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PROCEEDINGS

An International Workshop on Offshore Lease Abandonment and Platform Disposal: Technology, Regulation, and Environmental Effects

New Orleans, Louisiana
April 1996

Sponsored by:
- U.S. Department of the Interior, Minerals Management Service
- Louisiana State University, Center for Energy Studies

Cosponsored by:
- American Petroleum Institute
- Central Gulf Region Petroleum Technology Transfer Council
- Global Industries, Ltd.
- J. Ray McDermott, Inc.
- U.S. Department of Energy

Edited by Allan Pulsipher

LSU Center for Energy Studies, Baton Rouge, Louisiana

15 items

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An International Workshop on Offshore Lease Abandonment and Platform Disposal: Technology, Regulation, and Environmental Effects

Sponsored by:
U.S. Department of the Interior, Minerals Management Service
(Prepared under MMS Contract 14-35-0001-30794)
and
Louisiana State University, Center for Energy Studies

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American Petroleum Institute
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U.S. Department of Energy

Doubletree Hotel
New Orleans, Louisiana
April 15, 16, and 17, 1996

Edited by
Allan Pulsipher

The Center for Energy Studies
Louisiana State University
Baton Rouge, LA 70803
March 1997

Disclaimer

These proceedings were prepared under contract 14-35-0001-30794 between the Minerals Management Service and the Center for Energy Studies at Louisiana State University. The intent of the proceedings is to record what transpired at the workshop. Its publication does not in any way signify that its contents necessarily reflect the views and policies of either the Service or any other sponsor or cosponsor. Similarly, mention of trade names or commercial products does not constitute an endorsement or recommendation for use. The proceedings have not been reviewed by MMS for either content or compliance with their editorial standards. Issue papers, reports by individual working groups, and plenary speeches and presentations were edited for form only.

Availability

The *Proceedings* will be distributed to all registered workshop participants. A limited number of copies will also be available for distribution within MMS and other sponsoring or copsonsoring organizations. Copies of the proceedings are also available from the Director of Information at the Center for Energy Studies at a cost of $40.00.

Citation

The suggested citation for these proceedings is:

Pulsipher, A. G. (ed) Proceedings: An International Workshop on Offshore Lease Abandonment and Platform Disposal: Technology, Regulation and Environmental Effects, April 1996. Center for Energy Studies, Louisiana State University. Baton Rouge Louisiana. MMS Contract 14-35-0001-30794. 312 pp.

SUMMARY

This Proceedings volume includes papers prepared for an international workshop on lease abandonment and offshore platform disposal. The workshop was held April 15, 16, and 17, 1996, in New Orleans, Louisiana. Included in the volume are several plenary speeches and issue papers prepared by six working groups, who discussed: Abandoning Wells; Abandoning Pipelines; Removing Facilities; Site Clearance; Habitat Management, Maintenance, and Planning; and Regulation and Policy. Also included are an introduction, an afterword (reprinted with the permission of its author, John Lohrenz), and, as Appendix C, the complete report of the National Research Council Marine Board's *An Assessment of Techniques for Removing Fixed Offshore Structures*, around which much of the discussion at the workshop was organized. Short biographies of many speakers, organizers, and chairpersons are included as Appendix A. Appendix B is a list of conference participants.

ACKNOWLEDGEMENTS

Many people were instrumental in organizing and carrying out the workshop. At the Minerals Management Service, Charles Smith, who was the principal contact person, played a major role in the design of the workshop while Bud Danenberger's expertise and active participation contributed greatly to the workshop's success.

The cosponsors of the workshop were the American Petroleum Institute, the Central Gulf Region Petroleum Technology Transfer Council, Global Industries, Ltd., and J. Ray McDermott, Inc.

At LSU, Robert Baumann, Executive Director of the Center For Energy Studies and Managing Director of the Central Gulf Region Petroleum Technology Transfer Council, was a steady source of intellectual as well as financial support. Robert Carney, Director of the Coastal Marine Institute; James Coleman, Executive Vice Chancellor and Marine Board member; and Charles Wilson, Director of the Department of Oceanography and Coastal Science, were invaluable collaborators and participants. Irene Constantinou, Barbara Kavanaugh, and Mike Surman of the Center for Energy Studies staff and Brandi Baechle of LSU's Division of Conferences and Short Courses handled the logistics and publicity of the workshop with efficiency and aplomb. Eleanor Howes' technical editing improved the accuracy and readability of the proceedings immensely.

All of the members of the steering committee were generous with their advice and time, but three deserve special thanks: Paul Versowsky of Chevron Petroleum Technology Co.; Bob Stewart, President of the National Ocean Industries Association; and Peter Veléz, Manager of Regulatory Affairs for Shell Offshore.

Finally, a major reason the workshop was productive was the concise, readable and informed report of the Marine Board of the National Research Council, *An Assessment of Techniques for Removing Offshore Structures*, around which the workshop was organized. All the members of the committee responsible for the report should be acknowledged, especially its Chair, Pat Dunn, and Susan Garbini, who was the NRC's Project Officer for the Committee. With the NRC's permission, the complete text of the Report is included as Appendix C.

Conference Steering Committee

ALLAN PULSIPHER, *Chair*, Center for Energy Studies, Louisiana State University

PAUL BROUHA, Executive Director, American Fisheries Society

ROBERT CARNEY, Director, Coastal Marine Institute, Louisiana State University

LORI CAMERON, Executive Director, The Energy Council

JAMES M. COLEMAN, Executive Vice Chancellor, Louisiana State University

JOHN CULLEN, Health and Safety Executive

WILLIAM E. EVANS, President, Texas Institute of Oceanography, Texas A&M University at Galveston

SCOTT FARROW, Dames and Moore, Inc.

JOHN A. JONES, Exxon Production Research Co

RANDY LANCTOT, Director, Louisiana Wildlife Federation

JAMES LEHMAN, Trunkline Gas

CHARLES SMITH, Engineering and Technology, Minerals Management Service

GENE SPIVEY, Louisiana Department of Natural Resources

TOM SLOCUM, Halliburton/Total Abandonment Services

ROBERT STEWART, President, National Ocean Industries Associates

DANIEL J. SULLIVAN, Manager of Marine Operations, J. Ray McDermott, Inc.

MARY ANN TURNER, Environmental Policy and Programs, Minerals Management Service

PETER VELÉZ, Manager of Regulatory Affairs, Shell Offshore, Inc.

PAUL VERSOWSKY, Chevron Petroleum Technology Co.

DAVE WISCH, Texaco

Chairs and Co-Chairs of Working Groups

I. Abandoning Wells

Chair: TOM SLOCUM, Total Abandonment Services
Co-Chairs: JOHN LOHRENZ, Louisiana Tech
TOM DORMAN, Chevron
CHARLIE KELM, Halliburton

II. Abandoning Pipelines

Chair: KEN BREAUX, Project Consulting, Inc.
Co-Chairs: KURT CHERAMIE, Tennessee Gas Pipeline Company
DON DAVIS, Louisiana State University
REX MARS, Big Inch Marine Systems

III. Removing Facilities

Chair: VANCE MACKEY, III, Chevron Petroleum Technology Company
Co-Chairs: JAMES E. KIESLER, Global Movible Offshore
R. K. (Keith) SMITH, Shell Offshore, Inc.
GREG SCHULTE, Chevron Petroleum Technology Company

IV. Site Clearance

Chair: JOHN D. RULLMAN, Exxon Company USA
Co-Chair: MARIANO HINOJOSA, Louisiana Department of Natural Resources

V. Habitat Planning, Maintenance and Management

Chair: CHARLES A. WILSON, Louisiana State University
Co-Chairs: DON ALLEN, Chevron USA
RICK KASPARSAK, Louisiana Department of Wildlife and Fisheries
HAL OSBORN, Texas Parks and Wildlife

VI. Regulation and Policy

Chair: WIN THORNTON, Twachtman, Snyder & Thornton, Inc.
Co-Chairs: R. SCOTT FARROW, Dames and Moore, Inc.
WYNDYLYN M. VON ZHAREN, Texas A&M University, Galveston
DAVID J. WISCH, Texaco, Inc.

WORKSHOP PROGRAM

Monday April 15, 1996

16th floor

7:30 to 8:00	Registration and Coffee
8:00 to 8:15	Allan Pulsipher, Workshop Chair, Center for Energy Studies, Louisiana State University: Organization and Objectives of Workshop
8:15 to 8:25	Chris Oynes, Regional Director, Gulf of Mexico, MMS
8:25 to 8:45	Cynthia Quarterman, Director MMS, "Present and Future Priorities for Offshore Lease Abandonment"
8:45 to 9:15	Ambassador David A. Colson, U.S. Dept of State
9:15 to 10:15	Tom Gernhofer, Associate Director MMS, Moderator: Panel of Speakers on International Trends and Issues, . Bill Griffin, Phillips and E&P Forum . Clifton Curtis, Greenpeace International . Kent Jeffreys, independent oceans analyst
10:15 to 10:30	Break
10:30 to 11:00	F. Pat Dunn, Chair, Marine Board Study, *An Assessment of Techniques for Removing Offshore Structures*
11:00 to 12:15	Panel on Marine Board Study, Robert Stewart, President, National Ocean Industries Association, Moderator. . Len Ellis, principal analyst for GAO's study of federal lease abandonment . Bud Danenberger, Chief, Engineering and Technology Division, MMS . Mike Craig, UNOCAL, oil and gas industry view and concerns
12:15 to 1:30	BUFFET LUNCH - Paul L. Kelly, Vice President Rowan Companies Inc., and Chairman of the OCS Policy Committee, "Offshore Oil and Gas in the United States: Looking Ahead to the Millennium"
1:45 to 3:00	Introduction to the Tasks and Organization of the Working Groups: Paul Versowsky, Chevron Petroleum Technology Company Moderator -- Ten minute summary of each working group's agenda and issues paper by their respective chairs. . Tom Slocum, Halliburton, Chair of Work Group I - Abandoning Wells . Ken Breaux, Projecting Consulting Group, Chair of Work Group II - Abandoning Pipelines . Vance Mackey, Chevron Petroleum Technology Company, Chair of Work Group III - Removing Facilities . John D. Rullman, Exxon Company USA, Chair of Work Group IV - Site Clearance . Charles A. Wilson, Department of Oceanography and Coastal Studies, LSU, Chair of Work Group V - Habitat Planning, Maintenance and Management. . Win Thornton, Twachtman, Snyder & Thornton, Inc., Chair of Work Group VI - Regulation and Policy

2nd floor

3:00 to 3:30	Break

3:30 to 5:30 INDIVIDUAL WORK GROUPS MEET

WG-I **Abandoning Wells** - Rosedown B
Introduction and objectives, Tom Slocum, Halliburton; Groundrules, Tommy Dorman, Chevron; Agenda, Charles Kelm, Halliburton; General Discussion

WG-II **Abandoning Pipelines** - Rosedown A
Agenda, Ground Rules, Ken Breaux, Project Consulting; Presentation: Regulatory Issues, Don Davis, LA Oil Spill Program. Group Discussion.

WG-III **Facilities Removal** - Madewood B
Agenda, Groundrules Vance Mackey, Chevron; General Discussion

WG-IV **Site Clearance** - Madewood A
Agenda, Discussion, Issues Paper, John Rullman, Exxon and Mariano Hinojosa, LA DNR

WG-V **Habitat Planning, Management, and Maintenance** - Nottoway B
Agenda and Issues Paper, Chuck Wilson, LSU; Presentations: MMS' Reef Program, Villere Reggio, MMS; Louisiana's Program, Rick Kasprzak, LA DW&F; Texas' Program, Hal Osborn, TX P&WL; California Preserve, Daniel Frumkes: North Sea Artificial Reef Opportunities, Gordon Pickens, Auris Environmental.

WG-VI **Regulation and Policy** - Nottoway A
Agenda and Objectives, Win Thornton, TS&T; Policy Issues, Chair Mark Rubin, API; Bud Danenberger, MMS; Bill Griffin Phillips; Brian Shannon, ARCO; Maureen Walker, Dept of State.

6:00 to 8:00 Social at Top of International Trade Center with buffet, soft drinks, cash bar and band.

Tuesday April 16, 1996

16th floor

7:30 to 8:00 Continental Breakfast

8:00 to 9:00 Panel of Speakers on OCS Environmental Law and Regulation: Moderator, Lori Cameron, Executive Director of the Energy Council
- Robert B. Wiygul, Sierra Club Legal Defense Fund
- Barry St. John, Liskow and Lewis

9:00 to 10:15 Panel of Speakers on Financial Issues and Implications: Moderator Mandy S. Williams, Vice President, Global Industries Ltd.
- Accounting Issues, Sean Daly, Arthur Anderson
- Insurance and Bonds, Roy C. Die, Underwriters Indemnity
- MMS Bonding Issues, Robert Stewart, National Ocean Industries Association

2nd floor

10:15 to 10:30 Break

10:30 to 12:00 INDIVIDUAL WORKING GROUP MEETINGS

WG-I **Abandoning Wells** - Rosedown B
MMS and State Regulations Governing Well Bore Abandonments
Overview, Bill Martin, MMS; Cost, impact and minimum requirements, Tom Dorman, Chevron; API Standards and Best Practices, Terry Floyd, Mobil.

WG-II **Abandoning Pipelines** - Rosedown A
Presentation: Contractor's Scope of Work, Jim Macklin, Cal Dive. General Discussion.

WG-III **Removing Facilities** - Madewood B
Explosive Severing's Impact on Marine Life, Chair Greg Schulte, Chevron.
Presentations: Regulations and Impacts on Marine Life, Gregg Gitschlag, NMFS; Costs, Vance Mackey, Chevron; Explosives, Dave Siggers, Hitech and Alan Powell, U of Houston.

WG-IV **Site Clearance** - Madewood A
Presentations: Verification, Butch Ventura, CNG; Debris distribution and depth of verification trawling, Mike Parker, Exxon.

WG-V **Habitat Planning, Management and Maintenance**
Environmental Session - Attend WG-III on Impacts of Explosives (10.30-11:30) in Madewood B, then Panel Discussion on Explosives Impact and Bottom Cleanup, in Nottoway B - Ann Bull, MMS, Chair (11:30-12.00)

WG-VI **Regulation and Policy** - Nottoway A.
Regulatory Issues, Dave Wisch, Texaco Chair
Presentations: Mark Carr, UC Santa Barbara; Mike Craig, Unocal; and Brian Twomey, Reverse Engineering.

<u>16th floor</u>

12:00 to 1:00 BUFFET LUNCH - Bob Armstrong, Asst Secy. Land and Minerals Management, Dept of Interior, "Management of Federal Offshore Lands in the Public Interest"

<u>2nd floor</u>

1:00 to 3:00 INDIVIDUAL WORKING GROUP MEETINGS

WG-I **Abandoning Wells** - Rosedown B
"Best Practices, New Technology and Economics" Tom Slocum, Chair.
Presentations: Best Practices, Charles Kelm, Halliburton; P&A Economics, John Lohrenz, Louisiana Tech; Cementing Technology, Ronnie Faul, Halliburton; Explosives, Tommy Dorman, Chevron. Panel/Group Discussion.

WG-II **Abandoning Pipelines** - Rosedown A
Presentation: Special Fittings, Rex Mars, Big Inch Marine Systems.

WG-III **Removing Facilities** - Madewood B
"Pile and Conductor Severing"
Presentation: Current Severing Techniques, Greg Schulte, Chevron; Diver Cutting, Rick Bucher, Cal Dive; Abrasive Cutters, Jim Allen, HCS; Explosives, John Kenny, Senior Demex.
Panel/Group Discussion.

WG-IV **Site Clearance** - Madewood A
Presentations: Disposition of fish/shrimp taken in clearance/verification, Brandt Savoie, LA DW&F; Orphaned Sites, Earnest Burguieres, Former Com Conservation, LA DNR.
Site Clearance Summary Panel.
Fisherman's Gear Compensation:
Presentations: Snags, Ronald Dufrene, Shrimping Industry; Claims Verification and Hangs, Michael Warr, LA DNR.

WG-V **Habitat Planning, Management and Maintenance** - Nottoway B
"Permitting Session"
Presentations: MMS Regulations and toppling, standing in place and cutoff, Ann Bull, MMS; Corps of Engineer regulations and artificial reefs, Barton Rogers, ACOE; Coast Guard Regs, Rick Harrison, CG; Depth and platform fish, Dave Stanely, LSU; Liability, Fred Whitrock LA DNR; Cutoffs and remain in place, Jan Culbertson, TX P&WL. Panel/Group Discussion.

WG-VI **Regulation and Policy** - Nottoway A
"Environmental Issues"
Chairs: W.M. von Zharen, Texas A&M, Galveston and William E. Evans, Texas A&M, Galveston.

3:00 to 3:30 Break

3:30 to 5:00 FINAL INDIVIDUAL WORKING GROUP MEETINGS

WG-I **Abandoning Wells** - Rosedown B
"Liability and Environmental Issues"
Presentations: Best Practices, Charlie Kelm, Halliburton; MMS regs, Bill Martin, MMS; Special cementing slurries, Craig Alexander, Amerada Hess; Panel/Group Discussion.

WG-II **Abandoning Pipelines** - Rosedown A
Presentation: Case Study, Pipeline abandonment and pipeline reroute, Ken Breaux, Project Consulting.

WG-III **Removing Facilities** - Madewood B
"Deep Water Abandonments"
Presentations: GOM deep water platforms, George Sgorus, Shell; MMS regs and deep water, Felix Dyhrkopp, MMS; North Sea deep water abandonments, Joseph Gebara, Amoco; Panel/Group Discussion.

WG-IV **Site Clearance** - Madewood A
Fisherman's Gear Compensation (continued)
Presentation: Proactive ideas to remove hangs, Beau Martin, B&J Martin.
Fisherman's Gear Compensation Panel Summary and Discussion.

WG-V **Habitat Planning, Management and Maintenance** - Nottoway B
"Program Operation"
Presentations: Regional authority, sanctuaries and ocean ranching, Scott Nichols, NMFS; Encouraging monitoring, Ron Lukens, Gulf States Marine Fisheries Com; Industry perspective on Reef Programs in GOM, Don Allen, Chevron; Platforms and fish populations, Ann Bull, MMS; Habitat in OCS Deepwater Environments, Robert Carney, LSU CMI. Panel/Group Discussion, Hal Osborn, Chair.

WG-VI **Regulation and Policy** - Nottoway A
"Economic Issues" R. Scott Farrow, Dames&Moore, Chair.
Presentations, Walter Keithly, LSU; Tracy Lewis, U of Florida; Rodney Weiher, NOAA.

Wednesday April 17, 1996

16th floor

8:00 to 10:30 Summary of Discussion, Conclusions and Recommendations by Chair of each Working-Group
- Tom Slocum, Halliburton, Chair of Work Group I - Abandoning Wells
- Ken Breaux, Projecting Consulting Group, Chair of Work Group II - Abandoning Pipelines
- Vance Mackey, Chevron Petroleum Technology Company, Chair of Work Group III - Removing Facilities
- John D. Rullman, Exxon Company USA, Chair of Work Group IV - Site Clearance
- Charles A. Wilson, Department of Oceanography and Coastal Studies, LSU, Chair of Work Group V - Habitat Planning, Maintenance and Management
- Win Thornton, Twachtman, Snyder & Thornton, Inc., Chair of Work Group VI - Regulation and Policy

10:30 to 11:30 Response to workshop findings and recommendations by panel
- Robert Carney, Director, Coastal Marine Institute, LSU
- Bud Danenberger, Chief, Engineering and Technology Division, MMS
- Randy Lanctot, Executive Director, Louisiana Wildlife Federation
- Gary Magnuson, Center for Coastal Physical Geography, NOAA
- Robert Visser, Belmar Engineering

11:30 to 12:30 General Response and comments from members of workshop and wrap-up.

12:30 Summary and Adjourn - Allan Pulsipher

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INTRODUCTION

Nearly 500 top Minerals Management Service (MMS) officials, state regulators, offshore platform operators and contractors, fishermen, shrimpers, assorted academics, and environmentalists met in New Orleans on April 15 through 17, 1996. The group gathered under the title, "An International Workshop on Offshore Lease Abandonment and Platform Disposal: Technology, Regulation, and Environmental Effects." Their objectives were: 1) to discuss the recommendations of the March 1996 report of the National Research Council's Marine Board Committee, *An Assessment of Techniques for Removing Offshore Structures* and 2) to consider related issues associated with the removal and disposition of offshore platforms and pipelines.[1]

The objective of this volume is to summarize the information, analyses and recommendations that were discussed at the workshop. Following this introduction, the rest of this volume is organized into seven sections. The first section includes some of the principal talks or discussions of the plenary sessions of the workshop. The second through seventh correspond to the six working groups. Papers prepared for specific working groups are included in that section, whether they were discussed in that section or prepared following the workshop as comments.

Some working groups provided a structured and documented record; others chose group discussion rather than documentation. Regardless of the approach used, each of the working groups was successful and represented a significant contribution of time and effort on the part of those involved.

Appendices include biographical information on speakers and working group chairs and committees, a list of attendees, and the full text of the Marine Board report.

Words Matter

Although the conclusions and recommendations of the *Marine Board Report* were largely endorsed at the workshop, there were surprises. The biggest was the wide agreement that the words used for decades by MMS and the U.S. oil and gas industry to refer to the processes being discussed (i.e., "platform abandonment" and "disposal") were misleading and counterproductive and, therefore, needed to be changed.

In the Gulf of Mexico, where more than 4,000 of the world's 7,000 plus platforms are located, retired offshore platforms are either taken ashore to be reused and recycled or cleaned to the bare steel and sunk as artificial reefs to provide habitat for marine life. If explosives are used, the platform removal process is monitored by observers approved by the National Marine Fisheries Service (NMFS). The observers are to make sure that no endangered turtles or marine mammals are harmed. After removal, the sea bottom is trawled twice at perpendicular angles to insure that no debris remain. Finally, the liability of operators for offshore facilities is perpetual. If a platform or pipeline is sold, previous owners are still responsible for well plugging, platform and pipeline decommissioning, and site clean-up should the current owner be bankrupt or otherwise unable to perform. These procedures and practices reflect meticulous care of the environment.

Bill Griffin of Phillips Petroleum, representing the North Sea-based E&P Forum, pointed out the fact that to the person in the street "abandonment" suggests irresponsibility—like leaving a junk car in the dead of night in someone else's woods—while "disposal" has become a much-used euphemism for dumping. Referring to the process of removing retired offshore platforms by these terms inadvertently transfers their negative connotations to it. In addition, they are misleading terms to use with reference to a process that is so carefully regulated and monitored. Griffin's argument that "abandonment" and "disposal" are inaccurate and misleading terms was sufficiently persuasive that by the final day of the workshop most participants had followed, conversationally, his suggestion and were routinely substituting "decommissioning" for "abandonment."

In retrospect, a more accurate title for the workshop would have been, "Offshore Platform and Pipeline Removal and Recycling, Sea Bottom Clean Up and Marine Habitat Preservation."

Issue Papers and Working Groups

The workshop was planned by a steering committee representing a number of stakeholders with varied experience. They are identified in the front matter of these *Proceedings*.

As mentioned previously, the workshop was carried out largely through six "working groups." The chair of each group prepared an issues paper which, along with the Marine Board report, was sent in advance to the workshop participants. Each working group chair also developed an agenda and *modus operandi,* as well as a summary of the group's findings and recommendations. Chairs and Co-chairs of working groups are listed in the front matter, and committee members for each working group are identified in their respective sections of the report.

About half of the time available at the workshop was allocated to discussions and presentations within each working group. The other half was used for plenary speakers, many of whose remarks are also included in this volume, and reports by each working group to the workshop meeting as a whole.

Participants seemed to believe the workshop was a good use of their time. Although careful preparation by each of the working-group chairs was the major factor explaining the workshop's success, superb weather and buoyant energy prices also contributed.

Objectives

The mix of perspectives and experiences in each of the working groups varied, but each group tried to identify industry practices, governmental regulations, or related scientific or engineering uncertainties that, if changed or resolved, would improve MMS' ability to manage and plan for the development of the federal OCS. The working groups were asked to do this within the following framework of public policy goals or tests.

1) Minimize costs for operators, energy consumers, and taxpayers.
2) Identify, avoid, or mitigate negative effects on marine life and marine ecosystems associated with lease abandonment, pipeline and platform disposition practices, or regulations.
3) Promote wise use of marine habitat over the long term through habitat preservation, planning, and management.
4) Encourage optimal development, conservation, and recovery of the petroleum resources found in marine environment through efficient markets, regulations, and laws.
5) Stimulate the efficient, equitable, and balanced development and management of all marine resources and uses by reconciling lease abandonment and disposition practices with the aspirations of other ocean users such as recreational and commercial fishermen and shrimpers.

Viewed in isolation, each individual criterion meets the basic test of common sense and is widely accepted. The rub comes when satisfying one test interferes with accomplishing another. As in life, the 'real' test is how policies affect the trade-offs that inevitably have to be made.

A Central Trade-Off

Explosives are the technology of choice for cutting structural platform elements and well conductors because they are cheap, safe, and reliable. But explosives used in amounts routinely approved under MMS' generic permit would kill almost all of the sea turtles, marine mammals, and fish resident at the platform at the time of the explosion. However, as explained below, MMS' permits also include provisions which have proved very effective at protecting sea turtles and marine mammals. Thus the central trade-off, in essence, has been reduced to explosives or fish.

Using nonexplosive techniques such as abrasive, mechanical, or diver cutting will protect fish but, on average, about double the cost of decommissioning the platform to the operator (who, eventually, will pass it on to the consumer or stockholder) while, most offshore experts believe, increasing the risk of injury and death to divers and other offshore workers.[2]

A number of questions need to be answered to "make," or evaluate intelligently, the explosives/ nonexplosive trade-off. For example:

- Is the explosives/nonexplosive trade-off one that we can leave to the marketplace, or are important elements of the public interest involved?
- How much are we willing, or should we be willing, to pay to protect resident marine life?
- Should turtles, marine mammals, and fish receive equal weight in this comparison?
- How should the increased risk of accidents causing injury or death to humans that is associated with using nonexplosive techniques be factored in?
- Should explosive techniques simply be prohibited unless it can be demonstrated that nonexplosive ones are unsafe or impractical?

