more quickly. Recreation and tour operators would use these recovered beaches in preference to other more oiled beaches thus allowing those beaches time to heal naturally.

*1994 Update:* The Prince William Sound Shoreline Cleanup Plan calls for low altitude aerial surveys, the production of maps on the location and degree of oiling based on the aerial survey, and then "a limited number of ground surveys to verify and make more specific the data and information compiled during the broad scale surveys" (pp. 2-6). The Plan should be revised to require ground proofing of recreation and tourism sites in the spill affected area and to have a procedure whereby tour operators can report oiling to a person with authority to investigate.

#### Lesson 4

Agencies responsible for recreation and tourism resources, such as the Chugach National Forest and Alaska Department of Natural Resources, did not have inventories of recreation and tourism sites. This information was provided by a local person. The lack of site specific information on recreation and tourism usage may have been a contributing factor in the failure to protect some areas from oiling during the cleanup response.

*1994 Update:* Although OPA 90 (Sec. 4202 [4][c][ii]) states that area plans must "describe the area covered by the plan, including areas of special economic or environmental importance that might be damaged by a discharge," the responsible agencies have not inventoried, conducted baseline studies, or developed priority lists for recreation and tourism sites. Obtaining references, inventory, and baseline data on recreation and tourism resources should be a high priority for the responsible agencies and the writers of contingency plans.

Because of limitations on funding and the remoteness of many areas, site-specific information should simultaneously be collected for a number of purposes such as identifying sites for spill responders and damage assessment teams as well as for land management planners. A comprehensive information sheet needs to be developed and adopted by all the trustees and landowners that reflects not only their informational needs but also the needs of spill responders. A comprehensive information form assures that comparable data is collected on all sites, thus facilitating prioritization of sites.

Criteria for prioritizing recreation and tourism sites and the public policy issues involved in such a prioritization should be undertaken prior to and not after a spill. Likewise, the prioritization of recreation and tourism sites with respect to sensitive environmental sites, which again involves basic public policy questions, should be done before the oil hits the water.



## Lesson 5

Scarce response resources may be allocated not only on a basis of special economic or environmental importance (OPA 90), but also by "who screams the loudest." In early April 1989, the PWS Interagency Shoreline Cleanup Committee (ISCC) mapped the most sensitive areas for natural resources, subsistence, and commercial resources including recreation and tourism resources. However, because of the shortage of boom, importance of protecting fisheries sites, administrative problems in directing the early spill response, lack of pre-spill awareness of the importance of protecting certain recreation sites, and strong pressure from commercial fishermen to allocate all equipment to the protection of their resources, no recreation and tourism sites received protective booming. As a result, a number of important recreational beaches, such as those at the south end of Culross Passage, were subsequently oiled during the summer, while boats and boom were deployed to protect salmon streams miles from the nearest oil.

*1994 Update:* There are no provisions in any contingency plan covering Prince William Sound to assign priorities or cleanup commercial sites other than those used by the commercial fishing industry. Plans to use exclusion actions could cause increased damage to recreation and tourism sites that are not described in the area plan. The Prince William Sound Area Plan states that: "In the event that the location of a spill or the weather conditions do not permit open water containment/recovery, protection of the shoreline areas of greatest ecological sensitivity becomes paramount. It is recognized that it may be necessary to make tradeoffs in order to achieve optimum overall protection of the environment" (D-7). Although OPA 90 requires consideration of economic interests, this criteria omits them. For example, it excludes priority protection of the beach in front of a commercial lodge that serves 30,000 tourists a summer. Since lodges are generally immovable and because compensation may take years—if ever—to obtain, this criteria could easily bankrupt a business.

Under both Alyeska's Prince William Sound Tanker Spill Prevention and Response Plan and the Prince William Sound Nearshore Plan, recreation and tourism resources could be sacrificed during the response. The tanker plan states: "Exclusion actions are steps taken to prevent spilled oil from contaminating a specific area. These actions are usually taken for a definite purpose, primarily to protect: human life, wildlife and/or wildlife habitats, property, areas of aesthetic beauty, sacred cultural sites and cultural sites of great significance, [and] subsistence fishing areas. Exclusion actions are also taken to prevent oil from contaminating areas that are very difficult or

impossible to clean." Although wildlife resources important to recreation and tourism may be protected, recreation and ecotourism sites, such as the beaches in front of a lodge, trail head, or campsite, are not included. The plan states: "Actions may also be taken to utilize areas not identified for protection as oil capture/holding locations to enhance cleanup" (PWS Tanker, II, pp. RD IX-2). Not only are recreation and tourism sites not identified for protection, their non-inclusion as sensitive economic or recreational areas may now be a reason for using them as "oil capture/holding locations." The PWS Nearshore Plan describes shoreline entrapment which "can be utilized to entrap oil that has impacted the shoreline and is still mobile or to divert oil into a shoreline collection area to prevent impacting a more sensitive area" (3.47). Measures to protect the shoreline of bays used for entrapment are optional (3.47ff).

Because recreation and tourism sites are not listed in the sensitive areas database, they can be used for entrapment. For example, Prince William Sound has a number of bays with narrow entrances such as Sawmill Bay (Valdez Arm), Disk Cove (Disk Island), and Day Care Cove (Perry Island). These secure and protected anchorages are used by recreational boaters, charter boat operators, kayak tour operators, and hunters and hunting guides especially in adverse weather. Their narrow entrances should make them ideal for protective booming. Some would register high on a priority list for protecting recreation and tourism sites. However, the very feature that makes them desirable recreation and tourism sites also makes them attractive areas for corralling and booming oil. Similarly, unless camping areas and trailheads are delineated on maps, the beaches in front of them may be used for entrapment. As the PWS tanker plan is currently written, recreation and tourism sites could receive considerably more damage through sacrificial entrapment in a future spill than the last one. These are public policy decisions that have been made without the notification of or input from the ecotourism industry or recreational users.

## Lesson 6

Wildlife resources important to tourism may be damaged by people responding to spills who are unfamiliar with federal regulations and guidelines affecting wildlife and biological communities. Wildlife is certainly one of the most important natural resources on which ecotourism depends. In the early days of the spill, helicopters landed on sensitive vegetation, blue mussel beds, and even on a sea lion haulout. Helicopters and planes buzzed bald eagle nests and harbor seal haulouts. People trampled back and forth between the beach and uplands in heavily oiled boots and used the uplands as a latrine. The spill response was virtually

out of hand and threatened to become an even greater disaster than the spill itself. The U.S. Fish and Wildlife Service responded with publicity regarding federal restrictions concerning marine mammals and bald eagles. Helicopters were restricted from landing on blue mussel beds or sensitive vegetation.

*1994 Update:* Protecting wildlife resources may still be a problem. The PWS Shoreline Cleanup Plan states that "shoreline cleanup operations will observe recommended practices (sic)" (pp. 2-19). A list of suggested only recommended practices is given. The list includes "Ensure familiarity and compliance with all site surveys, advisories, and special instructions issued, including those relating to: seal haul outs; seabird rookeries; eagle nest avoidance; policy on collecting live and dead animals; policy on possession of animal parts from protected species such as marine mammals, eagle feathers, etc." (2-20). Regulations regarding the harassment of sea lions and whales are not mentioned. The plan does not include or give a reference to the location of regulations regarding the wildlife listed. The suggested recommended practices list does not suggest avoiding landing helicopters, boats, and heavy equipment on blue mussel beds or recommend against landing helicopters on sensitive vegetation.

## Lesson 7

The definition of biological cleanup can include or exclude some aesthetic cleanup. In the early months of the response to EVOS, biological cleanup was considered responsible if it caused less biological damage than leaving the oil in place. Later, biological cleanup had to demonstrate a biological net gain. This eliminated the option of removing tar balls and tar mats by low impact manual means with or without hand tools from lightly oiled, but high priority recreation and tourism sites, such as beaches in front of campsites.

Since there are a limited number of safe kayak haulout and hunting areas with level campsites and good drinking water, failure to remove the tar mats from these beaches has had an impact on recreational and tourism use. For example, a U.S. Forest Service study conducted in the summer of 1993 showed that 25% of the kayakers departing from Whittier on the western side of Prince William Sound still avoid the oil spill impacted areas. The National Outdoor Leadership School's records show trip guides have changed their routes and beaches since 1989 to avoid oiled areas (Twardock 1992).

*1994 Update:* Two different definitions of biological cleanup are given. The Prince William Sound Area Plan states that: "Shoreline cleanup

will be conducted when such removal can be accomplished with lesser environmental damage than actually allowing the oil to naturally weather and biodegrade" (D-8). Depending upon the definition of "environmental damage," this criteria might permit cleanup which could reduce economic damage to commercial operations without increased biological damage. The nearshore plan defines biological cleanup as cleanup with a biological gain. This would not permit cleanup for aesthetic purposes when there is no biological gain.

### Lesson 8

Housing for spill cleanup workers can extend the damage into non-injured areas. When EVOS occurred, an acute shortage of housing delayed the start-up of cleanup prompting the U.S. Army to offer to construct portable army camps for spill cleanup workers on Chugach National Forest lands adjacent to the spill. The Forest Service advised FOSC that housing aboard Navy vessels was preferable. If temporary camps had been permitted onshore, the long-term damage to recreation and tourism resources from the cleanup would have far exceeded the damage from the spill.

*1994 Update:* The PWS Shoreline Cleanup Plan describes the set-up time and units available for both onshore and off-shore housing. There is no discussion of the adverse impacts of onshore housing on public lands (pp. 3-7,8).

### Lesson 9

Back-country accommodations for scientific teams should be consistent with the standards of low impact use. Scientific research teams were permitted to camp ashore. Some, like those from the Fish and Wildlife Service, followed low impact camping procedures while others left campsites with heavily trampled vegetation, cut trees, and garbage, human wastes, and toilet paper strewn through the woods. Since these sites were previously used by recreationists and tourists, they suffered an adverse impact. Tour operators and others were forced to clean the sites before they could be used again.

*1994 Update:* Status unknown.

### Lesson 10

Restrictions should be placed on the use of areas adjacent to the spill to avoid transferring oil, human wastes, and garbage to the uplands. The Forest Service issued restrictions on the use of upland areas by oil spill workers. This prevented the transfer of oil clinging to boots to the uplands

ecosystem, the use of the woods as latrines, and the dispersion of trash and toilet paper. The Forest Service also restricted helicopter landings in the uplands to avoid damage to sensitive vegetation.

*1994 Update:* Some of the Forest Service's restrictions have been incorporated into the PWS Shoreline Cleanup Plan's list of suggested recommended practices (2-20).

## Lesson 11

Cleanup technologies should be evaluated for their impact on recreation and tourism resources. During EVOS, the FOSC authorized bulldozing to expose subsurface oiling. Bulldozers moved logs and boulders from the beach into the uplands area destroying shoreline hiking and campsites.

*1994 Update:* The Prince William Sound Shoreline Cleanup Plan does not approve or prohibit bulldozing as a cleanup technique. If bulldozing is not permitted, this will help protect campsites from damage. All cleanup techniques are evaluated for the effects on biological and cultural concerns. The effects on recreation and tourism concerns are not considered. The passive collection/manual removal method does not list hand-tool scraping, which was part of Alyeska's 1987 Oil Spill Contingency Plan (pp. 4-33). Hand-tool scraping is an effective way of removing small amounts of oil for aesthetic purposes.

## Lesson 12

Scientists should use methods for marking their sites that do not cause safety problems or detract from an area's visual quality. Scientific teams can use a variety of methods for marking their sites. During EVOS, Woodward-Clyde scientists used small, almost invisible magnetic markers. This was the safest and least obtrusive from the tourism point of view. Some federal agencies positioned rebar in the intertidal zone to mark plots. When the rebar was covered by water, it posed a serious safety threat to kayaks and inflatable rafts. Other scientists sprayed red paint in two and three foot high Xs and numbers on rocky cliffs, strung red streamers from trees, and put up red reflectors to mark control sites not in the oiled area. Since these sites were control sites in non-polluted areas that tourism companies were using, the markers had an increased adverse effect on the quality of the vacation experience. During a spill it is difficult enough for a company to provide a quality trip without this type of additional interference.

*1994 Update:* No information available.

### Lesson 13

Flight paths to and from a spill should be directed away from anchorages and known campsites to avoid disturbing people and businesses using these areas: During EVOS, helicopters going to and from the spill area flew low over anchorages and camping sites in the non-spill area from very early in the morning—roughly 6:00 am—to late at night—often after 10:00 pm. This had an unnecessary adverse effect on the quality of tourists' vacation experience. When the FOSC was notified, the practice stopped. Helicopters stayed at a higher elevation and flew over the water.

*1994 Update:* Flight patterns and the desirability of avoiding unnecessary disturbance to recreational users and tour operators in the non-oiled areas are not discussed in any contingency plan.

### Lesson 14

Salmon streams should be boomed in such a way as to permit continued use of an anchorage. During EVOS, fishing boats were hired to place protective boom around salmon streams. In some cases, such as Bass Harbor, Waterfall Cove, and West Finger, the boom was placed so that the entire anchorage was closed off. Unlike boom placed across the entrance to the hatchery at Lake Bay, boom across the anchorages could not be opened and closed to let boats in and out. No public announcements were made regarding the closure of these anchorages. Charterboat operators, displaced from their normal anchorages in the spill impacted area, had to contend with the unpublicized and additional loss of anchorages in non-oiled areas. This posed a safety and logistic problem for charter boat operators that made it even more difficult for them to continue their business.

*1994 Update:* The PWS Nearshore Response Plan describes the demobilization of protective equipment. There is no discussion of the method of protecting salmon streams, type of boom set up, or availability of standby crews to permit access to and from anchorages and campsites. Since access to anchorages is a potential safety problem in adverse weather, the plan should be amended to specify that protective booms should be constructed and maintained by crews so as to permit the use of anchorages when there is no imminent danger of oiling.

### Lesson 15

The FOSC should be requested to use all available means to announce the location and redeployment of cleanup operations and

housing vessels. Oil spill cleanup task forces and special cleanup operations were located in non-oiled anchorages or on the periphery of the oiled area such as at Eshamy and West Twin bays without public notice. For people traveling in slow boats, the discovery that an anchorage was in use for the spill response meant an extra one to three hours travel time to the next available anchorage or campsite. In adverse weather, this could pose a safety problem.

*1994 Update:* The Unified Area Plan (Annex I) and the PWS Area Plan have sections on public information and media. The unified plan lists guidelines for public information officers. Guideline (d) states: "When a spill occurs the OSC must immediately open communications with affected local communities, conveying facts needed by residents for their own response activities and protection of public health and resources. Initial phone calls to establish communication channels with local governments and appropriate organizations, such as fishermen and Native groups, should be followed by regular updates through spill bulletins, press releases, and briefings" (Unified Plan, 1-4). Commercial interests, such as tourism, are omitted. In fact, it would be difficult for a public information officer to contact tourism interests and organizations because none are listed in Annex E, Appendix III: Informational Resources. Since this is a potential safety problem, the Unified Area Plan should be amended to include prompt notification of the public by print and radio communications regarding the location of cleanup activities and supporting task forces.

Alyeska's PWS Tanker Spill Prevention and Response Plan includes a section on communications. Alyeska communications will be directed toward the spill response: "Spill response dispatchers receive and transmit radio and telephone message traffic in support of incident personnel and agencies external to the incident, provide dispatch services, and maintain 24-hour radio logs for documentation. The message center dispatcher receives, records, and routes information concerning critical oil spill tactical activities. Runners will distribute hard copy materials to response personnel" (700-6). There are no provisions for notifying the affected public of oil spill tactical activities. This could be amended to include notification of the OSC's public information officer.

## Lesson 16

Inadequate damage assessment studies of the natural resources on which recreation and tourism depend can mislead the trustees into believing that recreation and tourism resources were undamaged and do not need restoration. While the FOSC directed the cleanup response, the

trustees undertook a damage assessment of natural resources. As in the case of responding to the spill, no pre-spill planning had been done. For example, a list of recreation and tourism resources for the Prince William Sound area might include: lodges and commercial camps, forest service cabins, small boat harbors, boat ramps, unimproved boat launching areas, kayak and canoe launching sites, anchorages, mooring buoys, kayak and canoe haul out areas, portages, trailheads, picnic areas, wedding sites, commercial campsites, recreational campsites, permitted campsites, hunting camps, shoreline hunting areas, sportfishing areas, float and wheeled plane landing and drop off areas, wildlife viewing areas including killer whale rubbing beaches, coastal scenic areas along the highway, scenic areas along cruise ship routes, scenic areas along tour boat or charter boat routes, scenic areas along kayak routes, areas of special geological or botanical interest, beachcombing sites, areas used to study intertidal zone life, etc.

These resources were not included in the damage assessment. Projects to restore services provided by natural resources, such as the aesthetic quality of oiled beaches and re-establishment of intertidal zone communities, have not been funded.

Kayakers often camp on gravel sites in the upper intertidal area during neap tides to avoid damaging sensitive vegetation. Kayakers displaced from these beaches are now using more sensitive uplands. Although garbage cleanup and trampling studies which would help to restore lost aesthetic values and prevent damage to vegetative communities have been proposed to the trustees for funding, they remain unconsidered. Apparently, because of the inadequate damage assessment studies, some trustees believe that recreational users and the tourism industry did not lose any services provided by natural resources. The trustees, who must act by consensus, have funded only one project for the restoration of recreation—an administrative one.

*1994 Update:* The Natural Resource Damage Assessment's proposed rule (*Federal Register* 1994) recommends, but does not require, the trustees to develop pre-spill plans. Pre-spill plans provide agencies the opportunity to collect before a spill information on natural resources that would potentially be affected by a spill along high risk areas. The proposed rule recommends that recreational and commercial uses of land, fish, wildlife, and other natural resources could be inventoried, listed in a database, and tentatively prioritized before a spill occurs. It is important that agencies involve recreational groups and tourism businesses in the collection of this site-specific information. In the prefatory comments to the draft regulations, NOAA states: ". . . vital information can be gained



by those members of the public most familiar with the natural resources . . . the best time for public involvement is in the pre-spill planning when the trustee(s) is not engaged in actual discharge activities. . . . Members of the public are an excellent source of information about particular natural resources and available expertise in the community. The public, as the owners of the natural resources, have a real interest in the assessment and restoration and might provide a balanced representation of the public interest" (*Federal Register* 1994, p. 1099). Pre-spill planning can be done in conjunction with plans for identifying sites for spill protection and cleanup as well as with other programs the agency conducts.

### Lesson 17

Greater attention needs to be paid to how damage assessment places a value on an ecotourism "user day." Tourism businesses and recreational users requested that recreation and tourism damage assessment studies be conducted. Because the studies were secret, they could not be reviewed. On release of the studies, it was discovered that user days were grossly undervalued at between \$2.50 and \$5.00. By contrast, on a willingness-to-pay basis, tourists sailing with Alaskan Wilderness Sailing Safaris in 1988 were willing to pay \$110 a day more than for a similar trip in Puget Sound. Since ecotourism is based on a low-volume, high price model, traditional methods of valuing a user day that are based on high volume, low price scenarios are inadequate.

*1994 Update:* This is the topic of NOAA's proposed rule which was published in the *Federal Register* January 7, 1994. The situation encountered under EVOS should not occur in the future. Comments are due by July 7, 1994.

### Lesson 18

Ecotourism businesses dependent on natural resources oiled by a spill were denied the opportunity to recover lost profits because of the *Robins Dry Dock* and *Oppen* rules (*Robins Dry Dock and Repair Co. v. Flint* 275 U.S. 303 (1927), *Union Oil v. Oppen* 501 F.2d 558 (9th Cir. 1974)). Recreation and tourism businesses were classified under the general category of "Area Business Class." On the second issue, the federal judge issued his ruling on February 7, 1994 holding that: "The evidence shows that . . . the area businesses are not entitled to recover economic damages under *Robins Dry Dock*. The court finds that the businesses either did not have oiled property, or if they did have oiled

property, there was no causal connection between the property damage and their economic loss. . . . Among those plaintiffs who submitted opposing evidence are certain guides for sport fishermen and nature lovers. According to these plaintiffs, their affidavits establish that: Their businesses are dependent upon the condition of the waters and the fish in areas impacted by the *Exxon Valdez* spill. When the availability of salmon and other fish and the attractiveness of the marine environment were impaired by the spilled oil, these plaintiffs lost revenues because existing reservations were canceled and potential patrons were discouraged from booking new reservations. Some had their activities directly disrupted by the presence of oil in waters where they would have fished or observed wildlife with their clients. . . . Upon review of the evidence, the court finds that the plaintiff guides have failed to show that their economic claims were related to physical damage to property. Under the court's interpretation of *Robins Dry Dock* and *Oppen*, the plaintiff guides are not entitled to recover for their claimed damages." (Minutes of the United States District Court for the District of Alaska, In re the *Exxon Valdez*, February 7, 1994).

The Alyeska settlement, which was reached before the above decision, allows the area business class to receive a portion. This portion is substantially discounted in the disposition of the money to take account of the uncertainty of their status resulting from the *Robins Dry Dock* issue. However, recreation and tourism businesses will receive a portion of the claim, which will be pro-rated on the size of claim and expert's reports. This will be a deeply discounted claim settlement. In effect, recreation and tourism businesses will receive very little. They are certainly not going to be made whole for their losses. (Based on conversation with A. William Saupe, attorney with Ashburn and Mason, 10/12/93.)

*1994 Update:* OPA 90 states: "the responsible party . . . is liable for the . . . damages . . . equal to the loss of profits or impairment of earning capacity due to the injury, destruction, or loss of real property, personal property, or natural resources, which shall be recoverable by any claimant" (Sec. 1002.[b][2][E]). According to CDR Bill Miller of the U.S. Coast Guard National Pollution Fund Center, OPA 90 makes the *Robins Dry Dock* rule defunct with respect to oil spills (Pers. comm, 3/21/94).