At the moment, the implicit answers to most of these questions lie in existing laws and regulations.

The Endangered Species and Marine Mammals Acts, in effect, compel offshore operators, if necessary, to go to considerable expense to protect sea turtles and marine mammals from the effects of explosions. The National Marine Fisheries Service's Observer Program requires that operations involving explosives stop until all sea turtles or marine mammals are out of harm's way, regardless of the costs (which may run as high as $100,000/day) of keeping specialized equipment like derrick barges at the site. If protected turtles or mammals do not leave the danger zone, the operator may have no choice but to use nonexplosive technologies to remove the structure.

Fortunately, the evidence is quite persuasive that the NMFS's observer program has successfully mitigated the risks of explosives to sea turtles and marine mammals at a relatively modest expense. Strategies for reducing that expense even further are outlined in the Marine Board report and were discussed and extended at the workshop, but the adjustments are matters of "how much," not "whether."

In contrast, fish resident at platforms are neither endangered nor mammals and are not protected by existing legislation or regulations. Therefore, trade-offs involving fish mortalities from explosives are a different matter. Legislation exists at both the state and federal level requiring planning to encourage and enable responsible management of fish stocks or populations. But, given the relative insignificance of the numbers of fish killed annually by explosives at platform decommissioning compared to the number "harvested" intentionally by fishermen or unintentionally killed as part of an unwanted by-catch during shrimping and trawling, it is neither practical nor economically efficient to try to use fisheries management legislation as the foundation for new policies to regulate platform decommissioning.

Concern about fish killed during platform decommissioning operations surfaced repeatedly during the deliberations of the committee the Marine Board appointed to evaluate the effects of the explosives on the marine environment--as it did during the workshop. The committee concluded, however, that more information should be systematically gathered before regulatory recommendations could be made.

Working Group Wisdom

The papers prepared by each working group are reproduced in the third section of this volume. Each working group modified the methods and tests described previously to fit its own focus and method of operating. Some followed the framework closely, others only occasionally.

The working groups were asked to try to find 1) industry practices, by all industries involved, not just oil and gas, 2) specific federal or state regulations, or 3) managerial, scientific, or engineering questions that, if appropriately modified or resolved, would better satisfy the five public policy goals enumerated previously. In addition, the working groups were requested to specify any additional research or policy analysis that in their judgment would be required or useful in improving industry practices, regulations, or policies.

Response to the Marine Board's Report

A principal objective of the workshop was to disseminate and discuss the report by the National Research Council's Marine Board entitled *An*

Assessment of Techniques for Removing Offshore Structures, hereafter called "the Report."

The scope of the Report was intended to be limited to the effects of the explosives used in the decommissioning process on marine life and the marine environment. The Report summarized the information and deliberations of a committee composed of experts. The members of the committee included analysts specializing in aspects of the marine environment, explosives, and economics as well as individuals drawn from the offshore construction and oil and gas industries.

The Report itself was sent to all workshop participants in advance of the workshop. The chair of the Committee was Pat Dunn, who summarized the Report at the workshop. The Report was sponsored by the Marine Management Service, and its full text is reproduced as Appendix C of these proceedings.

The clear consensus at the workshop was that the information and analyses in the Report were accurate, balanced, and persuasive. Although the topics covered in the Report were central to the workshop, the scope of the workshop extended considerably beyond the scope of the Report.

The overlap of the Report and the workshop was greatest for Working Groups Three and Five—Removing Facilities and Habitat Planning, Maintenance, and Management. However, there was little in the Report on well or pipeline decommissioning or site clearance—Working Groups One, Two and Four.

The Report was summarized by dividing the committee's judgments and observations into findings, conclusions, and recommendations. Although working group discussions touched on each of these three categories, the following section relates workshop discussions to each of the 11 recommendations made in Chapter Six of the Report.

Recommendations for the Minerals Management Service

Recommendation 1:[3]

Change the minimum depth at which structures or well conductors must be severed from the current depth of 15 feet below the mudline to 3 feet below the mudline, provided that platform removal measures are employed that do not increase adverse environmental effects. Such measures include nonexplosive techniques, reduced charges, fish scare devices, or other effect mitigating methods. A 3-foot requirement would be consistent with regulations for the burial of pipelines as well as extensive research indicating that a 3-foot limit would provide ample protection against exposure of the remaining structural elements by erosion or scouring of the seabed.

Both the committee responsible for the report and the external reviewers regarded this recommendation as a noncontroversial but important recommendation. Surprisingly, it did not garner as much support at the workshop as they anticipated.

Bud Danenberger of the Minerals Management Service, in remarks during a plenary session, said the rationale for the change was to encourage the development and use of nonexplosive or advanced (smaller charge) explosive technologies in order to reduce future fish fatalities via bulk explosive charges. But Danenberger questioned the implicit trade-off. He asked: Should technologies to protect fish be encouraged if they increase the risk to humans? Or, conversely, why should use of bulk explosives be discouraged if they have the best safety record? Human safety, he argued, should be the overriding concern and should not be compromised by other objectives that regulators, interest groups, or operators may have.

The 15-foot cutoff depth, Danenberger said, was a conservative engineering standard that allowed for further cuts below the mudline should the initial attempt at fifteen feet fail. If bulk explosives do not complete the cut at minus three feet, what is the alternative? It may be impossible to place a new charge at three feet or deeper because of the damage of the first detonation, and cuts could not be made, legally, at a shallower depth.

In shallow areas with muddy bottoms, natural scours could expose elements cut at minus three feet, Danenberger said. Moreover, the danger to trawls and ships would be much greater if a perpendicular structural element was exposed, as contrasted to a structural element parallel to the bottom such as a pipeline.

These observations echo another trade-off or theme articulated in different contexts elsewhere in the workshop: the policy tradeoff between case-by-case regulations which take into account individual circumstances and characteristics as opposed to general or generic regulations requiring industry-wide uniformity. The former are usually more efficient in terms of costs incurred by the regulated but more expensive for the regulator to administer. Conversely, generic regulations often result in arbitrary and costly standards for individual cases but are usually easier and cheaper for the regulators to administer.

Working Group Three, specifically dealing with facilities removal, agreed with Danenberger's caution that a minus three foot cut depth may be too shallow in some areas of the Gulf of Mexico and recommended it not be promulgated as an across the board standard. However, they also agreed with the Report's finding that a minus 15 foot requirement was clearly too deep for advanced explosive or nonexplosive techniques to be developed or to become competitive with severing by bulk charge explosives.

Recommendation Two:

The Minerals Management Service should work with industry representatives, explosive experts, and other interested parties and user groups to develop guidelines for determining the size of explosive charges necessary for cutting a specific structural element.

Recommendation Four:

The Minerals Management Service should remove the limit of a maximum of eight detonations at any one time during the removal process, but retain the requirement of a 0.9-second delay between individual detonations.

Recommendation Five:

The Minerals Management Service should incorporate into the permitting process the flexibility, including necessary request procedures, to encourage testing of removal techniques that could reduce the risk to living marine resources.

These recommendations are interrelated, and it makes sense to discuss them as a group.

The weight and frequency limits on explosives in the current MMS regulations were implemented to reduce the risks to turtles and marine mammals. Because of the success of the observer program at mitigating risks to turtles and marine mammals, in the Report these measures, implicitly, were evaluated by their effects on fish.

For fish, the effects seem to be the reverse of those intended; i.e., the regulations tend to increase rather than decrease the number of fish killed.

As both the Report and workshop discussion pointed out, charges of up to 50 lbs are routinely approved under a generic permit. This, coupled with the facts that explosives are relatively inexpensive and that delays caused by having to set and detonate a second charge can be very expensive, has resulted in the 50-lb bulk charge becoming not only the maximum allowed by MMS' generic permit but also the minimum used in practice by the oil and gas industry.

If the 50-lb charge is too small to make the desired cut or if more than eight detonations are required to remove the platform, a second set of detonations will be required. Fish killed in the initial explosion will act as chum and attract fish from the surrounding area,which will be killed by subsequent explosions.

Moreover, as Working Group Three pointed out, the 50-lb limit was set when the platforms being removed were small and in shallow water. Larger platforms in deeper water may well need larger charges. It is true that deviations from the limits of the generic permit can be requested but, according to Working Group Three, this usually results in a delay of at least six months.

Recommendation Three:

The Minerals Management Service should allow removal of structures in 300 (or more) feet of water, with a cut at least 85 feet below the water surface, when nonexplosive or advance

explosive techniques are used. If the top of the remaining structure is 200 feet or more below the water surface, a buoy should be installed and maintained.

There was not extensive discussion of partial removal in the Report. It was linked with "toppling in place" or "leaving in place" as disposal strategies which both enhance the marine habitat and lower costs to operators. At the workshop, however, new research was reported in Working Group Five which indicated that the upper part of the platform provided most of the habitat for valuable reef fish. Toppling large platforms in place, e.g. platforms located in waters deeper than 300 feet, Working Group Five suggested, would provide little if any additional habitat for economically important reef fish. Similar questions were also raised about platforms partially removed or toppled so far from shore that few recreational fishermen were likely to visit them.

The key issue raised by this discussion is whether measures to enhance or protect habitat that benefit recreational or commercial fishermen are a necessary condition for disposing of a platform at sea, or whether such action could be justified by other criteria such as savings to operators and additional revenues for the relevant coastal state.

Recommendations for the National Marine Fisheries Service (NMFS)

Recommendation Six:

The NMFS, MMS, and appropriate state agencies should maintain the procedures of the existing Marine Mammal and Sea Turtle Observer Program, including the ban on night-time detonations, but shorten the required period of observation from 48 to 24 hours prior to detonation. The 48-hour timeframe is costly in terms of human resources and support equipment and does not produce any additional benefits over a 24-hour timeframe.

All of the working groups urged retention of the Observer Program, and none reported any disagreement with shortening the observation period. Working Group Three, however, pointed out that a majority of the sightings (of sea turtles and marine mammals) took place during the one hour aerial survey conducted immediately prior to the scheduled detonation. The Working Group also identified ambiguities and inefficiencies in the post-detonation survey which the Report did not consider.

Recommendation Seven:

NMFS, MMS, and appropriate state agencies should systematically gather more information to augment available information about the species, numbers, and age distribution of fish killed and fish surviving when platforms are removed by explosives.

The discussion in the Report makes clear that in addition to such tabulations of fish affected by explosions, research is needed on acoustic systems to "scare" or otherwise encourage fish to remove themselves from the danger zone around the platform. Working Group Three, while endorsing more research, raised the question of the allocation of such research between descriptive studies and applied research to remove sea turtles, marine mammals (neither of which appear to be a major problem) or fish from the danger zone during detonations of explosives. The Report did not indicate how or if such information should be used to modify existing policies.

Recommendations for the Offshore Industry

Recommendation Eight:

The offshore industry should develop a guidebook through appropriate industry-supported groups for using explosives in the platform removal process. The guidebook should deal with issues of reliability, environmental effects, and mitigation strategies including tradeoffs between depth of placement, size of charges, and associated environmental effects.

Discussions at the workshop were supportive of the development of such a guide, but several pointed out that before it could be developed, a decision would have to be made as to how effects on fish were to be evaluated. If they are not given the same or similar status as effects on sea turtles and marine mammals, what is the appropriate standard? As indicated, this observation is also relevant to the previous recommendation.

Recommendation Nine:

The offshore industry should sponsor and support programs to explore the feasibility and cost effectiveness of means of keeping fish, including the grouper/snapper complex, at a safe distance from removal operations.

This recommendation is quite similar to recommendation seven; but, in addition, it clearly infers that it may be desirable to elevate the status of some species of fish through regulation, or at least, do the research necessary to see how much it would cost to do so.

Recommendation Ten:

The offshore industry should investigate means of incorporating safe removal techniques and the reduction of environmental damage in the initial design [of the platform].

Although discussed by the committee and at the workshop, designs that would make removal safer and more environmentally benign are in gestation rather than readily available to the industry. Assurance of shorter-term stability and integrity has traditionally been valued much more highly than any of the financial or environmental effects associated with platform removal, simply because of the logic incorporated into the decision-making models used by platform operators--especially the use of discounting to convert cash flows over time into present values. There was little discussion in the committee or at the workshop as to how this recommendation would or could be implemented.

Recommendations to State Agencies

Recommendation Eleven:

Appropriate state agencies should evaluate the existing state-administered artificial reef programs to enhance their potential for accommodating more platforms (by increasing the number of sites, for example) as well as their potential for providing commercial, recreational, or environmental benefits to other ocean users. The evaluation should include consideration of potential liability as well as the longer-term issues raised by the eventual loss of marine habitat.

Less than ten percent of the platforms taken out of service in the Gulf of Mexico have been transformed into artificial reefs. The reasons for this apparently low rate of transformation are largely economic. Most of the platforms that have been removed were located in relatively shallow water, close to shore. Thus it was cost effective to take them to shore for salvage or reuse. As larger platforms in deeper waters further from shore are retired, the benefit to operators of being able to convert them to artificial reefs grows.

This recommendation was somewhat tangential to the charge given to the committee responsible for the Report. Thus there is only limited discussion of it in the Report. However, it was a recurring topic in the committee's deliberations, and when the workshop was planned there was unanimous agreement by the steering committee that a working group should be organized to discuss artificial reef and habitat issues. Working Group Five was organized and included administrators responsible for the leading programs as well as the principal academic experts.

Findings and Recommendations Beyond the Scope of the Report

The focus of the committee responsible for the Report was the effects of the uses of explosives on the marine environment. There are aspects of the decommissioning process, other than explosions, that have important effects on the marine environment--as well as aspects of the use of explosives that were not covered in the Report.

As an example of the latter, the members of Working Group One, who dealt with abandoning wells, concluded it was important to find out if explosions during the platform decommissioning process could affect the integrity of the well-plugging process that precedes the removal process. This possibility, as well as other conclusions, caused the working group to question whether meeting MMS requirements for well abandonment was a fully adequate criterion for establishing "best industry practices."

All of the key questions, findings and recommendations for each working group are found in their respective sections of the proceedings. However, in two areas falling outside the scope of the Report, the Working Groups seemed to be especially successful in raising questions that are important for decommissioning policy—Site Clearance, and Habitat Planning, Management and Maintenance.

Site Clearance

After twenty or thirty years of operation, the sea bed around an offshore platform will become littered with objects purposely or accidentally dropped off the platform as well as with remnants of the drilling process. Hidden from view, this accumulation usually is of no concern until the platform is retired from service and removed. Then, if the accumulated debris are not removed, other ocean users, particularly, fishermen trawling for shrimp, can snag their nets.

In state as well as federally controlled waters, governmental funds have been established to reimburse fishermen when their nets are damaged by snags attributable to oil and gas operations. The Working Group agreed that all stakeholders would benefit if the site clearance policy emphasis could be changed from compensation to prevention. Thus, they concluded, a proactive policy of locating and removing snags rather than the current passive practice of providing compensation to fishermen for nets snagged or lost was needed to prevent the need for continual compensation in the future.

One key to such an approach is creating effective incentives for snags to be promptly reported so they can be either removed or properly marked in a timely manner. The group cited a number of disincentives created by current regulations. When marine debris are recovered in fishermen's nets, for example, standard operating procedure under current law is to dispose of such debris overboard, at sea, because if they were to be brought ashore, the fishermen would be responsible for any costs associated with their disposal. Rather than assessing penalties, efficient regulations might pay bounties for identifying or removing significant snags or debris.

The Group cited other examples of this sort where relatively minor changes in regulations could reduce future costs to both platform operators and fishermen.

Realizing the political and regulatory difficulties of implementing changes in procedures and regulations, the Site Clearance Working Group also recommended that a "coalition" of ocean users be established to analyze and work for the implementation of such changes. Such a group was organized by members of the Working Group and has met several times since the Workshop was held.

Habitat Planning, Maintenance, and Preservation

Artificial reef programs in the Gulf of Mexico are widely regarded as a natural resource success story—a well-publicized "win/win" for the offshore oil and gas industry and the recreational and commercial fishing industry. But, surprisingly little research has focused on the optimal dimensions of the artificial reef phenomena over the longer term. For example, there are no estimates of how many platforms are likely to be converted to artificial reefs over the next ten or twenty years under current regulations. Similarly, surprisingly little research has focused on aspects other than the pure fisheries considerations such as the habitat and productivity of artificial reefs.

A research finding reported at the workshop that has major policy implications was that the upper 200 feet of a standing platform harbored almost all of the fish of interest to recreational or commercial fishermen. Thus, the working group concluded, while partial removal of platform located in deep water (say 400 feet for example) was accomplished by cutting the structure at 85 feet below the water surface, the remaining structure would provide habitat and thus satisfy traditional criteria defining an artificial reef. However if the same platform were toppled in place or cut below 200 feet from the surface it would not satisfy the criteria and probably should be classified, according to the working group as "ocean dumping."

Further, since such "ocean dumping" would most likely be prohibited, the operator would have to cut 15 feet below the mudline and tow it either to the shore or to an authorized artificial reef site, or raise the cut "far enough" above the 200-foot cut depth to preserve significant habitat for fish—provided the platform was located in an approved area for artificial reefs.

From a public policy perspective, this hypothetical example begs the question: Should the traditional fisheries habitat criteria be dispositive? Savings to the operator of disposing of a large platform in deep water, either through partial removal or toppling in place are likely to be very substantial. Under current arrangements these savings are split evenly with the state. Thus policies or regulatory criteria which have the effect of discouraging or precluding toppling or sinking in deep water have direct costs to operators and consumers as well as an opportunity cost to the state equal to the share of the savings it would receive if the platform were disposed of at sea. Efficient public policy requires that these costs be compared with the benefits derived from disposing of the platform on shore or at an alternative, habitat-providing destination.

The members of the Working Group on Habitat Planning, Maintenance, and Preservation, by and large, seemed to be satisfied with the traditional, habitat-providing criteria currently being used to plan and manage artificial reef sites. Nevertheless, they raised and discussed many of the problems that will become more consequential as development moves further from shore into deeper and deeper water. At present almost 600 platforms are located in water deeper than 150 feet and nearly 200 in water deeper than 250 feet.

Cross-Cutting Policy Themes

Most of the workshop discussion dealt with pragmatic, incremental improvements to existing industry practices and regulations; however, arguments for new and broader alternatives and approaches and dissents from the conventional wisdom emerged in a number of contexts.

Environmentalists' Perspectives on Decommissioning Policy. Perhaps the broadest as well as the most fundamental disagreement with current policy was outlined by Clifton Curtis of Greenpeace. Curtis' remarks are particularly relevant because Greenpeace has been the most visible and vocal environmental group concerned with offshore platform decommissioning and disposition issues. Greenpeace was the lead organization developing and publicizing the case against the disposition of the Brent Spar storage facility in the deep ocean, which led to the boycott and subsequent cancellation of the plan.

Clifton Curtis, a principal oceans advisor to Greenpeace, articulated the reasoning and value judgments behind the group's position with admirable precision and detail in a list of 19 points which is included in the next section of these proceedings. He told the workshop that explosives should be prohibited completely because of uncertainty about their effects on fish populations, as described in the Marine Board Report. However, much more fundamentally, Curtis argued that no additional platforms should be installed because they facilitated burning of fossil fuels, which would have to be curtailed drastically in the future to protect the environment and global climate.

Another speaker who addressed the workshop in plenary session from an environmental perspective was Robert Wiygul of the Sierra Club Legal Defense Fund. Wiygul, who authored a widely praised article on environmental regulation on the OCS,[4] cautioned the workshop that practices and policies developed in the Gulf of Mexico were not good precedents for regulating abandonments in other, newer, offshore areas. He argued that, in addition to physical differences, the Gulf is an old province, developed when public awareness and attitudes were much different. Now environmental concerns of the general public are both more intense and more generic. Wiygul also argued that environmentalists would continue to seek legislative or political expressions of their concerns because oil and gas industry expertise dominated the regulatory process.

Uniform v. Site Specific Regulations. Another perspective that emerged in several different contexts during the workshop was that specific, case-by-case regulation tailored to individual conditions should be substituted for broader, uniform, generic treatment.

Robert Visser, a veteran offshore analyst, argued that uniform regulations were inherently inefficient and should be replaced by regional regulations—even in the Gulf of Mexico. A minus 15 foot cut depth requirement may make sense in the areas of the Gulf that are so muddy it is difficult to distinguish where the water ends and soil begins. But, Visser maintained, such a cut depth requirement makes no sense in parts of the Gulf with hard bottoms or in California or Alaska's Cook inlet where there is little possibility of scouring.

Visser says that his argument also applies to international regulations. For example, the International Maritime Organization (IMO) requires retired fixed structures to be cut at 55 meters—which may be efficient in some locations but makes no sense in the Cook Inlet because the inlet is not navigable by ships with drafts greater than 35 feet.

As indicated previously, the trouble with case-by-case regulation is that it increases the direct costs of regulation to both the regulatee and the regulator. Although almost all MMS regulations have clauses providing for exceptions at the discretion of agency officials, such clauses are used only infrequently because it is usually cheaper to comply with standardized rules than to pay the costs of delay and additional paperwork associated with seeking an exception.

Incentives v. Regulation. An idea related to case-by-case regulation is the substitution of incentives or better information for regulation, so that unregulated behavior responding to the new information or incentives created produces the desired result--socially as well as privately. This approach is the reverse of the perverse incentives created by the generic permit specifying weight and number limits on explosive detonations, intended to protect turtles and marine mammals, that ends up killing more fish than would be the case without the regulations.

The discussion in Working Group One on well abandonment provides another example of how incentives work. The Working Group discussed whether satisfying current MMS regulations governing the well plugging and abandonment process was sufficient to meet the "best practices" standards of the industry. This may seem like a "man-bites-dog" sort of conclusion to many industry observers. But, from the standpoint of the perpetual liability current law places on the owners of the well, such regulatory "over achievement" may simply be prudent behavior that makes good business sense. Further, it illustrates how incentives (in this case, perpetual liability) may make regulation unnecessary or, in this case, irrelevant.

Site clearance appears to be an aspect of platform and pipeline decommissioning where better information and the use of incentives might be usefully substituted for traditional regulation. Although in theory all snag reports are collected by the Coast Guard and disseminated by their Notices to Mariners, at the workshop shrimpers and fishermen said such notices are received too infrequently to be useful and that vessels kept their own snag lists. Clearly, in the age of the internet such information can be collected and disseminated more efficiently—especially if an appropriate incentive scheme can be implemented to encourage those encountering snags to remove them (if feasible) or to report them to the appropriate authority.

Property Rights for Ocean Resources. At a higher level of abstraction, many of the problems discussed at the workshop can be analyzed by looking at them as departures from the arrangements used to govern the use, preservation, and disposal of resources in most aspects of society—property rights. The habitat benefits that platforms provide fish valued highly by fishermen, for example, enter the plans and calculation of those responsible for the operation and decommissioning of a platform only in a minor way via possible public relations effects.

If the platform operators owned the fish in the water column as well as the platform, thereby being able to prohibit, sell, or otherwise regulate attempts by others to try to catch them, estimates of the economic returns the value of the fish would enter into decisions made about operating and decommissioning platforms. In Japan, as Michael De Alessi of the Competitive Enterprise Institute points out in his contribution to this volume, near-shore sea bed is often under the control of fishing cooperatives, whose members often develop artificial reef programs to enhance the productivity of fishing grounds they control. Although technical and legal problems would have to evaluated and solved, such an approach may preserve more of the artificial reef habitat the oil and gas industry has created in the Gulf than traditional public regulation—which thus far has followed a conservative, slow growth strategy.

Notes

1. Committee on Techniques for Removing Fixed Offshore Structures, Marine Board, Commission of Engineering and Technical Systems, National Research Council. Washington D.C. National Academy Press, 1996. Where after referred to as the Report.

2. A.G. Pulsipher, J.E. Kiesler, V. Mackey, and W. Daniel, "Explosives Remain Preferred Method for Platform Abandonment," *Oil & Gas Journal*, May 6, 1996.

3. All recommendations are taken verbatim from chapter six of The Marine Board Report.

4. Robert Wiygul, "The Structure of Environmental Regulation on the Outer Continental Shelf: Sources, Problems, and the Opportunity for Change," *Journal of Natural Resources and Environmental Law*, v. 12, 1992.

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PLENARY ADDRESSES

- **Cynthia Quarterman**, *Director, U. S. Department of the Interior Minerals Management Service*
  "Present and Future Priorities for Offshore Lease Abandonment"

- **Ambassador David A. Colson**, *Deputy Assistant Secretary for Oceans, U. S. Department of State*
  "Statement before the International Workshop on Offshore Lease Abandonment and Platform Disposal"

- **W. S. Griffin**, *Phillips Petroleum Company and E&P Forum*
  "Decommissioning Offshore Structures - Projects and Policy"

- **Clifton Curtis**, *Biodiversity/Oceans Advisor Political Division Greenpeace International*
  "International Trends and Issues"

- **Leonard Ellis**, *principal analyst for GAO's study of federal lease abandonment*
  "Statement"

- **E. P. Danenberger**, *Chief, Engineering and Technology Division, MMS*
  "Comments on the Marine Board Report"

- **Michael Craig**, *UNOCAL*
  "Oil and Gas Industry View and Concerns"

- **Paul L. Kelly**, *Vice-President, Rowan Companies, Inc. and Chairman of the OCS Policy Committee*
  "Offshore Oil and Gas in the United States: Looking Ahead to the Millennium"

Present and Future Priorities for Offshore Lease Abandonment

Remarks of MMS Director Cynthia Quarterman to the International Workshop on Lease Abandonment April 15, 1996

Good morning. It is my distinct pleasure to welcome all of you—from throughout the United States and our many colleagues from abroad—to the International Workshop on Offshore Lease Abandonment and Platform Disposal.

I want to thank the Center for Energy Studies at Louisiana State University for sponsoring this workshop along with the U.S. Department of the Interior's Minerals Management Service. I also want to thank the primary co-sponsors—American Petroleum Institute, the Central Gulf Region Petroleum Technology Transfer Council, Global Industries, J. Ray McDermott—and others who have contributed resources and time to make this a successful event. And I want to thank some individual members of my staff for their hard work and professional expertise in making this workshop possible and for their years of dedication to ensuring that platform abandonment in federal waters is done with safety and environmental concerns at the forefront. Those individuals, whom you will be hearing from later this week, include Bud Danenberger, Charles Smith, Mary Ann Turner, Felix Dyhrkopp, Anne Bull, and Don Howard. I note those individuals because managers are only as good as the staff working with them. I have complete confidence in those individuals. That is imperative because, as the stewards of our nation's offshore resources, we must ensure that we leave the lands with which we've been entrusted in at least as good shape as we found them.

As Shell Offshore and its partner British Petroleum Exploration install the deepest man-made structure in the world, miles off this very coast, we come together from across the globe to discuss the destiny of these structures when they reach the end of their service lives. I've heard the process referred to as "The Death of a Platform," even though many of these structures will go on to provide wildlife habitats beyond our own lifetimes.

The issue of platform abandonment and removal is sensitive; there's no doubt about it. But through forums such as this, where we gather the world's experts to plan for the future step by step, we will, I hope, collectively be able to alleviate concerns and remove facilities with the same confidence with which we install them.

We have a lot of work to do in the area of platform abandonment and removal in order to ease state, federal, and private citizens' concerns. We've come a long way already, though. MMS's bonding requirements and industry's cooperation with those requirements have eased a variety of concerns to better ensure that offshore wells are plugged and facilities removed properly and that the American taxpayer will in no way foot the bill.

I recently read an article in the Los Angeles *Times* in which Tom Thomas, President of American Pacific Marine in Oxnard, California, stated that "removing oil platforms is four times harder than putting them up." Thomas was speaking about the dismantling of four oil rigs scheduled to take place in August offshore California, where passionate concerns still exist due to the 1969 oil spill. Thomas said, "after 30 years in the sea it's hard to tell how sound the metal is." He said, "Add to that the potential of an ocean swell, tsunami, or earthquake and things could turn very dangerous." Thomas says he worries.

MMS operates on the premise that "two heads are better than one." It is my hope that, through your input, in the not-so-distant future no one will have to worry. The fact that Thomas's platforms are located in state waters is irrelevant, because according to the basic premise of ecosystem management, nature knows no boundaries. We must all work together to ensure safe and environmentally sound removal of platforms across the globe.

There are a few points I want to mention today, and then I want to turn it over to the experts to begin the dialogue which will largely determine our future.

Let's not set out to fix what's not broken. There are two primary methods to remove platforms and several disposal options—all with advantages and disadvantages. The removal options are: 1) through explosives, which are used 70 percent of the time and have been determined to be the safest and usually the least expensive removal method; and 2) through abrasive or mechanical cutting, which often involves divers and may pose more danger to human life. Then the platform sections must be disposed of either by hauling them back to shore for retrofitting, for re-use, or for scrap metal or by toppling them in place or moving them to a different location to create an artificial reef.

When I say let's not fix what's not broken, I'm referring to the proposal that the London Convention Parties adopt a moratorium on at-sea disposal of decommissioned structures. As the United States' offshore oil and gas industry begins to invest millions of dollars in the deepwater Gulf and it is highly probable that the deepwater Gulf will become a primary supplier of domestic oil and gas in the near future, such a proposal could have a devastating economic impact on America's oil and gas industry.

Rather, I suggest that MMS, which reviews each abandonment proposal from both operational and environmental perspectives, believes the existing abandonment program is working well. I would encourage this forum to focus on new and improved technology to meet the challenges we face in finding the safest methods of platform abandonment and removal now and in the future so people like Tom Thomas in California won't have to worry.

I am pleased with the results of the independent review conducted by the Marine Board of the National Research Council, which determined that abandonment practices have been environmentally responsible. Add to that the efforts of the National Marine Fisheries Service's observation program and their determination that there have been no turtle or marine mammal fatalities since its inception in 1987.

And finally, I want to compliment the states of Louisiana and Texas in leading the nation in their artificial reef programs. These win-win programs are an outstanding example of cooperation among state and federal government, the oil and gas industry, and commercial and sport fisheries groups. I am also pleased with the cooperative efforts to improve site clearance practices and reduce fishing gear damage.

I do not fish, but those who do will attest to the fact that they catch more and bigger fish around abandoned platforms converted to artificial reefs. Louisiana now has recycled 58 platforms and Texas, 36. I was surprised to see, in addition, that four abandoned platforms have been converted to reefs offshore Florida.

I encourage the continued close working relationships with the states, the U.S. Coast Guard, the Department of the Navy, the Army Corps of Engineers, the National Marine Fisheries Society, and sport and commercial fisherman for the program to be effective. I also support and encourage the series of recreational fishing maps sponsored by the state of Louisiana, which lists rigs-to-reefs sites.

There are over 4,000 offshore platforms and 22,000 miles of pipelines located in the Gulf of Mexico. A quarter of these platforms are more than 25 years old. Between 100 and 200 of these will be removed each year. And there are more than 7000 platforms worldwide. So it's in the best interest of all of us to work together and to plan ahead.

In closing I cite some of the recommendations made by the Marine Board report entitled *An Assessment of Techniques for Removing Offshore Structures*, which each of you received in your registration packet. Some of those recommendations include changing the minimum depth at which structures must be severed from the current depth of 15 feet to 3 feet; working with industry to determine the appropriate size of explosive charges; looking at partial removal of structures in 300 feet (or more) of water; removing the limit on detonations at any one time; incorporating more flexibility into the permit process; continuing to work in cooperation with the sea turtle observer program; gathering more information on fish kill during explosives; developing a guidebook in conjunction with industry on recommended explosives practices; and sponsoring workshops and open forums to discuss acoustic methods of keeping fish at a safe distance.

This workshop is a step in the right direction.

I want to assure you that MMS will consider all recommendations proposed in the Marine Board Report and those developed at this workshop. On behalf of the U.S. Department of the Interior, let me say that your efforts here are greatly appreciated as they will have a major impact on future policies concerning offshore lease abandonment issues. We have not and do not intend to work in a vacuum, and we value the input of your professional expertise.

I thank my very professional staff, and I commend you all for working together to ensure we leave these lands beautiful for generations to come.

Statement of Ambassador David A. Colson
Deputy Assistant Secretary for Oceans
U.S. Department of State
before the
International Workshop on Offshore Lease Abandonment and Platform Disposal
April 15, 1996
New Orleans, Louisiana

Thank you, Mr. Chairman.

It is an honor to be asked to address this International Workshop on Offshore Lease Abandonment and Platform Disposal. It is a pleasure to be here.

But I come with some trepidation. You are the experts. You know the offshore oil and gas industry. You know the issues, the problems, the challenges, and the rewards. You are the pioneers who developed the technologies that are taking us to greater and greater ocean depths. You have seen the good years and the not-so-good ones. You have seen the U.S. offshore industry grow from a largely domestic endeavor to one that today is decidedly international.

You have developed a high degree of awareness about the environmental impacts of your actions and have responded to meet that challenge. Your record is excellent. And as we meet here today, you can be proud of your accomplishments.

What I want to tell you today is that your challenges are not over. From a technical perspective, I cannot tell you how to meet the new challenges, but I can tell you a little bit about their setting—their context—and try to impart to you the need for you—the industry—that complex of persons and companies—to continue to lead the rest of us to the best answers—the best solutions.

What I can bring to you is a perspective of someone who has worked in the international ocean policy arena for over 20 years. Probably, like many of you, I think I have seen it all. I have seen the ups and downs, the backing and filling, had some wins—and some losses—over that span of years. Mostly though, I have found that the issues do not go away.

But there have been some changes. Our world is a rapidly shrinking universe. Something called mad cow disease breaks out in the U.K., the world's beef industry goes goofy, CNN plays up the Hindu protest angle, and a few hours later at a restaurant in Singapore I am guaranteed that the beef is Australian. The world we work in today is small and getting smaller.

Our actions have effects on others, as their actions have on us. Who can doubt this?

Another thing that has changed and that is here to stay is the importance and influence of the environmental movement. Theirs is a power and influence that most Americans respond to. Just as happens in other segments of society, there can be abuse and misuse of that power serving only sensationalism. But in the main, environmental concerns touch a powerful chord in most of us; and you know that you must respond to those concerns if you are going to succeed.

A third area of change—actually it is not change so much as experience—is that we now have 40 plus years of experience with post-World War II international institutions, and we ought to be able to evaluate their strengths and weaknesses and learn something from our experience.

In the light of these changes, it is ever more important to conduct workshops such as this one, because they bring together those persons closest to the technologies, closest to the environment, closest to the economics, and closest to the pragmatic policy considerations to exchange views and to seek common ground.

Today, I want to develop these thoughts and relate them to the removal and disposal of offshore installations and structures. I will outline the international legal framework and explain the approach the U.S. Government has taken so far in addressing these issues internationally.

The recent imbroglio of the Brent Spar tells us something about the small world we live in, the power of the environmental movement, and the strengths and weaknesses of international institutions. The key factors were a multinational corporation operating under a U.K. permitting process, an environmental organization able to galvanize public attention, and a blurred vision of the role of international institutions even though the corporation was international, the environmental group was international, and the oceans are subject to international rules.

I want to use the Brent Spar today as an example of several points. But, first, I need to talk a bit about some international legal principles and to draw distinctions between words such as removal, disposal and dumping. Because, in point of fact, there are international legal principles that are applicable here, although, admittedly, they may not address all of the issues in play.

When someone says "the Law of the Sea" they may be referring to a set of general principles and practices that countries apply to their use of the ocean or to the four 1958 Geneva Law of the Sea Conventions, to which the United States is still party, or to the amended 1982 Convention which is now in force, has been amended to meet U.S. objections, is fully supported by the Administration, and is before the Senate for approval. In this regard, I simply would like to note the support for Senate approval voiced recently by the OCS Policy Committee with the support of the industry. For many good reasons. But let's just focus on the issue at hand.

You know better than I the nascent character of the offshore industry in the mid-1950s; at that time, in the 1958 Continental Shelf Convention, the United States agreed to a provision which states: "Any installations which are abandoned or disused must be entirely removed." (Article 5.5)

This standard, the "entirely removed" standard, became the basis for today's U.S. regulations that, as you so well know, require removal 15 feet below the mud line.

By the late 1970's, those familiar with offshore technology and trends recognized that "entirely removed" might be an appropriate standard for the technology of the mid-century but was unrealistic for the future and that a different international standard was required.

In response, during the Law of the Sea Conference in the 1970's, Article 60.3 was negotiated. It states:

> Any installations or structures which are abandoned or disused shall be removed to ensure safety of navigation, taking into account any generally accepted international standards established in this regard by the competent international organization. Such removal shall have due regard to fishing, the protection of the marine environment and the rights and duties of other States. Appropriate publicity shall be given to the depth, position and dimensions of any installations or structures not entirely removed.

The difference is clear: the 1958 Geneva Convention obliges the removal of installations in their entirety; the 1982 LOS Convention does not require installations or structures to be entirely removed, but sets a standard requiring a variety of considerations to be taken into account. Thus, the 1982 Convention provides for some flexibility, taking into account the new environments, depths, and technologies that characterize offshore development at the turn of the century. It recognizes, further, the need to take into account international standards established by the competent international organization.

The competent international organization to establish "generally accepted standards" under this Law of the Sea provision is the International Maritime Organization. This is a U.N. organization, headquartered in London, which, generally speaking, the U.S. strongly supports.

The United States took the lead in the mid-1980's to develop the guidelines to which Article 60.3 refers. We had a number of competing interests to satisfy. First, we were concerned about national security interests. We have a fundamental requirement in maximizing the flexibility and mobility of our armed forces over and under the world's ocean. The collision of a German submarine with a North Sea platform in 1988 illustrates the dangers posed by the structures even to the most sophisticated military hardware.

Certainly we were concerned, as well, with the safety of navigation for commercial craft. We were also concerned with the environmental effects of the removal operation. And, economic considerations relating to energy security and competitiveness also entered the picture.

Over a two-year period, the United States worked within the International Maritime Organization to devise standards that would reflect the standard of Article 60.3 of the 1982 LOS Convention. The guidelines which were ultimately adopted are based upon the premise that all abandoned and disused installations and structures on any continental shelf or in any exclusive economic zone should be entirely removed, except where non-removal or partial removal is consistent with the Guidelines and Standards.

In general, they provide that abandoned or disused installations or structures in less than 75 meters of water should be entirely removed; that such installations or structures installed after January 1, 1988, in less than 100 meters of water should be entirely removed; and that after January 1, 1998, no installation or structure should be placed on any continental shelf or in any exclusive economic zone unless its construction makes entire removal feasible. In cases of partial removal, an unobstructed water column of not less than 55 meters should be provided. As a practical matter, the Guidelines, at the end of the day, required total removal of over 90% of the then-current structures.

So far as I know, these guidelines are well respected and generally applied. So far as I know, no one alleges that the U.K. did not meet the relevant standards for removal of the Brent Spar.

But, of course, what you do with it after you remove it is a different matter. Thus, the key question now is not removal, but rather, disposal.

Neither the 1958 Geneva Continental Shelf Convention nor the 1982 LOS Convention refers directly to the fate of installations and structures once they have been removed from their original location. While the Law of the Sea contains general obligations to protect the marine environment, one must look to regional conventions or other more specific conventions to address in detail the question of what happens next.

Just to be clear, the remainder of this discussion assumes that the ocean is the proposed final resting place for this removed installation or structure. If land is its final site, that is outside my bureaucratic niche.

The deliberate disposal at sea of waste into the marine environment is normally called dumping—ocean dumping.

The 1972 London Convention is the global regime addressing ocean dumping. The United States and 74 other countries are party to the London Convention. A fact important to this discussion is that, of the about 40 countries that today operate offshore oil and gas installations and structures, only about half are party to the London Convention.

The London Convention includes within its definition of dumping "any deliberate disposal at sea of vessels, aircraft, platforms or other man made structures at sea." So, removing the Brent Spar, towing it to another ocean site, and sinking it to the seabed for the mere purpose of disposal was dumping within the meaning of the Convention, just as abandonment of an offshore platform in place, or toppling of a platform at site, for no purpose other than disposal, would be dumping within the meaning of the Convention.

Under the London Convention, just because an activity falls within the definition of dumping, does not mean you cannot do it. As presently constructed, the Convention has a prohibition on the dumping of certain substances on a black list, such as mercury and mercury compounds and nuclear waste; but, generally, a permitting process is allowed for national authorities to authorize the dumping of certain materials, such as dredge spoil, ships via scuttling, or, in this instance, an offshore platform. Thus, again, the U.K., a party to the London Convention, acted consistently with international norms when it issued a permit for the dumping of the Brent Spar.

So, what was the complaint about the Brent Spar? I cannot, of course, speak for the opponents. To the extent there was legitimate inquiry, however, it would have had to follow one of two paths. One set of questions might be, was U.K. law sufficient for rational decision making consistent with London Convention permitting requirements and was there full disclosure by the companies concerned; another question might be, were London Convention standards inadequate? I will not venture to comment on the sufficiency of U.K. law or company disclosure.

I will note, however, that the London Convention parties have not developed specific guidelines for the ocean dumping of offshore installations and structures, preferring to date to treat them generally like other bulky waste materials. Frankly, to date, this has largely been solely a U.S. problem in our near shore waters.

At the first meeting of the London Convention following the Brent Spar episode, the parties were confronted with a proposal by the Government of Denmark to adopt a resolution to impose a moratorium on the disposal at sea of offshore platforms, and to turn that into a legally binding ban in the protocol to the Convention now being negotiated. This proposal was made unapologetically and with no evaluation or analysis of any sort. It was supported by a few, such as the Dutch and Germans, and strongly opposed by the U.K., Norway, ourselves and virtually everyone else. It would be undiplomatic of me to question Denmark's motives. To some, however, I am sure it appeared to be a bold-faced move to play to the crowd by a country with a narrow, shallow continental shelf; to others, it was a facile political solution for an enormously complex problem; while to others it may have offered a solution tailored only to Danish dimensions.

In spite of the widespread opposition to the Danish proposal, international meetings such as the London Convention sometimes get dragged down by consensus making. Ultimately, in this case, the meeting punted the issue to the Scientific Group, with its report not due until 1997.

But one can assume the issue will arise again in 1996 as the Danes will no doubt continue to push, joined by a small group, and oblivious to the strength of the opposition, at the Diplomatic Conference to be held in November to adopt a protocol which will, in effect, amend the Convention. They will push for a binding rule banning the ocean dumping of an offshore installation or structure.

This effort will be opposed for three good reasons. I am confident that the United States and many other governments will be in the opposition.

First, the London Convention parties have already concluded that, where an installation is converted to another use such as an artificial reef, either by toppling, abandonment or placement on the sea bottom at another site, such disposal is not dumping within the meaning of the Convention, as it is not placement of matter for the purpose of mere disposal. Thus, the U.S. Rigs-to-Reefs program is not governed by London Convention provisions. We would not wish to see that program questioned by a flat-out prohibition on ocean disposal of disused installations and structures.

Second, we know we need a more balanced approach. The Marine Board of the National Research Council is recommending that more flexibility be built into U.S. removal regulations for a variety of well-documented reasons. Just as well, the ocean disposal option needs to be preserved as we move into the 21st century. This is not to say we will support irresponsible plans and actions in any respect nor that we will not seek the best environmental solution; it is only to say that all options need to be preserved to determine the best decommissioning process and outcome.

Third, the Law of the Sea provides clearly for partial removal; in such a case, that part which is not removed, but abandoned, is dumped within the meaning of the Convention. Thus, the Danish proposal not only is unwise, but contests basic Law of the Sea principles; we, and others, are not going to support that.

Having said that, we must be smart enough to see that the issue is not going to go away. There are too many hot buttons that can be pushed. It is essential that industry, government and environmental groups work together to identify sound approaches. You know what I believe the key is? It is one of the new buzz words: "transparency." A public that knows the facts and the issues is going to support balanced, informed and rational decisions. Lack of transparency fuels extremism and leads to stories about what someone is trying to hide.

The U.S. has strong, and in many cases the strongest, environmental programs in the world. Undoubtedly there is room for improvement. But our approach to these problems contains our own set of ingredients and our own way of balancing the priorities and the needs. At any step of the way we can learn from others; we, too, have a lot to offer.

We have offshore about 3,500 installations and structures, and have already decommissioned about 1,500 more. We have a publicly supported Rigs-to-Reefs program and, collectively, we have probably thought about these issues more than any other country. We are not going to be told how to go about this business; but we should not try to impose our own program. What we can and should do is provide leadership for the world to address this problem.

Each country has a different legal system, governmental priorities, motivations, economic strengths, environmental awareness. On an issue such as this, what we need is agreement on the objective; different systems, cultures, governments must find their own ways to meet the objective.

On the international institution front, we can see we have some work ahead of us. The disposal of offshore oil and gas installations and structures is an international issue, but we have about half the story taking place on our U.S. continental shelf. You have probably heard the Marine Corps aphorism: "if you are going to lead--lead; if you are going to follow--follow; otherwise, get out of the way." To my way of thinking, the U.S. has no choice but to get out in front and lead the international community. There are three basic choices with some possible mixtures among them. We can take on the issue squarely in the London Convention context and set about developing specific agreed standards for the dumping of installations and structures; or, we can address the issue in another forum like the International Standards organization among the countries most directly concerned; or, we can take on the issue on a regional basis.

Our job over the coming days is, with your help, to identify the approach that the United States should take and to sell the rest of the international community on it. The approach must make sense environmentally, economically and technologically. The challenge I want to leave you with is simply let's get on with it. I am very confident that we have a great deal to offer the world in this area. The best way to counter extreme proposals is to bring forward sound proposals around which those most directly concerned can rally.

In closing, I would like to again thank the organizers for inviting me to speak today. I hope I have given you something to think about; and, that in the days and weeks ahead, together we will develop an approach for U.S. international leadership on this all important matter.

Regulation and Policy: International Trends and Issues

Offshore Lease Abandonment and Platform Disposal: Technology, Regulation and Environmental Effects Decommissioning Offshore Structures - Projects and Policy

W. S. Griffin
Phillips Petroleum and E&P Forum

Abstract

As offshore oil and gas resources become exhausted, the associated production platforms and facilities will be decommissioned. The world-wide oil and gas industry is strictly regulated by global, regional and national guidelines which have been developed by governments to find the most responsible framework to perform the decommissioning.

In the summer of 1995, the Brent Spar incident brought uncertainty to decommissioning world-wide. In June of 1995, a moratorium prohibiting sea disposal within the North East Atlantic was imposed by the Oslo Commission, and an unsuccessful attempt was made in December of 1995 to impose a world-wide moratorium on sea disposal at the London Convention.

Introduction

Have you ever heard the following definition of an "idiot"? An idiot is a person who continues to do the same thing, but gets upset because he does not get different results.

From an international or global perspective our industry must learn to change our way of communicating with the general public or we will have one Brent Spar episode after another as we begin to decommission the larger offshore facilities around the world.

As a beginning, change your vocabulary and use the term "decommissioning" rather than "abandonment" when referring to the closing down and removal of offshore facilities. Can you imagine what picture must come to the mind of the German housewife or a resident of Colorado when he or she hears "abandonment"? In Germany the vision is probably of an automobile driven into the forest and just left. In Colorado it is probably a vision of the rusting remains of mining facilities. Another term used, which the public misunderstands, is "dump." Perhaps a better term would be "sea disposal."

The oil and gas industry is a responsible entity. It cares for the environment, and decommissioning will be carried out with the well-being of the environment as a major element of the decision process. Be careful of how the story is brought to the public.

There are more than 6,500 structures located on the Continental Shelf of some 53 countries. There are about 4,000 in the U.S. Gulf of Mexico, about 1,000 in Asia, some 700 in the Middle East, approximately 500 in Africa, about 350 in South America and a few more than 400 in Europe (North Sea and/or North East Atlantic). The actual world population of installations at a given time is not easy to determine. The population is constantly changing. It is a bit like trying to determine how many people the world-wide oil industry employs at a given time.

From Figure No.1, it is easy to see that the offshore industry is truly global. Since the industry produces an essential consumer commodity that makes a major contribution to the well being of the world's society, it is an industry that everyone recognizes. Decommissioning is a global issue; the world will be attentive to the connotations of the words used to describe it. "The world is watching decommissioning."

History

The first oil production was in 1859 in the state of Pennsylvania in the United States. The offshore industry is considered to have its beginning almost 100 years later, in 1947 in the Gulf of Mexico. There are earlier claims in the world about oil being produced from under bodies of water, but 1947 is the generally accepted date.

World regulators and authorities began very early to set requirements for decommissioning offshore facilities and are continuing to develop even more strict controls. International, national and regional requirements and controls have produced a strict but competent system. (Attachment No.1). The infrastructure that has been developed will require the total removal of almost 95% of current structures.

The 1958 United Nations Geneva Convention gave the legal framework for the exploitation of the Continental Shelves of the world. It contains article 5, paragraph 5 which states: "Due notice must be given of the construction of any installations and permanent means for giving warning of their presence must be maintained. Any installations which are abandoned or disused must be entirely removed."

In 1958 the only offshore production was in the U.S. Gulf of Mexico and in less than 30 meters of water. There were fewer than 1,000 structures, and their construction was not complex. (Figure No.2).

In 1969 the United States Geological Survey [(USGS), forerunner to the current Minerals Management Service (MMS)] issued Offshore Continental Shelf (OCS) Order No.3. Order No.3, which would be considered national (regional), specified that "All casing and piling shall be severed and removed to at least 15 feet below the Gulf floor and the location shall be dragged to clear the well site of any obstructions." By this time technology had allowed the industry to move to deeper water with complex structures and to other geographical areas of the world like South East Asia and the Southern Gas Basin of the North Sea. This was the first "Wake up call" to the world-wide offshore industry as to the degree of decommissioning that regulators were going to require. In general the industry had not heard about the 1958 Geneva Convention.[1]

The industry knew removal of the facilities would be required because offshore leases and licences contained mention of cessation of production and site restoration; they just had not thought about how to do it or to what degree.

During the 1970's and into the early 1980's, negotiations were ongoing for the United Nations Convention on the Law of the Sea (UNCLOS). These negotiations brought attention to the world authorities (see footnote below) of the 1958 Convention requirement of total removal. Delegations negotiating UNCLOS had oil industry advisors and government authorities responsible for offshore developments whom they were consulting as UNCLOS was hammered into place.

By 1982, when UNCLOS negotiations were being finalized, technology and the search for oil and gas had taken the industry to much deeper water and harsher environments that required very complex and massive structures. Developments in 300 meters with fixed structures were common, with structures weighing tens of thousands of tons.

During the late stages of negotiations of UNCLOS, the UK proposed softening the strict standard of the 1958 Convention. After hard bargaining, the present language of article 60.3 was adopted:

> Any installations or structures which are abandoned or disused shall be removed to ensure safety of navigation, taking into account any generally accepted international standards established in this regard by the competent international organization. Such removal shall also have due regard to fishing, the protection of the marine environment and the rights and duties of other States. Appropriate publicity shall be given to the depth, position and dimensions of any installations or structures not entirely removed.

The competent international organization was the International Marine Organization (IMO). In 1989 the IMO adopted "Guideline and Standards for the Removal of Offshore Installations and Structures on the Continental Shelf and in the Exclusive Economic Zone." These guidelines and standards will require the total removal of 90-95% of the current world-wide population of platforms but do give the Coastal State (host country) flexibility to deal with the expensive, dangerous and technically difficult installations on a case-by-case basis. At the time of the IMO negotiations it was thought that some 450 structures fell into the category in which a Coastal State could exercise some flexibility.