The interim rule, Claims Under the Oil Pollution Act of 1990, describes when businesses may file a claim for lost profits and earning capacity: "A claim for loss of profits or impairment of earning capacity due to the injury to, destruction of, or loss of real or personal property or natural resources may be presented by a claimant sustaining the loss or impairment. The claimant need not be the owner of the damaged property or resources to recover for lost profits or income" (Sec. 136.231).

Businesses must establish the following: "(a) That real or personal property or natural resources have been injured, destroyed, or lost. (b) That the claimant's income was reduced as a consequence of injury to, destruction of, or loss of the property or natural resources, and the amount of that reduction. (c) The amount of the claimant's profits or earnings in comparable periods and during the period when the claimed loss or impairment was suffered, as established by income tax returns, financial statements, and similar documents. In addition, comparative figures for profits or earnings for the same or similar activities outside of the area affected by the incident also must be established. (d) Whether alternative employment or business was available and undertaken and, if so, the amount of income received. All income that a claimant received as a result of the incident must be clearly indicated and any saved overhead and other normal expenses not incurred as a result of the incident must be established" (Sec. 136.233).

These requirements may be difficult or impossible for small businesses to meet. Establishing that natural resources have been injured, destroyed, or lost may require extensive costly studies if the studies are not done by the trustees. In most of Alaska, no baseline or even historical data is available for site-specific areas or wildlife resources used by ecotourism companies. Without site- or route-specific baseline data, small businesses will face the same problems of proving damages that the trustees had with EVOS. In addition, companies may have difficulty documenting the percentage of their profits that are derived from the use of natural resources such as a specific beach, a bald eagle nest, or sightings of Dall porpoise.

Compensation is limited to the "actual net reduction or loss of earnings or profits suffered" (136.235). These calculations must reflect adjustments for: "(a) All income resulting from the incident; (b) All income from alternative employment or business undertaken; (c) Potential income from alternative employment or business not undertaken, but reasonably available; (d) Any saved overhead or normal expenses not incurred as a result of the incident; and (e) State, local and Federal taxes" (136.235). Under these criteria, companies may find themselves in a Catch 22 situation: if a company decides to continue offering tours as some did during EVOS, the money they could have earned working in the spill response, might be deducted from their compensation under adjustment (c). It does not appear that businesses can recover the costs of proving damages to natural resources on which they depend.

There have been no court tests of claims made against the National Pollution Fund. However, in the *M/V Jupiter* case (Great Lakes area) where claimants first sought damages from the responsible party, the court

dismissed the claimants saying they did not have a proprietary interest (i.e. *Robins Dry Dock* rule). In reviewing the case, the Coast Guard felt that neither side explained the legislative history of OPA 90 to the judge (CDR Bill Miller, National Pollution Fund Center, Washington, D.C. 3/21/94). It may take years of court cases before there is settled law on the ability of commercial companies to recover damages resulting from an oil spill.

### **Topics Pertaining to Recreation and Tourism Not Covered by Current Contingency Plans**

1. Special economic interests in addition to commercial fishing should be included in the Unified Area Plan and PWS Area Plan information resource lists. Both the unified plan and the PWS area plan contain annexes listing a summary of area resources including personnel and information resources (Unified Area Plan, Annex E: Appendix III, PWS Area Plan, 1993, p. vi). The information resource consists of organizations and their phone numbers. The only commercial resource listed is the fishing fleet/organizations. Other commercial resources likely to be affected by a spill, including tourism and logging operations, are not listed. However, there may be times when the OSC would want to contact tour operators. The Alaska Wilderness Recreation and Tourism Association database contains the names and phone numbers of over 150 tourism businesses, including hunting guides and sport fishermen that operate in Prince William Sound.
2. The area plan should include provisions for notifying, locating, and evacuating people from an oil spill area or area likely to be affected by a spill. In Prince William Sound and many areas of Alaska, recreational users, tourists, hunters, commercial fishermen, sport fishermen, and subsistence gatherers may be dispersed throughout the area. A large or catastrophic oil spill at any time of the year could adversely affect some of these people. Some will have radios and a means of leaving the area; others may be dropped off by charter boats or airplanes and have no way of departing; others may be in kayaks or boats that would be unsafe to take through a heavily oiled area. Many of these people would not have a radio. In the event of a large or catastrophic spill, one priority should be to locate these people, notify them of the spill, provide safety equipment if needed, and arrange for their timely evacuation. The PWS area plan contains checkoff lists for notification. There is no place on these checklists for searching for or notifying people in the spill impacted or potentially impacted area. The section on safety covers safety factors affecting the spill response, not the safety of people possibly stranded in the spill area

(PWS Area Plan, H-5). The plan should be amended to provide for the location, notification, and evacuation of people caught in the path of the oil spill.

Alyeska's Tanker Plan and nearshore response plan call for the notification of communities, hatcheries, wildlife personnel, and others. The following potentially affected groups are not notified: (1) representatives of tourism and recreational interests; (2) public or private landowners such as the state marine parks, Ellamar residents, Stan Stephens Growler Island Camp, or landowners in Jack Bay; (3) tour operators, such as the National Outdoor Leadership School which could have up to 50 students camping in the area of the spill or its trajectory.

Alyeska's nearshore response plan might be amended to include the addition of an initial phase recreation and tourism protection unit group and leader under the nearshore group coordinator (2.2). The unit could initiate the search for persons camped or boating in the spill impacted area or its trajectory; map their locations; notify them of the spill; evacuate them if necessary or possible; provide them (by air drop) with respirators and protective clothing if they cannot be evacuated quickly; and serve as a communications base for calls from tour operators' onshore offices, relatives of recreational boaters, etc.

3. When ecotourism resources are affected, an ecotourism representative should be on the Multi-agency Coordination Committee (MAC). According to the unified plan, the Incident Command System for Oil and Hazardous Substance Discharges is designed "to organize and manage responses to incidents involving a number of interested parties in a variety of activities" (Unified Plan, B-1). Depending on the size and nature of a spill, the unified command may appoint a unified staff. If the need arises, the unified liaison officer organizes the MAC. Membership on the committee "will vary from incident-to-incident and from phase-to-phase, but may include senior level representatives of Local, State and Federal agencies, communities, landowners, leaseholders, and special interest groups affected by the spill" (Unified Plan, B-11). Presumably commercial interests such as fishing, tourism, and logging would qualify as "special interest groups affected by the spill." However, if the names of contact organizations for tourism are not listed in Annex E as informational resources, then it is less likely they will be contacted and invited to participate.

4. The unified plan should include a place on the FOSC checklist used for chemical countermeasures to note that a search has been made and evacuations conducted, if necessary, for people possibly in the target area.

The unified plan discusses chemical countermeasures: dispersants, chemical agents, and other spill mitigating substances, devices, or technology (Annex F). FOSC approval requires completion of a checklist. The checklist for using dispersants in zone 1 includes information on the distance to the nearest town, but does not include any references to other settlements, such as lodges, hunting camps or anchorages, or other human uses. There is no place on the form for the FOSC to know whether a search has been conducted and people evacuated. The checklists for using dispersants in zones 2 and 3 and undesignated areas and in situ burning include information on distances to the nearest town plus an additional section for resource agencies to complete. Commercial facilities and enterprises as well as public facilities and enterprises are listed. However, there is still no place on the form for the FOSC to know whether a search has been conducted for people in the area and evacuations made (Unified Plan, F-26-44). Since this is a potential safety concern, the unified plan should be amended.

5. There is a need for plan writers to communicate better with all affected publics and to make public policy decisions after consultation with all affected parties. Unlike environmental impact statements, contingency plans do not require public scoping sessions, public notification, or public comment periods. As a result, there is poor coordination between the writers of these plans and the public they are protecting. In some cases, important public policy decisions are made at the contingency plan level without public review. For example, a review of all the contingency plans shows that only one special economic interest, commercial fishing, has been included in the planning process. Others, such as ecotourism and logging, are excluded. And yet, both of these industries were and will be affected by oil spills. The decision to exclude them occurred without any public notice to either affected industry and without an opportunity for them to comment.

## Discussion

Since 1989, contingency plans for the Prince William Sound region have improved significantly. Alyeska is certainly to be commended for its work. However, although required by OPA 90 to describe "areas of special economic importance . . . that might be damaged by a discharge" (OPA 90 Sec. 4202[4][c][ii]), the plans have focused on protecting environmentally sensitive areas and commercial fisheries. No attention has been paid to protecting recreation and tourism resources or the people involved in those activities.

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## Then & Now: Changes Since the *Exxon Valdez* Oil Spill

Stan Stephens

*Prince William Sound Regional Citizens' Advisory Council  
P.O. Box 1297, Valdez, AK 99686*

### Abstract

This paper provides an overview of how factors that led to the nation's worst oil spill have been addressed since 1989.

The *Exxon Valdez* oil spill was not simply a freak accident. While Exxon was responsible, myriad other factors allowed it to happen. It could have been prevented by stronger prevention practices and vigilant government oversight. Once the spill occurred, better response planning could have lessened the impacts.

Prince William Sound and communities in the path of tanker traffic are better protected from major spills. Industry, government agencies, and the communities are better prepared to respond should a spill occur. Important steps have been taken to prevent oil spills from occurring. Crews are better trained and monitored. Masters are held to more stringent requirements. Measures have been instituted to increase chances of safe passage and reduce the possibility of accidents. Yet gaps remain.

Some issues—such as towing capabilities and inadequate weather data—are only beginning to be addressed. Several important prevention measures, such as double hulls on tankers and a study of human factors in tanker operations, will take time to implement.

The federal rule-making process is slow and many of the actual requirements and specific decisions have yet to be clarified and formalized in final regulations. Laws that appear strong when enacted can be weakened through vague regulations and inadequate funding.

The most alarming barrier to continued progress is a relatively recent development: the State of Alaska's retreat from its commitment to oil spill prevention and response.

Alaskans who care about the safe transportation of oil and environmental protection must define ground gained since 1989, continue to monitor implementation of new laws, strengthen weak areas, and close gaps that remain. Continued vigilance will be essential to ensure that protections aren't diluted and that gains are not lost as political memory dims.

## Introduction

Myriad factors contributed to the *Exxon Valdez* oil spill. The oil industry, government agencies, elected officials, and, to some extent, the citizens of Alaska share responsibility for conditions that allowed the spill to happen and failed to ensure timely, effective cleanup. The oil industry failed to maintain adequate prevention and response systems. Regulatory agencies failed to protect public resources because of ineffective or inadequate monitoring, oversight, and enforcement. State and federal elected officials were unwilling to pass laws strong enough to protect the environment and give regulatory agencies the funds they needed to protect public resources. Most Alaskans simply weren't paying attention.

The *Exxon Valdez* oil spill was caused by the ship's master and crew. It could have been prevented by stronger prevention practices and vigilant government oversight. Once the spill occurred, better response planning could have lessened the impacts.

Are the resources and communities of Prince William Sound and the Gulf of Alaska better protected from a major oil spill than they were five years ago? Can we breathe easier?

We—the Prince William Sound Regional Citizens' Advisory Council—believe the sound and communities in the path of tanker traffic are much better protected now; yet more remains to be done. And sadly, we must also keep looking over our shoulder to ensure that protections aren't diluted and that gains are not lost as political memory dims.

In a moment I will review RCAC's perspective of those changes and improvements that we believe account for a higher degree of safety in oil transportation. I will also discuss problem areas and gaps in prevention and response. But even as we look back at the last five years, gains we've made are at risk of erosion. State legislation with a strong likelihood of passage would change how prevention, response, and oversight activities and projects are funded. This legislation is alarming because, if passed, it could seriously weaken many of the protections added in the wake of the *Exxon Valdez*.

Perhaps more disturbing is what this legislation symbolizes in terms of Alaska's political climate, attitudes toward the oil industry, and political power in Alaska. We risk sinking right back into the complacency that enabled the *Exxon Valdez* to occur. The irony is that the standard bearer of this effort to reduce industry's tax burden is none other than Exxon.

Our systems are only as good as the public will to support them. If you leave here with nothing else, leave with that.

## Prevention

Once oil is spilled on water, it is never fully contained and recovered. The best-laid response plans in the world are no guarantee that any spilled oil will be recovered. Severe weather conditions can render useless even the best response plan. The first line of defense must be prevention.

### Vessel Traffic and Navigation

Significant steps have been taken the past five years to prevent oil spills. Numerous changes have been made to update and improve the U.S. Coast Guard's Vessel Traffic Service. These changes enhance the Coast Guard's ability to monitor and provide traffic advisories to inbound and outbound tankers.

- Radar coverage, and reporting and communications have been upgraded.
- The one-way zone was extended to Bligh Reef for vessels of 1,000 or more gross tons, giving a greater margin of safety in ice conditions. More recently, in response to the *Overseas Ohio* incident, shippers voluntarily began using ice scouts to alert tankers to glacial ice in the shipping lanes.
- A watch supervisor was added to the Vessel Traffic Center, and the qualifications and training for watch standers have been upgraded and expanded.
- New repeater towers have been installed by Alyeska to allow better two-way communications between tankers and the terminal, and a fixed navigational aid tower has been installed on Bligh Reef.
- Tanker tracking has improved and will get even better later this year when the Differential Global Positioning System is in place. Tankers' positions are now tracked and plotted every three minutes through the Valdez Narrows; and every six minutes elsewhere in the radar coverage area between the terminal and Bligh Reef.

The Differential Global Positioning System will be fully in place this summer, but even now the equipment is helping vessels avoid hazards. Most of the Coast Guard vessels and 18 tankers already have onboard equipment that alerts them to marine hazards such as shallow water and reefs. If the *Exxon Valdez* had had a black box, the crew would have been

warned about Bligh Reef. When the GPS is fully operational, the Coast Guard will be able to do a much better job of tracking vessels.

Speed restrictions are tighter now. Alyeska limits the speed of the escort vessels to 10 knots in the Sound, effectively limiting the speed of the tanker, as well.

Tankers must remain in the traffic lanes, although they can request Coast Guard permission to move from one lane to the other if circumstances warrant.

### Weather Considerations

New weather restrictions have been imposed. The Coast Guard closes Port Valdez to tanker traffic if sustained winds in the Narrows reach 40 knots. Between 30 and 40 knots, additional tugs are assigned through the Narrows: two tugs for tankers up to 100,000 dead weight tons, and three tugs for larger vessels.

In sustained winds over 40 knots, Alyeska suspends escorts altogether. If such winds come up when escorts are underway, they proceed except in rare extreme conditions when they may turn back.

Last year, the Coast Guard captain of the port in Valdez added new weather restrictions at Hinchinbrook Entrance: outbound laden tankers do not transit Hinchinbrook if sustained winds in the Gulf of Alaska are 60 knots, or seas reach 15 feet.

Although we knew it was a problem before, the grounding of the *Braer* in Shetland last year brought home the need for better and more timely information about weather conditions in the Sound and at Hinchinbrook Entrance. Readings from the wind measuring station at Potato Point aren't always a reliable gauge of actual conditions. Sometimes the only real-time information about wind and sea conditions is from a vessel already underway.

RCAC is actively lobbying our congressional delegation, and anyone else who can help, for additional weather reporting stations. The Coast Guard and industry are supporting these efforts, as well.

### Tanker Crews

Several changes have been made affecting tanker crews. Alcohol screening is now standard. Tanker captains take a breath test within an hour of sailing and crew members suspected of consuming alcohol are tested. Crew with blood alcohol content of .04% are denied access to the terminal and tanker.

A state-certified ship's pilot must be on board all tankers between Bligh Reef and the terminal. A federally licensed pilot or two licensed

deck officers must be on watch on the bridge while the vessel is underway between Bligh Reef and Seal Rocks. To reduce the risk of fatigue-induced accidents, crew work hours are limited. These all represent significant improvements but more work is needed. The human factors that contribute to marine accidents need to be fully studied and solutions found to reduce human error.

One of the studies required under the Oil Pollution Act of 1990 (OPA 90) will address some of these human factors, and the two RCACs are jointly sponsoring a scoping study of human factors issues.

### Escorts and Towing

The Coast Guard has always required laden tankers to have one tug escort through the Valdez Narrows, but now each tanker is accompanied by at least two escort vessels—usually one tug and one escort response vessel—from the terminal to Hinchinbrook Entrance. This is probably the single most important change since 1989. Up to two additional tugs may be required depending on weather conditions and vessel size.

Although all laden tankers transiting Prince William Sound must carry special towing equipment, there is a wide range in deployment speed because of differences in stowing practices. On some ships, the towing package can be deployed in 15 minutes or less with a deck crew of two. On others, preparing the towing equipment would take at least several hours by a crew of eight—far too late to make a difference in the Narrows.

The ability of escort vessels or tugs to assist a tanker in trouble is also in question. Concern is especially high through the Valdez Narrows, where navigable water shrinks to a half nautical mile. A tanker disabled at the narrowest point could hit the rocks in less than 10 minutes. Averting a grounding in that situation would depend on the escort tug's ability to push or pull the tanker away from the rocks. It is not at all clear that the assist tugs and escort vessels are capable of doing so.

The findings of a study cosponsored by RCAC and the Prince William Sound Tanker Association should provide us with some concrete data to assess whether current practices and equipment are adequate. The report should be finalized and released in the next month or so. The Coast Guard is also very interested in the study and has delayed federal regulations on escort requirements until the report is available.

### Tankers

In terms of preventing or mitigating tanker spills, one of the most important steps is the federal requirement that by 2015, all tankers in U.S. waters must have double hulls. Studies indicate double hulls could have

prevented five of the six major oil spills in Alaskan waters between 1975 and 1990. One study estimated double hulls could have reduced the amount of oil spilled by 60% to 80%.

Though not related to the *Exxon Valdez*, the Coast Guard since 1989 has required more stringent inspections of tankers vulnerable to structural failure. A related issue that I hope we at RCAC do some work on is the structural stresses caused by severe conditions in the Gulf of Alaska.

## Oversight

### Citizen Involvement

Long before the *Exxon Valdez* became a household word, people in Prince William Sound had implored Alyeska to form a citizens advisory group. Until the spill, of course, those requests were rebuffed. The regional citizens advisory councils for Prince William Sound and Cook Inlet provide an avenue for citizen involvement in the issues and decisions that affect their lives and communities. While the councils are still young, and have their share of controversy, I think there's little question that they contribute significantly to safer oil transportation.

The councils also ensure that as most people get on with their lives, someone outside industry and government is paying attention.

### Regulatory Oversight

Regulatory oversight changed fairly dramatically after the 1989 spill. As I mentioned earlier, the bad news is that legislation expected to pass this year could result in serious backsliding or outright loss of some of those gains.

Legislation passed in 1990 gave the Alaska Department of Environmental Conservation more authority, resources, and funding to monitor and oversee industry operations and implement spill prevention and response programs.

ADEC can now require and enforce prevention measures as conditions for approval of contingency plans. Such measures include more training, more equipment, more inspection and maintenance of equipment, better record keeping, and specific requirements for laden tankers.

An important element in the changes was expansion of an existing fund to ensure that reserves would be available to respond to a major oil spill and provide a long-term funding source for the state's spill prevention and response programs. The money for this expanded role comes from a 5¢ conservation surcharge on every barrel of oil produced in Alaska. Another improvement was consolidation of oil-related functions into a

single Spill Prevention and Response Division within the Department of Environmental Conservation.

Regulatory authority increased at the federal level, too. The Coast Guard has a more direct role in spill prevention and response and much greater regulatory oversight of oil transportation.

## Oil Spill Response

One of the procedures instituted after the spill is a nice symbol of the dramatic change in response preparedness. All tankers docked at the terminal are surrounded with containment boom while cargo is being transferred so that any spill there can be contained immediately. It's important to acknowledge the huge strides that have been made since 1989. The equipment, personnel, and resources now standing by will—God and weather permitting—mean far less damage when and if another spill occurs.

## Contingency Plans

The speed and effectiveness of responding to an oil spill hinge on the availability of equipment, resources, and trained personnel. Responding to a spill depends on planning, preparation, and weather. State and federal agencies have expanded plan requirements and changed some of the assumptions. Shippers and Alyeska must provide greater assurances that personnel are being trained, that equipment and resources are available and can be mobilized quickly, and that all players have practiced their roles in preparation for an actual spill. An important change since 1989 is that industry must plan for larger spills than before and ensure that more spill response equipment will be immediately available.

## Equipment

Weather conditions were ideal for oil recovery the first three days after the *Exxon Valdez* ran aground. Seas and winds were calm. But the equipment wasn't ready. Seventeen hours after the grounding, neither the leading edge of the spill nor the grounded tanker had been boomed. The few skimmers on scene were operating ineffectively. Two hours later, skimming was forced to stop, pending arrival of more storage capacity.

The most dramatic change since 1989 has been in spill response readiness through Alyeska's Ship Escort and Response Vessel System, or SERVS. SERVS ranks among the top oil spill response forces in the world, and may well be the best.

- Trained response crews are on duty 24 hours and a response fleet is on standby alert whenever a laden tanker is transiting Prince William Sound. Task forces, each with a trained crew and a large barge with two skimming systems on board, are stationed at strategic sites.
- Equipment and procedures are tested in drills and exercises to reduce confusion and surprises in an actual incident. A unified command system coordinates management, resources, and roles, enabling people from different agencies and organizations to work together.
- Local vessels are trained to transport response equipment, deploy and tend boom, and mobilize pre-staged equipment to protect fish hatcheries.
- Spill containment and removal equipment is stockpiled at fish hatcheries, and community response centers have been established in Chenega, Cordova, Tatitlek, Whittier, Valdez, Kodiak, Seldovia, and Seward to coordinate emergency responses, manpower, and equipment.
- Storage capacity has been vastly increased. Alyeska maintains storage capacity for nearly 20 million gallons of recovered oil and water, and recently let a contract for construction of 48 mini-barges which will be used to recover and store oil close to shore.
- Much more attention is now paid to protecting shoreline threatened by spilled oil that has escaped initial containment. Next month in Seldovia we'll see the first demonstration of the state prototype for nearshore oil spill response depots.

### Gaps

Progress notwithstanding, there's more work to be done. Some elements of response planning have yet to be implemented and accountability must be clear and enforceable.