At the close of the IMO debate, the world had a framework within which it could work for the removal of structures, but the question of disposal was not clear.

In 1991 the London Convention (LC) reviewed the IMO Guidelines and determined that there was no need to make changes or additions to the London

Convention to allow for sea disposal of platforms. At the December 1995 meeting of the LC, an attempt was made to establish a moratorium prohibiting sea disposal of platforms. This effort was soundly defeated.

By the end of 1991, from a world or global perspective, the issue of decommissioning seemed to have a direction.

Of course, for the NE Atlantic (North Sea) the Oslo Commission reviewed the IMO Guidelines in 1990 and developed an annex to their Convention dealing specifically with platforms. It is the Oslo Convention which requires sea disposal of platforms to be in a minimum of 2000 meters of water and at least 150 nautical miles from land. It is to be noted that OSCOM issued a moratorium on sea disposal in the summer of 1995 as a result of the Brent Spar debate.

Today it is thought there are more than 600 large structures world wide. The definition of "large"is as specified in the IMO Guidelines—standing in more than 75 meters of water or having a substructure weight in excess of 4,000 tonnes. It is important to note that a platform in 50 meters of water with a substructure weight of 5,000 tons would fall into the category of large. These large structures are located on the Continental Shelves of some 30 Coastal States. The US has the most, with around 200, followed by India with 75, the UK and Norway with more than 50 each, the Congo with 35, and Malaysia with 30; the remainder are scattered around the world.

These large structures will probably have political and economic repercussions, and the world will watch as their decommissioning is carried out. In reality these are the ones the current debate is about, because for all intents and purposes the others will be removed and taken ashore.

There have been several attempts to estimate the world-wide cost of total removal. In 1983 the E&P Forum conducted a survey of member companies' platforms and determined that the cost could be as high as $40 billion USD in 1983 terms for an estimated 7,000 structures.

In 1987, the US Coast Guard commissioned a study that estimated a $24 billion USD cost for approximately 6,000 structures.

Other studies have been made; and, although different studies produce different estimates, the consensus on the scale of costs involved is that they are large.

Industry Position

As a result of last summer's Brent Spar incident, the industry has organized to try to communicate our story to authorities, ministers, public and special interest groups, etc. United Kingdom Offshore Operators Association (UKOOA) and the Oil Industry International Exploration and Production Forum (E&P Forum) are working together on this and on November 30, 1995, published "Decommissioning Offshore Oil and Gas Installations: Finding the Right Balance."

Thirty-seven oil companies and six trade associations support the document. Although it is slanted to address the European perspective, the document can be used for the world-wide issue.

"Finding the Right Balance" forced the industry to agree to four main points that set out the industry position on decommissioning. Four fundamental beliefs underlie the industry's commitment to achieving the best, most responsible, solution to decommissioning:

1) The oil and gas exploration and production industry supports regulatory decisions based upon the pursuit of sound science, reason and the careful balancing of environmental, safety, health, and technological and economic considerations;
2) These principles should apply to decommissioning and disposal decisions just as they do to other areas of exploration and production activity;
3) Each facility to be decommissioned is different. There is no single answer which will strike the right balance among complex factors in each situation; and
4) The industry recognizes the need for dialogue and discussion with governments and society at large regarding the implementation of a regulatory system consistent with these principles.

In agreeing to these four points, the industry also came to the realization that the ultimate decision for how a particular installation is to be decommissioned will be made by the host government. The industry or operator must supply the government with information in at least four key areas (others may appear) to be considered in reaching a decision. These are:

- potential impact on the environment;

- potential impact on human health and safety;
- technical feasibility of the plan; and
- economic impact.

A fifth area which the industry and host government must try to influence is public concern.

All of these factors must be carefully examined before the best option for each installation can be determined. A major problem to resolve is how much weight should be given to each factor. Different interest groups have different ideas about how to weigh each factor. Despite significant scientific input, there is still a degree of uncertainty about the effect each factor can produce. That is why the industry strongly recommends that all options be kept open so that the host government can select the best solution for each individual case.

Conclusion

The issue of decommissioning offshore facilities is global. Over 53 countries or more than 25% of the sovereign states recognized by the United Nations are faced with the issue. There are very strict international rules in place and efforts by special interest groups continue to try to make them even stricter.

There is no doubt that the decommissioning of the very large structures will cause public concern. The world will be watching. The industry must be transparent and communicate, communicate and communicate with all interested parties. There is no way that decommissioning of these very large structures can be done without dialogue.

The industry is committed to:

- Supporting regulatory decisions that are based on sound science;
- Using these principles in all areas of the business;
- Recognizing that each facility is different; and
- Engaging in dialogue with all parties.

It is inherently wrong to throw anything into the sea, but it is also inherently wrong to damage the environment onshore, or expose workers and society to danger. Sometimes a lesser wrong has to be selected to produce the overall best solution when <u>all</u> factors are fully considered. The industry has never proposed anything other than total removal for 90 to 95 percent of the structure.

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1. Oil companies must look to the host country to identify international agreements like the 1958 Geneva Convention and integrate them into their own regulations.

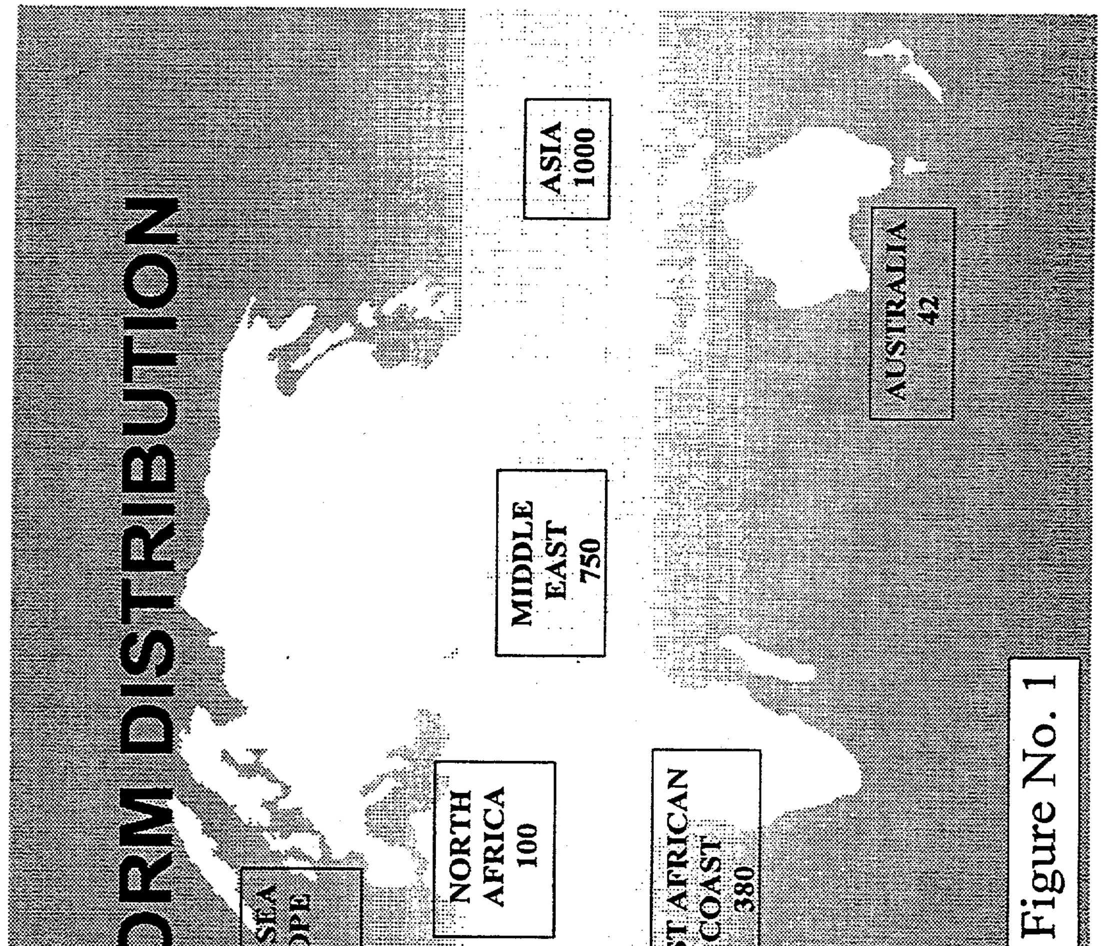

1996 PLATFORM DISTRIBUTION
COOK INLET
15
OFFSHORE
CALIFORNIA
30
GULF COAST
4000
NORTH SEA
& EUROPE
400
NORTH
AFRICA
100
WEST AFRICAN
COAST
380
SOUTH
AMERICA
340
MIDDLE
EAST
750
ASIA
1000
AUSTRALIA
42

Figure No. 1

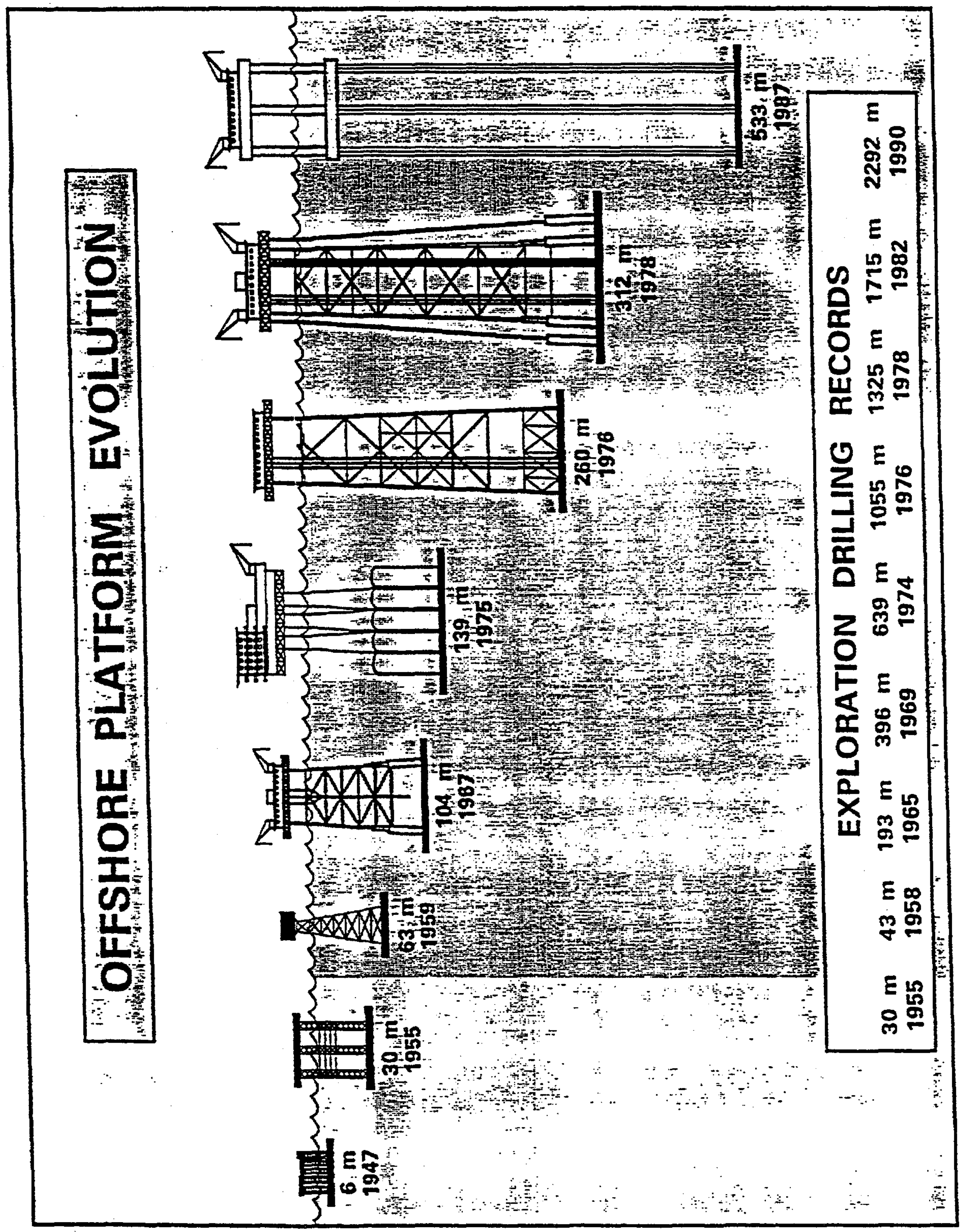

OFFSHORE PLATFORM EVOLUTION
6 m 1947
30 m 1955
63 m 1959
104 m 1967
139 m 1975
260 m 1976
312 m 1978
533 m 1987
EXPLORATION DRILLING RECORDS
30 m 1955
43 m 1958
193 m 1965
396 m 1969
639 m 1974
1055 m 1976
1325 m 1978
1715 m 1982
2292 m 1990

Figure No. 2

History

- 1958 United Nations Geneva Convention
- 1969 United States Geological Survey (USGS) Offshore Continental Shelf (OCS) Order No. 3
- 1982 United Nations Convention on the Law of the Sea
- 1989 International Maritime Organization (IMO) Guidelines
- 1990 Guidelines for the Disposal of Offshore Installations at Sea (OSCOM)
- 1991 London Convention (LC)
- 1992 Oslo & Paris Convention (OSPAR)
- 1995 OSPAR Ban

Attachment No. 1

International Trends and Issues

Clifton Curtis, Biodiversity/Oceans Advisor
Political Division, Greenpeace International

International Workshop on Offshore Lease Abandonment and Platform Disposal:Technology, Regulation and Environmental Effects
15-17 April 1996, New Orleans, Louisiana, U.S.

The nineteen (19) position statements in this paper represent Mr. Curtis' best efforts to capture Greenpeace's views on ocean disposal or dumping of wastes and other harmful substances, including offshore oil and gas platforms. These statements, though, have not been formally approved as Greenpeace policies, although a number of them have appeared in Greenpeace documents or public statements. For this document, "dumping" refers to any deliberate disposal at sea of wastes or other matter, consistent with the London Convention (1972).

General Considerations

1. To protect the environment, everyone has the responsibility to minimize the generation of wastes. First and foremost, toxic wastes should not be produced. There is growing support for "zero discharge" as the only responsible way to go: either the operations meet a clean production test, or you do not produce the product.

2. If toxic wastes are produced, they should be detoxified, and if that is not possible, they should be contained (isolated from the biosphere) in above-ground, monitored, retrievable, safe storage. In this regard, difficulties with respect to monitoring and retrieval at sea (if necessary), make land options far preferable. Recycling is only acceptable for non-hazardous wastes and then only after all waste prevention methods have been exhausted.

3. The precautionary principle, which has gained almost universal acceptance in the past decade, emphasizes pollution prevention and places the burden of proof on prospective polluters to demonstrate the absence of any legitimate concern regarding potential harm to the environment or human health. In the face of residual scientific uncertainties—including those concerning cumulative impacts of ocean dumping of other platforms—as well as other ocean activities, ocean dumping of potentially harmful wastes is an unsustainable practice and is politically untenable.

4. The oceans are a living, interconnected environment that can return toxic or harmful wastes to human beings via ocean food chains. For such wastes, adverse impacts are exacerbated by bioaccumulation, whereby organisms concentrate noxious material over time. In addition, as a result of biomagnification, persistent toxins are passed along the food chain, accumulating in progressively higher concentrations. As a result, animals feeding higher on the food chain—e.g., marine mammals and humans—risk high levels of tissue contamination, with resulting adverse physiological and genetic health impacts.

5. There is an insufficient understanding of the deep sea environment, making it impossible to predict the effects of ocean dumping of oil and gas platforms on deep sea ecosystems. New discoveries surface regularly. Scientific opinion on the capacity of the seas to absorb wastes is rapidly evolving. Nonetheless, it is well known that the oceans are a severe environment. Pressures and temperatures reach planetary extremes there, and the corrosive powers of ocean waters are legendary. The oceans can be a very destructive environment for placement of humankind's wastes.

6. The oceans represent a "global commons" which should be preserved for the benefit of all people and future generations. It is fundamentally unfair for a minority of the planet's population to disproportionately damage shared marine resources and thus deprive the vast majority of their rights. Stated differently, people care not only about their own backyard; they also care about the oceans, which are everyone's backyard.

7. Misguided arguments used by some proponents of ocean dumping to suggest that environmentalists unfairly treat the oceans as sacrosanct, and off-limits to toxic wastes, ignore the compelling evidence of serious and increasing contamination of marine and coastal ecosystems. This contamination comes from many pathways and sources, including industrial pipelines, stack emissions, pesticide and other toxic runoff, sewage overflows, plastics and marine debris, and ocean dumping of sewage and contaminated dredge spoils. Some of these wastes end up in the deeper ocean, as well as polar regions, via atmospheric and ocean transport mechanisms.

8. Ocean dumping of any human waste, and in particular toxic or particularly harmful wastes, creates a negative precedent for dumping other wastes or matter in the sea, and risks undermining international agreements. Related to this, the dumping of industrial wastes at sea has been banned, effective 1 January 1996, pursuant to an amendment to Annex I of the London Convention. That ban should apply to all industries, including the offshore industry, rather than allowing the perpetuation of an unjustified double-standard situation. (See also, attached Annex.)

Oil/Fossil Fuel Considerations

9. Oil-related past, present, and projected environmental damage shows that continued reliance on fossil fuels will result in significant adverse impacts on the marine, terrestrial, and atmospheric environments on which humans and other species depend. Oil is a threat to the environment from extraction through production to its end use. The oil industry is neither clean nor sustainable.

10. Current impacts on the atmosphere pose a particularly grave threat to environmental security. According to the great majority of the world's climate scientists, business-as-usual reliance on fossil fuels (oil, coal and gas) is expected to generate catastrophic global warming in the decades to come. Insurers, bankers, investment analysts, and industry leaders are taking this threat seriously, as documented in *Climate Change and the Financial Sector: The Emerging Threat, The Solar Solution*, 212 pages (1996), edited by Greenpeace's Dr. Leggett.

11. Climate change is not the only serious environmental problem posed by the use of oil and other fossil fuels. The burning of fossil fuels also produces air pollutants that are wreaking a tragic and costly toll on human health, damaging forests, reducing crop yields and eroding national monuments and buildings. Its transport at sea results in the annual discharge of several million tons of oil to the world's oceans and coastal areas, with consequent adverse effects.

12. Concerted international action is needed to reduce emissions of greenhouse gases and to move aggressively toward renewable energy, efficiency, and conservation. The need for action is unprecedented both in scale and urgency, especially for action to end the world's addiction to oil and other fossil fuels.

13. Further steps should be taken to much more effectively factor in the adverse societal, economic, and environmental costs associated with the extraction and use of oil and other fossil fuels. Implementation of those steps, among others, will assist in moving toward a more proper allocation of real costs of such fuel sources.

14. The offshore oil and gas industry should be held to a standard of strict, absolute, and unlimited liability with regard to its activities, i.e., liability for all costs, including both preventive and clean-up and restoration measures, and damages resulting from such activities (including loss of public and private uses of the resources).

Oil & Gas Platform Considerations

15. Assuming that new offshore oil and gas installations, equipment or pipelines are put in place, in derogation of the considerations in paragraphs 1-13, such a decision should be subject to the precondition that total removal to shore is guaranteed. Consistent with this view, governments whose countries border the Northeast Atlantic have agreed to "encourage those responsible for the design and construction of offshore installations to work towards ensuring that their design and construction does not preclude any environmentally sound disposal option," Final Declaration of the Ministerial Meeting of the Oslo/Paris commissions, 21-22 Sept. 1992 (emphasis added).

16. Offshore exploration and drilling for oil, pursuant to "normal" operating procedures, result in wide-ranging adverse effects on the environment. Areas of particular concern are the impacts of seismic surveying; minor spills during production;

transfer and transport of the finished product; and operational discharges of process wastes, e.g., drill cuttings, drilling muds and additives, produced waters, deck drainage and domestic sewage. Far more effective regulations are needed, internationally, to control, restrict, and/or prohibit operational discharges and other adverse impacts from offshore installations. (See, e.g., "Discharges from the Offshore Industry: The Environmental Effects of Oil and Gas Exploration Production," submitted by Greenpeace International to the London Convention Consultative Meeting, 4-8 December 1995, prepared by Simon Reddy, David Santillo and Paul Johnston.)

17. Existing offshore oil and gas installations, including platforms, equipment, pipelines, storage tanks and other technical equipment, should be brought ashore, rather than dumped in deep or shallow waters. While there may be a few exceptions, e.g., concrete structures for which there is compelling evidence of greater environmental harm associated with removing them than leaving them in place, the general presumption should favor removal.

18. Given direct, indirect, and residual environmental costs—e.g., energy consumption, CO_2 production, replacing wasted materials with new materials, job opportunities, recycling— associated with platform abandonment/recovery options, the potential savings possible from recycling steel jackets and topsides justifies the effort to recover and recycle those materials, with such efforts capable of being done in an environmentally friendly and cost efficient manner. (See, e.g., "Offshore Abandonment Activities: The Energy and Environmental Impacts," Society of Petroleum Engineers, SPE 30373 (1995)). Where recovery has not already been agreed, detailed environmental costs/savings assessments should be required.

19. Ocean dumping or in situ toppling of "cleaned" steel installations, including "rigs-to-reefs," is unacceptable because they still pose potential harm to fishing operations, and because they undermine or contradict general considerations in paragraphs 1-8, as well as paragraph 18, above.

- Annex -

Ministerial Declaration of the Fourth International Conference on the Protection of the North Sea, Esbjerg, Denmark, 8-9 June 1995, paragraph 54:

> The Ministers are AWARE that an increasing number of offshore installations in the North Sea are approaching the time of their decommissioning. Even if the offshore installations are emptied of noxious and hazardous materials, they might still, if dumped or left at sea, pose a threat to the marine environment. Disposal of such installations on land by recycling recyclable materials and by ensuring safe and controlled disposal of unavoidable residues would be in accordance with generally agreed principles of waste management policy (underline emphasis added).

NOTE: In the summer of 1995, following Shell's decision not to dump the Brent Spar at sea, some media and oil industry officials made a big deal of an interpretive error made by Greenpeace with respect to an assessment of a Brent Spar sample—an error that Greenpeace itself made public at the end of its campaign. While they tried to convert Greenpeace's error into an "apology" implying support for ocean dumping, that data and analysis were never a determining factor in Greenpeace's decision to oppose sea dumping of the Brent Spar.

As with the above excerpt from the North Sea Conference Ministerial Declaration, agreed to in early June 1995—which was accepted by Belgium, Denmark, France, Germany, Netherlands, Sweden, Switzerland, and the European Commission (though not by Norway or the UK)— Greenpeace opposed ocean dumping of the Brent Spar from the inception of its campaign and continues to oppose ocean dumping of offshore installations, "even if...emptied of noxious and hazardous materials."

Statement of Leonard Ellis
Senior Evaluator, US General Accounting Office

delivered at the International Workshop on Offshore Lease Abandonment and Platform Disposal Technology, Regulation, and Environmental Effects

New Orleans, Louisiana
April 15, 1996

Good morning. I want to thank the sponsors of this conference for inviting me to serve on this panel. I have been asked to discuss the General Accounting Office (GAO) work which resulted in our May 1994 report entitled "Offshore Oil and Gas Resources: Interior Can Improve Its Management of Lease Abandonment" (GAO/RCED-94-82). I have also been asked to comment on the 1996 National Research Council Marine Board "Assessment of Techniques for Removing Offshore Structures." Before I do so, I must mention that because GAO staff often move from one subject to another with each review that we do, I have not maintained ongoing knowledge of offshore lease abandonment in the nearly two years since our report was issued.

GAO's 1994 Report

GAO received a request from the Senate Committee on Governmental Affairs to evaluate Outer Continental Shelf (OCS) oil and gas lease abandonment, including, among other things, Minerals Management Service (MMS) actions to minimize the environmental impact of lease abandonment. To evaluate environmental effects we reviewed laws and regulations, we interviewed representatives of MMS, the academic community, the National Marine Fisheries Service (NMFS), the oil and gas industry, the Gulf of Mexico Fishery Management Council, the U.S. Army Corps of Engineers, and environmental groups, and we reviewed relevant documents. We found sufficient documentation to establish that using explosives to remove offshore structures kills nearby marine life.

MMS had already acknowledged this fact. For example, in 1986 MMS began formal consultation with NMFS under the Endangered Species Act to limit the use of explosives in order to protect endangered turtles. In addition, a 1987 MMS environmental assessment of potential impacts associated with the removal of offshore structures noted that, unlike explosives, nonexplosive removal methods minimize or eliminate harm to marine life. Further, MMS 5-year oil and gas Environmental Impact Statement for 1992-97 states that "platform removal could result in harm to sea turtles and marine mammals when explosive structure-removal operations are conducted."

Despite this knowledge, we found surprising data on the removal methods that were being used by companies. Of the 570 structures removed from the Gulf of Mexico from 1987 through 1992, two-thirds were removed using explosives. Of further interest, some companies were virtually exclusively using explosives, and we generally found that they had little documentation on cost, safety, or convenience, for example, to back up their decisions. Further, they generally expressed either a lack of knowledge of or a lack of interest in nonexplosive methods.

In addition, our review of MMS structure removal records for 1987-92 showed many examples of companies switching to nonexplosive methods after initially requesting approval for using explosives. Furthermore, a 1987 Corps of Engineers paper on structure removal in Louisiana state waters noted that the Corps had received 15 requests to use explosives, but a standard Corps request for information on why explosives were needed resulted in 11 of those 15 requests, or 73%, being withdrawn in favor of nonexplosive methods, without any attempt to provide the information that may have resulted in Corps approval for the use of explosives.

Among other data that we accumulated, including information on removal methods, the facts that one-third of OCS structure removals were already being done without using explosives, that some companies appeared not to be knowledgeable on nonexplosive methods, and that MMS and Corps data showed that nonexplosive methods could, at least at times, be substituted for explosive methods led to a relatively clear conclusion. Nonexplosive methods of structure removal must already be feasible for at least some removals and could possibly be used more than they were being used.

Then, because of the harm that explosives can do to marine life and the potential to use explosives less often, we examined MMS actions related to the use of explosives. We found that although one of the purposes of the OCS Lands Act (OCSLA) is to encourage the development of new and improved technology to eliminate or minimize the risk of damage to the environment, MMS had not weighed the costs and benefits of nonexplosive removal methods nor encouraged their use, and further, that MMS actions may actually encourage the use of explosives.

For example, in 1993 the MMS Gulf of Mexico Region proposed to NMFS relaxing the limits on the use of explosives, even though exceptions to the limits could already be requested and one MMS official told us that companies have rarely requested exceptions. We found that MMS initiated the proposal without adequate study or justification. And an MMS Gulf of Mexico official told us that encouraging the use of nonexplosive methods is not MMS' responsibility and that MMS is not concerned with what method is used.

Some companies told us that if MMS encouraged or required nonexplosive removal methods, companies would have an incentive to develop this technology, This reflects a 1985 National Research Council report that stated that as the number of structure removals increases, removal proficiency will improve. Furthermore, one company told us that MMS' proposal actually encourages the use of explosives and serves as a disincentive to using nonexplosive methods.

As a result of our work on environmental effects of offshore structure removal, we recommended two things for MMS to do. First, encourage the use of nonexplosive technologies for removing offshore structures, whenever possible, that will eliminate or minimize the risk of harm to the environment and marine life. Second, study the feasibility, benefits, and costs of mandating the use of nonexplosive methods of removing offshore structures, whenever possible, because of the harm that explosives do to marine life.

There is a reason for two recommendations on the same theme. Despite the evidence on the harm that explosives can do to the marine environment and OCSLA's purpose to encourage the development of new and improved technology to eliminate or minimize the risk of damage to the environment, some companies were routinely using explosives. Thus, we believed that MMS could take a more proactive role in encouraging that companies consider and, if possible, use nonexplosive technologies. Then, because we found conflicting opinions and an inadequate body of knowledge on the feasibility of using nonexplosive technologies, we urged MMS to stimulate development of such knowledge.

MMS' response to these recommendations was well stated. MMS agreed that abandonment technology needs further review and assessment. MMS also said that many factors, including safety, cost, water depth, and other things, will be taken into account when it evaluates structure removal applications. Of course, once the technology is further reviewed and assessed, that new information can help MMS in its evaluations, which brings us to the Marine Board report.

1996 Marine Board Report

The 1996 Marine Board report on techniques for removing offshore structures was requested by MMS to address our recommendation that MMS study the feasibility of using nonexplosive methods. As far as GAO is concerned, by taking that action MMS has addressed our recommendation, and the recommendation will be closed. Many GAO reviews are designed to evaluate how federal programs are managed. As such, GAO reviews often do not include technical experts who might evaluate whether a specific action is the best action that could have been taken. For example, in this review we did not do any work that would have led to a recommendation specifying when explosive and nonexplosive removal methods should be used. Instead, GAO reviews often evaluate whether agencies have done what could best enable them to manage their programs. Thus, in this review, we found that explosives can harm the marine environment, that some companies were routinely using explosives while other companies were not, that MMS had not been encouraging the use of nonexplosive structure removal methods, and that more information was needed to help MMS make any decision on using explosives. MMS requested the Marine Board study to obtain the needed information. We would not attempt to evaluate the Marine Board's technical study but, instead, accept that the Marine Board has the expertise to conduct such a study, making the study the best available information. Thus, regardless of the findings of the Marine Board, the study serves as a valuable tool that can enable MMS to make decisions on structure removal methods, and our concern about MMS' not having enough information to make structure removal decisions has been resolved.

This concludes my comments. Again, I thank the sponsors of this workshop for inviting me to participate.

(The views contained herein are those of the author, not necessarily of the General Accounting Office.)

Comments on the Marine Board Report presented by E.P. Danenberger, MMS at the Abandonment Workshop

April, 1996
New Orleans, LA

This is a summary of the presentation.

I commend the Marine Board for its attention to human safety issues. We've heard and read a lot about the use of explosives, but the most important statistic associated with explosive removals is sometimes overlooked: there have been no human fatalities from explosive removals.

The key point in this whole debate is human safety. Any change to accommodate other objectives should not increase human risk, which leads to the first question I'd like to pose for the participants in this workshop.

Do we need to discourage the use of bulk explosives? If the answer is yes, we need to explain why. We are not killing turtles now, although we are, of course, killing fish but apparently not in numbers that are significant. Is change in removal depth the answer?

Should we encourage the use of removal strategies that are more dependent on divers? Bulk charges don't normally need divers; mechanical removal/shaped charges do. Does this enhance safety? It may lower the risk per dive, but increase the number of dives.

Is three feet deep enough in the shallower areas of the Gulf of Mexico? The 15-foot requirement goes back 30 years, primarily for abandoning wells since there were few platform removals at that time. It was a conservative requirement—one could normally get inside well casing with cutters, and it is easier to come up the hole with cutters if the first attempt is unsuccessful. However, this figure has never been fixed and firm; if design precludes a 15-foot below mudline removal and sea floor conditions are stable, lesser depths have been and should be allowed.

Potential problems with a three-foot below mudline removal requirement include:

- The Marine Board Report points to up to three to five foot scours depths in water depths of less than 30 feet and scours of up to two feet in deeper waters.
- There are areas with unstable sea bottoms, and a three-foot requirement may not be enough of a safety margin when the remaining structure may last a hundred years or more.
- Trawls plow into soft sea bed muds.
- The Marine Board Report suggests that the current three-foot cover now required for pipelines is adequate. However, pipelines primarily feature smooth surfaces and "self-deepen" through time.
- External impacts on exposed pipelines have been the causes of all major spills associated with offshore production in the past 15 years.
- During Hurricane Andrew, 496 pipeline segments were damaged, at least nine pipelines lost cover, 10 pipelines were damaged by mud slides, and 18 were damaged by dragging anchors.
- If the cut at three feet is unsuccessful, is it feasible to go deeper?
- It may be difficult to define the mudline or sea bottom. How should drilling cuttings and shell piles be treated?
- Will operators be comfortable with a three-foot standard, knowing that they may have to take costly corrective action if it proves an inadequate margin through time?

The cut depth may not be a case of one size fits all. That is why MMS has used a conservative removal depth with opportunity for case-by-case adjustments.

It may make more sense to use a zonal approach linked to water depth, currents, bottom conditions, fishing activity and whether the structure will remain at the site as an artificial reef.

If the structure remains at the site as a reef, who is responsible for it? Further, will operators be willing to share with the state half of the enormous saving that would be realized from toppling or partially removing the very large platforms in very deep water? Are there benefits other than the savings for operators and consumers if structures are disposed of far offshore in very deep water?

In regard to partial removal, is a cut 85 feet below the surface adequate? IMO guidelines specify 55 meters. Is partial removal acceptable to the Navy? I am happy to report that MMS is already applying several of the recommendations made in the Marine Board report. For example:

- The Marine Board recommends testing a shallower cut depth, and this is already being done on a case-by-case basis.
- Similarly, several MMS/NMFS studies are under way to answer questions about fish kill during removal operations.
- With NMFS, MMS is also reviewing regulations governing the size and frequency of explosive charges.
- MMS also allows partial removal of platforms if it is consistent with the applicable artificial reef program.
- Finally, MMS is also investigating means of incorporating in the design of future platforms features that will make removal easier and safer.

The Gulf is tremendously productive, in terms of both its fisheries and its oil and gas reserves. Many platforms are approaching the end of their service. Wherever it is possible, we should take advantage of the fact that these structures can continue to contribute to the Gulf of Mexico's productivity even when the oil and gas have stopped flowing.

Oil and Gas Industry View and Concerns
presented by Michael Craig, UNOCAL
at the Abandonment Workshop

April 15, 1996
New Orleans, LA.

Initial Comments:

* I do not presume to speak for the industry, but rather as an employee of an international operator with 300 platforms in the Gulf of Mexico, where removals are exceeding new installations.

* Costs associated with abandonments are straight off the bottom line—they add not one barrel of oil or cubic foot of gas. We are profit-making entities intent on increasing shareholder value, ethically and responsibly by conforming to all laws and regulations. We are here striving to find a reasonable balance between costs to operator and environmental protection. These are not necessarily mutually exclusive.

* Offshore disposal involves "clean" steel. The Brent Spar incident was an anomaly exacerbated by erroneous data. With disposal options, there would be no toxic materials involved—the basic earth elements of steel (C, Mg...) would be returning to their origin.

* For "abandonment," read "decommissioning."

With these comments in mind, let me present three groups of Oil and Gas industry concerns.

The first group relates to:

- PARTIAL REMOVAL OF DEEPER WATER STRUCTURES
- OCEAN DISPOSAL OF DEEPER WATER STRUCTURES
- EXPANSION OF RIGS-TO-REEFS PROGRAMS
- CLEAR & REASONABLE ASSET TRANSFER RESPONSIBILITIES

The offshore should be divided into 3 depth zones: "shallow"—shelf; "deeper"—to shelf edge and beyond (300'-2000', limit of fixed structures); "deep"—deepwater (floating production systems with template). The real issues surround the middle zone.

1. The key issue of the conference is that regulations are needed to allow a one-step, stand-alone option that permits partial abandonment. Texas has set a two-step precedent including enhancement of the marine environment.

2. Similarly, another stand-alone option is needed: "disposal" in isolated, stable sites. Again, this is a "dust to dust" scenario.

3. In addition to the above expansions, expand existing shallow water rigs-to-reefs programs; provide for the clear discharge of liability; I suggest that the Texas and Louisiana programs interface to mix best of both; expand the Louisiana areas, move to site-specific plans.

4. "Sunset" properties are being transferred more and more to independents; bigger operators are implementing bonding/letters of credit/escrowing production revenues. At present, this process is not well orchestrated.

The second group of concerns relates to:

- SHALLOWER PILE & CONDUCTOR CUTOFF DEPTH
- IMPROVED SEVERING TECHNIQUES
- NO CHARGE NUMBER LIMIT
- QUANTIFIABLE KILL VOLUMES RELATIVE TO BYCATCH
- NMFS MONITORING PROGRAM IMPROVEMENTS

1. A shallower cutoff depth promotes use of nonexplosives; this is crucial to diver safety for large caissons and stiff soils (Cook Inlet). However, it is inconsistent with current pipeline abandonment requirements.

2. The eventual target is zero fish kill. Recognizing environmental pressure to limit damage (e.g., GAO report), there is a need to promote more efficient explosive charges and reliable alternate nonexplosive options. Operators support service companies. Should government pick up the cost increase?

3. There will be fewer occasions for explosive charges with less resulting fish kill and turtle exposure if the number of charges permitted in a single operation is not limited to eight or fewer.

4. Data suggest that fish kill resulting from explosives used for habitat removal is a tiny fraction of the impacts due to commercial trawling. It is important to reduce uncertainties; therefore, solid, reliable data are needed to quantify this.

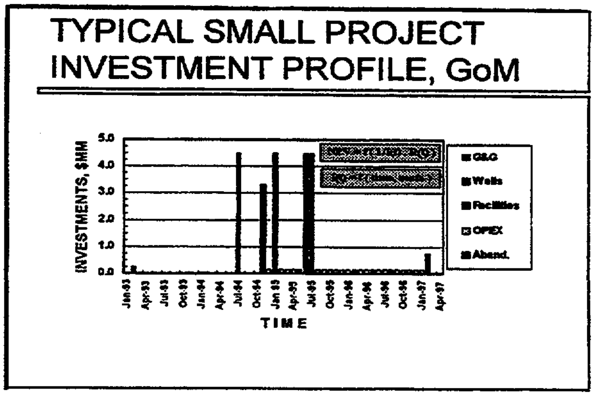
5. Present regulations were made without turtle/mammal damage data. Data collected so far indicate minimal impact on turtles and mammals. Monitoring requirements should be relaxed in light of this.

The third group of industry concerns relates to:

- CLEAR, REASONABLE, ENFORCED REGULATIONS
- PROBABILITY BASED FORMAT FOR LIABILITY COST ESTIMATES

1. In the Gulf of Mexico (GOM), shallow water regulations are basically working well. Outside GOM, the situation is quite the contrary. First, a process of regulation setting is needed to have a clean start and clean finish, involving the public as required, workshops, etc.... Once regulations are final and an operator is in full compliance, the operator must not be held hostage by minority groups.

2. Every asset—platform, plant, well, pipeline—owned or shared by an operator worldwide needs an abandonment cost estimate, whether its abandonment is imminent or not—for portfolio management, depletion plans, SEC reporting, amortization and tax purposes. To capture future regulatory and marketplace uncertainties, Unocal has treated estimates in a probabilistic way ... P10/P50/P90 - P90 one-off abandonment cleared to shore, P10 part of "batch" abandonments with partial removal allowed, e.g., existing edge of shelf platform P10/P90 $4MM/$45MM.



Example of the investment profile typical of a GoM marginal field development. 4-well gas play in -200' WD, production tied back to host. In new project economics (NPV evaluation) abandonment costs have a minor impact. It is quite the contrary for the sale of sunset assets, or for played-out fields where abandonment costs come at the worst time—at low revenues and high operating expenses. Again, zero capital value is added.[1]

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1. Conference PS: For the record, and for the benefit of the person who coined the phrase (it was not I, contrary to what RCV implied), it is "Fish **Huggers**" not "Fish Lovers."

Offshore Oil and Gas in the United States: Looking Ahead to the Millennium

Remarks by Paul L. Kelly, Vice President, Rowan Companies, Inc., and Chairman, OCS Policy Committee

Introduction

I want to thank the Workshop organizers for giving me the opportunity to be here with you today as you discuss one of the most important issues facing offshore petroleum stakeholders in the years ahead. As Chairman of the OCS Policy Committee I share your view that, as increasing numbers of platforms and pipelines are decommissioned and disposed of, it is important that the relevant techniques, policies and regulations be discussed and evaluated in an open, objective and inclusive way. I particularly want to express my appreciation to the international participants for being here and to welcome you to the Gulf of Mexico, currently the hottest offshore province in the world in terms of both ongoing developments and new geological prospects.

Moving Beyond Conflict to Consensus

In 1993 the OCS Policy Committee delivered a report to U.S. Secretary of the Interior, Bruce Babbitt, titled *The Outer Continental Shelf Oil and Gas Program: Moving Beyond Conflict to Consensus.* In that report, which reflected the views of the diverse interests represented on the Committee, including the coastal states, local government, the petroleum industry, commercial, and sports fishing, and the environmental community, we reviewed how a decade of prevailing controversies and the measures used to deal with them had seriously diminished the effectiveness of the federal OCS oil and gas program in helping to meet our nation's energy needs. Undertaking an independent and objective assessment of the history and current state of the OCS program, the Committee concluded that there is a need to maintain an active OCS oil and gas program to continue to help in meeting U.S. energy requirements for the foreseeable future. However, if the program was to proceed successfully out of its present state of conflict and controversy, a new paradigm of OCS decision making would be necessary.

The Committee concluded that offshore lease sale moratoria are a symptom of the federal government's past hierarchical approach to OCS decision making and that the OCS process should be modified to focus more on reaching consensus in order to obviate the need for moratoria. Recognizing that interests and priorities on these issues differ throughout America, we recommended that regional task forces should be established to build consensus on OCS leasing. The first such task force to be formed was organized in Alaska in conjunction with Interior's formulation of the new Five-Year OCS Leasing Program for the years 1997-2002. As a result of the successful Alaska Regional Task Force efforts and its recommendations to the Minerals Management Service by way of the OCS Policy Committee, four lease sales including five geological basins offshore Alaska are included in the proposed Five-Year Plan which is now working its way through the regulatory approval process.

Other recommendations in the report included one that impact assistance and revenue sharing measures should be enacted for coastal states and localities and that incentives to industry—especially relating to royalty relief—should be considered further. It may come as a surprise to many of you that the legislative and regulatory initiatives now being implemented with regard to royalties paid in connection with shallow and deep water production in the Gulf of Mexico received significant impetus from the OCS Policy Committee's 1993 report. The report also states that MMS's environmental studies program continues to need adequate funding, good science, and appropriate cooperation among MMS and other involved parties. Another recommendation—that the MMS develop a good data management program and dissemination system for all the valuable environmental information that has been accumulated over many years—is well on the way to being implemented.

I mention the report because its theme, "moving beyond conflict to consensus," reflects in large part what you are about in New Orleans this week.

The decommissioning of offshore oil and gas installations is a complex topic with many facets not always understood by all relevant stakeholders. Finding the right framework which balances the crucial and inter-related requirements of environmental protection, human health and safety, technological possibility, and economic concerns is not easy. A workshop like this, where all these factors which must be balanced can be discussed objectively and openly among all the important stakeholders, offers an opportunity to turn conflict into consensus, and I hope you will take advantage of it. You are the people with the knowledge and talent to reach common sense solutions to these problems using good science. Certainly we are better off resolving these issues among ourselves—environmentalists, government agencies, fishing interests, and the petroleum industry alike—than we are allowing legislatures to do it on their own. When legislative bodies act in a hurry, unpredictable things can happen. For example, look at the Oil Pollution Act of 1990. Six years after its enactment, the U.S. Interior Department is still unable to enact implementing regulations for "offshore facilities" under its jurisdiction because to do so would immediately reduce oil and gas production in the Gulf of Mexico by at least 30 percent—not a good idea when oil is at $24 and natural gas is over $2.30—and wreak economic havoc on the independent petroleum industry, marina and recreational boat owners, and numerous other facilities and businesses up navigable waterways hundreds of miles inland from the coast! Certainly Congress did not intend for OPA 90 to have all these effects when it drafted its response to the terrible transportation spill in Prince William Sound, Alaska. The OCS Policy Committee has made some recommendations on how to correct this problem; and, hopefully, these will be included in corrective legislation when Congress approves the 1996 Coast Guard Authorization Act now pending.

Likewise, similar risks and uncertainties exist when legislators decide the pendulum has swung too far in favor of environmental protectionism or that the costs and benefits of protecting our land, air and water are out of balance. All this leads me to conclude that it might be better for all of us to look to ourselves rather than to our legislative bodies for solutions to our problems. I am sure that even some of the government agency representatives here with us today will agree. It is better that we reach <u>our</u> consensus if we can and then go to the legislative bodies when necessary. It reminds me of the famous Chaplain of the U.S. Senate, Dr. Edward Hale, who was once asked the question:

"Doctor, when you pray as Chaplain of the Senate, do you look at the tragic condition of the country and the many problems existing in the country and then pray that the Almighty will give the senators the wisdom with which to resolve those problems?"

And Dr. Hale replied, "No, I do not look at the country and pray for the senators. I look at the senators and then pray for the country."

Current E & P Activity

While this is a workshop specifically focused on offshore lease abandonment and platform disposal, it might be useful for you to hear an update on current exploration and production (E & P) activity since this is the milieu in which these activities exist.

It is important that we understand current levels of petroleum industry exploration and production spending and activity because they have such an important impact on the global economy. To give you some idea of the magnitude of this industry, in 1996, 275 oil and gas companies plan to spend $63.9 billion on worldwide exploration and production, up by 7.7% from the $59.3 billion spent in 1995. This is the greatest planned increase since 1990. The combination of a firmer outlook for natural gas prices, good drilling success, and improved cost efficiency is what appears to be lifting spending plans in 1996.

Breaking down the $63.9 billion, about $18.2 billion will be spent in the United States, $6.6 billion in Canada and $39.1 billion international. The numbers also show a trend towards more offshore spending, with three times as many companies (30%) planning to increase offshore expenditures as plan to increase onshore expenditures (9%). Nearly two thirds of U.S. majors expect E & P to represent a larger portion of total capital spending in 1996 than in 1995.[1] This is the largest shift toward E & P spending we have seen in 14 years. In the same survey the industry's three top regions with the greatest perceived exploration potential are Latin America (60%), Asia/Pacific (53%) and the Gulf of Mexico (30%). The Gulf of Mexico's high ranking along with two much larger continental regions is really quite extraordinary when you think about it. In my opinion it marks the emergence of the Gulf from a perceived marginal development region into a reborn world-class exploration area.

The large increases in international expenditures are the reflection of a sea change now underway in the attitudes and politics of the developing world where national oil companies are either privatizing or opening up areas for exploration by foreign companies. Contract terms, taxes, and fiscal regimes are all being revised as countries compete for limited investment capital. Never before have foreign opportunities for U.S. and European companies been greater.

From the perspective of the offshore drilling contractor, the results of current market trends have been dramatic. We see a 5% increase in rig activity in the North Sea and an 8- to 9-percent increase in Africa and Latin America this year. In the U.S. we expect rig activity to increase at least 4 percent in 1996—the largest advance since 1993.

The supply of offshore rigs is tight right now and becoming more so. Utilization rates for actively marketed rigs are 82% for semi-submersible units (floating rigs used to drill in deeper waters) and 87% for jackup rigs, the highest levels since 1985. Offshore drilling contractors are finally profitable again for the first time in more than a decade.

Importance of New Technologies

Despite the tightening of industry capacity for rigs, equipment and services, finding costs have continued to decline due to the proliferation of new technologies such as 3-D seismic and sophisticated graphics imaging, horizontal/extended reach drilling and subsea completions. These new technologies provide some powerful advantages:

- The American petroleum industry has gone "high tech." There are more super computers owned by companies in this industry than any other. Moreover, the petroleum industry consumes more computer equipment in general than any other industry except the computer industry itself. 3-D seismic and state-of-the-art graphics imaging techniques allow oil companies to improve their finding costs significantly by drilling only those prospects most likely to contain commercial quantities of oil and gas. Because more potential dry holes are excluded up front, oil companies can significantly improve their success ratios and substantially lower their finding costs. One smaller oil and gas producer in Houston recently disclosed that it has raised its success ratio to 75% from 18% by using the newer seismic technologies.
- Similarly, the use of horizontal/extended reach drilling has enabled oil companies to significantly reduce the number of wells and production platforms in drilling prospects, as multiple formations can be penetrated (often miles from the wellsite) by drilling only one wellbore instead of the many that were drilled in the past.
- Subsea completion technologies and combination mobile drilling and production rigs have enabled more prospects to be drilled without the use of expensive (often $500 million to $1 billion) production platforms. As a result, rig activities have flourished in more mature markets such as the U.K. sector of the North Sea, where the average size of new fields has dropped from over 1 billion barrels to as low as 25-50 million barrels in recent years. Key future technologies will include multi-lateral completion techniques, where multiple-producing zones are targeted by reentering old vertical wells. The cost savings of targeting additional oil and gas formations in such wells is compelling, as about 60% of a well's cost relates to drilling the vertical portion. We will also see in the future more advanced mobile drilling units such as the *Rowan Gorilla V*, a large new hostile-environment jackup rig scheduled for delivery in 1998 which will be able to drill exploration and development wells and then stay on site as a production platform for the life of the field, thereby saving the oil company operator the higher costs of building and later removing a fixed platform. The *Rowan Gorilla III* is currently involved in such a project offshore Nova Scotia.

The result of these technologies and the efficiencies and cost reductions realized by oil company operators is that the threshold market price of oil or natural gas at which it pays to drill has been reduced. This is why we see E & P expenditures rising despite relatively flat world oil prices.

Also, one important thing that all these technologies have in common is that they all will contribute to a reduction in the number of permanent production platforms to be installed in the future.

Gulf of Mexico

Because the Gulf of Mexico is still among the three most highly rated prospective regions in the world for explorationists, this area is worth some special mention.

Today we have about 155 mobile offshore drilling rigs working in the Gulf, the highest number in six years. This makes it the most active area in the world by far. By comparison the North Sea, the second most active region, has 82 rigs working, and the total world supply of offshore rigs is 446. Thus, 35% of the worldwide rig fleet is currently drilling in the Gulf of Mexico.

What makes the Gulf so successful? The technologies and economic factors I just mentioned are vitally important, but there are other factors as well:

- Central Gulf of Mexico Lease Sale 152 held by the Department of Interior's Minerals Management Service (MMS) last year was the most successful sale held in several years with companies bidding a total of $307 million for 588 tracts. There is obvious continuing interest in the Gulf both on the shelf and in deep water. The next Central Gulf sale, to be held on April 24, could be a barn burner.
- After considering possible alternative approaches and rejecting them, MMS has confirmed that area-wide leasing will continue in the Gulf with sales in the Central and Western Gulf to be held annually, as in the past, in the years 1997-2002. This has removed an important uncertainty for operators and will build confidence in a reliable, predictable leasing program in the Gulf in the years ahead.
- Large natural gas discoveries have been made in a deep geological target beneath Mobile Bay known as the "Norphlet Trend." Twenty-five to 27% of U.S. natural gas production now comes from the Gulf of Mexico. About 10% of that amount already comes from the Norphlet Trend, which is believed to extend farther offshore Alabama and Florida. The future potential of this region could be very large and highly significant for total U.S. natural gas production. Watch for the results of a well now being tested by Chevron off Pensacola, Florida.
- Phillips Petroleum and its partners, Amoco and Anadarko, announced last year that their sub-salt discovery, *Mahogany,* in the Ship Shoal Area offshore Louisiana, is commercial. While some sub-salt dry holes have also been drilled, as expected, Phillips and Anadarko just announced another significant discovery in the sub-salt zone in the Ship Shoal Area, the Agate No. 1 well. This is encouraging additional drilling in sub-salt areas in the Gulf. Sixty percent of the Gulf subsea land mass contains salt structures, and 3-D seismic helps us see geological formations below them more clearly.
- Companies are encouraged by the new authority given by Congress and the President to MMS to reduce or eliminate royalty in order to encourage production in water depths of 200 meters or more. A report from the National Petroleum Council entitled *Research, Development and Demonstration Needs of the Oil and Gas Industry* states that "Deepwater exploration and production in the Gulf of Mexico will progress rapidly during the next 10 to 20 years, primarily due to the advancements in technology and the high per-well producing rates recently confirmed. It is highly probable that the Deepwater Gulf will become the primary supplier of domestic oil and gas in the near future." An interesting sidebar to this projection is that Shell Oil Company and its partners—Amoco, Mobil and Texaco—announced in March they plan to drill a well in the Alaminos Canyon 200 miles offshore Texas in 7,625 feet of water. This will be the deepest water ever for an offshore well.
- MMS seems willing to use royalty policies and increased flexibility with regard to new and existing leases to encourage and maximize production and full depletion in marginal fields, thereby increasing returns for both investors and U.S. taxpayers. The agency also has clarified procedures by which independent companies can obtain royalty relief in depleting fields. Finally, MMS is acting to reform OCS operating regulations to reduce costs.
- Actions by the OCS Policy Committee, MMS, and Congress concerning proposed amendments to the Oil Pollution Act of 1990, which will

resolve problems in implementing the financial responsibility requirements of the Act, have given independent oil and gas operators renewed confidence that they can remain active players in the Gulf over the long term. We hope to have final action on this legislation shortly.