- Little progress has been made in setting up response corps and emergency depots.
- Kodiak Island and the southern Kenai Peninsula were hit by oil from the *Exxon Valdez*, but little has been done to assess the needs of those areas or provide them with response resources.



- An issue of growing concern to us is the relationship of Alyeska to the Prince William Sound Tanker Plan. The Prince William Sound plan has been Alyeska's plan for the initial response to a tanker spill in the sound. Alyeska has moved away from responsibility for the plan, arguing that it is merely a response action contractor for the shippers. That raises troubling questions about accountability, and ultimately liability for compliance with the plan. We fear, with justification, that those organizations and corporations who should be held accountable and liable are shielding themselves behind the ship owner, which may in fact have exactly one asset: the tanker. That will leave the public holding the bag.

### **Conclusion**

There can be little question that Prince William Sound, and communities at risk of spills from the Trans Alaska Pipeline System trade tankers, are better protected than they were five years ago. Industry and government deserve credit for what they've done. We have stronger prevention measures, better response capabilities, and more attentive oversight.

Yet, it is all quite fragile. Outside the impact areas, public sentiment is fickle and political memories are short. What's more, as throughput declines, pressures will increase on industry to cut costs. We cannot for a moment relax.



## **Citizen Oversight Under OPA 90: Report Card from Prince William Sound**

H.E. "Stan" Stanley

*Prince William Sound Regional Citizens' Advisory Council  
750 W. Second Avenue #100, Anchorage, AK 99501-2168*

### **Abstract**

This paper will provide an overview of the experience and work of the Regional Citizens' Advisory Council of Prince William Sound (RCAC) in terms of whether it has met implicit and explicit expectations of its founding members, residents of the affected region, Alyeska Pipeline Service Company, and the Oil Pollution Act of 1990 (OPA 90).

Section 5002 of OPA 90 establishes a demonstration project in which local citizens have direct involvement in operations, practices and regulatory issues related to terminal facilities and crude oil tankers. By virtue of its contract with Alyeska Pipeline Service Company, the RCAC is certified as the alternative advisory group in lieu of council as permitted under OPA 90. If the demonstration projects are successful, citizen advisory groups will be established at other oil terminals in the United States.

Perceptions about the RCAC's role and function vary. Some observers believe the RCAC is overly critical and adversarial, while others criticize it for working too closely with industry. Who are the citizens of the Citizens' Advisory Council and does the RCAC represent them and their concerns?

Some of the expectations may have been unrealistic. Language in OPA 90 notwithstanding, fundamentally conflicting interests make it highly unlikely that conflict, mistrust and confrontation will ever be eliminated altogether. On the other hand, citizen involvement appears to be contributing to more responsible and responsive industry operations and regulatory decisions.

### **Introduction**

Four years ago last December a group representing communities and interest groups impacted by the *Exxon Valdez* oil spill incorporated as a nonprofit called the Regional Citizens' Advisory Council. With funding and a contract with Alyeska Pipeline Service Company, and later a federal mandate, the organization set out to pave a new era in citizen empower-

ment. In some ways, the premise was simple: If citizens have a greater voice in decisions that affect their lives, oil transportation will be safer.

Citizens, through their representatives on the council and committee volunteers, sit at the table and have effected some tangible changes.

But some of the assumptions we began with have not borne out and unexpected challenges have cropped up. How well RCAC confronts and deals with those challenges will determine our effectiveness, our longevity, and the degree to which the RCAC model is applied in other places and in other industries.

## Genesis

The Regional Citizens' Advisory Council was born out of chaos, anger, outrage, and alienation: the chaos of the spill, anger at industry's arrogant and ultimately empty assurances, and outrage at the flimsiness of the spill response and government's flaccid and inept oversight.

No one was prepared for a spill of that magnitude—not Exxon, not Alyeska, not the regulators. Complacency—of industry, regulators, and even the general public—was the root cause of system failure.

The founding principles of the citizens advisory council boil down to two: That people with the most to lose were in the best position to keep complacency at bay, and people with the most at risk from oil transportation had to have a say in the decisions that affect their lives and livelihoods. The shift in political climate wrought by the *Exxon Valdez* presented an opportunity for citizens to make inroads impossible before.

Both the contract with Alyeska and the provision in federal law for citizen oversight came from Cordova, specifically Cordova District Fishermen United. CDFU representatives were familiar with Sullom Voe, the North Sea terminal in Shetland where a citizens group advises industry in the operation of the terminal.

After the spill, Jonathan Wills, a Shetland activist and journalist, came to Alaska and urged CDFU to push for the Sullom Voe model in this country.

As early as May 1989, Cordova fishermen were traveling to Washington, D.C., to lobby for a citizens group in federal law. They pitched it to Alyeska, too, as a way of making retribution and as a source of positive public relations.

Nowhere was the shift in political climate more startling than at Alyeska. Where the previous president had been arrogant and dismissive, Jim Hermiller embraced the concept of citizen involvement and put himself on the line in the face of resistance from some of the owner companies.

The first meeting of citizen representatives took place in Anchorage in July 1989. The group's efforts those first six months were on negotiating terms of a contract with Alyeska, and reviewing Alyeska's newly-revised oil spill contingency plan. At the same time, Alaskans were working with Senator Frank Murkowski's staff in Congress to incorporate the citizen oversight model into the bill that would become the Oil Pollution Act of 1990.

In December 1989, the Regional Citizens' Advisory Council incorporated as a nonprofit. In February 1990, after six months of negotiation, RCAC and Alyeska signed a contract. RCAC had insisted on, and won, four key provisions: absolute independence from Alyeska, generous access to Alyeska facilities, a guaranteed source of annual funding, and assurances that the contract would last as long as oil flows through the pipeline.

In return, RCAC was to provide services to the public and Alyeska. These services include local and regional input on issues related to contingency planning, environmental protection and oil transportation; research and monitoring; and information to the public about Alyeska's capabilities in oil spill prevention and response, and environmental protection.

## **Accomplishments and Success**

So how has it fared, this American experiment in citizen involvement?

Citizens are consulted on policy development and decision-making in ways unimaginable five years ago. We sit side by side with industry and regulators in spill drills, working groups, and task forces. Our comments are sought on oil spill prevention and response, terminal operations, and vessel traffic issues. We help write regulations, revise contingency plans, and cosponsor important studies.

There can be little question that the contract with Alyeska, combined with the legal clout of OPA 90, has pushed open the doors to citizen participation. Through the RCAC, citizens' concerns and perspectives have a voice they have never had before. How we use this opportunity will bear heavily on whether the RCAC indeed serves as a far-reaching model for systemic citizen participation in industry and government decision-making.

Despite formidable challenges, which I will discuss a little later, our first four and a half years have brought substantive achievements. One of the foremost lessons of the 1989 oil spill was the need to keep at bay a recurrence of the industry and government complacency which so

contributed to the *Exxon Valdez*. We do that by keeping alert. It would be unrealistic to expect the general public to stay on top of the myriad issues associated with terminal and tanker operations, spill prevention, and response. Once a crisis has passed, people get on with their lives, as well they should. But somebody needs to keep paying attention. That is one of the things RCAC does best on behalf of the communities and interests we represent.

RCAC devotes enormous time and resources to reviewing oil spill contingency plans and working with industry and regulators to make those plans better. Late last year we completed a protocol for reviewing contingency plans. We review and comment on state and federal regulations. In several cases, RCAC has been included in working groups organized to formulate rules and regulations pertaining to oil spill prevention and response. RCAC participates in major drills as planners, participants, and observers, and offers constructive critiques. We monitor response capabilities and availability of personnel and equipment.

At the terminal, RCAC monitors operations, offers suggestions, and recommends system and operational changes to minimize environmental impacts of the terminal facilities. Independent studies provided data about sampling and testing at the ballast water treatment plant. We hired top-rate consultants to help us do an independent review of Alyeska's Valdez Air Health Study, and pressed for installation of controls to reduce vapor emissions from the terminal. RCAC monitors tanker and traffic issues and advocates for changes to augment oil spill prevention. We are spearheading a drive to convince the federal government to install additional weather reporting stations in Prince William Sound. In a cooperative effort with industry and regulators, we cosponsored a study of disabled tanker towing. This study, which should be completed within the next month or so, will help us assess whether current equipment and practices are adequate to assist tankers in trouble.

RCAC is conducting two studies to better prepare the region for a future spill. We are in the second year of a long-term environmental monitoring program to gather baseline data about the presence and source of hydrocarbons in Prince William Sound and the Gulf of Alaska. One of the obstacles to assessing the damages from the 1989 spill was a lack of baseline data to tell us conditions before the spill. The environmental monitoring program should provide the scientific data to assess the impacts of oil transportation and any future incidents. In the second project, we are taking what was learned about the impacts of the spill on people and communities to develop response strategies to employ in the event of another major spill. The concept here is to minimize those human and community impacts through planning.

## Results

The fact of RCAC's existence and the political climate from which it emerged allow citizens to be represented before industry and regulators. Our \$2 million a year funding from Alyeska allows us to pay for the work needed to support the citizens' interests: studies and reports that help our board make informed decisions and take reasoned positions; staffing; and operational support of the board and committee volunteers.

The sheer opportunity to participate and make our case to decision-makers is a profoundly significant improvement over the old standard operating procedure. Citizens had little if any access to industry and no formal avenue for expressing their concerns and views. Citizens could register their concerns to regulators through public review and comment processes, but too often such forums were merely *pro forma* and citizens' voices fell on deaf ears.

The fact of citizen participation, the chance to be heard, is no small gain. But is that enough? At some point, we must assess the results of our efforts. Ultimately, RCAC is advisory. Is the advice being taken? Are our efforts resulting in safer terminal operations and oil transportation?

Tangible results are not always easy to gauge, but I think we have clearly scored some:

- Pressure from RCAC convinced Alyeska to agree to install a vapor control system at the terminal.
- RCAC's dogged conviction that shorelines can be protected from the leading edge of an oil spill resulted in the development and acceptance of nearshore response as an element in spill response planning.
- Without RCAC and several years of painstaking negotiations, a study of disabled tanker towing would never have been done.

These are examples (and there are other important ones, as well) of efforts by RCAC that have or likely will produce tangible change in behavior directly affecting the safety of tanker transportation and oil terminal operations. Ultimately, RCAC is an opportunity to influence decisions and behavior. Our ability to persuade—using objective, well-researched information and reasoned positions—is paramount to the ultimate success of this experiment in citizen participation.

## Are They Listening?

Among industry and regulators, we have encountered varying attitudes toward citizen involvement, and responsiveness to citizen concerns.

The value of citizen involvement and responsiveness to citizen concerns are distinct but closely related. In some ways, embracing the principle and practice of citizen involvement can be more difficult than responding to citizen concerns. Sometimes, we drive them up the wall. We know too little. We know too much. We don't know nearly as much as we think we do. These are the complaints we hear when we sit at the table with industry and regulators. To be sure, that is not always the case, and some are sincerely sold on the value of citizen involvement.

As a 28-year Coast Guard veteran, I empathize with people just trying to do their jobs. The vast majority of us at RCAC are not experts. Many of us are more knowledgeable than the average citizen, but that doesn't put us on the same professional and technical level as the experts in industry and government. At times, we fail to remember that. Responsiveness to citizen concerns is more than just whether they do what we want. Much of it boils down to a willingness to listen with an open mind. Unfortunately, some in industry and government tend to dismiss citizen concerns out of hand. What some of them have been slow to learn is that even if a citizen's concern stems from lack of knowledge or understanding, that concern is valid in the sense that it must be addressed. Those who ignore the value of citizen input, those who close their minds and ears to different, less-educated viewpoints, are those most at risk of sinking back into complacency.

If those we try to influence are not listening, or if they cease to listen, we must ask ourselves whether part of the reason lies with us. I believe it does. The most nagging, thorny conflict in the relationship between RCAC and Alyeska is how we resolve differences.

We do have a mutual policy of "no surprises," which means we let Alyeska know there's a problem before we run to the media with it or otherwise publicize our criticism. Alyeska, in turn, is to give us notice of decisions and issues in our areas of interest. Unfortunately, there are a lot of people to train on both sides and not everyone—especially within RCAC—is complying with the "no surprises" policy.

More difficult is the question of timing and discretion. Alyeska (and regulatory agencies, too, for that matter) want the opportunity to work out differences and disagreements free of the pressure cooker atmosphere that inevitably descends when the press gets wind of conflict. Give us a chance to work it out, they say, before you alert the troops and



call the press. Their view is that cooperation and diplomacy are inherent in the advisory relationship and that is what sets RCAC apart from traditional activist groups.

While most within RCAC support the concept of cooperation, RCAC's independence—and public perception of that independence—are a cornerstone of the contract. There is serious concern within RCAC that the type of cooperation Alyeska seeks would undermine RCAC's independence and public perception of our independence.

Some of our board members also believe their responsibility to the citizens means that everything they hear, see, and read must be shared. They believe their obligation to the public precludes them from holding something back from the citizens they represent, even for a short time. Not all our board members feel this way, but it's an awkward issue for most of them. I believe the dilemma stems from conflicting views about the nature of RCAC's relationship to Alyeska on the one hand, and confusion about the nature of our responsibility to the public on the other.

### **Identity and Conflicting Expectations**

Is RCAC a whistle-blowing watchdog or simply an advisory group? Our name notwithstanding, this question is not as simple as it might seem. It is complicated by unrealistic and contradictory language in the Oil Pollution Act of 1990.

#### **OPA 90**

Depending on where you look in Section 5002 of the Oil Pollution Act, the RCAC is supposed to: (a) forge a trusting partnership with industry and government, (b) act as an oversight group, or (c) simply advise industry and government.

RCAC has already been judged on "trust and partnership," which stems from intent language in OPA 90. The intent language speaks to lofty goals: a long-term partnership between citizens, industry, and government; converting mistrust into trust and confrontation to consensus.

Referencing those goals, an audit by the U.S. General Accounting Office last year took us to task for failing to single-handedly promote trust, cooperation, and partnership. We thought that was pretty silly, since first, it made the citizens alone accountable for what must be a shared responsibility, and second, the GAO put disproportionate emphasis on getting along, while being virtually silent on whether RCAC is making oil transportation safer.

While the lofty goals in OPA 90 have come back to bite us, we bear some responsibility for the problem since many in our organization had a

strong hand in writing Section 5002. The model for Alaska was Sullom Voe, the terminal in the Shetland Islands. The vision was to clone Sullom Voe, but the framers of OPA 90 failed to take into account political and jurisdictional differences between Shetland and the United States. Failure to fully appreciate those differences has resulted in unrealistic expectations.

Britain's political culture is very different from ours. Closed doors and private negotiations between regulators and industry are standard. Meetings of our Sullom Voe counterpart, the Shetland Oil Terminal Environmental Advisory Group, are not open. Although its reports are available to the public, its advice and recommendations remain confidential unless the local governing body, the Shetland Island Council, chooses to make them public.

With a political culture much closer to that of private corporations, the citizen group in Sullom Voe is comfortable working in an environment that prizes confidentiality and discretion. Proponents of that system say it promotes frank discussion, cooperation, and consensus-building.

By contrast, the vast majority of RCAC meetings are open. Reports are available to the public and released to the news media. RCAC's policies are to operate consistent with open government practices, even though it is a private entity. The RCAC board has been very reluctant to hold anything close to its chest, much to the dismay of Alyeska, which has long sought—and still seeks—the opportunity to work on differences free of media attention and external pressure.

Another critical difference between Sullom Voe and Alaska is that in Shetland, the local governing body has extraordinary jurisdictional authority. With power vested in the citizens, industry there has much greater incentive to listen and reach agreement. Simply put, the playing field is even at Sullom Voe; it isn't here because the citizens, and the local governments they represent, don't wield anything close to that level of authority.

Even if consensus in the broad sense were possible, we question whether it would be desirable. Consensus for its own sake is meaningless. It has value only to the extent that it can foster safer terminal and tanker operations. The very foundations of capitalism put industry at odds with the interests of the people and communities who depend on the resources most at risk from that industry. To ignore or underestimate the inherent conflicts would be naive, foolhardy, and ultimately unproductive.

The lofty goals of OPA 90 are troublesome because they set up the citizen councils for failure by holding them to one unattainable goal, consensus; and a rather vague one, long-term partnership.

In summary, the expectations of OPA 90 were that RCAC would be a means of turning conflict into consensus, and of building trust and cooperation between citizens, industry, and government.

## Alyeska

Alyeska's expectations were more specific and in some areas, different. Clearly, public relations was a powerful incentive and for good reason, since that was in part how it was sold. Public relations tends to be a dirty word, but Alyeska's expectations of RCAC as a public relations asset should not detract from the integrity with which Jim Hermiller approached RCAC. He and others at Alyeska wanted to do the right thing. They sincerely wanted a way to involve citizens of the spill-impacted region. But in terms of RCAC improving Alyeska's image and its relations with the public, that must be a big disappointment. Instead of a public relations boost, I think it's safe to say that RCAC has been a source of headaches for Alyeska.

There are important areas in which RCAC has met expectations. It is an effective forum for addressing citizens' concerns. RCAC does provide Alyeska with constructive advice and recommendations and inform the public about Alyeska's capabilities in environmental protection and oil spill prevention and response.

But it's fairly clear to me that other expectations have not been met. Alyeska expected fewer conflicts with citizens, not more. Alyeska expected RCAC to elicit input from citizens in the communities, as well as from council members and committee volunteers. We've found that difficult under our current structure. Perhaps most important to Alyeska, they expected RCAC to be a mechanism for resolving differences in a non-adversarial, nonconfrontational environment. In practice, that has been the exception.

## Public

Public expectations are more difficult to pin down. To the extent that the public is aware of RCAC, I think they expect us to help prevent oil spills and to generally pay attention in ways that no one was doing before the *Exxon Valdez*.

A vocal segment of the public believes RCAC is a watchdog. They see RCAC's main function as keeping industry in line. This group accuses us of being a lapdog instead of a watchdog if we aren't sufficiently adversarial.

My personal opinion is that RCAC must and can reconcile its obligation to the public with the need to be effective in its relationship with industry. Our best chances for influencing industry lie in persuasion, not bashing. If we insist on waging wars in the media before we give them even a chance to address our concerns, the whole experiment will eventually fail.

## Advice

Based on our experiences, I offer the following advice to would-be citizens groups:

- Define clearly and succinctly how you intend to relate to industry and citizens. The more clearly you define these relationships from the start, the easier it will be to keep focused on your mission and cope rationally with the inevitable criticisms.
- Keep your board small; a large board almost inevitably makes it harder to achieve a quorum and conduct business.
- Be prepared for criticism from all sides and don't let pressure from different quarters budge you from your mission. Being a citizens group shouldn't mean you jump every time one of your citizens demands it. The organization must represent and reflect citizens as a whole, or it won't last. Once you begin serving only the desires of select individuals or particular interest groups, you no longer serve all your constituents.
- An organization that relies heavily on volunteers must do some extra planning, because a significant volunteer work force carries different challenges. In the first few years, we've been spoiled by some extraordinary volunteers on the board and committees—people who were committed, knowledgeable, and able to devote hundreds of hours to RCAC work. But passions cool over time and people burn out. Any organization that leans heavily on volunteers must be sufficiently flexible to accommodate turnover and the ebb and flow of a volunteer work force. In our efforts to be volunteer-driven, we have probably put too many demands on volunteers. We need to be clear in our expectations, but fair and realistic in our demands on them.
- Clearly articulate and communicate each individual's obligations and responsibility to the group. Highly motivated people who are passionately concerned about the issues have at times gone off on their own, forgetting that as participants in RCAC, they are obligated to work within the group's processes and to comply with its policies. Just as RCAC is responsible to all of its 18 member organizations, all the people associated with RCAC have obligations and responsibilities to the group as a whole.

## Conclusion

The Prince William Sound RCAC has tallied up some impressive successes and accomplishments in these first four years. Citizens have a voice in decisions that affect their communities and their lives. Citizen participation is yielding improvements in terminal operations and oil transportation. Of the substantive work that lies ahead for the RCAC, the most critical and difficult by far is to find a mutually satisfying relationship with Alyeska.

Given commitment and good faith efforts on all sides, no problem is insurmountable. Challenges notwithstanding, citizen advisory councils are a grand idea. The closer we can move to widespread recognition of the value of and need for citizen involvement, the better off we'll all be. The rewards are deceptively simple: safer transportation of oil.



## **Oversight of the Marine Industry in Western Alaska**

**Capt. Max Miller and Lt. Dave Haynes**

*U.S. Coast Guard, Marine Safety Office  
510 L Street #100, Anchorage, AK 99501*

The *Exxon Valdez* oil spill greatly influenced the federal and state governments and public to ensure greater prevention and response capabilities of the marine and oil industries. The Oil Pollution Act of 1990 (OPA 90), passed by Congress on 4 August 1990 and signed into law by the President on 18 August 1990, has provided for increasing public and government oversight of the industry.

In Western Alaska, the oil and marine industry has made great improvements in its ability to respond to oil spills. Significant improvement is continuing. A greater emphasis is being placed on prevention to integrate with the present emphasis of response. Many issues came out of OPA 90, such as drug and alcohol testing requirements, development of Regional Citizens Advisory Councils (RCAC), and the National Preparedness Response Exercise Program (NPREP). Although there were many other developments and requirements mandated by OPA 90, these programs represent additional areas of oversight by the Coast Guard.