Overall the Gulf of Mexico looks good to the industry in terms of both the geological prospects and the regulatory regime. What we have in the region are three new frontier areas--the Norphlet Trend, the sub-salt zone, and the ultra-deep-water Gulf--all of which are exciting and have long-term potential. At the same time, MMS is taking actions which indicate the agency has become more sensitive to the fact that governments, as well as companies, must compete for limited investment capital. As a result, a number of operators plan to increase the role of the Gulf in their global exploration strategies. Natural gas prices, another important factor in this market, have strengthened in the U.S. recently as gas in storage has been reduced to practically nothing by the cold winter which in April still will not die. Indeed, drilling activity should increase in the second and third quarters over presently robust levels as companies race to make gasoline for an anticipated busy summer driving season and replenish natural gas in storage in time for next winter.

Given the fact that most other offshore regions of the U.S. are off limits to explorationists, with the exception of five basins offshore Alaska, where no commercial discoveries have been made to date, I have an image of the Gulf of Mexico as a separate and highly rated "exploration country," if you will. While MMS has been constrained from expanding the OCS program much beyond Alaska, the Gulf and existing producing areas in the Southern California region, the agency is working hard to make the Gulf attractive and globally competitive for domestic and international investors. At the same time, it is following good conservation practices and maximizing economic return for U.S. taxpayers, all in the national interest.

U.S. Offshore Strategy

If we look at current U.S. offshore oil and gas strategy, what have emerged are a short-term strategy and a long-term strategy.

The short-term strategy is to make the Gulf of Mexico as attractive as possible in terms of both government policies and the regulatory framework so that domestic production of oil and gas from this region can be maximized. In so doing the Government and industry have the support of the citizenry of the states and localities along the Gulf Coast where employment, economies, and tax bases and revenues are closely tied to the offshore enterprise and people are comfortable with it.

The long-term strategy is to work in a slow, deliberate manner to "move beyond conflict to consensus" in frontier OCS regions along the East Coast and West Coast of the United States and the Florida Panhandle so that more offshore activity might take place in those regions after the millennium. This can be accomplished only through good communication and educational outreach programs as well as consideration for the concerns of and involvement by all the stakeholders. After its successful experiment in Alaska, the OCS Policy Committee certainly would like nothing better than to see the next two regional task forces be formed in the Florida Panhandle region and in North Carolina, two highly prospective natural gas areas; and we have offered our assistance to the Governors' offices in both states in this regard.

International Standards Making

In a matter of more direct concern to the Workshop, the United States participates in the work of the International Maritime Organization in London (IMO) through the Department of State. The Department of State has established the Shipping Coordinating Committee which coordinates all input of the U.S. to IMO and includes various working groups. The U.S. Coast Guard provides a majority of the technical input to the Shipping Coordinating Committee, and in almost all cases involving the IMO assembly and its various committees and subcommittees, provides a delegation to each body's session.

The U.S. offshore industry's input into this process comes largely through the Coast Guard's National Offshore Safety Advisory Committee (NOSAC) which includes representatives of the various offshore industry sectors and the public, including yours truly as one of two representatives of the drilling sector.

Last year NOSAC formed a task group to study what seemed to be a consensus view that United States response to numerous initiatives of IMO and the International Organization for Standardization (ISO) affecting the U.S. offshore petroleum industry needs to be better coordinated both between responsible government agencies and industry and among various sectors of the industry itself. I was asked to chair the task force. On November 7, 1995, we delivered our report to NOSAC and the Coast Guard. If you are new to the IMO and ISO standards making process I recommend the report to you as a good primer on how the process works. Copies can be obtained from the Coast Guard's Office of Merchant Marine Safety, Security and Environmental Protection, and I also have a few extra copies if you want to leave me your card.

The report contains a number of recommendations on how U.S. participation in IMO and ISO can be improved, and, while we are still awaiting an official written response from the Coast Guard, we are already seeing recommendations in the report being implemented. For one, NOSAC has now established a standing committee to network with the Coast Guard on IMO and ISO issues, give advice and make recommendations and help find suitable technical experts on matters raised in the standards organization. We are also seeing increased use of electronic communications to exchange information. In fact, the Coast Guard now has a World Wide Web Home Page. And, finally, the industry itself and its various trade associations in the U.S. and the United Kingdom have begun exchanging information and views on IMO and ISO initiatives. During the preparation of the NOSAC report, the controversy over the Brent Spar disposal reached its peak and served to provide a wake-up call to the U.S. offshore industry to become more involved in international standards making.

One of the things the NOSAC task group found to be anomalous from this side of the Atlantic was that, whereas the regulatory bodies of leading offshore petroleum producing nations such as the United Kingdom and the United States have in recent years been attempting to move away from overly prescriptive, command and control regulation towards mature systems of motivated, performance-oriented self-regulation, many of the initiatives now before IMO seem to be moving in the opposite direction. Also, it seems that the offshore industry must continue to be vigilant in taking the actions necessary to ensure that its vessels and equipment are not rolled into unsuitable rule making aimed at more traditional deep water marine fleets because the movers of these regulations overlook the uniqueness of offshore vessels and equipment and their special, more industrial functions.

We also saw a need to defend ourselves from the notion that "one size fits all." For example, because of the much more hostile working environment, helicopter decks on mobile offshore drilling rigs and production platforms are constructed to withstand much more severe stress from wind and wave than is necessary in the more benign environment we have in the Gulf of Mexico. Yet, twice in the last five years we have had to fight successfully to prevent IMO from adopting a single tier helideck standard. The cost to retrofit helidecks on MODUs in the Gulf of Mexico and elsewhere outside the North Sea has been estimated to be as much as $2 million per rig, but many IMO members seemed unconcerned by this. Therefore, another recommendation contained in the NOSAC report is that the need for good costs/benefits analysis be stressed more in the international standards making process.

It seems to me that last year's proposal to IMO from Denmark that Contracting Parties to the London Convention of 1972 agree on a moratorium on the disposal at sea of decommissioned offshore installations in favor of dismantling and disposal on land was a similar single solution proposal that simply just would not fit in the Gulf of Mexico and many other regions where various offshore stakeholders are comfortable choosing from a variety of disposal options on the basis of environmental and economic impacts, good science, and common sense. As we all know, each facility to be decommissioned is different, and there is no single answer which will strike the right balance among the many complex factors in each situation.

Conclusion

In closing, I want to wish you all well in your Workshop endeavors. Looking at the program, you have much to do in just three days. But it need not all be labor. Your situation makes me recall the cry of Prime Minister Sir Winston Churchill when he was on his way to America on the *Queen Mary* in 1953. In the majestic main saloon after dinner, he and his party were being served brandy. Churchill asked his science adviser, Lord Cherwell, whether all the liquor he had consumed in his life would fill the hall.

Cherwell took out the slide rule he always carried with him, and after some calculation on paper, told Churchill and the party that his combined liquor consumption would fill the saloon about to Churchill's nose.

Sir Winston, seeming a bit disappointed, reflected a bit and then said, "When I look at the high expanses of this hall and then think of my seventy-nine years, I can only say how much there is left to do and how little time there is to do it."

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Working Group One: Abandoning Wells

Chair: **Tom B. Slocum**, *Halliburton/TAS*
Co-Chairs: **Tommy D. Dorman**, *Chevron USA, Inc.*
John Lohrenz, *Louisiana Tech University*
Charles H. Kelm, *Halliburton Energy Services*

Panel and Committee Members:

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Ronnie Faul	HES	(504) 593-6705	(504) 593-6725
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Jim Yancey	Superior Well Service	(504) 393-7774	(504) 393-0003

AGENDA: ABANDONING WELLS GROUP

Day One (4/15/96)

I. Summary of Workgroup's Agenda and Issues Paper - Tom Slocum — 2:00 - 2:10

II. Abandoning Wells Workgroup Introductions — 3:30 - 4:40

- Introduce Chairs, Co-Chairs, Permanent Members, and Panel Participants for each issue - Tom Slocum — 3:30 - 3:40
- Review ground rules for workshop discussion - Tommy Dorman — 3:40 - 3:50
- Review detailed agenda including key panel speakers, workgroup issues, and key topics for discussion under each issue - Charles Kelm — 3:50 - 4:20
- General question and answer period — 4:20 - 4:40

Day Two (4/16/96)

I. MMS and State Regulatory Requirements Governing Wellbore Abandonments — 10:30 - 12:00

- Review issues statement and key discussion topics - Charles Kelm — 10:30 - 10:35
- MMS - Bill Martin — 10:35 - 11:00
  Overview of current regulations and the impact on the industry
- Chevron - Tom Dorman — 11:00 - 11:10
  Review of cost and potential impacts for using MMS/State abandonment requirements. Questions concerning minimum requirements
- Mobil - Terry Floyd — 11:10 - 11:25
  Review of API Standard & "Best Practices" relating to wellbore abandonments
- Panel/Group Discussion — 11:25 - 12:00

Desired Outcomes

1. Review
2. Brainstorm desired states, propose recommendations, and/or issue to be addressed.
   a. Possible regulation changes to investigate minimum standards
   b. Technical advances needed and/or technical changes in regulations

II. LUNCH — 12:00 - 1:00

III. Co-existence of Best Practices, New Technology & Economics — 1:00 - 3:00

- Review issues statement and key decision topics - Tom Slocum — 1:00 - 1:05
- Halliburton - Charles Kelm — 1:05 - 1:30
  Oil Industry's perspective of current "Best Practices" techniques
- Louisiana Tech - John Lohrenz — 1:30 - 1:45
  Economics of the P & A process in industry
- Halliburton - Ronnie Faul — 1:45 - 2:00
  Cementing technology issues - new products, techniques, and API slurry standards
- Chevron - Tommy Dorman — 2:00 - 2:10
  Explosives - What innovations are being developed to improve this technique and increase its viability for future projects? How does this affect surface cement plugs?
- Panel/Group Discussions — 2:10 - 3:00

Desired Outcomes

1) Review of pros and cons, as well as costs of current cutting severing techniques available for casing, conductor, and pile severing.
2) Brainstorm desired states and/or propose recommendations to reach desired states for the following:
   a) Possible regulatory changes to investigate:

Cementing	Mechanical Cutting	Explosives
API Standards	reduce 15' BML cut depth	reduce NMFS regs.
"Best Practices"	new technology	shaped charges

   b) Technological advances needed and safety issues:

Cementing	Mechanical Cutting	Explosives
improved slurry design	new technology	shaped charges
new techniques	improved reliability	minimize blast effects
		reduce amounts

IV. BREAK 3:00 - 3:15

V. Liability and Environmental Issues 3:15 - 5:00

- Review issues statement and key discussion topics - Tom Slocum 3:15 - 3:20
- Halliburton - Charlie Kelm 3:20 - 3:45
  Discussion of "Best Practices" procedures for service companies and operators
- MMS - Bill Martin 3:45 - 3:55
  Review MMS regulations relating to liability and environmental issues
- Amerada Hess - Craig Alexander 4:00 - 4:20
  Special cementing slurries & techniques
- Panel/Group Discussions 4:20 - 5:00

Desired Outcomes

1) Discuss current wellbore abandonment processes in the Gulf of Mexico and process improvements using API standards and "Best Practices."
2) Brainstorm desired states, propose recommendations, and/or issue to be addressed:
   a) Possible regulatory changes to investigate:
      - Need for change in wellbore abandonment regulations.
      - Will special abandonment techniques be allowed?
      - Pressure testing requirements.
   b) Technological advances needed and/or safety issues:
      - Cost-effective cutting techniques.
      - New cementing technology.
      - Advanced wireline tools and technology.
      - Explosives severing using shaped charges.

Abandoning Wells Working Group

ISSUES

Introduction

The primary objective of this working group is to identify major technical, regulatory, and environmental issues that are relevant to the abandonment of offshore wellbores. Once the issues have been identified, the working group also has the objective of making recommendations or providing potential solutions for consideration. Areas for process improvement will be identified and "best practices" will be discussed and compared to "minimum standards." The working group will primarily focus on wellbore abandonment in the Gulf of Mexico. However, workshop participants are encouraged to discuss international issues which may be relevant to wellbore abandonment practices in the Gulf of Mexico.

The Abandoning Wells Group has identified several major areas for discussion that have concerns related to both operators and service companies performing wellbore abandonments in the Gulf of Mexico. The following broad topics were selected for the agenda:

- MMS minimum requirements and state regulations.
- Co-existence of best practices, new technology, and P & A economics.
- Liability and environmental issues relating to wellbore abandonment.

This paper will review current practices and regulations involving wellbore abandonments in the Gulf of Mexico in regard to the main topics listed above. The objective of this paper is to address a selected list of issues relative to these topics for a panel discussion session and not to specifically review all issues under these broad topics. Key speakers or committee members will present a review of the subject surrounding the issue with supporting data prior to each discussion. The purpose of the panel discussion is to obtain input on each issue that is of primary concern to the participants in the session. The working group committee will facilitate the discussion and provide a summary to the various working groups. A final issue paper will be drafted which will provide recommendations for future research and regulatory or policy adjustment.

MMS Minimum Requirements and State Regulations

Federal and state regulations concerning wellbore abandonments in the Gulf of Mexico and other offshore areas are not consistent. Regulations among states vary, and interpretations of MMS regulations are not consistent among districts. Primary concerns are the broad interpretation of regulations, lack of consistency among regulatory agencies, and the implications relating to successful wellbore abandonment process.

Current MMS regulations are very broad, with the most emphasis placed on isolation of the production intervals. The MMS relies on their experienced district personnel to apply the best technology and review abandonment procedures for approval. Examples of potential problem areas in the current regulations include: 1) No specifications on protecting freshwater bearing sands; 2) Identification of preferred approach for isolating an uncemented annulus; 3) No specifications on quality of cement slurry; 4) Number of cement plugs required does not change; and 5) No reference to API Abandonment Standards in Subpart G.

<u>Issue #1</u>: *Does meeting minimum MMS standards assure a successful long-term wellbore abandonment? If not, what needs to be changed?*

- *Are the regulations too broad?*
- *Should API standards and "Best Practices" be considered?*
- *What are the liability implications?*
- *Is there an incentive for us to perform the best possible abandonment?*

<u>Issue #2</u>: *Should P & A practices be consistent with drilling and completion practices?*

- *Clean annulus before cementing?*
- *Circulate cement vs. bullheading.*
- *Minimum pressure loss during test vs. acceptable 10% loss.*

<u>Issue #3</u>: *Should MMS and state regulations be consistent for wellbore abandonment operations?*

- *Are objectives the same?*
- *Why do differences exist?*
- *Do both incorporate API standards or "Best Practices"?*
- *What is the economic impact?*

Better quality products and procedures are continuously being developed for producing wells as technology changes. The technology improvements are incorporated into developing production projects early since there is an economic incentive to the operator to maximize well performance. Improvements in the wellbore abandonment process are driven by economics and MMS requirements. The MMS must have a process to review technology changes and a method for incorporating the new technology into abandonment planning by the operator.

Issue #4: *How often should regulations be reviewed or revised as technology changes?*

- *What is the current review procedure?*
- *Have revisions been made due to technological changes?*
- *How can regulations be revised to incorporate new technology?*
- *What is an acceptable review or revision schedule?*

Issue #5: *What minimum standards should be required of service companies who perform wellbore abandonments?*

- *What are the existing requirements?*
- *Should there be an additional training standard?*
- *What are the liability issues?*
- *What are the minimum technical competency requirements?*
- *What are the minimum financial or bonding requirements?*

Co-existence of "Best Practices," New Technology, and Economics

There are difficult decisions being made every day between the "best practice" to be used during each stage of an abandonment, the minimum requirements specified by the MMS regulations, and P & A economics—which dictate to the operator the need for cost reductions whenever possible. The impact of these choices could potentially result in a poorly executed wellbore abandonment with future liability consequences. As a result of these considerations, the majority of abandonments, at best, meet only the minimum requirements. Somehow, we must balance these issues to achieve a reliable and cost-effective abandonment without compromising future liabilities.

Issue #6: *Are MMS regulations too flexible to ensure an effectvie wellbore abandonment in general?*

- *Is there consistency in interpretation of regulations?*
- *Do regulations reflect API standards or "Best Practices"?*
- *How is new technology incorporated?*
- *Is there room for potential errors?*
- *What are the surveillance methods used for compliance?*

Issue #7: *Should the regulations reference API Recommended Practices/Bulletins to ensure good techniques are used?*

- *Currently regulations do not reference API standards.*
- *API standards are updated every five (5) years.*
- *Well abandonment standards are included in the API bulletin.*
- *What is the impact of API standards on MMS requirements?*

Issue #8: *Should MMS requirements reflect a "best practices" approach with exceptions granted by the MMS based on technical merit when a "best practice" cannot be met due to the well's mechanical condition?*

- *Are current requirements too broad and not specific?*
- *Less MMS responsibility due to "Best Practice guidelines.*
- *Overall economic impact on industry.*
- *Future concerns regarding liability issues.*

Under current regulations, there are no cement slurry specifications references, and the selection of a cement design is usually made by the operator or service company. Referencing an API standard would ensure that an appropriate cement design will be used for the specific depth and temperature in the wellbore. Lack of a proper cement slurry design can ultimately result in cement degradation and loss of sealing integrity of the cement plug. Other issues relating to the cementing process are: "bullheading" cement down the annulus, and determining the number of cement plugs required based on well depth.

Issue #9: *Should cement slurries used in wellbore abandonments be required to meet API recommended standards?*

- *Is cement degradation a problem?*
- *What are the API recommended standards on*

cement plugs?

- *Is cement slurry testing a necessity?*
- *Are most ement plugs designed according to API specs?*
- *Why not use cement standards associated with usual plug back or squeeze operations?*

Issue #10: *Is "bullheading" cement down an annulus an appropriate approach to cementing off an annulus?*

- *What are current MMS regulations?*
- *Are there problems associated with this technique?*
- *Could there be cement contamination problems?*
- *Are there alternative methods?*

Issue #11: *Should the number of cement plugs used in the wellbore abandonment process depend upon well depth?*

- *Are two cement plugs (barriers) sufficient for any depth well?*
- *Should there be other criteria based on depth?*
- *What is the primary concern in deep wells?*
- *Are cement slurries modified for deep wells?*

Liability and Environmental Issues

There are many unanswered issues involving wellbore abandonment liability and the future impact to the environment of a minimally abandoned wellbore.

Issue #12: *Is a mechanical bridge plug an acceptable alternative to cement as the surface plug or should it be run in conjunction with a cement plug?*

- *Is a top cement plug in the surface casing adequate?*
- *Should the bridge plug be placed in the production string?*
- *What should be the final test specifications?*
- *Should the production casing be cut prior to placing the surface cement plug?*
- *Should every abandonment include at least one bridge plug?*

Issue #13: *Should all annuli be pressure tested, and is a pressure test on a casing annulus acceptable proof that the annulus is sealed, even if cement calculations show no cement present?*

- *Are current regulations sufficient?*
- *Should it be acceptable to test and squeeze cement in all casing annuli before working on the production casing?*
- *What should be the "Best Practice" in setting the top surface plug?*
- *Should MMS inspectors witness the final plug test, or what should be the appropriate verification method?*

Issue #14: *Should special abandonment techniques be used in specific situations when shallow gas is a known problem in the area, when plugging perforations for zone changes, or when abandoning sub-sea wells?*

- *What are acceptable alternative methods?*
- *Should sub-sea wells require special regulations?*
- *Should cement be placed, whenever possible, across each shoe to ensure a barrier to upward migration of oil and gas?*
- *How important is the producing zone abandonment versus protection of fresh water sands?*

Issue #15: *When is it appropriate to use mechanical cutting, hydrajetting, jet cutting, and explosives in wellbore abandonment operations?*

- *What is the preferred method and why?*
- *What is the most reliable?*
- *Which method is the most environmentally acceptable?*
- *Under what circumstances should explosives be used?*
- *How do the methods compare with one another?*

DISCUSSION AND SUMMARY

Scope

Working Group #1 focused its efforts on major technical, regulatory, and environmental issues relating to wellbore abandonment operations that are of primary concern in assuring an effectively plugged wellbore. All issues included for discussion were considered relevant for any wellbore abandonment operation, regardless of location.

Activities of Working Group

Based on input from operators, service companies, and the MMS, a set of potential issues was developed and circulated through the committee members prior to the Workshop for their review and comment. Based on their input on the relevance of each issue, the final list of issues for the Workshop was developed.

The discussions of the Work Group were focused on three main areas:

- MMS and State Regulations
- Co-existence of Best Practices, Technology, and Economics
- Liabilities and Environmental Responsibilities

Conclusions of Working Group

1. Establish an advisory group of industry experts to work with the MMS to review new technology and provide input on abandonment issues. The existing regulations, when followed to the letter, result in a minimally abandoned well. There was debate within the working group on whether the existing regulations by themselves ensure long-term abandonment success. The advisory group would work with the MMS to review abandonment issues and to ensure that appropriate practices are recommended for every abandonment situation.

2. Establish a data base of abandonment practices for long-term tracking purposes. Abandonment operations offshore have only been active for a few decades. It will take time to ensure that the techniques being used are adequate. A data base that is developed as wells are abandoned and that includes information on the abandonment practices used will be very useful in the future should one or more of the abandonments fail.

3. Encourage operators to use non-explosive cutting techniques (abrasive cutting, mechanical cutting or diver assist) for shallow pipe recovery operations, whenever possible (via a NTL, LTL or MMS policy). Currently, the risk to the wellbore's cement plugs from the explosion's shock waves has not been quantified. In addition, there is recognized risk to marine life in the platform area. The work group feels that additional research that quantifies the shock effect to the cement must be completed before explosive severing should be considered as a preferred technique for shallow pipe recovery

4. The MMS needs to become more consistent in regards to policies and procedures. The industry advisory group recommended earlier could aid the MMS in standardizing their policies and procedures to ensure uniformity in the interpretation of regulations by MMS personnel.

Discussion of Individual Issues

A total of 19 issues were addressed during the workshop. The following summarizes the discussion on each of the issues.

__Issue #1:__ *Does meeting the current MMS regulations assure a successful long-term wellbore abandonment? If not, what needs to be changed?*

There was a very spirited discussion of this issue, and no consensus was reached as to whether existing regulations ensure successful long-term wellbore abandonment. It was pointed out that abandonments have been done offshore for the past 30 years with only a handful of obvious failures. Everyone agreed that the existing regulations were minimal and that many operators exceed those requirements without a formal mandate. It was also pointed out that over 50% of the abandonments being submitted to the MMS today meed only the minimum requirements. Abandonments are expected to last long enough for Mother Nature to restore the wellbore to its pre-drill condition. It is doubtful that the current abandonment history is adequate to ensure that future problems will not develop in a minimally abandoned well.

__Issue #2:__ *Should an attempt be made to clean an annulus before it is cemented?*

No consensus was reached on this issue. It was pointed out that API Bulletin E3 recommends circulating cement into an annulus but does not address cleaning the annulus prior to cementing. It was also pointed out that circulation and the use of chemicals are the recognized techniques that potentially could clean the annulus prior to cementing. The use of a thermite device was also suggested as a potential cleaning technique though cost may be a factor. A clean annulus prior to cementing was recognized as being important in ensuring a successful cement job.

__Issue #3:__ *Are current pressure test requirements adequate?*

Current regulations require either that 15k lbs of weight set on the cement plug or that a 1,000 psi pressure test be performed for 15 minutes with no more than a 10% pressure loss. There was discussion but no resolution of whether or not these test requirements are adequate. API Bulletin E3 recommends the pressure test but does not include the weight test as an option. The pressure test in API is not limited to 1,000 psig, but specifies that the squeeze be tested to 1,000 psig above the squeeze or pump in pressure, but still allows a 10% pressure loss during the test. There was some concern that a pressure loss could be an indication of a cement problem and should not be accepted unless the source of the loss could be identified.

Issue #4: *Should MMS and state regulations be consistent for wellbore abandonment operations?*

The discussion was limited to Louisiana regulations. There has been no formal dialogue between the state and MMS on wellbore abandonment issues. The general consensus was that many operators are taking a very conservative approach and following the more stringent regulation, which is the MMS requirement in most cases. There are several differences between the two regulations concerning both the length of cement plugs and testing requirements

Issue #5: *Should service companies performing turnkey P&As be required to meet specific minimum technical standards?*

The liability in federal waters should be placed on the operator to make sure he uses a reputable company. He should know the qualifications of the company he uses for turnkey and T&M work. Most operators have a representative onboard during P&A operations, but there are exceptions and this is a concern. The federal regulations are clear--the operator is responsible for future problems. In Louisiana state waters, there is some question about who is responsible as there are a large number of orphan wells.

Issue #6: *How often should regulations be reviewed or revised as technology changes?*

There does not appear to be strong need to specify a specific revision requirement. Historically, regulations have been revised every eight years. It has been almost eight years since the last change, and the MMS plans to revise the regulations again in the near future. The MMS uses NTLs (Notice to Leases) and LTLs (Letters to Leases) in the interim to address specific technical issues and new technology prior to each major revision of the regulations.

Issue #7: *Should the regulations reference API Recommended Practices/Bulletins to help ensure that good techniques are used?*

Throughout the MMS regulations many API documents have been referenced though there are no specific references within the wellbore abandonment section. In 1993 the API published Bulletin E3 which specifically addresses wellbore abandonments. The MMS plans to review the appropriate API Practices/Bulletins before the next revision and reference API documents or sections of documents that they feel are appropriate. They do not want to make the API document a standard within itself.

Issue #8: *Should MMS requirements reflect a "Best Practices" approach with exceptions granted by the MMS based on technical merit when a "Best Practice" cannot be met due to the well's mechanical condition?*

The MMS requires operators to submit their abandonment plans for review and approval. If operators cannot meet the current regulations, they must request a departure from the regulations, which is reviewed by the MMS. The MMS believes their requirements with review represents a "Best Practices" approach. No consensus was reached on this issue. Since the regulations provide so much flexibility, abandonments can be done within the regulations that do not meet commonly accepted definitions of a "Best Practice." The MMS depends on their engineers to ensure "Best Practices" are applied.

Issue #9: *Should cement slurries used in wellbore abandonments be required to meet API recommended practices?*

There was no agreement on this issue. API Specification 10 provides cement design parameters. Most P&A procedures provide cement volume requirements, but do not specify the cement properties nor do they reference API Spec 10. The MMS will review Spec 10 with the other API Practices/Bulletins and, if appropriate, will reference the spec when they update the regulations.

Issue #10: *Is "bullheading" cement down an annulus an appropriate approach to cement off an annulus?*

The MMS regulations require each annulus to be cemented, but they do not specify how the cement is to be placed. There is concern that bullheading cement increases the chances of cement contamination if the annulus is not properly flushed prior to cementing. It was the consensus of the workshop that bullheading is not a preferred technique, but it is an acceptable technique in some circumstances. Whether it is an appropriate technique will need to be decided on an individual well basis depending on the situation within the wellbore.

Issue #11: *If cement calculations indicate an annulus to be isolated, but it marginally fails the pressure test, what should be done?*

How this problem should be addressed will depend on each well's specific circumstances. A well with pressure on the annulus indicating communication with a reservoir is a major concern. Diagnostics potentially need to be run to determine the source of the pressure and an effective isolation technique. Wells that fail the pressure test but do not have a positive pressure are also a potential problem, and a "best practices" approach will need to be used to cement off the annulus in order to get a successful pressure test.

Issue #12: *Should every abandonment include at least one bridge plug in the production or larger casing?*

There was some concern about requiring a bridge plug in every abandonment. There are situations in gas wells and wells with severe mechanical problems where a bridge plug is a definite advantage, but there is some economic impact. A bridge plug is a recognized risk reducer, especially when associated with the surface plug. A bridge plug can stop gas migration. It is an appropriate option, depending on the risk, but probably should not be a requirement.

Issue #13: *Should each annulus be pressure tested as part of the P&A?*

There is no current requirement to pressure test annuli. There is only the requirement to place a 200' cement plug in each open annulus. It was the consensus of the workshop that each annulus should be tested. Currently, each MMS District sets its own requirements and there is no consistency between MMS Districts. The MMS agreed to take this under advisement and to discuss testing requirements at their next district-wide meeting. The age and condition of the casing and whether it has pressure on it should be taken into account when establishing the test requirements.

Issue #14: *Are there additional methods of permanently isolating or plugging perforations in the abandonment process that should be considered favorably by the MMS?*

The current regulations provide multiple options for permanently abandoning a set of perforations. It is very difficult to meet the abandonment requirements as you move up the hole during the production phase. In a lot of wells it is not possible to place a 50' to 100' plug in a well and still complete in the next production horizon. Currently this is handled on a case by case basis within each MMS District with the acceptable technique specified by the MMS District. The question is, "Is there some methodology that we can talk about that allows us to view the abandonment of the zones and/or the abandonment of the liability of the wellbore before we get into the total P&A of the wellbore?" It was agreed that this is an issue within the MMS, and they plan to get their workover engineers together in the near future to draft general guidelines for the operators that will ensure more consistency between MMS Districts. One option that will not be considered adequate will be the closing of a mechanical sleeve.

Issue #15: *Should any special precautions or abandonment techniques be used when shallow gas is a known or a suspected problem in the area?*

Current regulations do not require any special precautions. It is important that the operator advise the MMS of the potential shallow gas, and some extra precautions may be required. It is recognized that the operator is responsible for all future problems. One option would be to abandon these wells early so their stability can be observed before starting the platform removal. This could reduce the risk and economic impact of annular gas.

Issue #16: *How important is the production zone abandonment when compared to the surface isolation and the protection of the shallow fresh water sands and the Gulf waters?*

It was agreed that proper abandonment of the production zone and any over-pressured intervals in the wellbore is paramount to successful wellbore abandonment. The operator should make all diligent efforts to ensure the bottom of the hole is properly abandoned and then move up the hole to isolate the fresh water sands and the surface.

Issue #17: *When should explosives be used to sever casings below the mudline?*

There are several concerns with using explosives in a wellbore. First, the shock impact of the explosion on the green cement is unknown. Second, if multiple strings are being cut, there is high likelihood that the casings will be significantly deformed making reconnection in the future difficult and expensive. Third, the shock waves created are harmful to marine life in the immediate area. It was agreed that we need more research on the explosive option and its impact on the cement plugs in the well and the environment. Until the research is completed, the use of an explosive charge should be the last option selected for wellbore abandonment.

Issue #18: *Should the production casing be cut prior to placing the surface cement plug to minimize the stress/shock impact to the cement plug when the casing is cut?*

It was agreed that it is desirable to eliminate the stress in the production casing before setting the surface plug. What was not agreed to was the technique or timing to be used. There are multiple methods available. One approach would be to jet cut the casing while the cement is still in the liquid phase. This would probably not be detrimental to the cement, but it still has a negative environmental effect. A second approach would be to cut the casing deeper in the well (>300' below the mudline) and circulate the surface plug into place through the cut.

Issue #19: *Currently, there is no required method of inspection or verification for proper wellbore abandonments. How can we ensure that approved procedures and required regulations are being followed?*

This is more a surveillance/data base issue than a performance issue as stated. There have to be some professional ethics and trust as the operator is ultimately responsible for all future problems. The operator is responsible for reporting on-site activities and making sure the work is completed in a professional manner. We also recognize there is a potential need for a data base on P&As for long-term surveillance similar to the data base on casing pressures that currently exists.

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3

Working Group Two: Abandoning Pipelines

Chair: **Ken Breaux**, *Project Consulting Services, Inc.*
Co-Chairs: **Kurt Cheramie**, *Tennessee Gas Pipeline Company*
Jim Macklin, *Cal Dive International*
Rex Mars, *Big Inch Marine Systems*
Don Davis, *Louisiana Applied Oil Spill Research and Development Program*

AGENDA: ABANDONING PIPELINES GROUP

Day 1 (4/15/96)

I.	Summary of Workgroup's Agenda and Issues Paper - Ken Breaux		2:40 - 2:50
II.	Pipeline Abandonment Workgroup (Session I)		3:30 - 5:00
	- Introduce Chair, Co-Chairs, Speakers and Panel Participants - Ken Breaux	3:30 - 3:40	
	- Review agenda and ground rules for workshop discussion - Ken Breaux	3:40 - 3:50	
	- Presentation of First Issues Paper on Regulatory Issues - Dr. Don Davis	3:50 - 4:15	
	- General discussion of relevant issues	4:15 - 5:00	

Day Two (4/16/96)

I.	Pipeline Abandonment Workgroup (Session II)		10:30 - 12:00
	- Introduction - Ken Breaux	10:30 - 10:40	
	- Presentation of Second Issues Paper on Contractor's Scope of Work - Jim Macklin	10:40 - 11:10	
	- General discussion of relevant issues	11:10 - 12:00	
II.	Pipeline Abandonment Workgroup (Session III)		1:00 - 3:00
	- Introduction - Ken Breaux	1:00 - 1:10	
	- Presentation of Third Issues Paper on Specialty Fittings - Rex Mars	1:10 - 1:40	
	- General discussion of relevant issues	1:40 -2:30	
	- Open question and answer period	2:30 - 3:00	
III.	Pipeline Abandonment Workgroup (Sesson IV)		3:30 - 5:00
	- Introduction - Ken Breaux	3:30 - 3:40	
	- Presentation of typical case study, Pipeline Abandonment and Pipeline Reroute - Ken Breaux	3:40 - 4:15	
	- General discussion of relevant issues, open question and answer period.	4:15 - 5:00	

Abandoning Pipelines Working Group Regulatory Issues

Introduction

The history of hydrocarbon development in Louisiana and off its coast is one of the interdependence of technological innovation, entrepreneurial risk-taking, resource management, judicial decisions, legislation, marketing, employee good will, infrastructure and support services, coupled with favorable geologic structures that made early exploration and development relatively easy. Mariners sailing off the coast of Louisiana and Texas in the 1600's recorded one of the earliest known natural oil seeps. They shrugged it off as unimportant, as there was no market for the substance they witnessed. The seepage, however, provided a tiny clue to the vast storehouse of hydrocarbons trapped in the earth's crust extending from the uplands, through Louisiana's swamps and marshes, and into the subaqueous habitats of the Gulf of Mexico–the world's ninth largest body of water. In all cases, each move into a new geographic province required considerable change in operation philosophy and in the science supporting the exploration and development activity. As technology changed, or was developed to meet the industry's needs, new frontiers were explored. However, with time–as is the case with any nonrenewable resource–fields and wells lost their productive life. They had to be abandoned. In fact, the Minerals Management Service suggests that within the next 10 years the offshore industry will remove 150 platforms per year, or nearly half of the current number of production units. The industry will be asked to dispose of nearly one unit every 2.4 days. If this is the case, abandonment issues are going to continue to surface.

The Offshore Age of Hydrocarbon Development

To operate in Louisiana's wetland habitats, drilling contractors needed a shallow-draft drilling platform—developed by the Texas Company (now Texaco) engineers in 1933 (Franks and Lambert 1982). In that same year, the first attempt was made to drill a well in the Gulf of Mexico; thus, the offshore industry was born. With this new drilling technology wildcatters intensified their exploration efforts. Renewed interest was spurred on and offshore. The industry changed in 1947 when a consortium led by Kerr-McGee successfully completed a well out-of-sight of land (Barnes and McCaslin 1948). Within seven years after the initial offshore discovery, oil companies extended the offshore frontier to 50 miles. By 1955 more than 40 offshore rigs were in operation (Larson *et al.* 1980; Davis and Place 1983). They were not without problems—hurricanes, high winds, corrosion, anchor fatigue, and ever-lengthening supply lines pushed up costs (Mandke, Wu and Marlow 1995). Nevertheless, since completion of the first well, more than 3700 drilling and production platforms are now anchored to the floor of the Gulf of Mexico collecting mineral fluids that are transported by pipeline to shore-based installations (U.S. Department of the Interior 1994). In fact, the world's greatest subaqueous pipeline network moves these mineral fluids to processing plants that support a national and international industrial infrastructure (Tabberer *et al* 1985; Wicker *et al* 1989A; Wicker *et al* 1989B).

By every measure, the offshore industry has been a success. In fact, as of August 1994 there were on Federal offshore lands alone 30,970 oil and gas wells utilizing 21,232 miles of pipeline. This resource base is second only to Federal income taxes in adding to the Federal treasury. More than $100 billion has been added to the country's general fund from Federal offshore lands. More importantly, from a national energy perspective the oil and gas from these leases move through pipeline corridors that make landfall throughout south Louisiana (National Petroleum Council 1994). These lines are responsible for transporting about 95% of Outer Continental Shelf (OCS)-derived oil and 100% of the natural gas. Consequently, in a relatively short period Louisiana has became the nation's energy center and pipeline hub (Tabberer *et al* 1985; Wicker *et al* 1989A; Wicker *et al* 1989B).

Pipeline Installation and Removal

When drilling crews have completed the petroleum or natural gas well and installed the Christmas tree, there remains the crucial job of moving the recovered petroleum or natural gas from the well to the purchaser. This complex job involves construction and installation of flow lines, operating and treating equipment, and in some cases, tank batteries. Once this equipment is installed, roustabouts, pumpers and other production personnel are responsible for maintaining it in good operating order for the life of the field. Originally, petroleum discovered offshore moved on shore through a fleet of reconditioned Navy Landing Ship Transports (LST's) and small oil tankers. This was a cumbersome and uneconomical means of moving product to shore and was quickly replaced by pipelines (Davis and Place 1983). Many of these early lines are still in use, after more than 30 years of service.

When a field has been discovered and is ready to go"on line" the industry relies on pipeliners to either build a completely new line or tap into an existing network. These crews work to ensure the mineral fluids get to market in a safe and timely manner. Moreover, in the exploration phase, the industry must decide on the most economical means of moving their product to market. In the northern Gulf of Mexico the most expeditious way to accomplish this task is by using a system of collection and distribution pipelines (Davis 1991; National Petroleum Council 1994).

Each pipeline corridor or right-of-way represents an independent unit, characterized by tributary lines that have coalesced into an integrated, complex network of transport arteries. The offshore zone is, therefore, laced with a labyrinth of subaqueous pipelines. Construction of the pipeline maze has been in direct response to drilling activity on the Gulf of Mexico's continental shelf. With aggressive exploration, the transport routes had to expand. The end result is a complex pipeline network that is being expanded constantly (LeBlanc, D.J. 1986; Wicker *et al* 1989A; Wicker *et al* 1989B). Conversely, as wells go "off line" many of these lines are deactivated and most are abandoned in place. In some cases decommissioned lines have been reactivated, thereby saving the costs associated with a) complete removal and b) installation of a new pipeline. In fact, nearly every day segments of these lines are being abandoned.

Pipeliners are, in fact, often the last to get involved in the development process, but they are another obligatory link in the industry's evolution. The industry has become so important that a number of pipelines coalesce near Henry, Louisiana, at a collection point labeled the "Henry Hub." This gauging station serves as the industry's commodity marker. Prices are set through the Henry Hub. This distinction evolved because of the industry's presence offshore and the vast array of pipelines required to move product onshore. The current system involves more than 160 major pipeline corridors that originate in Federal offshore waters and make land fall in Louisiana (Davis 1991).

Pipeline Abandonment and Associated Regulatory Issues

Offshore, not only do the wells have to be abandoned, but so do the pipelines that serve as the fluid conduits into the nation's markets. The process of abandoning/relinquishing or rerouting an offshore pipeline is initiated when a producer notifies the pipeline company, in writing, that they intend to remove an existing production platform. This request to abandon the associated pipeline(s) is made in order to facilitate the platform removal project.

This letter initiates the removal process and is crucial to the process. In fact, when this written request is received, a number of pertinent issues surface relating to the abandonment/removal/ relinquishment of the associated pipeline segment(s). Equally important is that the producer allows the pipeline company enough time to adequately prepare for the abandonment/relinquishment/ reroute. This point cannot be overemphasized, as lead time is essential in completing the required work in an efficient manner. Once the pipeline company has received written notification of the producer's intent, they can then begin the paperwork required to abandon/relinquish/ reroute the pipeline serving the platform that will be decommissioned. Some of the key issues that need to be addressed include:

1. Pipeline Abandonment on the Outer Continental Shelf (OCS): Removal vs. Abandonment in Place, and is the pipeline in state and/or federal OCS waters
    - Cost
    - Liability
2. What regulatory departments have jurisdiction over pipelines on the OCS?

- Minerals Management Service
- Department of Transportation
- Federal Energy Regulatory Commission
- Corps of Engineers

3. What is the status of the new Memorandum of Understanding between the Minerals Management Service and the Department of Transportation regarding pipelines on the OCS?
4. What are the regulatory requirements that must be meet to abandon/relinquish pipelines on the Outer Continental Shelf (OCS)?
   - Department of Interior (DOI) vs. Department of Transportation (DOT)
   - Temporary Cessation/Permanent Abandonment/Relinquishment
   - What are the Definitions of Pigging, Flushing and Plugging.
   - Industry Standards vs. Agency Expectations?
5. What are the requirements for reactivation of abandoned/relinquished pipelines on the OCS?
6. Are there any potential complicating issues related to the pipeline company's or producer's responsibility related to the abandoned pipeline segment(s)?

1. Removal vs. Abandonment in Place

Abandonment costs associated with an abandonment in place will vary depending on numerous factors including water depth, pipe size, side valves, etc. However, as a general rule in estimating abandonment costs, \$20,000 - \$25,000/day can be used in water depths less than 300 feet. In water depths greater than 300 feet, \$36,000/day should be used. Also, a typical abandonment project should be completed in approximately 4 - 5 days. Therefore, an abandonment in shallow water should run between \$80,000 and \$125,000 with a deep water abandonment running between \$144,000 and \$180,000.

How does this cost compare with completely removing a pipeline in OCS waters? A typical spread required for pipeline removal could range from \$85,000/day to \$150,000/day, depending on numerous factors. Intuitively, the time required to complete the pipeline removal and the costs associated therewith would be considerably longer and larger than those for an abandonment in place. Also, pipe disposal costs, less any scrap value, should be added to the total cost of removal. An important factor to note is that very few, if any, complete pipeline removals have been performed in the Gulf of Mexico.

The liability issue only arises when a pipeline is abandoned in place. According to MMS regulations as outlined in *Oil, Gas and Sulphur Operations in the Outer Continental Shelf, 30 CFR 250, Subpart J, Pipelines and Pipeline Rights-of-Way, subsection 250.159(c)(9).* "Upon relinquishment, forfeiture or cancellation of a right-of-way grant, the right-of-way holder shall remove all platforms, structures, domes over valves, pipes, taps and valves along the right-of-way. All of these improvements shall be removed by the holder within 1 year of the effective date of the relinquishment, forfeiture or cancellation unless this requirement is waived in writing by the Regional Supervisor. All such improvements not removed within the time provided herein shall become the property of the United States, but that shall not relieve the holder of liability for the cost of their removal or for restoration of the site. Furthermore, the holder is responsible for accidents or damages which might occur as a result of failure to timely remove improvements and equipment and restore a site."

2. Departmental Jurisdiction

DOI - The DOI"s exclusive jurisdiction with respect to pipeline activities extends upstream from the outlet flange at each facility where produced hydrocarbons are first separated, dehydrated or otherwise processed to each production well in the OCS. In addition, those pipelines necessary for the development of a lease, i.e., gas-lift gas or supply pipelines, are under DOI's exclusive jurisdiction.

DOT - DOT regulations prescribe minimum safety requirements for pipeline facilities and the transportation of gas, including pipeline facilities and the transportation of gas within the limits of the OCS. Excluded from DOT jurisdiction is the offshore gathering of gas upstream from the outlet flange of each facility on the OCS where hydrocarbons are produced or where produced hydrocarbons are first separated, dehydrated or otherwise processed, whichever facility is farther downstream; onshore gathering of gas outside any area within the limits of any incorporated or unincorporated city, town or village; onshore gathering of gas outside any designated residential or commerical area such as a subdivision, business or shopping center, or community development.

FERC - Facilities that are used for the transportation of hydrocarbons, i.e., jurisdictional facilities, are regulated by FERC. Facilities used for the gathering/production of hydrocarbons, i.e., non-jurisdictional facilities, are not regulated by FERC.

The commission has formulated physical and geographic criteria to be used in the analysis for determining whether the "primary function" of a facility is the transportation or the gathering/production of natural gas. The "primary function" test has been found by FERC to be applicable to both onshore and offshore facilities. Factors used are: (1) length and diameter, (2) extension of facility beyond field, (3) geographic configuration, (4) location of compressors and plants, (5) location of wells along facility, and (6) operating pressure. The commission has also considered nonphysical criteria such as the intended purpose, location, and operation of the facility, and the general business activity of the owner of the facility.

COE - Corps jurisdiction covers offshore pipelines which cross safety fairways or anchorage areas, or pipelines that cross into state waters.

The extensive jurisdictional overlapping of these agencies can be a nightmare for companies operating on the OCS. Striving to appease all agencies is a difficult undertaking, if not an impossible one. A joint accord between DOI, DOT and the FERC would greatly ease operational responsibilities for companies caught in the federal web of bureaucratic regulations.

3. Memorandum of Understanding (MOU)

Recognizing that their jurisdictional boundaries overlapped, in May of 1976, the Department of Transportation and the Department of the Interior executed a Memorandum of Understanding regarding offshore pipelines. This agreement outlined DOT responsibilities, DOI responsibilities and joint responsibilities over pipelines located on the OCS.

One of the critical issues addressed in the MOU states that "DOI, in issuing rights-of-way, rights-of-use and easements on the OCS for offshore pipelines which are subject to DOT's offshore pipeline regulations, will condition those rights and easements on the pipelines being designed, constructed, operated and maintained in compliance with the applicable DOT regulations." Another critical issue states "DOI will perform inspection and enforcement activities necessary to enforce its regulations and OCS Orders relating to pipelines on the OCS. With respect to other offshore pipelines originating on the OCS and subject to DOT regulations, DOT and DOI will coordinate and perform inspection activities. In the latter case, the DOT will perform enforcement activities and the DOI will provide the DOT with reports of DOI inspections for such further enforcement actions as may be appropriate."

4. Procedures/Requirements

According to MMS regulations, *subsection 250.156, Abandonment and out-of-service requirements for DOI pipelines,* the following regulations apply to pipelines on the OCS:

(a)(1) A pipeline may be abandoned in place if, in the opinion of the Regional Supervisor, it does not constitute a hazard to navigation, commercial fishing operations, or unduly interfere with other uses in the OCS. Pipelines to be abandoned in place shall be flushed, filled with seawater, cut, and plugged with the ends buried at least 3 feet.

(2) Pipelines abandoned by removal shall be pigged, unless the Regional Supervisor determines that such procedure is not practical, and flushed with water prior to removal.

(b)(1) Pipelines taken out-of-service shall be blind flanged or isolated with a closed block valve at each end.

(2) Pipelines taken out-of-service for a period of more than 1 year shall be flushed and filled with inhibited seawater.

(3) Pipelines taken out-of-service shall be returned to service within 5 years or be abandoned in accordance with the requirements of paragraphs (a)(1) or (2) of this section.

According to DOT regulations as outlined in *Pipeline Safety Regulations, 49 CFR 192, Subpart M, subsection 192.727, Abandonment or inactivation of facilities,* the following regulations apply to pipelines:

(a) Each operator shall provide in its operating and maintenance plan for abandonment or deactivation of pipelines, including provisions for meeting each of the requirements of this section

(b) Each pipeline abandoned in place must be disconnected from all sources and supplies of gas; purged of gas; in the case of offshore pipelines, filled with water or inert materials; and sealed at the ends. However, the pipeline need not be purged when the volume of gas is so small that there is no potential hazard.

(c) Except for service lines, each inactive pipeline that is not being maintained under this part must be disconnected from all sources and supplies of gas; purged or gas; in the case of offshore pipelines, filled with water or inert materials; and sealed at the ends. However, the pipeline need not be purged when the volume of gas is so small that there is no potential hazard.

MMS regulation *30 CFR 250.158(c)* contains the following language:

(c) The lessee or right-of-way holder shall report to the Regional Supervisor any pipeline taken out of service. If the period of time in which the pipeline is out of service is greater than 60 days, written confirmation is also required.

This paragraph has been outlined by the MMS in that an operator has 30 days in which to determine if a line is out of service. Verbal notification must be made within 48 hours of the time a pipeline is deemed to be out of service. Written notification, i.e., temporary cessation of use, is required to be filed within 60 days subsequent to the time that the line is deemed to be out of service. Therefore, a temporary cessation of use should be filed if the line will remain out of service for more than 90 days.

MMS regulation *30 CFR 250.164* states that "a right-of-way grant or a portion thereof may be surrendered by the holder by filing a written relinquishment in triplicate with the Regional Supervisor. It shall contain those items addressed in *250.157 (c)*." *250.157 (c)* states that "an Application to abandon a lease term pipeline or relinquish a right-of-way grant shall be submitted in triplicate to the Regional Supervisor and shall include the following: (1) Reason for operation, (2) Proposed procedures (3) As-built location plat, (4) Length in feet of segment to be abandoned or relinquished and (5) Length in feet of segment remaining."

5. Reactivation Requirements

Technological advances and various other factors in today's petroleum industry have spurred a mini-boom in drilling activity, the likes of which has not been seen since the late 1970's - early 1980's. The introduction of 3-D Seismograph has been responsible for a large portion of this activity and has dramatically changed the outlook of the industry as a whole. With producers discovering new hydrocarbon deposits in areas that were once thought to be depleted, the reactivation of abandoned/relinquished pipelines will become an ever-increasing trend.

Currently, there are no written procedures regarding the paperwork necessary to reactivate abandoned/relinquished lines on the OCS. If a pipeline has been abandoned in place and relinquished with the MMS, all rights have been forfeited, including ownership of the line. However, liability for the line remains with the company. If plans are to return a relinquished pipeline to service, MMS's unwritten policy will only allow the original company that relinquished the line to file for a new pipeline right-of-way covering the existing line. MMS approval of the new right-of-way application thereby transfers ownership of the pipeline back to the original company and accepts the new pipeline right-of-way associated therewith.

Additional Issues of Concern

An industry-wide problem are lines abandoned 20 to 25 years ago whose "as builts" have been lost, destroyed and/or misplaced. These are abandoned by grandfathered rules. Even so, there are no real rules or guidelines pertaining to these pipelines. Many transmission companies have cleaned up these old lines. That is their records have been brought up to date. Nevertheless, there are still some lines that are abandoned or orphaned that need to be identified and properly documented.