### **Drug and Alcohol Testing of Mariners**

On November 21, 1988, the Coast Guard issued regulations on the implementation of a program for chemical, drug, and alcohol testing of commercial vessel personnel. Although these regulations were in place before the *Exxon Valdez* oil spill, the need for broader application and enforcement of these regulations was realized. Since then, regulatory modifications have been added to the 1988 rules to encompass most of the maritime industry. Now the tests apply to personnel on any U.S. vessel greater than 200 gross tons or any U.S. vessel less than 200 gross tons which requires a Coast Guard licensed operator. The burden is upon the marine employer to ensure such a program is in place and that its applicable employees comply. The burden on the Coast Guard is to ensure the industry does its job. In addition to all other measures, effective 1 January

1994, employers must submit a yearly report on their drug and alcohol test program. The report must contain the number of employees, number of tests performed, number of negative and positive tests, number of applicants denied employment, number of employees with past positive drug tests returning to duty, and number of employees refusing to test. In addition, OPA 90 specifically states that a Merchant Mariner Document (MMD) cannot be issued to an individual if the individual does not allow the Coast Guard access to the information in the National Driver Register. The Coast Guard can also review the criminal record of that individual prior to issuing a document or license.

As before, whenever a serious marine accident occurs, the marine employer is required to ensure that those persons directly involved are tested for drugs and alcohol. The Coast Guard may also require a drug test of any persons involved in a serious marine accident.

### **Regional Citizens Advisory Councils (RCAC)**

Section 5002 of OPA 90 established the Oil Terminal and Oil Tanker Environmental Oversight and Monitoring Act. This part of OPA 90 was established because of the appearance of complacency on the part of industry and government, and provides for a process that fosters a long-term partnership of industry, government, and local communities overseeing compliance with environmental concerns.

One method of developing this additional level of oversight, the development of citizens' councils, is referred to as the prescriptive option. In this case, OPA 90 sets the requirements dealing with matters such as council membership and responsibilities, the maximum level of funding to be provided by industry, and the interaction of federal agencies with the councils. A second method, referred to as the alternative voluntary option, allows these councils to form, but not in specific compliance with OPA 90. This option allows that the councils have a funding contract with the oil and tanker interests in the region and that the Coast Guard has certified that the alternative voluntary council fosters the goals and purpose of the act and broadly represents the interests of the communities near the oil terminals. As a result, Alaska has two councils formed under this alternative voluntary option.

It's taken these five years since the *Exxon Valdez* oil spill for each of the RCACs to develop into the organizations we see today. According to an August 1993 GAO report, the early development stages were rocky, even to the point of dissolution. Both RCACs appear to be in sound condition and are making significant progress in their mandated area of responsibility. Cook Inlet RCAC's 1993 annual report states that 1992 was their year to grow and learn, and 1993 was their year of action.



The councils' open meeting forum provides an excellent place for the exchange of ideas among the local communities, industry, and the federal and state governments for preventing future oil spills into the Alaskan environment.

### **National Preparedness Response Exercise Program**

OPA 90 requires an extensive spill response exercise commitment from the industry. Drill requirements include qualified individual notification drills, on board emergency procedures drills, spill management team tabletop drills, equipment deployment drills, and announced drills. In order to coordinate the onerous drill requirements, the involved federal regulatory agencies pioneered to eliminate duplication of exercises otherwise required by each regulatory agency. By participating in NPREP, vessels and facilities will accredit themselves, and as such will essentially comply with all drill mandates of OPA 90. It allows for contingency plan holders of vessels and facilities regulated by the EPA, Coast Guard, MMS, or RSPA, and identifies who must conduct drills under existing regulation to receive concurrent drill credits.

NPREP went into effect October 1, 1993. The first official drill year is January to December 1994. Every three years all components of an entire response plan must be exercised. (See Appendix A for the exercise program summary.)

### **Prevention is the Key**

In the wake of the *Exxon Valdez* oil spill, most can agree that it's by far more cost effective for both government and nongovernment entities to prevent spills than it is to respond to them. Since the enactment of OPA 90, the liability for oil spills has increased significantly as has the penalty for accidental or intentional discharge of oil or oily substances. As such, the prevention of oil spills from vessels or facilities becomes more critical than ever.

The National Contingency Plan (NCP) (40 CFR Part 300) disposes the federal government's general oil spill response pattern. When proper notification of an oil spill has been made, the Coast Guard conducts an initial assessment to determine the response required and issues a Notice of Federal Interest (NOFI) to the "responsible party." When more than one source is suspected, multiple notices will be issued. The notice tells the responsible party that the federal government (Coast Guard) has an interest in the spill, and if the responsible party fails to take the proper cleanup action, the Coast Guard will arrange for spill cleanup. The responsible party may then be liable for all costs associated with the

cleanup, including the cost of deploying Coast Guard assets. Whenever the responsible party fails to take the proper cleanup and removal actions, the Coast Guard can assume complete control of the spill and immediately contract an oil spill response organization (OSRO) to conduct the cleanup.

When a spill is federalized, the Coast Guard requests Oil Spill Liability Trust Fund (OSLTF) money, at which time a federal project number (FPN) is issued to track all expenditures. A project cost ceiling is estimated and a OSRO is hired to conduct the response and cleanup. The responsible party is immediately issued a Notice of Federal Assumption (NOFA), which informs the responsible party that the federal government has assumed the response and will conduct the response in accordance with the NCP. At all times, the OSRO is under the direction of the pre-designated federal on-scene coordinator (FOSC).

If the responsible party properly conducts the cleanup, then the Coast Guard is directed to advise and consult. If the Coast Guard determines that the responsible party is not sufficiently or properly conducting, or they are not capable of conducting, the cleanup, then the Coast Guard will federalize the spill and assume all cleanup efforts. Again, the responsible party will be liable for all Coast Guard costs associated with the cleanup.

At any time during a spill response, and when the spill has been federalized, the responsible party may assume the response effort and undertake the cleanup contract. Accordingly, the responsible party has three options: to conduct the response themselves, to hire a different OSRO, or to renegotiate the contract under which the Coast Guard's OSRO is operating and assume the cleanup in its entirety. However, the spill will remain federalized, and the Coast Guard will continue to use its OSRO until the responsible party can fully assume and properly maintain the response effort.

Upon completion, and when no further associated cleanup, equipment cleaning, or replacement costs are incurred, the Coast Guard completes all cost documentation and submits the report to the National Pollution Funds Center (NPFC) in Arlington, Virginia. The NPFC will then attempt to collect all government and third party claims from the responsible party. When all reports are completed, the case is closed.

It's clearly much easier, and by far more cost effective, to prevent oil spills than it is to respond to them.

## Appendix A

### Summary for National Preparedness Response Exercise Program

#### *Qualified Individual Notification Drills*

- |                    |           |
|--------------------|-----------|
| 1) Facilities      | Quarterly |
| 2) Manned Vessels  | Quarterly |
| 3) Unmanned Barges | Quarterly |

#### *Notification Drills*

- |                        |           |
|------------------------|-----------|
| 1) Area                | Quarterly |
| 2) Offshore Facilities | Annually  |

#### *Onboard Emergency Procedures Drill*

- |                   |           |
|-------------------|-----------|
| 1) Manned Vessels | Quarterly |
|-------------------|-----------|

#### *Emergency Procedures Drill*

- |                    |           |
|--------------------|-----------|
| 1) Unmanned Barges | Quarterly |
|--------------------|-----------|

#### *Spill Management Team Tabletop Exercise*

- |                                   |          |
|-----------------------------------|----------|
| 1) Facility Spill Management Team | Annually |
| 2) Vessel Spill Management Team   | Annually |
| 3) Area (Federal Government) Team | Annually |
| 4) Spill Management Team          | Annually |

#### *Equipment Deployment Drills*

- |  |              |
|--|--------------|
| 1) Facilities w/Facility Owned Response Equip.   | Semiannually |
| 2) Facilities w/o Facility Owned Response Equip. | Annually     |
| 3) Vessels                                       | Annually     |
| 4) Area (Federal Government)                     | Annually     |
| 5) Owner/Operator                                | Semiannually |

#### *Unannounced Drills*

- |  |                        |
|--|------------------------|
| 1) Response Plan Holders w/in Area                 | Annually               |
| 2) Pipeline Owner/Operator Max. Twenty (20) Drills | Annually               |
| 3) Offshore Facilities.                            | Determined by Regional |

#### **Supervisor**

#### *Owner/Operator Internal Notification Drills*

- |                             |                              |
|-----------------------------|------------------------------|
| 1) Pipeline Owner/Operator. | As Indicated by O/O Response |
|-----------------------------|------------------------------|

#### **Plan**

#### *Internal Tabletop Exercise*

- |                             |                              |
|-----------------------------|------------------------------|
| 1) Pipeline Owner/Operator. | As Indicated by O/O Response |
|-----------------------------|------------------------------|

#### **Plan**

#### *Owner/Operator Deployment Drills*

- |                             |                              |
|-----------------------------|------------------------------|
| 1) Pipeline Owner/Operator. | As Indicated by O/O Response |
|-----------------------------|------------------------------|

#### **Plan**

#### *Area Exercises*

- |                            |                           |
|----------------------------|---------------------------|
| 1) Area Response Community | Triennially for Each Area |
|----------------------------|---------------------------|



## **Development of a Unified Federal/State, Coastal/Inland Oil and Hazardous Substance Contingency Plan for the State of Alaska**

**Carl Lautenberger**

*U.S. Environmental Protection Agency, Joint Pipeline Office  
411 W. 4th Avenue #2-C, Anchorage, AK 99501*

**Leslie A. Pearson**

*Alaska Department of Environmental Conservation  
3601 C Street #1334, Anchorage, AK 99503*

### **Abstract**

The passage of the Oil Pollution Act of 1990 (OPA 90) expanded the existing federal planning and response framework in several ways. OPA 90 created a new requirement for facility and tank vessel response plans and an "area-level" planning and coordination structure to help supplement federal, regional, and local planning efforts. OPA 90 amended the existing Clean Water Act (CWA), section 311(j)(4) which establishes area committees and area contingency plans (ACPs), as primary components of this structure.

In 1980, the Alaska State Legislature enacted legislation which defines the state's policies regarding oil spills. Following the T/V *Exxon Valdez* oil spill, in 1989 and 1990 the legislature passed further legislation to expand and strengthen the state's oil spill program. Specifically in 1989, Senate Bill 261 required the Alaska Department of Environmental Conservation (ADEC) to develop, annually review, and revise the State Oil and Hazardous Substance Contingency Plans, (State Master & Regional Plans). State regional plans serve as annexes to the State Master Plan.

This paper presents the coordinated and cooperative efforts by government agencies and local entities toward creating a "unified" Federal/State, Coastal/Inland Oil and Hazardous Substance Preparedness and Response Plan and the development and progress of "unified" Sub-Area/Regional Contingency Plans for the State of Alaska.

## Existing Planning Preparedness Efforts

### Federal

As established by OPA 90 and the Clean Water Act (CWA), area/regional committees have three primary responsibilities:

1. The preparation of an area contingency plan (ACP).
2. Working with state and local officials to enhance contingency planning and assure pre-planning of joint response efforts including appropriate procedures for mechanical recovery; dispersal; shoreline cleanup; protection of sensitive environmental areas; and protection, rescue, and rehabilitation of fisheries/wildlife.
3. Working with state and local officials to expedite decisions for the use of dispersants and other mitigating substances and devices.

The final planning function does not supersede the federal on-scene coordinator (FOOSC) and Alaska Regional Response Team (ARRT) "authorization for use" and preplanning provisions contained in the National Contingency Plan (NCP).

The statute requires that each area plan when implemented in conjunction with the NCP be adequate to remove the worst case discharge and to mitigate a substantial threat of discharge. The plan includes a description of the geographic area, presence, and proximity of natural resources, environmentally sensitive areas, population concentrations, location of drainage/geologic-topographic features, location of water supplies, beaches, ports, recreational areas, zones of seasonal significance, and migratory bird flyways. The area plan will also describe in detail responsibilities of owner/operators, federal, state, and local agencies potentially involved toward removing a discharge. An equipment list within the plan shall include firefighting, dispersant, in situ burning, chemicals, available personnel, and other mitigating substances plus procedures to be followed for obtaining an expedient decision regarding their use. Most important of all, the plan will describe its relationship with the other ACPs and vessel/facility contingency plans.

To implement these statutory requirements, a risk assessment is necessary to identify the geographical area's facilities, petroleum vessel transportation, environmental characteristics, and public health and welfare concerns. ACPs may be used to satisfy the need for an on-scene coordinator (OSC) contingency plan under the NCP, 40 CFR 300.210(d).

## State

In 1989, Senate Bill (SB) 261 required DEC to develop, annually review, and revise the State Oil and Hazardous Substance Contingency Plans (State Master & Regional Plans). Alaska State legislation requires the state's Master & Regional Contingency Plans to clarify and specify the respective responsibilities of federal agencies, agencies of the state, municipalities, facility operators, and private parties whose land or property may be affected by a discharge. Responsibilities include assessment, containment, and cleanup of a catastrophic oil discharge or a significant release of a hazardous substance into the environment.

In 1990 the law was revised again with the passage of House Bill (HB) 566 which requires the State Master Plan to consider the elements of a vessel or facility oil discharge contingency plan approved or submitted for approval as per state statute. The plan is required to include an incident command system (ICS) that clarifies and specifies the responsibilities of federal, state, and local agencies, facility operators, and private parties for emergency response, assessment, containment, and cleanup of oil and hazardous substance discharges. The State Master Plan also identifies actions necessary to reduce the likelihood of catastrophic oil and hazardous substance discharges.

Alaska Statute 46.04.210 requires the development of state regional plans which serve as annexes to the State Master Plan. The regional plans are not stand-alone documents but fall under the umbrella of the State Master Plan. Regional plans contain detailed, localized information regarding facility location, assessment of hazards posed by facilities, transportation corridors, environmentally sensitive areas, emergency spill response equipment and personnel, and information regarding local emergency response capabilities including the Local Emergency Planning Committee (LEPC) status.

## Local

The Superfund Amendment and Reauthorization Act of 1986, Title III (SARA Title III) and Alaska Statute 46.13.090 requires the LEPCs established in Local Emergency Planning Districts (LEPDs) to develop local emergency plans. Local emergency plans shall: include identification of facilities and transportation routes; establish emergency response procedures for public notification, protection, and evacuation; establish notification procedures for responders; develop methods for determining the occurrence and severity of a release; identify emergency response equipment; develop a training program and schedule for local emergency responders; establish methods and schedules for plan exercises; designate

a community coordinator and facility coordinators to implement the plan; and include an ICS. The local emergency plans shall consider elements of a state-required and approved oil discharge plan and have the capability of being integrated with existing plans.

Although the original federal requirements focused LEPC planning and preparedness efforts on extremely hazardous substances, on September 25, 1990 the Alaska Legislature and State Emergency Response Commission (SERC) broadened that focus to include oil and petroleum products.

Figure 1 illustrates the interrelationship and proposed integration of local, state, and federal planning efforts. Although OPA area plan and state regional plan requirements do not mirror each other they are essentially identical in intent.

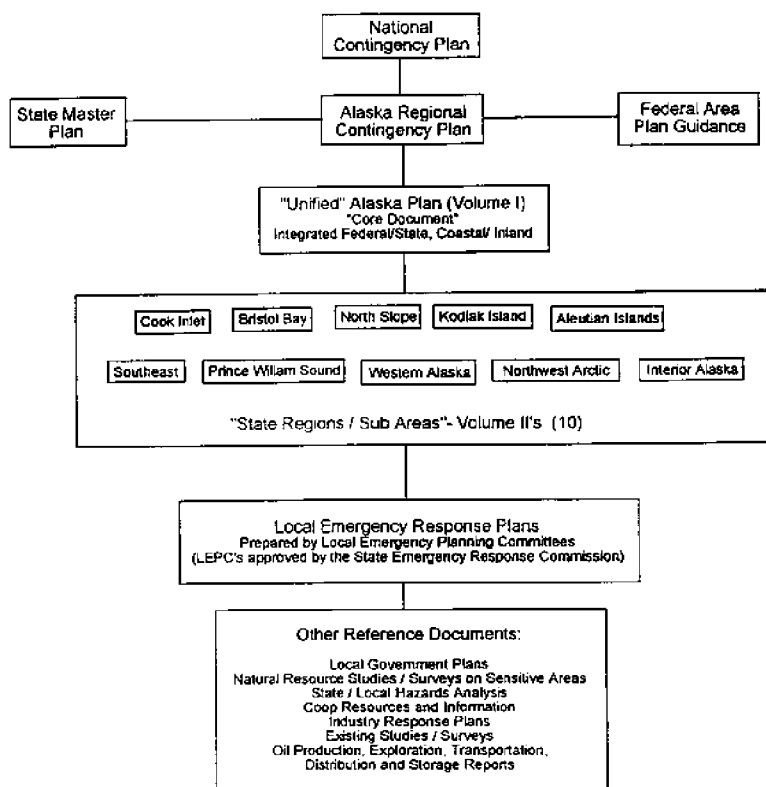


Figure 1. Integrated federal/state/local coastal/inland oil and hazardous substance contingency planning.



## **Geographic Planning Boundaries**

### **Federal**

OPA section 4202(b) requires the President to designate areas for which area committees are established. Through Executive Order 12580 as amended by Executive Order 12777, the President delegated to the Administrator of the Environmental Protection Agency (EPA) responsibility for designating areas and appointing the committees for the "inland" zone. The United States Coast Guard (USCG) was given the responsibility for designating areas and appointing area committees for the "coastal" zone.

The inland and coastal zones are geographical areas additionally modified by certain "incident-specific" circumstances that delineate which federal agency provides the lead role with a pre-designated FOSC for response to an oil or hazardous substance discharge. In general, the inland and coastal zones are delineated by a boundary line in Alaska that is located 914 meters inland from the mean high tide line. Any area seaward of that line is considered as coastal zone and areas inland of that line are designated as inland zone. These initial designations are further modified or defined by incident-specific conditions including the source of the discharge/release, the nature of the product, and the area impacted by the spill. For further detail refer to the memorandum of understanding (MOU) between the EPA and USCG regarding designation of the inland and coastal zones in Alaska for response purposes.

In a Federal Register Notice published on April 24, 1992, the EPA and USCG jointly announced the designation of areas and area committees under OPA 90 for inland and coastal zones. Due to the split of jurisdiction and responsibilities between EPA and the USCG as previously discussed, and inherent differences in organizational structure of the two agencies, each agency took separate but compatible approaches in establishing initial designations. Nationwide, the EPA designated the existing 13 RRT areas as the initial areas for which ACPs must be prepared in the inland zone. The USCG designated the coastal portions of the existing 49 Captain of the Port (COTP) zones as the initial areas for which ACPs must be prepared in the coastal zone. In Alaska this has the effect of initially establishing one statewide inland area by EPA and three USCG coastal areas which correspond to the boundaries of the Alaska USCG COTP zones.

Both the EPA and USCG have the authority and intent, if appropriate, to further subdivide initial areas, both coastal and inland, into smaller, more localized areas for which ACPs will be developed.

## State

In 1991, 18 AAC 75.495 established within the State of Alaska ten regions for the purpose of preparing regional oil and hazardous substance contingency plans as required by AS 46.04.210. The ten regions are, Southeast Alaska, Prince William Sound, Cook Inlet, Kodiak Island, Aleutian, Bristol Bay, Western Alaska, Northwest Arctic, North Slope, and Interior Alaska (see Figure 2).

## Local

Within the state's ten regional boundaries are LEPDs. Presently, 26 LEPDs exist within the state. LEPDs have been established using borough boundaries and regional educational attendance areas. Within the LEPDs, 11 LEPCs have been approved by the State Emergency Response Commission (SERC) (see Figure 3). The state has made an effort to use pre-existing boundaries for planning purposes.

To facilitate the coordination and development of sub-area/regional plans, the federal agencies have agreed to utilize the existing ten regional planning boundaries within the state.

### **Strategy for Developing Area/Regional Plans Integrated with Existing Federal, State, and Local Plans and Planning Efforts**

In view of the existing planning requirements, efforts, and products present at private, local, state, and federal government levels, the following course of action has been taken to develop OPA 90 and state mandated Area/Regional, Coastal/Inland Contingency Plans. The USCG, EPA, and DEC have prepared joint plans to cover all of Alaska. The "unified" Alaska Plan (Volume I) incorporates key provisions of the existing Alaska Regional Response Team's Regional Contingency Plan for Alaska and the state's Master Plan. Volume I isn't a reproduction of the existing plans mentioned but has incorporated appropriate sections from both plans plus added internal EPA, USCG, and DEC information regarding resources, personnel, and organizational structure. Volume I has also incorporated key provisions of local government response plans developed by LEPCs and applicable information from industry response plans developed in accordance with state and federal planning requirements. The "unified" plan (Volume I) was granted approval by the SERC on February 17, 1994. The plan presently awaits approval by the ARRT.

Alaska has been subdivided into smaller areas for detailed sub-area/regional planning. The sub-areas are based on the existing state regional

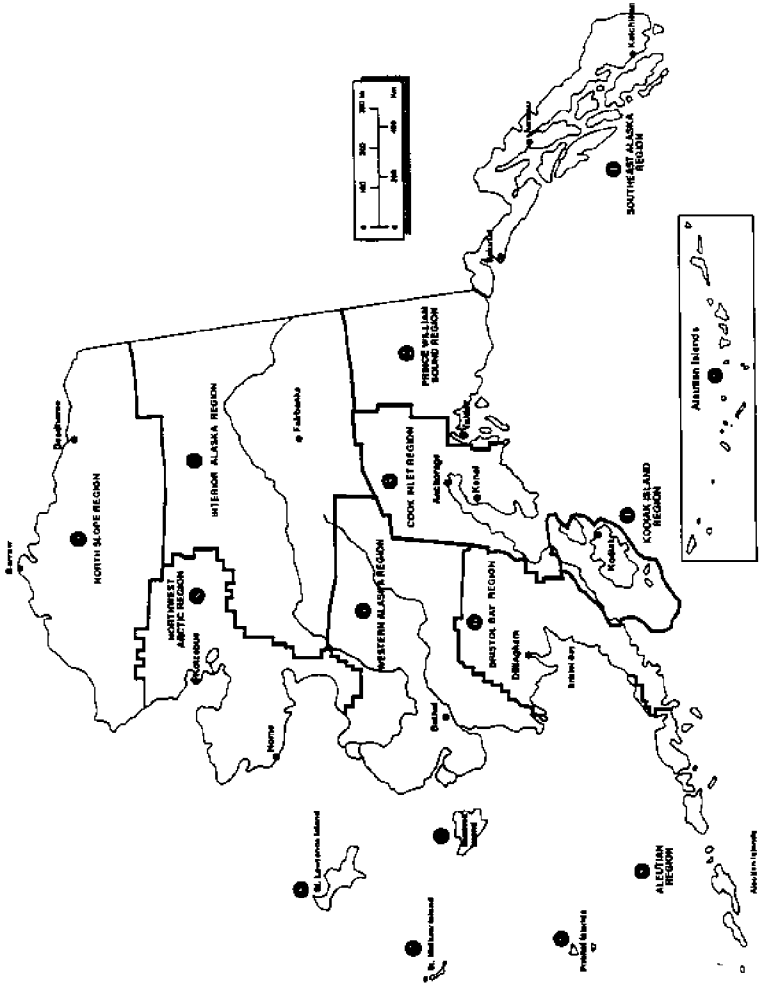


Figure 2. Regional master discharge prevention and contingency plan boundaries (18 AAC 75.495).

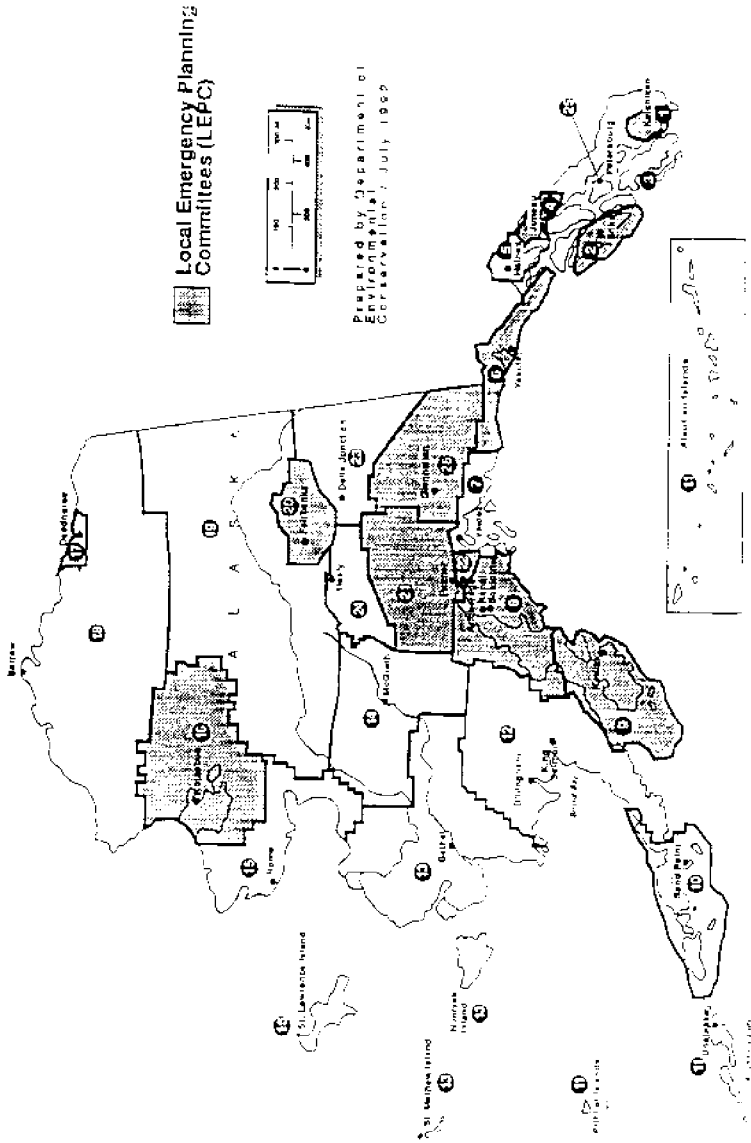


Figure 3. Local emergency planning districts and approved local emergency planning committees.

planning boundaries designed for oil and hazardous substance planning. The sub-area/regional plans are being developed on a priority schedule based on potential threats for worse case discharges. Ten sub-area/regional supplements (Volume II) will be developed by the area committees. When possible, coastal zone area committees will be co-chaired by a USCG OSC and a DEC regional planner. The inland area committees will be co-chaired by an EPA OSC and a DEC regional planner. If an area such as the North Slope or Cook Inlet is co-terminus with a high priority coastal area, efforts will be made to coordinate EPA/state planning with USCG lead through a combined committee. Joint planning efforts will result in the production of common plans that could satisfy both state and federal requirements.

LEPCs and industry representatives will be encouraged to participate with the federal/state planning efforts. Many LEPCs are currently conducting hazards analysis for their planning districts. Such information will be extremely beneficial to the sub-area/regional planning efforts in developing a risk assessment of the area. Including these people on the committee will ensure realistic information regarding local conditions and lead to compatible private, local government, state government, and federal plans.



## The States/British Columbia Oil Spill Task Force: Going Beyond Response

Jean R. Cameron

*States/British Columbia Oil Spill Task Force*  
811 SW Sixth Avenue, Portland, OR 97204-1390

### Abstract

The States/British Columbia Oil Spill Task Force was a reaction to two major West Coast oil spills, the *Nestucca* and the *Exxon Valdez*. It has gone beyond reaction, however, to become a proactive force for development and implementation of prevention, preparedness, and response policies and programs by the four U.S. states and one Canadian province which together cover the west coast of North America from Mexico to the Arctic.

Working together over the last five years, the oil spill task force developed and has been implementing more than 90 recommendations to prevent oil spills and improve response. Members have continued to coordinate on various initiatives, the most recent of which is a new Five Year Strategic Plan focusing on development of a prevention program package, more consistent and effective response policies, improved communications among member agencies, and greater public involvement in our efforts.

### Introduction

As evidenced by this conference, our collective response to the *Exxon Valdez* oil spill continues to this day. The States/British Columbia Oil Spill Task Force was also a response to that spill, in part, yet the task force has evolved into a mechanism which goes beyond response—or reaction, if you will—to become a forum for proaction; for proactive development of prevention and preparedness programs; for proactive sharing of data, ideas, and experiences which thereby gives greater leverage to individual jurisdictional efforts; and for a proactive stance on provincial and states' rights to regulate and respond on behalf of their unique environmental resources. We accomplish all this with a commitment to consensus which is enhanced rather than restricted by our international nature and the diversity of interests among our members and their constituencies.

In explaining how the task force goes beyond response, this paper describes our accomplishments over the last five years and our vision for the next five years as set out in our newly adopted strategic plan.

### The First Five Years

The States/British Columbia Oil Spill Task Force actually originated in response to another major spill on the West Coast, one which occurred three days before Christmas 1988, when the tank barge *Nestucca* broke its towline off the coast of Washington and was subsequently rammed by its tug as it attempted to recapture the barge. Approximately 231,000 gallons of fuel oil were spilled in Washington's coastal waters, eventually contaminating more than 110 miles of Washington and British Columbia coastline, including pristine shores of the Olympic National Park.

That incident prompted Washington Governor Booth Gardner and British Columbia Premier William Van der Zalm to sign a Memorandum of Cooperation creating the States/British Columbia Oil Spill Task Force to coordinate spill prevention and response between those two jurisdictions. Ironically, the day after the first meeting of the new task force three months later was the day that the *Exxon Valdez* grounded on Bligh Reef, spilling oil that would affect more than 1000 miles of Alaska's coastline. That incident not only prompted Washington and British Columbia to invite Alaska to join the task force, but Oregon and California were drawn in as well as they dealt with issues related to moving the stricken vessel down the Pacific coast for repairs.

The oil spill task force was subsequently formalized in its present form by a Memorandum of Agreement signed by the governors and premier in 1989, who have designated their lead state spill prevention and response agencies to represent them to the task force. Currently, these task force member agencies are:

British Columbia Ministry of Environment, Lands, and Parks  
Alaska Department of Environmental Conservation  
California Department of Fish and Game, Office of Spill  
Prevention and Response  
Oregon Department of Environmental Quality  
Washington Department of Ecology  
Washington Office of Marine Safety

From the beginning, task force representatives shared a sense of common purpose focused on proactive development of prevention and response policies and programs. Its mandate was to investigate ways to prevent oil spills, review response procedures, assess means for handling



compensation claims, and develop coordinated contingency planning requirements.

Based on the work of four committees (Prevention Alternatives, Emergency Response, Financial Recovery, and Technology Sharing), as well as extensive public input, the task force published a major report the next year which included 46 joint policy and program recommendations aimed at federal or state/provincial agencies and the oil transportation industry. The report also contained a number of recommendations specific to each member's jurisdiction, which members had committed to implement within their jurisdictions.

These recommendations covered:

- Vessel traffic reduction, through petroleum conservation, with alternative routes and modes to protect sensitive areas.
- Vessel traffic management, using tug escorts, Vessel Traffic Service (VTS) systems, near miss reporting systems, vessel safety measures, and improved tow cables and towing systems.
- Vessel design standards, including double hulls, and improvements in onboard navigation systems.
- Personnel standards, such as spill prevention and response training requirements for vessel and tug crews, and for petroleum facility workers; mariner qualifications; and assignment of dedicated crews to tugs and tank barges.
- Enforcement, penalties, and liability programs, such as strong sanctions, proof of financial responsibility, natural resource valuation, cost recovery, states' rights to exercise liability standards, increased Coast Guard enforcement, and adequate enforcement staff for states/province.
- Regulatory oversight, focusing on requiring spill response and prevention contingency plans, establishing minimum planning standards and cleanup requirements, encouraging local participation, and requiring periodic inspections.
- Spill response standards, such as standards for response equipment and personnel, response training, response drill requirements, transfer operation program reviews and spill containment requirements, contingency planning, mutual aid arrangements, and use of incident command systems (ICS) during response.

- Research coordination was also recommended, plus development of a spill prevention education strategy for industry and the public.

Since publication of the report, most of these recommendations have been incorporated into state and provincial programs. They are also reflected in the Oil Pollution Act of 1990 and subsequent U.S. federal rulemaking. Also pursuant to a recommendation in the report, member agencies have continued to coordinate on a number of levels.

We have coordinated our response to regulatory initiatives at the federal and international levels. For example, the task force has submitted consensus comments on a number of federal initiatives ranging from safety measures for single hull vessels to onboard response equipment requirements, drill and exercise programs, escort vessel requirements, and the U.S. National Contingency Plan.

The task force and its member jurisdictions have coordinated with the Pacific States Marine Fisheries Commission to develop an educational program targeted at private and commercial fishermen. The program aims at reducing small oil spills which result from overfilling fuel tanks or dumping oily bilge waters. It has also produced a single, easy to remember, coast-wide oil spill reporting number (1-800-OILS-911) which automatically routes the call to the emergency service of the state or province from which the call originates.

Task force members signed agreements at their last annual meeting (July 1993) which committed them to common use of this number and the related educational program, and to use of the unified command structure of the incident command system; to mutual assistance procedures in the event of a spill event which exceeds a member's response capacity or is likely to cross jurisdictional borders; and to a procedure for sharing the multimedia spill tracking GIS system developed by BC Environment.

In addition, the task force has continued to work on consistent policy development through annual updates of rule comparisons, by circulating drafts of regulatory proposals, and by sharing information through quarterly meetings and a monthly information exchange, as well as through ongoing informal contacts.

And in the most concentrated effort at proactive coordination since the development of the 1990 report, the oil spill task force has just completed a strategic planning process which began with our 1993 annual meeting and planning retreat, has included a stakeholder survey and public comment on the draft plan, and is involving a wide range of interests in its implementation.

## The Next Five Years

While program development has followed roughly the same track in each jurisdiction as a result of the 1990 effort, differences exist either as a result of varied experience or the unique nature of one jurisdiction or another. We have decided that it is time to take stock of those differences, and so have begun what we are calling a "program consistency review" to compare major elements of our programs.

This review will examine prevention and contingency planning requirements, prevention program elements, wildlife rehabilitation and volunteer training programs, public education programs, resource damage assessment programs, financial responsibility requirements, responder immunity, response organization standards, inspection programs, ICS policies, penalties, and incentive programs.

This review will provide a basis for recommendations to member jurisdictions regarding program conflicts, gaps, and steps to improve consistency. We strive for greater consistency not just because the regulated community seeks it, but because we acknowledge that consistency can enhance the effectiveness of all our efforts, both for prevention and response.

Our 1994-1999 Strategic Plan acknowledges that many elements of our preparedness and response programs need "fine-tuning." Initially we are focusing on drills and exercises, on our regulations governing cascading of private equipment, and on our regulations governing the use of in-situ burning and dispersants. Other priorities over the next five years will include unified command training, sensitive area protection strategies, salvage, decanting, and natural resource damage assessment policies, volunteer programs, incident investigations, and spill volume determination methodologies.

Yet our strategic plan echoes the 1990 report in acknowledging that no matter how effective our preparedness programs or how efficient our responses, the most effective program is a good prevention program. Based on an evaluation of spill causes and a comparison of existing prevention programs, we will move on to develop a "prevention program package" that can be adapted by each member jurisdiction. That package will address such elements as:

- Training and standards intended to minimize human errors.
- Design and operation standards for vessels, facilities, and pipelines.

- Criteria for vessel traffic routes and monitoring, exclusion zones, sanctuaries, navigation standards, and piloting.
- Coordinated vessel inspection and screening based on a compatible West Coast database and compatible risk assessment criteria.
- Identification of resources to assist vessels at risk.
- Incident investigation and evaluation for purposes of updating our understanding of the causes of spills.
- Public education programs which involve concerned citizens in reducing small chronic spills.
- A spill prevention awards program.

Our efforts to prevent oil spills from vessels will be greatly assisted by the fact that one of our members, the Washington Office of Marine Safety, is dedicated solely to development and implementation of prevention programs focusing on vessels. They have already taken the lead in development of a vessel risk database, screening and inspection programs, and programs focusing on reducing human error.

And both our preparedness/response and prevention efforts will include analysis of issues of jurisdictional authority as well as coordination on research and development of new technologies, plus advocacy for research priorities with federal and private funders.

Who will make all this happen? According to our strategic plan, the public will play a major role. Workgroups are being created to implement these projects, and we currently have 27 volunteers from industry, environmental groups, and other state or federal agencies joining representatives from task force agencies to do the analysis and develop the recommendations to our members which are required in each instance. Projects will be taken on each year, as announced in each draft Annual Work Plan, which goes to our nationwide stakeholder mailing list for comment.

## Conclusion

What do we expect to accomplish by these efforts? We expect to:

- Prevent oil spills on the West Coast—both large spills that occur rarely but cause catastrophic impacts, and small spills that occur daily and have an equally devastating cumulative effect.

- Coordinate communication, policy development, response capabilities, prevention and preparedness initiatives, and education in order to maximize efficiency of effort; to learn from one another and share ideas and products.
- Clarify the roles and responsibilities of state and provincial agencies and federal agencies in order to reduce regulatory gaps, overlaps, and conflicts.
- Advocate in national and international arenas on selected issues of common concern, earning respect through credibility, clarity of purpose, and collaboration.
- Educate the public on the impacts of oil spills and issues relating to spill prevention, response, and remediation. Work cooperatively with federal agencies, vessel operators, the oil industry, response contractors, interest groups, and all concerned citizens to create opportunities for political and technological breakthroughs by serving as a catalyst for progressive change.
- Serve as a model of cooperation and coordination for the rest of North America.

Needless to say, this amount of effort and the controversial nature of some of these issues will test our commitment, both to the effort necessary and to our goal of consensus. Yet we believe that our individual efforts represent investments which guarantee payoffs in the form of more efficient state or provincial government programs leveraging greater protection for our varied and unique marine resources.



## **Development of Technology Protocols for Oil and Hazardous Substance Spill Response Appropriate for the State of Alaska**

**Leslie A. Pearson**

*Alaska Department of Environmental Conservation  
3601 C Street #1334, Anchorage, AK 99503*

### **Abstract**

On March 24, 1989, as the oil spread from the T/V *Exxon Valdez* throughout Prince William Sound, the floodgate swung open and entrepreneurs raced out to promote the use of their concepts, inventions, or products designed for spill response. Thousands of product packets were submitted to the U.S. Coast Guard, Environmental Protection Agency, Exxon, and the state. At that time, there were no standard tests and methodologies adopted by the federal and state government to review and screen the products.

In 1990, the Sixteenth Legislature reviewed issues related to response actions and planning involved in the release or threatened release of oil or a hazardous substance. One of the outcomes of that review was the establishment of Title 46, Chapter 13, which founded the Alaska State Emergency Response Commission (SERC) and the Hazardous Substance Spill Technology Review Council (HSSTRC). AS 46.13.100 indicates that the Legislature "(1) finds and declares that there exists a lack of scientific knowledge concerning the availability, properties, and effectiveness of various hazardous substance containment and cleanup technologies; and (2) concludes that it is in the best interest of the state and its citizens to establish a Hazardous Substance Spill Technology Review Council . . . to assist in the identification of containment and cleanup products and procedures for arctic and subarctic hazardous substance releases and make recommendations to the departments and agencies of the state regarding their use and deployment."

As a consequence of this conclusion, AS 46.13.120 mandates that the HSSTRC establish testing protocols to be used by the Department of Environmental Conservation (ADEC) to evaluate the effectiveness of oil and hazardous substance spill technologies for use in the state. Two protocols have been developed to date. The protocols for chemical product use and bioremediation product use are designed to be utilized by the vendor or manufacturers prior to, rather than during a spill event. The protocols are intended to expedite the

approval and potential use of a new product that has never been utilized on a spill in the State of Alaska.

## Introduction

The HSSTRC held their first meeting on March 20, 1991 and staff presented a draft protocol packet to the members. The HSSTRC reviewed the packet and recommended to staff the need to research the status of protocols and standards development on a national and international level. The staff's finding on testing protocols/standards development are:

- The American Society for Testing and Materials (ASTM) established the F-20 Committee on Hazardous Substances and Oil Spill Response. The scope of the committee is to formulate test methods, specification, classifications, standard practices, definitions, and other standards pertaining to performance, durability, strength of systems, and techniques used for the control of oil and hazardous substance spills.
- The Canadian General Standards Board (CGSB) established a sorbent subcommittee to develop a testing protocol and manage a qualification and certification list for sorbent materials. Environment Canada had taken the lead in organizing and coordinating the development of sorbent testing standards for oil and hazardous substance spill response. In cooperation with the USCG, Marine Spill Response Corporation (MSRC), and Environment Canada, a sorbent database has been developed to assist consumers with the selection of sorbents for industrial, freshwater, marine, and land application.
- The Department of Interior, Minerals Management Service (MMS), U.S. Environmental Protection Agency (EPA), USCG, U.S. Navy, and Environment Canada developed two protocols for testing containment booms and skimmers in a test basin environment with petroleum products.
- The National Environmental Technology Applications Corporation (NETAC) and the EPA Bioremediation Action Committee (BAC) prepared a draft Oil Spill Bioremediation Products Testing Protocol Methods Manual in 1992. The protocols are designed to standardize procedures for identifying the effectiveness and safety of different bioremediation products.



A conclusion from the research was that a gap exists for protocols/standards relating to the use of chemical and biological products for arctic and subarctic conditions. The NETAC bioremediation protocols indicate the use of seawater from the southeast portion of the United States which does not provide a realistic medium for Alaskan waters.

The Protocol for Chemical Product Use and Bioremediation Product Use on Spills in Alaskan Waters is designed as a literature review criteria for evaluating response technologies and also provides an initial series of testing procedures for spills in arctic/subarctic conditions.

### **Purpose**

The primary purpose of the development of protocols is to establish some order to the entropy that occurs during all spill events. The protocol package is designed: (1) to develop criteria to be used to evaluate chemical and bioremediation response technologies; (2) to provide direction to vendors, manufacturers, and proponents on approval procedures for product use on spills in Alaska; and (3) to provide an initial series of testing procedures for chemical and bioremediation products to be used in marine/freshwater, arctic/subarctic conditions.

### **Potential Criteria for Technology Evaluation**

In order to comprehensively evaluate various types of technology for dealing with spills, it is necessary to have a set of well defined criteria that may be used to balance performance and net environmental benefit. The types of criteria that should be considered include efficiency, risk analysis, and feasibility.

### **Efficiency**

Efficiency is defined as the ability of a method to meet established cleanup goals. Efficiency measures might include such factors as the percentage of spilled product recovered or neutralized, and such measures could vary greatly depending on the environmental setting. While inherently simple in concept, efficiency measures may be quite difficult to implement in the field. For example, oil recovered after a spill contains a certain amount of water that, if not accounted for, may give a positive bias to the amount of oil recovered. Also, the success of bioremediation techniques measured on the basis of respirometric measurement of oxygen consumption could be biased by other factors that affect oxygen consumption. Careful controls, proper selection of analytical procedures, and explicit quality assurance programs will be necessary to firmly and quantitatively establish the efficiency of any particular type of technology.

## Risk Analysis

The proponents of a product should be capable of showing how risk to aquatic life and resources is in fact reduced by their product and application. In determining risk factors involved in using a product, it is important to consider any potential human health impact due to toxic considerations. Additionally, it is important to consider the toxicity of a product and a product/spill material mixture to a suite of species from various taxa. Testing a suite of species will account for individual species tolerance to different classes of compounds. Toxicity must be examined as a function of area impacted, relative level of toxicity, and the duration of toxic conditions. Potential bioaccumulation concerns should be addressed, and toxic consequences should be thoroughly researched through literature review. It is important to have preliminary knowledge of both acutely toxic levels and chronic or sublethal toxic levels. There are environmental endpoints other than toxicity that should be targets of technology performance and safety. For example:

- eutrophication (from nutrients or other biostimulatory substances);
- bioaccumulation (trace elements in nutrient and bioremediation mixes, synthetic chemicals in chemical treatments, dispersants, sorbent material, etc.);
- biological communities' integrity and recovery (i.e., washing temperatures or pressure that strike a balance between shoreline ecosystem damage and oil removal);
- geomorphological integrity of shorelines (i.e., berm relocation, washing pressure or dispersants affecting grain size, porosity, and thus inhabitants such as clams).

## Feasibility and Logistical Analysis

The protocol process for spill technologies considers the relative feasibility of different products in relation to Alaska locales. The following are factors that should be considered for evaluating feasibility:

- availability in relation to Alaska locations;
- time required to execute the methodology;
- type of spill the technology is effective on at the surface, near surface, and subsurface;

- cost/efficiency comparison for the methodology and other potential techniques;
- logistic consideration necessary for implementation and demobilization of the methodology;
- setting restrictions for the methodology;
- environmental variables, concentration of materials and their potential influence on the efficiency of the methodology (e.g., temperature and other climatic factors; competitive uptake of nutrients by shore plants and algae); and,
- liquid and solid waste streams generated by the method, including analysis of stability, biodegradable characteristics, reusability, and disposal options.

Impacts such as trampling marshes to apply a product and the disturbance to wildlife reproduction from machinery are additional logistical considerations for testing a product.

A comprehensive protocol procedure must take into consideration all of the factors that play a role in determining the ultimate feasibility of a technology for the multitude of settings and environmental conditions found in the State of Alaska. It will not be enough for a product to be shown to be benign in a risk analysis and effective in one or possibly more field applications. To receive support from the federal on-scene coordinator (FOSC), state on-scene coordinator, and Alaska Regional Response Team, the technology must be shown to be effective under all of the settings and environmental conditions for which its use is proposed.

### **Protocol Overviews**

AS 46.13.120 mandates that the Hazardous Substance Spill Technology Review Council establish testing protocols to be used by the ADEC to evaluate the effectiveness of spill technologies for use in the state. The purpose of this section is to:

- provide protocol overviews for the two categories of technology, chemical and biological, and,
- provide guidance for testing sorbent and mechanical products to manufacturers and vendors.

The overview for each category is procedural outlines which provide a framework for the development of a detailed and definitive review structure. The Protocol for Chemical Product Use on Spills in Alaskan Waters is patterned after the State of Alaska Protocol (Viteri and Clark 1990). The Protocol for Bioremediation Product Use on Spills in Alaskan Waters is patterned after the combined NETAC/ADEC protocol for bioremediation (NETAC 1992).

Although approximately 30% of the product testing inquiries come from sorbent manufacturers and vendors, staff recommended the HSSTRC not develop a protocol for sorbent use in Alaska. Instead, the HSSTRC was encourage to adopt the protocol developed by the CGSB and utilized by Environment Canada. Environment Canada has taken the lead in developing and testing sorbent products for oil and hazardous substance spill response. A sorbent database has been developed by the U.S. Coast Guard, Marine Spill Response Corporation, and Environment Canada to assist consumers with the selection of sorbent products. Information obtained from the sorbent tests performed by Environment Canada should be submitted to the Alaska Department of Environmental Conservation, Division of Spill Prevention and Response, 410 Willoughby Avenue, Suite 105, Juneau, Alaska 99801.

These protocols are designed to assist in determining criteria that may be used to balance product performance and net environmental benefit. The types of criteria considered include efficiency, efficacy, toxicity, and risk analysis.

The methodologies described in the protocols are intended to provide the product proponent with a basic means to develop information which may demonstrate the ability of the particular product. The protocols are not designed to preclude research and development of future innovative technologies.

All of the protocols include and allow for product testing on "spills-of-opportunity." Prior to testing a product on a spill-of-opportunity, the proponent must obtain a letter from the ARRT giving them authorization for use.

## Conclusion

Although the protocols represent a HSSTRC consensus regarding the demonstration of a product's capability, they are by no means the only methods to provide such information. Using these protocols and gathering the data is no guarantee that any particular product will be selected by a spiller, the state, or the ARRT for use on a spill. Products which do not have this type of information may find difficulty in demonstrating their

value for spill response. A product proponent, manufacturer, and/or vendor is required by the National Contingency Plan (NCP), Subpart J, to submit a Request for Authorization of Use to the ARRT prior to field testing in Alaska. It is the responsibility of the spiller, FOSC, and SOSC with assistance from the ARRT and the federal/state resource trustees to make the decisions as to how they will manage the response to a spill. Product data gathered using the protocols will be provided to the FOSC, SOSC and ARRT to assist in the decision-making process.

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# **A Research Program to Ensure That Best Available Technology Is Used in Preventing and Responding to Oil Spills in Alaska and the North Pacific**

Walter B. Parker

*Alaska Hazardous Substances Spill Technology Review Council  
3724 Campbell Airstrip Road, Anchorage, AK 99504*

## **Abstract**

This paper will identify the gaps in present oil spill prevention and response programs in Alaska as identified by the Alaska Hazardous Substances Spill Technology Review Council (HSSTRC). It will then discuss the research program being set up to fill these gaps and to ensure that best available technology is available to Alaskan shippers and responders. This plan will describe research goals in several areas including prevention, response, remediation, damage assessment, and restoration. The HSSTRC is coordinating this plan in cooperation with the Interagency Federal Oil Spill Coordinating Committee.

Funding for research will be discussed, in particular the utilization of \$5 million from the *Exxon Valdez* criminal settlement appropriated for oil spill research and development (R&D) in the 1993 Alaska Legislature for use until December 1, 1997.

## **Introduction**

The most important element in formulating a research program to ensure that best available technology is used in preventing or responding to oil spills in Alaska and the North Pacific is: a knowledge of the history of spill prevention and response in the region, and use of a reasonable forecast of the future of oil and gas development in Alaska.

It is the fashion among many in Alaska, in industry, government, media, and universities, to take the position that since North Slope reserves are declining, there is no justification for major improvements to the system. Few publicly take the position that oil and gas will be produced and transported in Alaska for at least the next 20 years and more probably the next 50. Few are willing to take the position that the risk of oil spills will be with us for the foreseeable future. Thus, the need for

improvement of prevention and response systems is not lessened, but is a constant that should have ongoing risk analysis applied to point the way to the most effective improvements that can be supplied by industry and government research and will be mandated by the regulatory agencies when necessary.

In recent years, since the demise of the Soviet Union, it has also become fashionable to take the position that the need for domestic production is no longer a strategic requirement of the United States and that the U.S. oil industry should seek its new reserves in areas where costs are less and regulation less stringent. This view is not reflected in most foreign policy publications, such as *Foreign Affairs* or *Foreign Policy*, where most analysts define a far more dangerous world than that of the Cold War. The danger to the United States may be less, but the overall world picture is one of increasing nationalistic and ethnic strife, leaving the United States as the only dominant power to play policeman to the world—a lonely position at best—and one that could become untenable if the United States must constantly rescue overseas energy sources from local wars without the security of domestic energy sources to rely upon. For this and many other reasons, it seems a reasonable assumption that oil and gas development will continue in Alaska. The North Sea operators seem to have reached that conclusion based upon their recent investment schedules.

While present North Slope reserves are around 6 billion barrels and Cook Inlet 100 million or so, it seems likely that new finds will lead to between 10 and 20 billion barrels transported through Alaska and its adjacent waters over the next 20 years. The risk ahead is as great or greater than the risk behind us if we allow present systems to continue without substantial improvement.

### **Risk of Present Systems**

The main disadvantage of present systems that have transported Cook Inlet oil and gas for over 30 years and North Slope products for 17 years is the age of the physical plant. Replacement will be a much larger factor in the future than in the past. The question most operators must face is whether their best solutions rest with increasing maintenance costs or replacement. Then the decision is whether risk will be lessened by replacement with best available technology or whether replacement will be dictated by the lowest cost.

Sometimes best available technology and lowest cost solutions may coincide, but this happy situation cannot be counted on by regulators whose driving motive is to lessen risk.



Measuring risk against pre-*Exxon Valdez* risk, one must look at pipeline components that are 5 years older in most cases, tankers that are 5 years older, manning practices at sea and ashore that have shown no dramatic improvements, no big improvement as yet in support systems such as pilotage, vessel traffic systems, and navigation in the marine environment, or fail-safe operating procedures on the pipeline.

There have been analyses of risk undertaken in the past five years, by the Bureau of Land Management (BLM) recently on the Alyeska pipeline and by the Coast Guard on tankers that revealed the problems of those tankers constructed of high tensile steel. However, these have not as yet resulted in changes or solutions. A most dramatic change has been in the restrictions placed upon operations in high winds at Hinchinbrook Entrance by the Coast Guard Captain of the Port at Valdez after interviews with tanker captains revealed their fears of operating in high winds in the approaches from the Gulf of Alaska.

The major requirements imposed on tankers by the Oil Pollution Act of 1990 (OPA 90) and State of Alaska actions that are presently in place, are tug escorts to Hinchinbrook Entrance and two watch officers at all times in coastal waters. Taken together, these probably balance the increased age of the ships, so overall risk is about what it was on March 24, 1989.

### **Present Status of Oil Spill Response Actions**

As a result of Alaska legislation and OPA 90 requirements, the oil spill response systems in Prince William Sound and Cook Inlet should be highly effective when mechanical recovery is possible. Great progress has also been made in in-situ burning but present techniques are limited to periods when the oil can be boomed to effect a controlled burn.

The two areas of most concern in response and recovery are those periods when wind and wave action prevent mechanical recovery and those areas distant from any response depot. The most likely and presently preferred bad weather response would be use of dispersant. This is beginning to target research requirements so that dispersants can be more closely matched to the oil they are dispersing and to the water temperatures in the arctic and subarctic areas.

The need for better response in areas distant from response depots will lead to a closer examination of what is possible with on-board response systems. This will focus on the possibilities of greater use of chemical responses and of enhanced bioremediation.

## **The Role of the Hazardous Substance Spill Technology Review Council (HSSTRC)**

In the aftermath of the *Exxon Valdez* oil spill, some 1300 offers were made to the federal and state responders on better ways to recover oil. Many of these proposals were put before the Sixteenth Alaska Legislature. One of the outcomes of this dialogue was the establishment of the HSSTRC within the Alaska State Emergency Response Commission (SERC). The HSSTRC's primary responsibility is to ensure that best available technology is known to and available to Alaskan responders.

The HSSTRC is made up of members from state agencies (Alaska Department of Environment Conservation (ADEC) and the Department of Military Affairs (ADMA)), federal agencies (the Coast Guard and EPA), the University of Alaska, the Governor's Science Advisor, the Prince William Sound Science Center, and four private members, one from each of the state's four judicial districts.

The HSSTRC has formed a close working relationship with the federally sponsored Oil Spill Recovery Institute (OSRI) created in OPA 90. OSRI staff is under contract to ADEC to aid the HSSTRC in implementing its goals.

The following areas of interest are being followed by the HSSTRC:

- The interaction of human factors and the use of new technology in hazardous substance and oil spill prevention and response.
- New technologies in spill prevention and response that offer promise in meeting the needs of federal/state area plans.
- Technologies for dealing with the radiation detection and containment problems of Alaska.

A strategic plan for guiding research in these areas is under development by staff at the OSRI. Three working groups composed of HSSTRC members, government agencies, Regional Citizens' Advisory Councils (RCACs), Local Emergency Planning Committees (LEPCs), and industry have been set up to provide input to the HSSTRC in guiding strategic plan development. The three groups focus on human factors, radiation, and the overall strategic plan. Other groups will be established if necessary in other areas. The first draft of the strategic plan will be available on or about 30 April 1994, the plan on or about 1 August 1994.

The strategic plan will be designed to provide a strong arctic-subarctic component to the federal plans being developed by the Inter-agency Federal Oil Spill Coordinating Committee. Its primary purpose

will be to provide guidance to Alaska Department of Environmental Conservation and other agencies in their research programs over the next three years.

Much of this research will be funded by the \$5 million ADEC received from the *Exxon Valdez* criminal settlement through the 1993 Alaska Legislature. It is our intent to use these funds to provide a base for cooperative efforts with the federal government, other states, RCACs, and industry whenever possible.

We are already using HSSTRC funds in this manner whenever possible, most recently to fund a workshop on Oil Spill Response in Dynamic Broken Ice held in Anchorage 6-8 March 1994 in cooperation with the Cook Inlet Spill Prevention & Response Inc. (CISPRI), Cook Inlet RCAC, ARCO, and Alaska Clean Seas (ACS). Ice has been a HSSTRC priority since its beginning in 1991.

The HSSTRC is very pleased with the progress made on in-situ burning as a response tool. When we have all the information in on the Newfoundland burn, in which we participated, we can plan our next step in this area. We have received great support from industry co-ops, i.e. ACS and CISPRI, in getting to our present position.

As stated before, areas of concern remain oil spill recovery in bad weather when mechanical recovery is not possible and recovery in areas distant from response centers. This includes almost all of Western Alaska, Bristol Bay, and Aleutian areas distant from Dutch Harbor. A possible answer to the latter problem may lie in enhanced on board recovery, an area the Coast Guard and affected shippers are beginning to confront.

In human factors, after our initial identification of this area as one requiring attention, Cook Inlet RCAC sponsored a meeting attended by many organizations dealing with spill response and oil transportation in general. As a result of this meeting, Prince William Sound RCAC and Cook Inlet RCAC are funding a joint investigation into human factors in Alaska. The results of this will be available to us as input to our strategic plan.

As we pointed out in the prevention section of our 1992/1993 annual report, 73% of all marine incidents are due to human factors, i.e. lack of training in new procedures, fatigue, complacency, and other causes. The host of new technologies that are becoming available to mariners emphasizes the need for concentration on human factors now.

Remote sensing and coordination of geographic information systems continue to be priorities of the HSSTRC. We have funded the University of Alaska to investigate the use of radar satellites in tracking oil spills in the Arctic Ocean and the Gulf of Alaska.

In its first report (1993), the National Research Council's Marine Board Committee on Oil Spill Response strongly made the point that the Federal Interagency Oil Pollution Research and Technology Plan was severely lacking in the areas of prevention. In our last HSSTRC report, we identified areas of improvement needed in ships, crews, powerplants, navigation systems, steering systems, human factors, and vessel traffic systems. We are already seeing a good deal of activity by federal agencies and industry in several of these areas. We intend to continue closely coordinating with the interagency committee, the Arctic Research Commission, and the members of our working groups to enhance prevention in all elements as rapidly as possible.

### Summary

The cost of maintaining a strong R & D position by the State of Alaska can be handled by minimal expenditures on improving the prevention and response to oil spills. The three-year strategic plan being developed now will expend about \$2 million per year.

This funding will provide independent state programs and state participation in federal and industry programs that are relevant to Alaska problems. The state funding has been used in the past to level research in the direction necessary for Alaska to accomplish its goals in spill prevention and response.

Some feel the job has been done and it is time for *Exxon Valdez* to go away. Some feel that we should maintain a continuing state presence in research on prevention and response to oil spills as long as the state is in the oil business, whether that be another 20, 50, or 100 years. The cost of ongoing R & D for 100 years will be 15% of the cost of the single incident of the *Exxon Valdez*.

## Screening for Acceptable Risk

Barbara Herman

Washington State Office of Marine Safety  
P.O. Box 42407, Olympia, WA 98504-2407

### Abstract

Screening for Acceptable Risk explores an innovative program developed by the Washington State Office of Marine Safety (OMS) to screen cargo and passenger ships for risk posed to the marine environment. The Washington State OMS screening program uses a database of risk-related vessel data and a risk matrix based upon expert opinion of experienced Puget Sound mariners. The matrix prioritizes ships for boarding and inspection.

The risk matrix relies upon 11 weighted risk elements such as vessel age, flag, and casualty history. Each ship screened by the matrix receives a numerical score and is assigned a priority for boarding. Ships found to pose high risk are boarded by OMS personnel and examined with an emphasis on human factors. Data gathered during boarding further populates the OMS database.

A "confidence interval" now being designed by OMS will measure the performance of the screening program. Risk predicted by the matrix will be compared to actual findings of OMS vessel examinations. These findings will facilitate continuous improvements in the risk assessment process.

Consistent with recent reports linking most vessel casualties with human error, OMS's early findings call for increased collection of information on management practices, personnel histories, and records of past vessel incidents. A coordinated international effort by government and industry is needed to make significant human factors data available to the world maritime community for vessel screening and marine safety purposes.

### Introduction

The 1991 Washington State Legislature responded to the *Exxon Valdez* spill by creating the Washington State Office of Marine Safety (OMS). OMS is the nation's first state oil spill agency with the principal mission of oil spill prevention, rather than response. OMS has moved assertively to establish innovative programs to reduce the risk of marine oil pollution events in Washington State.

The 1991 Washington Legislature directed OMS to establish a screening program to identify large cargo and passenger ships that "pose a

substantial risk of harm to the public health, safety, and environment" (RCW 88.46.050). This paper explores the recently developed OMS screening program to identify high risk cargo and passenger ships.

### **Overview of the OMS Vessel Screening Program**

Washington State's screening program for cargo and passenger vessels 300 gross tons or larger begins when a vessel submits an advance notice of entry prior to entering Washington State waters (WAC 317-30-080). The advance notice of entry provides times of arrival and departure, port arrangements, and basic vessel information.

Upon receiving a ship's notice of entry, OMS enters relevant data on that ship into a risk matrix. Data on each arriving ship are accessible to OMS from various sources, including the advance notice of entry, Lloyd's Register of Ships, U.S. Coast Guard casualty and violation histories, agents, owners, operators, and various publications. OMS also regularly reviews various trade publications for risk information including Lloyd's List, The Journal of Commerce, Marine Response Bulletin, and Golob's Oil Spill News Letter. OMS maintains this data in the OMS Marine Information System.

The risk matrix was developed by OMS using expert opinion and available data. The matrix assigns risk weights to vessel particulars including vessel age, vessel type, classification society, owner type, and flag. Changes of classification society, owner, and flag are also entered into the matrix. History of vessel casualties and violations are entered when available. The matrix generates a numerical score for each vessel which in turn establishes a boarding priority.

Vessels receiving a high priority for boarding are referred to the OMS Puget Sound field office for boarding and examination. Additional data gathered during boarding are also entered into the OMS Marine Information System for use in future inspections of that vessel and to populate a database of risk-related information.

### **History and Development of the OMS Risk Matrix**

Early in 1993, the Washington State Office of Marine Safety, working in conjunction with the National Ports and Waterways Institute, a consortium of universities including The George Washington University, Rensselaer Polytechnic University, and Louisiana State University, began development of a vessel risk model for Puget Sound and the Strait of Juan de Fuca. Because sufficient reliable data are currently not available to adequately evaluate risk, a model based upon expert opinion was selected.

By concentrating on Puget Sound and the Strait of Juan de Fuca, OMS gathered all available local data. To support the risk model, data was obtained from the U.S. Coast Guard and the Marine Exchange of Puget Sound, including casualty data from the Coast Guard CASMAIN file, pollution data from the Coast Guard Marine Safety Information System, and Unintended Incident Data from the USCG Puget Sound Vessel Traffic System.

Approximately 35 maritime experts were extensively interviewed, representing the U.S. Coast Guard, Puget Sound Pilots, Columbia River Pilots, the shipping industry, the towboat industry, and environmental groups. The results of questionnaires completed by the experts comparing relative risk situations were computer generated and mathematically tabulated.

The results of the data collection and expert opinion survey were then integrated into the risk matrix. Eleven risk categories were identified including such factors as age, flag, and vessel type. Each of the 11 risk categories were further divided into subcategories which correspond to the risk posed. For example, under "flag," five subcategories were created: (1) U.S./Canadian, (2) traditional maritime, (3) flag of convenience, (4) new offshore, and (5) other. Each category was defined and assigned a numerical score representing the risk posed by that category of vessels in the opinion of the Puget Sound experts.

To illustrate this process, the *M/V Isabella*, a Panama flag ship, would receive a score of 0.016975 for the flag category. This score is assigned to all ships sailing under a flag of convenience, in this case Panama. If the *M/V Isabella* had been a Canadian flag ship, a score of 0.003575 would have been recorded to reflect the lower risk determined by the experts to be attributed to a Canadian flag ship.

Each of the 11 risk categories are similarly scored for each ship. The result is a numerical score reflecting the relative risk posed by that ship. Washington OMS forwards data on high risk ships to the OMS Puget Sound field office with a recommendation for boarding. High risk ships are then boarded by OMS inspectors.

### **The Eleven Risk Matrix Elements**

The OMS risk matrix consists of 11 statistically weighted risk elements. These elements were chosen by the experts as relevant indicators of risk. The elements were also chosen because the data required are available in maritime publications and existing databases. Discussion of each of the 11 elements follows.

## Vessel Age

Vessel age is divided into three increments: 0-15 years, 16-25 years, and 25 years or older. Older ships are assigned higher weights. The 16-25 year increment coincides closely with protection and indemnity (P&I) club data indicating ships in the 15-20 year age range generally submit a disproportionate number of structural failure claims. Beyond 15 years, even well maintained ships begin to suffer from metal fatigue and the cumulative effects of shear and bending stresses on the hull. Beyond 25 years an increasingly heavy maintenance burden increases risk.

## Vessel Type

Vessel type is divided into six subcategories: (1) uninspected vessel, (2) tug with tank barge, (3) ferry, (4) tanker, (5) dry/log carrier, and (6) container. OMS regulates cargo and passenger vessels of 300 gross tons or greater, so most private yachts, small fishing boats, and other small craft are not represented in the vessel type category. According to expert opinion, uninspected vessels, which include fishing vessels, pose the greatest risk and accordingly receive the highest weighting. American flag fishing vessels are often uninspected and are exempt from pilotage.

Oil tankers receive the third highest risk weight due to the potential for a catastrophic spill. Bulk carriers, general cargo ships, and log carriers are allocated the fourth highest level of risk. P&I club data shows a relatively high percentage of structural failure and pollution claims for these vessels.

Container ships, car carriers, and Roll-on/Roll-off ships are in the lowest risk group. These ships tend to be more professionally operated, cleaner, and newer than other vessel types. Container ships and car carriers are in the business of transporting high value cargo and are almost always in the liner trade. These and other favorable factors contribute to a low risk weight.

## Redundancy of Systems

Redundancy of mechanical, navigation, and electrical generation systems on board ships is divided into three subcategories: (1) no redundant system, (2) partial, and (3) total. Total redundancy receives the lowest risk weighting. To qualify for total redundancy, a ship must have twin screws, two independent sources of electrical generation, two steering systems, and two radars. With the exception of many passenger vessels, most vessels receive the partial redundancy risk weight due to being a single screw vessel. A vessel with no redundancy is rarely encountered and usually involves a ship with severe impairments.



## Class Society

Class society has three subgroups: (1) International Association of Classification Societies (IACS), (2) IACS/associate, and (3) non-IACS. A vessel which is classed by a classification society that belongs to IACS receives the lowest risk weight due to high standards required by IACS. Eleven classification societies are IACS members. Four classification societies hold IACS associate status, which receives the next highest risk weight. Classification societies that are neither IACS nor IACS associates are labeled "other" and receive the highest risk weight. Approximately 30 other classification societies worldwide fall in the "other" group. Unclassed vessels such as fishing and ferry boats receive the "other" risk weight as a default value.

## Owner Type

Owner type lists four owner subcategories including: (1) shipping companies, (2) operating companies, (3) governments, and (4) single ship owners. The experts concluded that a ship owned by a shipping company poses the least risk. Shipping companies are generally well organized and staffed by maritime professionals. A shipping company is in the primary business of owning and operating ships. An operating company may be a bank or other financial institution with limited expertise as a ship owner or operator and is considered a higher risk.

Ships owned by governments receive the second lowest risk weight. National governments tend to be strongly regulatory and generally conscientious in shipboard management practices. The highest risk weight accrues to single ship owners. Single ship owners historically hire lower paid crews, spend less on maintenance, and rely on minimal shoreside staffing.

Determining ship ownership can be difficult. Vessel ownership is often heavily veiled for legal or financial reasons. Because ownership type is a valid risk indicator, increased access to ownership information would improve screening capability.

## Pilotage

The matrix assigns zero risk weight to vessels with a pilot on board and very high risk weight to vessels with no pilot. U.S. flag vessels of less than 1600 gross tons do not require a pilot in Washington State. The "no pilot" risk weight is the highest single risk value in the matrix. The experts clearly view presence of a pilot as a major marine safety factor.

## Changes in Status

The following are viewed as significant risk factors: (1) changes in ownership, (2) changes in flag, and (3) changes in classification society. The highest risk weight in this category is assigned to vessels with a recent ownership change. Changes of ownership almost always imply risk. When a ship changes owner, an array of unknowns is introduced. Management practices change, new crews are often hired, and organization can falter. For similar reasons, a change of flag receives the second highest risk weight in the change category.

Change of class receives slightly lower risk weight than change of flag. When a ship changes from a non-IACS classification society, like the Croatian Classification Society, to an IACS member like Det Norske Veritas (the Norwegian Classification Society) or the American Bureau of Shipping, the class upgrade is not considered a "change" and no values are assessed. A switch between two IACS classification societies is similarly not considered a change. Class changes which are valued include changes from an IACS or IACS associate member to a non-IACS class society, changes between two non-IACS members, and multiple changes in a short time period even if the ship ultimately is classed by an IACS class society.

## Flag

Flag has five subcategories: (1) U.S./Canadian flag, (2) traditional maritime, (3) flag of convenience, (4) new offshore, and (5) other. The experts assigned low risk weightings to U.S./Canada flags and traditional maritime flags (Japan, United Kingdom, Norway, Sweden, Denmark, France, Germany, Italy, Netherlands, and Finland). The flags listed in the three other groups each received similar and higher risk weights. The remaining categories are traditional flags of convenience (Liberia, Panama, Malta, Bermuda, Bahamas, Cyprus, Singapore, and Hong Kong); new offshore registries (Vanuatu, Marshall Islands, Cayman Islands, Honduras, Isle of Mann, Netherlands Antilles, Madeira, and Gibraltar); and "other," which receives the highest risk weighting and includes all other flags.

## Violation History

Violation history assigns weights to reportable marine violations: (1) no violation, (2) recent major violation, (3) recent minor violation, (4) repeated major violation, and (5) repeated minor violation. The highest risk weight is assigned to "repeated major violations" followed by "repeated minor violations" followed by "recent major violation" with the lowest risk assigned to "recent minor violation."

## Vessel Casualty History

Vessel casualty history refers to marine casualties including collisions, groundings, fires, and other accidents that result in damage to the vessel. Matrix subcategories are the same as for violation history and rely largely upon Coast Guard definitions of major and minor events: (1) no casualty, (2) recent major vessel, (3) recent minor vessel, (4) repeated major vessel, and (5) repeated minor vessel. Other casualties include serious injuries and loss of life.

## Key Personnel History

Key personnel history lists personnel violations of senior officers on board the vessel, including the master, chief mate, chief engineer, and first assistant engineer. Subcategories are the same as those found under violation history: (1) no violation or casualty, (2) recent minor personnel, (3) recent major personnel, (4) repeated minor personnel, and (5) repeated major personnel. This human factors information is second only to "no pilot" as a high valued risk score. The difficulty of accessing reliable key personnel history is the single most significant obstacle to effective vessel screening.

## OMS Vessel Screening History

The OMS vessel screening program officially began September 24, 1993. During the four-month period through January 28, 1994, approximately 1,438 cargo and passenger vessels and 276 tank ships (total 1,714) entered Washington State waters.

OMS staff resources for screening are not sufficient to screen each ship with the matrix. Accordingly, OMS conducts a cursory screening of every incoming ship to determine whether the ship is likely to receive a high score on the risk matrix. Cursory screening is accomplished by reviewing vessel information in Lloyd's Register of Ships. Lloyd's Register enables the screener to quickly ascertain whether the vessel is likely to score high under the risk matrix. The vessels which are likely to receive a high score are formally screened with the matrix.

Vessels screened with the matrix receive a normalized relative risk score, which is expressed as low (0-10), moderate (11-15), high (16-25), very high (25-50), or extremely high (over 50). During this four-month period, 265 vessels (15%) were identified as likely to score high and were subsequently screened with the matrix as shown in Tables 1 and 2. Early results of the OMS screening program suggest that bulk carriers tend to pose a higher degree of risk than other ship types. This is due primarily to scores received on changes, flag type, and ownership type.

**Table 1. Scores of 265 ships screened with the OMS risk matrix.**

Boarding Priority	Number of Ships	Total Percent
Low priority	8	3 %
Moderate Priority	102	38 %
High Priority	113	43 %
Very High Priority	40	15 %
Extremely High Priority	2	1 %

**Table 2. Ship types of 155 vessels receiving a high priority score with the OMS risk matrix.**

Type of Ship	Number of Ships	Total Percent
Bulk Carriers	92	59 %
General Cargo Ships	16	10 %
Container Ships	10	6 %
Vehicle Carriers	10	6 %
Refrigerated Cargo Ships	10	6 %
Tankers	10	6 %
Fishing Vessels	5	3 %
Training Ship	1	1 %
Research Vessel	1	1 %

### A Sample Screening

The *M/V Zhuang He* entered Puget Sound on February 25, 1994. The vessel is a nine-year-old container ship sailing under the flag of mainland China and classed by Zianlian Chuen, the China classification society. The *M/V Zhuang He* received a high priority (21.8) for boarding. Appendix A illustrates the operation of the OMS risk matrix. The six-decimal figures found in the weight column are relative statistical weighing factors and not percentages.

Factors contributing to the high priority score for the *M/V Zhuang He* were classification society type, change of classification society, flag type, and a recent major casualty.

The China classification society is an IACS member, but only receives the IACS Associate risk weight. The experts recommended that three IACS classification societies, the China classification society, the Russian Register of Shipping, and the Polish Register, be assigned the IACS Associate risk weight for purposes of risk analysis to reflect a higher risk rating than other IACS members.

The change of class on the *M/V Zhuang He* occurred between two IACS members, Germanischer Lloyd (the German classification society), and the China classification society. Normally, such a change would not be assessed, but since the China classification society has been accorded IACS Associate status, this change is regarded as a downgrade, and therefore an indicator of risk.

The flag of China receives the highest level of risk of any flag type. The experts placed the China flag in the "other" category as a slightly higher risk than flags of convenience. The ship received a recent major casualty score based upon an October 27, 1993, incident in which the *Zhuang He* struck the breakwater and grounded while proceeding toward the entrance to the Panama Canal.

### **The Matrix and Vessel Boardings**

The purpose of the screening program is to provide guidance to OMS on vessels to board for inspection. The matrix provides an approximation of risk that should correspond with actual shipboard conditions. To test the validity of the matrix, OMS is devising a scoring system for vessel boardings that will allow a comparison of the predicted risk, based upon the matrix, against an actual risk assessment determined by OMS inspectors after ship inspection.

Before such a "confidence interval" may be established, the vessel boarding process must be fully quantified. Upon boarding a ship which has received a high score under the matrix, OMS inspectors examine a number of areas, including:

#### **Operating procedures**

- cargo and bunker transfer
- navigation
- engineering
- emergencies
- watch procedures
- management practices

#### **Technology**

- navigation
- communications
- deck equipment
- engineering equipment
- construction
- spill response

**Management**

- audits and inspections
- environment and pollution
- maintenance
- safety

**Personnel**

- communications (languages spoken)
- health and fitness
- manning
- training
- working hours restrictions

After boarding, each of these areas is scored, given a statistical weight, and a boarding score is calculated. This numerical score may then be compared with the risk score derived from the risk matrix. For example, if a ship receives both a matrix risk score of "very high" and a "poor" boarding score, the matrix accurately predicted the risk posed by the vessel. In essence, risk is predicted by the matrix and verified by actual observation during the boarding process.

OMS is currently quantifying vessel boarding criteria. When a significant number of boarding scores have been compared to the corresponding relative risk scores provided by the matrix, OMS may report the percent accuracy of predicted risk and a confidence interval will have been established. The confidence interval serves as a valuable quality assurance measure that signals the need to modify and improve the matrix.

### **Acquisition of Human Factors Data**

The information highway has certainly not found its way to the maritime industry. As a result, the most critical information in the matrix is the most difficult to ascertain. Vessel casualty history, key personnel data, and data on shipboard management practices provide critical human factors information essential to assessing risk. Unfortunately, this information is often closely held and difficult to obtain.

While governments and industry maintain a wide variety of informational materials critical to screening ships for risk, the means to convey this information to needed users does not yet exist. To populate the OMS marine casualty database, considerable effort is being made to identify and gain access to existing casualty databases. Some of the organizations that maintain marine casualty databases include the United States Coast Guard (MSIS), foreign coast guards, the Paris Memorandum of Port State Conventions, P & I clubs, Lloyd's of London, Lloyd's (SEADATA), and shipping company vetting departments.

The international maritime community must establish a priority to commit resources to collectively making information universally available about vessel casualty histories, personnel performance records, and actual shipboard management practices. This critical information is essential to governments and industry seeking to reliably screen ships for risk.

### **Conclusions**

The Washington Office of Marine Safety is committed to innovative strategies to prevent oil spills. Identifying high risk vessels is an integral component in any program to reduce the risk of spill events. The OMS screening and boarding programs are designed to identify and assist vessels which do not present an acceptable risk to the marine environment. In this context, acceptable risk is the amount of risk posed by a well managed vessel in good condition. Acceptable risk is posed by shipboard officers and crew who understand and care about the marine environment and who are trained in the prevention of pollution events.

### **Acknowledgment**

Laura Stratton, OMS Vessel Screening Specialist, assisted in the preparation of this paper.

## Appendix A

### OMS risk matrix screening of the M/V Zhuang He

Name of Vessel M/V Zhuang He

Screening Date 02/22/94

Lloyd's No. 8321723

Name of Screener Laura Stratton

No. Item	Specific	Weight			
1	Age	0-15 Years Old	0.005516	X	1985 = 9
		15-25 Years Old	0.013706		
		Over 25 Years	0.036932		
2	Vessel Type	Uninspected Vessel/			
		Fishing Vessel	0.00671		
		Tug w/Tank Barge	0.005507		
		Ferry or Pass. Vessel	0.002025		
		Tanker	0.002836		
		Dry/Log Or			
		Bulk Carrier	0.002216		
Container/Car	0.001842	X	Container		
	Carrier/Ro-Ro				
3	Redundancy	No Redundancy	0.028028		
		Partial	0.010166	X	
		Total	0.005482		
4	Class Society	IACS	0.007858		
		IACS/Associate	0.014866	X	ZC
		Non-IACS	0.041744		
5	Owner Type	Shipping Company	0.009843	X	Cosco Shanghai
		Government	0.01579		
		Single Ship	0.025526		
		Operating Company	0.025587		
6	Pilot	Pilot on Board	0	X	
		No Pilot	0.130694		
7	Changes	Owner Change	0.039409		
		Class Change	0.033898	X	GL to ZC
		Flag Change	0.034123		
8	Flag	US/Can Flag	0.003575		
		Traditional Maritime	0.004206		
		Flag of Convenience	0.016975		
		New Offshore	0.016623		
		Other	0.016999	X	
9	Violation History	No Violations	0.0046		
		Recent Major	0.014927		
		Recent Minor	0.008005		
		Repeated Major	0.038337		
		Repeated Minor	0.019542		



10 Vessel Casualty History	No Casualties	0.007849	
	Recent Major	0.024856	X See Comments
	Recent Minor	0.014996	
	Repeated Major	0.073245	
	Repeated Minor	0.03458	
11 Key Personnel History	No Violations or Casualties	0.011028	
	Recent Major	0.036058	
	Recent Minor	0.018786	
	Repeated Major	0.092925	
	Repeated Minor	0.041582	
Total Score Items 1-11		0.117986	
Normalized Total	(Max 1.0)	0.217766302	
Normalized Score	(Max 100)	21.77663016	
Priority for Boarding	<b>High Priority</b>		
	Low Priority		0-10
	Moderate Priority		11-15
	High Priority		16-25
	Very High Priority		26-50
	Extremely High Priority		50-100
Comments: Struck breakwater at Cristobal, Panama and grounded. Major damage to bulbous bow with multiple openings. No pilot on board at time of incident. Class change from GL To ZC. Counting ZC as IACS Associate. GT: 24,438 LOA: 199.15 M (653 Ft)			
ETA Pilot Station:	02/25/94 at 0600 : PS		
Destination:	Seattle: Pier 18		
Agent Name:	Norton Lilly		
Agent Phone No:	206-623-0930		



## The Citizens' Perspective of Spill Response

Joe Banta, Tom Copeland, and Tim Robertson  
*Prince William Sound Regional Citizens' Advisory Council*  
*Oil Spill Prevention and Response Committee*  
750 W. Second Avenue #100, Anchorage, AK 99501-2168

### Abstract

This paper discusses the oil spill response strategy termed nearshore response as developed following the *Exxon Valdez* oil spill. Nearshore response in this context is a method of response using local fishing vessels and expertise to contain, recover, or divert oil that has escaped containment at the scene of the spill in order to prevent shoreline impacts.

### Introduction

During the 1989 *Exxon Valdez* Oil Spill (EVOS) it became immediately apparent that there were areas of spill response which were not addressed by responders in both a *geographic* and *strategic* sense.

*Geographic:* There are some waters in the Gulf of Alaska which are not covered by response actions of the two major spill response organizations, Alyeska Pipeline Service Co. and Cook Inlet Spill Prevention and Response Organization. An example of such a geographic gap would be a spill outside of the Hinchinbrook Entrance of Prince William Sound (PWS).

*Strategic:* The other gap in spill response not covered by response action in 1989 is the strategy for which local residents coined the term, "nearshore response." This concept was born out of the fishing and local vessel response which recovered oil-on-water during the many weeks of recovery efforts that it took to pick up the widely dispersed oil throughout the bays and passages of PWS and the Gulf of Alaska (GOA).

### Nearshore Response

Much effort has gone into beefing up the initial response capabilities in PWS, and now that capability is recognized as one of the finest in the world. If weather, machinery, and personnel all cooperate to provide optimum conditions, the initial response may be able to effectively contain

and clean up much of the next spill in PWS. However, the fact remains that there is no guarantee of such optimum conditions, and it is likely that some or much oil will escape initial containment efforts. This threat proves the need for nearshore response.

As it was defined by a working group on the subject, *nearshore response is the effort to contain, recover, or divert oil that has escaped containment at the scene of the spill in order to prevent shoreline impacts.* It is within the framework of nearshore response that local residents and their vessels most clearly fit into the spill response activities.

The value of local knowledge was one of the major lessons learned from the EVOS. Fishermen and local residents clearly proved their capability to respond to oil spills in the successful protection of the PWS salmon hatcheries such as the Armin Koernig Hatchery in Port San Juan. Local response also revealed that there is no question about whether or not the residents of the area will respond—the question is how to focus this wealth of local knowledge and resources so it can most effectively be used in spill response.

One illustration of the efficiency of local fishermen and their vessels is when 100 PWS purse seine vessels captured approximately 15,000 tons (30,000,000 lbs) of herring in one hour of fishing time in 1992. The volume of this catch is equivalent to about one-third of the weight of the EVOS spilled crude oil. This shows that local knowledge and efficient vessels designed for local waters can be a valuable resource in the recovery of whatever is targeted for catch. That target can be spilled oil as well as whatever fish are in season. Alaskan fishermen are seasoned experts at converting their vessels to participate in many fisheries, often under a time crunch as fishing seasons may run into each other. The targeting of oil spills fits well into this framework. In addition, there are dozens of charter boat operators licensed and prepared to transport oil spill response crews as well as the sport fishermen they transport in their regular season.

## **1990 Legislative Oil Spill Response Requirements**

Both state and federal legislative requirements which resulted from the EVOS placed an emphasis on the use of local resources as well as strategies which could make use of these resources for nearshore response as follows:

- The State of Alaska mandates the establishment of local equipment depots and local response corps (under SB 264 passed in 1989).
- The federal Oil Pollution Act of 1990 (OPA 90) requires that oil spill response in Prince William Sound include the mobilization of

local resources (Section 5005). USCG regulations promulgated pursuant to OPA 90 establishes requirements that at least 20% of response equipment required by the USCG be capable of operating in waters of six feet or less. This requirement was to ensure adequate response in the nearshore zone.

- Alaska HB 567 increased the standards for oil spill contingency planning and response for both crude and non-crude oil.
- The Alaska Department of Environmental Conservation (ADEC) required PWS crude oil shippers to develop a nearshore spill prevention and response plan as part of the conditional approval of their overall contingency plan following the EVOS.

### **1991 Nearshore Workshop**

In June 1991, the public, industry (crude and non-crude, large and small), state and federal regulators, and fishermen attended a PWS Regional Citizens' Advisory Council (RCAC) workshop to define nearshore response and discuss the needs in that new field. The results of this workshop were then used to help guide further development of the nearshore response concept. Prior to the workshop, ADEC made the development of "nearshore response planning" a condition of approval of the Alyeska PWS Tanker Spill Prevention and Response Plan.

### **1992 Nearshore Response Plan**

In June 1992 a joint industry/regulatory agency/citizen group called the Nearshore Response Working Group completed over a year's worth of work and meetings with industry contractors and planners who were developing industry's nearshore spill response plan. The end result of the cooperation and give and take of these meetings was the development of the first-ever comprehensive nearshore plans which were submitted to ADEC on June 1, 1992. These plans recognize the importance and benefits of using local residents and resources to capture spilled oil.

One of the lessons learned from the EVOS was that fishermen did not have enough storage available for recovered oil, and at times even had to release boomed oil due to lack of storage and pumps. The work group process did not resolve this issue—which is fundamental to the success of nearshore response. Thus, the process left unanswered the questions of what is the appropriate type of intermediate storage container for recovered oil and how many of those containers are needed to ensure adequate storage and transfer during a nearshore response.

RCAC opposed the use of skid-mounted deck tanks as proposed by industry and promoted the use of small "mini-barges" which RCAC felt could carry much more oil and allow simpler and longer response operations and transfers. Fortunately, a USCG decision based upon stability concerns and oil storage vessel certification processes precluded the use of deck mounted tanks on fishing vessels. That decision left industry with only the mini-barge concept as the best option for its nearshore response storage. PWS industry shippers proceeded with plans to build a 250 bbl barge. Cook Inlet shippers opted for a 100 bbl mini-barge. Both industry groups focus on a barge which is less than 15 gross tons to minimize more stringent construction, inspection, and licensing requirements. Another option recently developed by the USCG is a Vessel of Opportunity Skimming System (VOSS).

Concurrently, ADEC, with RCAC's encouragement, initiated development of a Nearshore Strike Team Demonstration Project to build a 650 bbl mini-barge with a skimmer system, and train local residents to use this equipment as part of the state mandated establishment of local equipment depots and local response corps mentioned earlier. While the PWS industry mini-barge concept is based on a static process of boom towing, stopping, pumping recovered oil, then booming again, the state and Cook Inlet concept is based upon a dynamic process of constant boom towing and pumping (skimming) at the same time without the need to stop. The USCG VOSS is a dynamic system which has the option of operating in nearshore waters depending on the depth of the vessel using the system.

One initial benefit of the state project has been the demonstration of the feasibility of constructing, inspecting, and licensing barges over the benchmark of 15 gross tons. A recent USCG decision has clarified that there is no towing license requirement for oil recovery barges under 15 gross tons, while for barges over 15 gross tons a Master's license will be sufficient.

### **Implementing the Nearshore Response Plan**

When the plan development began, RCAC was interested in identifying how to bring together all the previously mentioned components—local knowledge, legislative requirements, nearshore response, and lessons learned from the EVOS—into an organization which could most effectively implement nearshore response plans. This interest brought RCAC to the study of a regional oil spill cooperative. An RCAC study looked at options for an organization which could fill the need for implementing nearshore response activities on a local community-based level.

However, industry concerns and funding questions precluded the development of a regional oil spill cooperative.

In early 1994, RCAC and Alyeska met with the Alaska Fish Spotters Association (AFSA) and discussed how best to incorporate the use of fish spotter pilots and their local knowledge into nearshore response. Alyeska and AFSA are continuing discussions on development of a more formal relationship. RCAC is encouraged by these steps and looks forward to the concepts being addressed by the shipping companies for use in long-term response.

In the spring of 1994, both industry's and the state's prototype barges will undergo Alaska sea trials. RCAC will be carefully evaluating these options to see if they address the problems left unresolved by the existing spill response capability in RCAC's region: the need to equip and train local residents to respond to spills, especially in the area of nearshore response oil storage, and the need to effectively organize, train, and use the capabilities of the local fishing fleet and other local resources.





## Participants

Abeshouse, Bob

ABC News  
157 Columbus Avenue  
New York NY 10017

Abordaif, Faisal

The George Washington Univ.  
Dept. of Engineering Management  
7621 Virginia Lane  
Falls Church VA 22043

Allen, Jennifer

Washington State Univ.  
SE 215 Pioneer Way  
Pullman WA 99163

Aspland, Jerry

ARCO Marine, Inc.  
300 Ocean Gates  
Long Beach CA 90802

Bader, Gary

Alyeska Pipeline Service Co.  
1835 S. Bragaw M.S. 538  
Anchorage AK 99512

Baffrey, Michael

Minerals Management Service  
949 E. 36th Avenue #603  
Anchorage AK 99508-4302

Baily, Doug

Ashburn & Mason PC  
1130 W. 6th Avenue #100  
Anchorage AK 99501

Baker, Clifford

Carlow International, Inc.  
3141 Fairview Park Drive #750  
Falls Church VA 22042

Baldwin, Robert

BP Oil Company  
200 Public Square 6-1617P  
Cleveland OH 44114-2375

Banta, Joe

Prince William Sound RCAC  
750 W. 2nd Avenue #100  
Anchorage AK 99501

Barber, Ed

State Pipeline Coordinator's Office  
411 W. 4th Avenue #2  
Anchorage AK 99501

Barker, Jocelyn

Prince William Sound RCAC  
750 W. 2nd Avenue #100  
Anchorage AK 99501

Bassier, Anne

BP Exploration  
P.O. Box 196612  
Anchorage AK 99519-6611

Baxter, Brenda

Alaska Sea Grant College Program  
Univ. of Alaska Fairbanks  
P.O. Box 755040  
Fairbanks AK 99775-5040

Bergmann, Pamela  
U.S. Dept. of the Interior  
1689 C Street #119  
Anchorage AK 99501-5126

Bernton, Hal  
Anchorage Daily News  
2164 Alder  
Anchorage AK 99508

Birnbaum, Molly  
DEC/JPO  
411 W. 4th Avenue #26  
Anchorage AK 99501

Bodron, Capt. Don  
Chief, Marine Safety Division  
17th Coast Guard District  
P.O. Box 25517  
Juneau AK 99802-5517

Britt, Bill  
EMCON Alaska, Inc.  
201 E. 56th #300  
Anchorage AK 99518

Bronson, Mike  
EMCON Alaska, Inc.  
201 E. 56th Avenue  
Anchorage AK 99518

Brown-Maunder, Susan  
Regulatory Affairs Consulting  
P.O. Box 112556  
Anchorage AK 99511-2556

Bruce, David  
Dept. of Environmental Conserv.  
400 Willoughby Avenue #105  
Juneau AK 99801-1795

Burgoyne, Bill  
P.O. Box 2891  
Palmer AK 99645

Byers, Kurt  
Alaska Sea Grant College Program  
Univ. of Alaska Fairbanks  
P.O. Box 755050  
Fairbanks AK 99775-5040

Cameron, Jean  
States/British Columbia Oil Spill  
Task Force  
811 SW 6th Avenue, 9th Floor  
Portland OR 97204-1390

Carr, Matthew  
Environmental Protection Agency  
222 W. 7th Avenue #19  
Anchorage AK 99513-7588

Casey, Tom  
Thomas Casey Consultants  
11261 Snowline Drive  
Anchorage AK 99516

Clark, Maureen  
Alaska Public Radio  
810 E. 9th Avenue  
Anchorage AK 99501

Coleman, Wayne  
Prince William Sound RCAC  
750 W. 2nd Avenue #100  
Anchorage AK 99501

Collier, Tracy  
NOAA/NMFS  
2725 Montlake Boulevard East  
Seattle WA 98112

Cromey, Bill  
Titus Corporation  
705 W. 6th Avenue #207  
Anchorage AK 99501

Dahl, Sue  
Micro Analysis & Design, Inc.  
4900 Pearl East Circle #201 E  
Boulder CO 80301

Darnell, Joan  
National Park Service  
Dept. of the Interior  
2525 Gambell Street  
Anchorage AK 99503-2892

Davis, Marcia  
BP Exploration  
P.O. Box 196612  
Anchorage AK 99519-6611

Davis, Randall  
Texas A&M Univ.  
Dept. of Marine Biology  
P.O. Box 1675  
Galveston TX 77553

Dearborn, Ron  
Alaska Sea Grant College Program  
Univ. of Alaska Fairbanks  
P.O. Box 755050  
Fairbanks AK 99775-5040

Dekin, Jr., Albert  
Binghamton Univ.  
Dept. of Anthropology  
P.O. Box 6000  
Binghamton NY 13902

Dey, James  
Cook Inlet RCAC  
11355 Frontage Road #228  
Kenai AK 99611

Duggins, Alan  
BP Pipelines (Alaska) Inc.  
P.O. Box 190848  
Anchorage AK 99519

Eliassen, Eric  
Southwest Alaska Pilots Assoc.  
P.O. Box 977  
Homer AK 99603

Erickson, Bruce  
Dept. of Environmental Conserv.  
Western District Office  
3601 C Street #1334  
Anchorage AK 99503

Evanoff, Gail  
Prince William Sound RCAC  
750 W. 2nd Avenue #100  
Anchorage AK 99501

Evans, L.J.  
EVOS Trustee Council  
645 G Street  
Anchorage AK 99501

Feraro, Kim  
Anchorage Daily News  
1001 Northway Drive  
Anchorage AK 99501

Ferry, Leann  
Prince William Sound RCAC  
750 W. 2nd Avenue #100  
Anchorage AK 99501

Fineberg, Richard  
Research Associates  
P.O. Box 416  
Ester AK 99725

Fink, Mark  
AK Dept. of Fish and Game  
333 Raspberry Road  
Anchorage AK 99518

Fowler, Marjorie  
Prince William Sound RCAC  
750 W. 2nd Avenue #100  
Anchorage AK 99501

Geiselman, Joy  
Minerals Management Service  
949 E. 36th Avenue #603  
Anchorage AK 99508-4302

Giesen, John  
Teex-Oil Spill Control School  
Texas A&M Univ.  
P.O. Box 1675  
Galveston TX 77553

Ginalias, Jeff  
AK Dept. of Natural Resources  
Division of Oil and Gas  
P.O. Box 107034  
Anchorage AK 99510-7034

Ginsburg, Patty  
Prince William Sound RCAC  
750 W. 2nd Avenue #100  
Anchorage AK 99501

Gordon, Philip  
1605 Elmendorf Drive  
Anchorage AK 99504-2422

Gottlieb, Judy  
National Park Service  
2525 Gambell Street  
Anchorage AK 99503

Greer, Jed  
Greenpeace  
462 Broadway 6th floor  
New York NY 10013

Grikis, Joseph  
J.F. Grikis, Corp.  
P.O. Box 1666  
College Park MD 20741

Gynther, James  
U.S. Coast Guard ESB/AED  
Research and Development Center  
1082 Shennecossett Road  
Groton CT 06340-6096

Hammond, Laura  
UNOCAL  
P.O. Box 196247  
Anchorage AK 99519

Harrald, John  
The George Washington Univ.  
Dept. of Engineering Management  
2130 H Street NW #632  
Washington DC 20052

Hass, Tim  
KTUU  
630 W. 4th Avenue  
Anchorage AK 99501

Hawe, Christopher  
North Coast Consultants, Inc.  
3514 W. 4th Avenue #A  
Anchorage AK 99517

Heiman, Marilyn  
North Coast Research  
1407 W. 31st #100  
Anchorage AK 99503

Heimbuch, Floyd  
Prince William Sound RCAC  
750 W. 2nd Avenue #100  
Anchorage AK 99501

Herman, Barbara  
Wash. State Office of Marine  
Safety  
711 State Avenue NE, 2nd Floor  
P.O. Box 42407  
Olympia WA 98504-2407

Hillman, Sharon  
SERVE  
P.O. Box 109  
Valdez AK 99686

Hite, David  
Prince William Sound RCAC  
750 W. 2nd Avenue #100  
Anchorage AK 99501

Hyde, Sean  
Ecology & Environment, Inc.  
840 K Street #100  
Anchorage AK 99501

Johnson, Margy  
Prince William Sound RCAC  
750 W. 2nd Avenue #100  
Anchorage AK 99501

Karey, Gerald  
Platt's Oilgram News  
1200 G Street NW #1100  
Washington DC 20005

Karterman, Don  
C.R. Lewis Company  
1500 Post Road  
Anchorage AK 99501

Kelly, Vince  
Prince William Sound RCAC  
P.O. Box 2862  
Valdez AK 99686

Kendrick, Suzie  
Cook Inlet RCAC  
TOEM Committee  
P.O. Box 4502  
Soldotna AK 99669

Kennedy, Janet  
Kinnetic Laboratories, Inc.  
403 W. 8th Avenue  
Anchorage AK 99501

Kim, Susan  
KIMO 13  
2700 E. Tudor  
Anchorage AK 99507

Kurtz, Rick  
National Park Service  
2525 Gambell Street #107  
Anchorage AK 99503-2892

LaRocque, Jean  
Environmental Info Services  
P.O. Box 188  
Valdez AK 99686

Lautenberger, Carl  
Environmental Protection Agency  
222 W. 7th Avenue #19  
Anchorage AK 99513-7588

Lawn, Dan  
P.O. Box 188  
Valdez AK 99686

Lee, John  
Battelle Seattle Research Center  
4000 NE 41st Street  
Seattle WA 98105

Lee, Linda  
P.O. Box 1424  
Valdez AK 99686

Lentfer, Jack  
Marine Mammal Commission  
P.O. Box 2617  
Homer AK 99603

Leschine, Thomas  
Univ. of Washington  
School of Marine Affairs  
3707 Brooklyn Avenue NE  
Seattle WA 98195

Lethcoe, Nancy  
AK Wilderness Recreation &  
Tourism Association  
P.O. Box 1353  
Valdez AK 99686

Levine, Robert  
ARCO Marine, Inc.  
P.O. Box 100360  
Anchorage AK 99510-0360

Lohman, Thomas  
North Slope Borough  
P.O. Box 69  
Barrow AK 99723

Lowry, Paul  
Minerals Management Service  
949 E. 36th Avenue #603  
Anchorage AK 99508-4302

Magyar, Lori  
Dames & Moore  
5600 B Street #100  
Anchorage AK 99518-1641

McCart, Janet  
BP Exploration  
P.O. Box 196612  
Anchorage AK 99519-6611

McCullum, Paul  
Cook Inlet RCAC  
TOEM Committee  
P.O. Box 2016  
Homer AK 99603

McCord, Elizabeth  
Cook Inlet RCAC  
11355 Frontage Road #228  
Kenai AK 99611

McDonagh, John  
BP Exploration  
P.O. Box 196612  
Anchorage AK 99519-6611

McKean, Richard  
Dept. of Environmental Conserv.  
411 W. 4th Avenue #2C  
Anchorage AK 99501

Means, Phillip  
U.S. Coast Guard  
Marine Safety Office  
510 L Street #100  
Anchorage AK 99501

Meckstroth, Michelle  
Prince William Sound RCAC  
750 W. 2nd Avenue #100  
Anchorage AK 99501

Meitner, Jim  
TESORO  
P.O. Box 3369  
Kenai AK 99611

Merrick, John  
Koniag, Inc.  
4300 B Street #407  
Anchorage AK 99507

Miller, Capt. Max  
U.S. Coast Guard  
Marine Safety Office  
2375 Jimmy Johnson Boulevard  
Port Arthur TX 77640

Mortenson, Dorothy  
AK Dept. of Natural Resources  
3601 C Street #916  
Anchorage AK 99503-5936

Mulligan, Conrad  
42, Ransden Road  
Orpington  
Kent BR5 4LT  
ENGLAND

Mullin, Joseph  
Minerals Management Service  
Tech. Assessment & Research  
381 Elden Street, MS-4700  
Herndon VA 22070-4817

Murrell, Thomas  
Minerals Management Service  
949 E. 36th Avenue #603  
Anchorage AK 99508-4302

Nagatani, Patricia  
Hawaii Dept. of Health  
5 Waterfront Plaza  
500 Ala Moana Blvd. #250C  
Honolulu HI 96813

Nalder, Eric  
Seattle TIMES  
1120 John Street  
Seattle WA 98109

Nance, Lt. I.  
17th Coast Guard District  
P.O. Box 25517  
Juneau AK 99802-5517

Nelson, Kristen  
Alaska Journal of Commerce  
P.O. Box 102278  
Anchorage AK 99517

Newman, Anthony  
3936 Bryant Ridge Road  
Anchorage AK 99504

Nowak, Michael  
Colorado College  
14 E. Cache La Poudre  
Colorado Springs CO 80903

Nyberg, Don  
BP Exploration  
P.O. Box 196612  
Anchorage AK 99519-6611

O'Brien, David  
EMCON Alaska, Inc.  
201 E. 56th #300  
Anchorage AK 99518

O'Connor, Kristina  
AK Dept. of Natural Resources  
Division of Oil and Gas  
P.O. Box 107034  
Anchorage AK 99510-7034

O'Leary, Michelle  
Prince William Sound RCAC  
750 W. 2nd Avenue #100  
Anchorage AK 99501

O'Shea, Kevin  
Dept. of Environmental Conserv.  
411 W. 4th Avenue #2C  
Anchorage AK 99501

Parker, Walt  
Alaska Hazardous Substance Spill  
Technology Review Council  
3724 Campbell Airstrip Road  
Anchorage AK 99504

Pearson, Leslie  
Dept. of Environmental Conserv.  
Southcentral Regional Office  
3601 C Street #1334  
Anchorage AK 99503

Pfeiffer, Karl  
Prince William Sound RCAC  
8341 Paine Road  
Anchorage AK 99516

Phillips, Natalie  
Anchorage Daily News  
14001 Northway Drive  
Anchorage AK 99517

Piper, Ernie  
144 E. 11th #A  
Anchorage AK 99501

Powers, Cdr. Geoff  
U.S. Coast Guard MSO  
2760 Sherwood Lane #2A  
Juneau AK 99801-8545

Prentiki, Richard  
Minerals Management Service  
949 E. 36th Avenue #603  
Anchorage AK 99508-4302

Quesnel, Paul  
BP Exploration  
P.O. Box 196612  
Anchorage AK 99519-6611

Ranger, Richard  
ARCO Alaska, Inc.  
P.O. Box 100360  
Anchorage AK 99510

Regg, James  
Minerals Management Service  
949 E. 36th Avenue #603  
Anchorage AK 99508-4302

Rice, William  
National Park Service  
2525 Gambell Street #107  
Anchorage AK 99503-2892

Rosen, Yareth  
Reuters  
810 E. Ninth Avenue  
Anchorage AK 99501

Rosenberg, Ronnie  
Green Party of Alaska  
841 9th Avenue  
Fairbanks AK 99701

Rufe, Radm. Roger  
Commander  
17th Coast Guard District  
P.O. Box 25517  
Juneau AK 99802-2517



Salmon, David  
Prince William Sound Science  
Center  
P.O. Box 705  
Cordova AK 99574

Schaefer, Rob  
KTUU  
630 W. 4th Avenue  
Anchorage AK 99501

Scheel, David  
Prince William Sound Science  
Center  
P.O. Box 705  
Cordova AK 99574

Scott, Gordon  
Prince William Sound RCAC  
750 W. 2nd Avenue #100  
Anchorage AK 99501

Sienkiewicz, Mark  
Dept. of Environmental Conserv.  
Kenai District Office  
35390 Kalifornsky Beach Rd. #11  
Kenai AK 99669

Sikora, Jerome  
Department of the Navy  
Carderock Division  
Naval Surface Warfare Center  
Bethesda MD 20084-5000

Slater, Claudia  
AK Dept. of Fish and Game  
333 Raspberry Road  
Anchorage AK 99518

Slyman, Paul  
Oregon Dept. of Environmental  
Qual.  
811 SW 6th Avenue  
Portland OR 97204

Smith, Caryn  
Minerals Management Service  
949 E. 36th Avenue  
Anchorage AK 99508

Spitzer, Cdr. James  
Commanding Officer  
USCG Pacific Strike Team  
Hanger 2, Hamilton Field  
Novato CA 94979

Stahl-Johnson, Kristin  
Prince William Sound RCAC  
P.O. Box 2661  
Kodiak AK 99615

Stanley, Stan  
Prince William Sound RCAC  
750 W. 2nd Avenue #100  
Anchorage AK 99501

Starratt, Patricia  
Alyeska Pipeline Service Company  
1835 S. Bragaw M.S. 542  
Anchorage AK 99512

Steiner, Rick  
Alaska Marine Advisory Program  
Univ. of Alaska Fairbanks  
P.O. Box 830  
Cordova AK 99574

Stephens, Stan  
Prince William Sound RCAC  
P.O. Box 1297  
Valdez AK 99686

Stock, Ledr. Gary  
17th Coast Guard District  
P.O. Box 25517  
Juneau AK 99802-5517

Stolls, Amy  
Oil Spill Intelligence Report  
3225 Benton Place SW #304  
Seattle WA 98116

Strickland, Dan  
Pacific Fishing  
H CO 4 Box 9304-D  
Palmer AK 99645

Stringfellow, Robert  
Minerals Management Service  
949 E. 36th Avenue #603  
Anchorage AK 99508-4302

Sullivan-Garcia, Doreen  
Dept. of Environmental Conserv.  
Anchorage District Office  
3601 C Street #1334  
Anchorage AK 99503

Sundet, Kathrin  
AK Dept. of Fish and Game  
333 Raspberry Road  
Anchorage AK 99517

Swanton, Nancy  
Minerals Management Service  
949 E. 36th Avenue #603  
Anchorage AK 99502

Sweeney, Tom  
Prince William Sound RCAC  
750 W. 2nd Avenue #100  
Anchorage AK 99501

Szabo, Dave  
BP Exploration  
P.O. Box 196612  
Anchorage AK 99519-6611

Tadolini, A.M.  
Alyeska Pipeline Service Company  
1835 S. Bragaw Street M/S 569  
Anchorage AK 99512

Tomingas, Henry  
Fairweather Marine/Ocean  
Explorers  
Box 111321  
Anchorage AK 99511

Tomlin, D.C.  
Bureau of Indian Affairs  
1675 C Street  
Anchorage AK 99501

Tomrdle, Lisa  
Prince William Sound RCAC  
750 W. 2nd Avenue #100  
Anchorage AK 99501

Totemoff, David  
BP Exploration  
P.O. Box 196612  
Attn: Prudhoe Bay Asset Area #2  
Anchorage AK 99519-6611

Townsend, Richard  
Townsend Environmental  
117 North Young Drive  
Otis OR 97368

Trudgen, Dave  
Alyeska Pipeline Service Co.  
1835 S. Bragaw M/S 538  
Anchorage AK 99515

Tuomi, Pam  
IWR  
2036 E. Northern Lights Blvd.  
Anchorage AK 99508

Turco, Kathy  
Institute of Marine Science  
Univ. of Alaska Fairbanks  
P.O. Box 757220  
Fairbanks AK 99775-7220

Tuttle, Maryellen  
Dames & Moore  
5600 B Street #100  
Anchorage AK 99518-1641

Ulvestad, Dennis  
Prince William Sound  
Community College  
P.O. Box 97  
Valdez AK 99686

Vasiliev, Sergej  
KIMO 13  
2700 E. Tudor  
Anchorage AK 99507

Vidrine, Grant  
BP Exploration  
P.O. Box 196612  
Anchorage AK 99519-6611

Walker, Jeffrey  
Minerals Management Service  
949 E. 36th Avenue #603  
Anchorage AK 99508-4302

Warren, Roy  
Dept. of Environmental Conserv.  
SE Regional Office  
210 S. Willoughby Avenue #105  
Juneau AK 99801

Weaver, Lou  
Prince William Sound RCAC  
750 W. 2nd Avenue #100  
Anchorage AK 99501

Weaverling, Charles  
Box 895  
Cordova AK 99574

White, Jan  
Univ. of California Davis  
VM:PMI  
Davis CA 95616

Whitney, John  
NOAA SSC for Alaska  
510 L Street #100  
Anchorage AK 99501

Widom, Ivan  
Prince William Sound RCAC  
750 W. 2nd Avenue #100  
Anchorage AK 99501

Williams, Mike  
Cloverland North  
6035 Tanaina Drive  
Anchorage AK 99502

Willis, Robin  
AK Dept. of Fish and Game  
333 Raspberry Road  
Anchorage AK 99518

Wills, Jonathan  
Shetland Islands Council  
Sundside  
Bressay  
Shetland ZE2 9ER  
SCOTLAND

Wolfe, James  
USDA Forest Service  
P.O. Box 21628  
Juneau AK 99802

Wuerth, Soren  
The Cordova Times  
P.O. Box 200  
Cordova AK 99574

Yancey, William  
Hi-Test Laboratories, Inc.  
P.O. Box 87  
Arvonnia VA 23936

Yender, Ruth  
NOAA/HAZMAT  
7600 Sand Point Way NE  
Seattle WA 98115

Zeiner, Kelly  
AK Dept. of Natural Resources  
3601 C Street #916  
Anchorage AK 99503-5936

Zseleczy, Pete  
BP Exploration  
P.O. Box 196612  
Anchorage AK 99519-6611