Summary

The issues outlined in this paper are not intended to be used as guidelines. They are only intended to spur discussion regarding these key points. We want to emphasize that our goal was to prepare a document that would not only inform all interested parties about pipeline-related abandonment matters, but would serve as a tool to generate meaningful discussion from our industry and agency participants. From this discussion, we hope a number of issues have surfaced. Further, through this type of dialogue we hope to bring about some form of consensus on approaching the problems associated with pipeline reactivation, abandonment and relinquishment.

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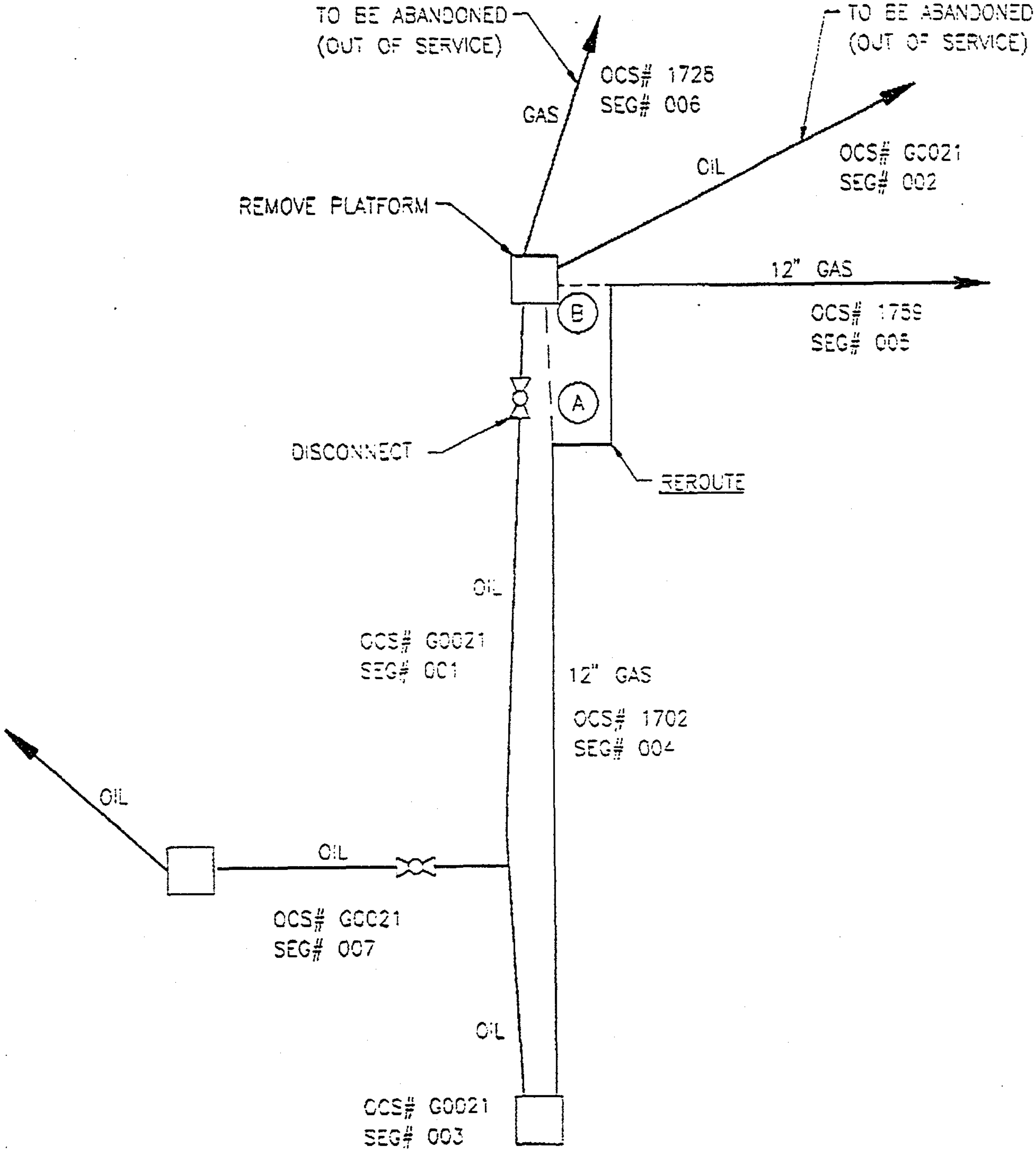

CASE STUDY LAYOUT

4

Working Group Three: Removing Facilities

Chair: **Vance Mackey**, *Chevron*
Co-Chairs: **Greg Schulte**, *Chevron*
Jim Kiesler, *Global Movible*
Keith Smith, *Shell*

Panelists:
Gregg Gitschlag, *NMFS*
Colleen Cogan, *NMFS*
Ken Hollingshead, *NMFS*
Felix Dyhrkopp, *MMS*
Vance Mackey, *Chevron*
Mac McDonald, *J. Ray McDermott*
John Kenny, *Senior Demex*
Dave Siggers, *Hitech*
Mark Day, *Mobil*
Allen Powell, *University of Houston*

Comment:

Alan Powell, "Some Preliminary Notes on Blast Wave and Fish Kill Estimation"

AGENDA: FACILITIES REMOVAL GROUP

Day One (4/15/96)

I. Summary of Workgroup's Agenda and Issues Paper - Vance Mackey 2:00 - 2:10

II. Facilities Removal Workgroup Introductions 3:30 - 4:40
- Introduce Chairs, Co-Chairs, Key Speakers, and Panel Participants for each issue - Vance Mackey 3:30 - 3:40
- Review detailed agenda including key panel speakers,workgroup issues, and key topics for discussion under each issue - Vance Mackey 3:40 - 4:10
- Review ground rules for workshop discussion - Vance Mackey 4:10 - 4:20
- General question and answer period 4:20 - 4:40

Day Two (4/16/96)

I. Explosive Severing and the Impact on Marine Life 10:30 - 12:00
- Review issues statement and key discussion topics - Greg Schulte 10:30 - 10:35
- NMFS - Gregg Gitschlag 10:35 - 11:00
  NMFS - Overview of current regulations and the impact on marine life (turtles, marine mammals, and fish) found to date from the use of explosives for severing. Impact of explosives as compared to the impact from other industries. Is any future research needed to identify the impact on marine life as a result of explosives severing operations?
- Chevron - Vance Mackey 11:00 - 11:10
  Review of costs and potential impacts of using explosives under current NMFS regulations. Questions concerning post-detonation surveys.
- Hitech - Dave Siggers/Allen Powell 11:10 - 11:25
  What aspects of explosive detonations affect marine life? What advances in mitigation techniques have been made and/or are being developed to minimize blast effects/
- Panel/Group Discussions 11:25 - 12:00

Desired Outcomes:

1) Review environmental impact of using explosives (quantify turtle and marine mammal impact; try to get a handle on impact of fish kill), discuss economic impact of current regulations, and discuss explosives mitigation techniques available or being developed.
2) Brainstorm desired states, propose recommendations on research needed to reach desired state, and/or identify additional issues to be addressed.
   a) Possible regulation changes to investigate (see issues paper for entire list):
      - Could night time explosives use be permitted under certain conditions?
      - Is there a need for a post-detonation survey?
      - Could the 48-hour pre-detonation survey be reduced?
      - Are NMFS surveys needed at every site if site history exists?
      - Should more than 8 shots in sequence be allowed?
      - Is there an acceptable minimum explosive limit not requiring NMFS observers?
   b) Technological advances needed and/or safety issues:
      - Reduce amount of explosives needed to sever conductors and piles.
      - Minimize blast effects.
      - Develop efficient and cost-effective mitigation techniques.

II. LUNCH 12:00 - 1:00

III. Pile and Conductor Severing Techniques 1:00 - 3:00

- Review issues statement and key discussion topics - Vance Mackey 1:00 - 1:05
- Chevron - Greg Schulte 1:05 - 1:30
  Oil industry's perspective on current severing techniques.
- Cal Dive - Rick Bucher 1:30 - 1:45
  Inside burn-offs: How can they be done safely? What are the applications/ limitations? What are the safety concerns? What training exists? What innovations are being developed to improve this technique?
- HCS - Jim Allen 1:45 - 2:00
  Abrasive cutters: How do they work? What are the applications/ limitations? What are the safety concerns? What innovations are being developed to improve this technique?
- Senior Demex - John Kenny 2:00 - 2:10
  Explosives: What innovations are being developed to improve this technique and increase its viability for future projects?
- Panel/Group Discussions 2:10 - 3:00

Desired Outcomes:

1) Review of pros and cons as well as costs of current severing techniques available for conductor and pile severing.
2) Brainstorm desired states and/or propose recommendations to reach desired states for the following:
   a) Possible regulatory changes to investigate (see issues paper for entire list):

Diver burning	Abrasive cutting	Explosives
reduce 15' BML cut depth		
reduce NMFS regs		

   b) Technological advances needed and safety issues

Diver burning	Abrasive cutting	Explosives
improve burning rods	cutting large-diameter pipe	
improve cut range	best practice by ADC	
reduce amount needed	improve cutting efficiency	
minimize gas build up	method of checking out	
improve cut speed	minimize set-up time	
minimize blast effects	improve reliability	
est. burning programs		

IV. BREAK 3:00 - 3:15

V. Deep Water Abandonments 3:15 - 5:00

- Review issues statement and key discussion topics - Keith Smith 3:15 - 3:20
- Shell - George Sgorus 3:20 - 3:45
  What current deep-water platforms exist in the GOM? What are the oil industry's current removal options? What future technological and regulatory advances are needed to help define a deep-water abandonment strategy? Have any precedents been set?
- MMS - Felix Dyhrkopp 3:45 - 3:55
  What are the MMS's current regulations concerning deep water abandonments? Are departures from the present regulations possible? How are existing versus future installations viewed in this respect? Do any avenues exist for the industry to provide input relative to future regulation changes? What does the MMS see as issues that need to be addressed before regulatory changes can be made? How does the MMS feel about partial abandonments?

- Amoco (UK) - Joseph M. Gebara 4:00 - 4:20
  What are the current regulations in the North Sea concerning deep water abandonments? What removal techniques are being developed for deep water platforms in the North Sea?
- Panel/Group Discussions 4:20 - 5:00

Desired Outcomes:

1) Discuss current deep water platform inventory in the GOM and the current abandonment processes available for these deep water platforms. Discuss whether or not abandonment precedents have been set.
2) Brainstorm desired states, propose recommendations, and/or issues to be addressed:
   a) possible regulatory changes to investigate (see issues paper for entire list):
      - Need for change in deep water abandonment regulations.
      - Will partial abandonments be allowed?
      - Can artificial reefs be established around deep water platforms?
   b) Technological advances needed and/or safety issues:
      - Cost-effective external severing techniques to facilitate partial abandonments.

Facilities Removal Working Group

ISSUES

Introduction

This working group's first objective is to identify major economic, technical, and regulatory constraints on operator practices and decisions relevant to offshore facilities removal. Then, the group will try to make recommendations as to regulatory and policy adjustments, additional research, or process improvements and/or technological advances, that may be needed to improve the efficiency and effectiveness of the removal process. The working group will focus primarily on issues dealing with Gulf of Mexico platform abandonments.

In order to make the working group sessions as productive as possible, the Facilities Removal Working Group will focus on three topics that address a majority of the concerns and/or constraints relevant to facilities removal. The three areas are:

- Explosive Severing and its Impact on Marine Life
- Pile and Conductor Severing
- Deep Water Abandonments

This paper will outline the current state of practice in the offshore industry, identifying current regulations and specific issues encountered when addressing each of the three main topics above. The intent of the paper is to highlight potential issues for panel discussion, not to provide a detailed review of all data relevant to the topic. Before each panel discussion, key speakers will review data and information to facilitate development and discussion of the main issues of each topic.

Please refer to the attached agenda for the workshop format, key speakers, presentation topics, and panel participants. The goal of the panel discussions is to identify key issues for each of the three topics above. The working group will also make recommendations on how to proceed on these key issues.

Explosive Severing and its Impact on Marine Life

Explosives are currently the most widely used severing technique for offshore abandonments in the Gulf of Mexico (GOM). Explosives are most widely used because explosives are safe, reliable and cost effective. The major concern about the use of explosives is the possible impact they may have on marine life. The primary environmental concern in the past few years has been the possible impact that explosives might have on turtles and marine mammals.

In 1988 the National Marine Fisheries Service (NMFS) enacted an Incidental Take Statement for the taking of sea turtles. This take statement outlines the measures that are required if explosives are used for offshore platform removals. These measures were developed to help minimize the impact of incidental takings and to help quantify the actual impact on both sea turtles and marine mammals.

A brief summary of mitigative measures follows:

1) Qualified observers must be used to monitor the area around the site before, during and after detonation of the charge for the existence of sea turtles in the vicinity of the platform site. Coverage shall begin at least 48 hours before the detonation.
2) On days that blasting is to occur, a 30-minute aerial survey must be conducted within one hour before and one hour after detonation.
3) If sea turtles are observed in the vicinity (within 1000 yards of the site) of the platform prior to detonation, blasting will be delayed until the sea turtles are removed to at least 1000 yards from the site.
4) Detonation of the explosives will occur no sooner than one hour following sunrise and no later than one hour before sunset.
5) During all diving operations divers will be instructed to scan the subsurface areas surrounding the site for sea turtles and marine mammals.
6) Charges must be staggered 0.9 seconds for each grouping of detonations.
7) The use of scare charges should be avoided.
8) A report summarizing the results of the removal mitigation measures must be submitted to the MMS within 15 working days of the removal operations.

The Minerals Management Service (MMS) has been granted approval authority by the NMFS for explosives removal requests that meet specific criteria. The key criteria are: 1) Individual explosive charges must be less than 50 lbs; 2) No more than eight (8) explosions can be detonated in any one grouping; and, 3) Explosives must be detonated in the interior of piles and/or conductors.

In November 1995 the NMFS issued an Incidental Take Statement for the takings of bottlenose and spotted dolphins. Included in this statement were additional mitigative requirements to be followed during removal operations using explosives. The dolphin mitigative requirements were similar to those for sea turtles with one exception. The new requirements stipulate that an additional post-detonation aerial or vessel survey be conducted no earlier than 48 hours and no later than one week after the platform is removed. The requirement may be waived if a systematic diver or ROV survey is conducted within 24 hours of the explosive detonation.

Another concern that needs study is the impact that explosive severing has on the fish population. The NMFS has started conducting offshore studies which try to quantify the number and type of fish killed by the explosive blast. These offshore studies involve counting fish that float to the surface as well as estimating those that sink to the sea bottom. A key speaker from the NMFS will review data concerning what they have found from these studies.

Issue #1 Since data have been collected by the NMFS observers at explosive severing operations over the past several years and have shown that explosive severing has little or no impact on the populations of sea turtles and marine mammals, should the mitigative measures currently required be reduced and, if so, to what extent?

1a Could the 48-hour pre-detonation survey be reduced?

1b Could the newly implemented post-detonation survey be eliminated?

1c Could night time explosive use be permitted if there had been no sea turtle or marine mammal sightings?

1d Could more than eight charges be detonated in a series?

1e Would this eliminate the potential for a chumming affect?

1f Could the 50-lb generic permit limit be increased?

1g Are pre- and post-detonation aerial surveys necessary if there have been no sea turtle or marine mammal sightings?

1h What should be the minimum amount of explosives that legally can be shot without NMFS observers?

1i Should the generic permitting of external explosives be allowed?

Additional Questions:

1j What is the purpose of the newly implemented post-detonation survey and the 48-hour to 7- day waiting period?

1k Are there any documented cases where a marine mammal has been killed by explosives used for severing offshore platforms?

1l Will a mortally wounded dolphin still be at the removal site after the 48-hour waiting period?

1m If a dolphin is found after the 48-hour post-detonation waiting period, what information will the NMFS be able to determine from the corpse?

1n Since no limits are defined in the regulations, what are the survey limits of the newly implemented post-detonation survey?

1o What beneficial impact on the fish population does a typical platform have over the years it is installed (20 year life is typical)?

1p What is the impact of the fish kill as a result of the explosives blast on the overall fish population? How does this impact compare to the beneficial impact of the platform in place over a period of 20 years? Can these questions be quantified? What research is needed to help quantify the impact?

1q What is the impact of the fish kill as a result of the explosive blast in comparison to that of other industries (i.e., that of the bycatch from trawlers)?

1r What cost-effective techniques are available to minimize blast effects on marine animals? What research is needed to help develop mitigative techniques?

Pile and Conductor Severing

There are several methods currently available for severing conductors and piles in the Gulf of Mexico: explosives, diver burning, mechanical cutting, and abrasive cutting. As mentioned above, explosives are currently the most commonly used, safest, most cost efficient, and most reliable method for severing piles and conductors. Current technology surrounding the alternative severing techniques may require trading-off safety, cost efficiency, and/or reliability when using that technique. The extent of the trade off depends on the severing technique and the conditions surrounding the application.

The pile and conductor severing section of the workshop will discuss the pros and cons, comparative costs, and current and desired states of development for each method.

Regulations on cut-off depth and the NMFS mitigative measures play major roles in determining the severing option is used. Current regulations require all piles and conductors to be severed a minimum of 15 feet below mudline (BML). The 15-foot BML requirement can be a disincentive for methods other than explosives because of safety, costs, and reliability concerns which will be discussed in detail at the workshop.

Issue #2 Current regulations require that all piles and conductors be severed at a minimum of 15 feet below mudline (BML). Since there seems to be no basis for the 15-foot depth, should the cut-off depth be reduced for methods other than explosives?

Additional Questions:

2a What is the basis for the current 15 foot BML requirement?

2b Would raising the 15 foot BML cut-off requirement adversely affect other uses of the OCS?

Issue #3 Can diver burning to sever piles (internally and externally) and conductors be done safely and under what conditions?

3a Could the Association of Diving Contractors (ADC) endorse best practices for burning as a severing technique (internal as well as external burning techniques)?

3b Could the ADC endorse minimum burning program requirements for diving contractors performing burning operations?

Additional Questions:

3c Have all Gulf of Mexico diving contractors established burning programs to ensure that divers are properly trained on internal and external burning techniques and hazards?

3d What technological advances are necessary to make underwater burning safer and more efficient?

3e What limits should be set on inside burn-offs?

3f What conditions are required to perform burning operations safely?

Issue #4 Are Abrasive/Mechanical cutters a cost-effective method of severing offshore piles and conductors?

Additional Questions:

4a What are the limitations of abrasive cutters?

4b What technology is needed to improve the cost effectiveness of abrasive cutters (i.e., cut verification technique, multiple non-grouted casing string cutting, multiple eccentric casing strings, large diameter casing strings)?

4c What are the limitations of mechanical cutters?

4d What technology is needed to improve the cost effectiveness of mechanical cutters (i.e. cut verification technique, multiple eccentric casing strings, large diameter casing strings)?

Issue #5 Can the amount of explosive used to sever piles, conductors and large diameter caissons be reduced to decrease the environmental impact and still be as reliable as current techniques?

5a Could the poundage of explosives necessary to sever piles and conductors effectively be reduced? Ideally the explosive amount should be reduced below a limit which would require NMFS observation.

5b Could the amount of explosives necessary to cut large-diameter caissons (6- to 14-foot diameter) be reduced below the generic, 50-lb limit?

Additional Questions:

5c What technological advances in explosive technology are necessary to reduce the amount of explosives required to sever piles/conductors effectively?

5d What advances in explosive technology are necessary to cut large-diameter caissons/ pilings?

Deep Water Abandonments

Approximately 98 percent of the structures in the GOM are in shallow water (less than 300 ft. deep) and can be removed or reefed fairly routinely with the removal equipment and techniques available today. There are an increasing number of platforms being installed in water depths greater than 300 ft. which cannot be removed so routinely. New removal and disposal techniques must be developed in order to abandon these platforms in the future. Regulations are not yet in place to help guide these efforts. The presentations on this topic will center on removal options available to the industry today and the industry's perspective on each option.

Issue #6 Oil Industry and Regulatory direction on deep water abandonments.

6a Should partial abandonments be allowed as the normal abandonment technique for structures in water depths greater than 300 feet?

6b Should additional reef sites be established to accommodate deep water sites?

Additional Questions:

6c What abandonment options for deep water platforms are available to the oil industry?

6d What do(es) the MMS see as the most promising abandonment option(s) available for deep water abandonments?

6e What are the concerns about partial abandonments (i.e. minimum cut-off depth below MLW)?

6f Can each deep water platform site be considered an artificial reef site?

6g What avenues exist that would allow the oil industry to provide input to future regulatory changes?

6h What would the key drivers behind a regulatory change be? What would be the main hurdles to get over?

6i What research or technological advances are necessary to facilitate deep water abandonments?

DISCUSSION AND SUMMARY

The objective of the Facilities Removal work group was to identify major economic, technical, and regulatory constraints on operator practices and decisions relevant to facilities removal. The working group also had the objective of making recommendations on potential regulatory or policy adjustments, recommending additional research required to more accurately address removal issues, and identifying process improvements and/or technological advances needed to facilitate the removal process. The working group primarily focused on issues dealing with Gulf of Mexico platform removals.

The working group's agenda was broken into three (3) sessions as follows:

- Explosive Severing and the Impact on Marine Life
- Pile and Conductor Severing
- Deep Water Removals

Each session began with presentations by key speakers who gave detailed reviews of current topic information to help facilitate development and discussion of the main issues. The presentations were followed by panel discussions on the key issues. Please see the Facility Removal work group agenda for a list of key speakers and panel participants.

The purposes of this paper are to summarize the agenda for each of the three (3) sessions, list the issues developed in the sessions, briefly discuss positions and concerns brought up concerning each issue, and list the recommendations that were developed through the panel discussions. The positions and concerns listed under each issue were major discussion points during panel discussions. Positions/concerns from work group participants were captured and documented regardless of validity.

I. Explosive Severing and the Impact on Marine Life

Explosives are currently the most widely used severing technique for offshore removals in the Gulf of Mexico (GOM). The major concern surrounding the use of explosives for platform removal is the possible environmental impact that explosives may have on marine life. Key speakers for this session were from the National Marine Fisheries Service (NMFS), oil industry, and explosives industry. The NMFS speaker gave an overview of the current regulations and reviewed the NMFS observer data showing the impact that explosives have had on marine life (turtles, marine mammals, fish) to date. Next, an oil industry representative gave a brief review of the cost and potential impact that the NMFS observer program has on a typical removal project. Lastly, an explosives industry representative reviewed the aspects of explosive detonations that affect marine life and potential mitigative techniques existing or in development.

The major issues in this session dealt with the viability of the current regulations regarding explosive severing and possible changes to those regulations that would help streamline explosive operations while ensuring the impact to marine life would continue to be minimized. Below is a list of the issues raised, the positions and concerns discussed for each, and the recommendations developed from the discussions:

1.) NMFS Regulations

Data have been collected by the NMFS observers at explosive severing operations over the past several years and has shown that explosive severing has little or no impact on the population of sea turtles and marine mammals. Therefore, should the mitigative measures currently required be reduced and if so, to what extent?

1(a) - Reduction of the 48 hour pre-detonation survey

Positions/Concerns

- There was a consensus that the NMFS program is good and that their observer program raises awareness of potential impact to endangered species during explosives operations.
- There was a consensus that the 48-hour pre-detonation watch could be reduced to require no more than 24 hours of observation time.
- The NMFS program needs to maintain flexibility on pre-survey requirements.

Recommendations

1) Develop a team consisting of NMFS, Minerals Management Service (MMS), and industry (Offshore Operators Committee) to discuss and revise the existing NMFS monitoring requirements. Any revisions should consider reducing the survey time to one full daylight hour watch or less. Revisions need to have flexibility built in to allow the observer on site to have the authority to make the call on the amount of watch needed. The work group recommended that a joint meeting occur within three (3) months. This corresponds to recommendation #6 of the Marine Board study, except that the work group does not recommend a full 24-hour watch. Since observations at night are extremely limited, the working group is recommending one full daylight hour watch or less.
2) NMFS and MMS need to modify Section 7 Endangered Species Act Consultation based on the outcome of the meeting between the NMFS, MMS and industry. The time frame estimated for this activity is between three (3) and six (6) months.
3) Research in this area should concentrate on the development of an alternative turtle detection method such as sonar.

1(b) - Viability of the post-detonation survey (marine mammals survey)

Positions/Concerns

- Current regulations requiring the survey do not clearly define survey requirements and limits.
- The current NMFS observers data show that out of the thousands of marine mammals sighted during explosive severing operations, no marine mammal mortalities due to explosives have been documented.
- No process is currently in place to allow oil companies to retrieve an injured or dead marine mammal that may be sighted during the post-detonation survey. Retrieval is necessary to determine cause of injury or death.

Recommendations

1) The NMFS and industry (OOC) need to meet to discuss the post survey requirements, trial period for collecting data, and develop a review process once the trial period is over. The team should also develop a process that would allow for the retrieval of injured or dead marine mammals to determine cause. The time frame for holding this meeting should be within one (1) to three (3) months.
2) Regulations for the marine mammal survey need to change to match any changes in the survey requirements for endangered species (turtles). If both the mammal and endangered species requirements do not change concurrently, the pre-survey requirement will remain at 48 hours. The effort and time to change the marine mammal requirements will be substantially more than that for endangered species as the mammal requirements are a regulation.
3) Research should concentrate on quantifying the lethal effect explosives may have on marine mammals.

1(c) Quantifying the impact that explosives severing has on fish populations

Positions/Concerns

- The impact that explosives have on the fish populations is not fully understood.
- The MMS needs to increase the scope of the fish mortality studies (deeper water depths, different times of the year, etc.). Who is going to pay for this research?
- Where should the MMS spend their research money? Should research money be spent on counting fish, developing scare techniques, or working with the explosives industry to develop new explosives techniques?
- NMFS needs to determine the productive capability of the structure over the life of the structure in regards to fish populations and roll this into their impact calculations. Increased regulations may result in a decrease in the number of structures which in turn may result in a decrease in the productive capability of the structures installed in the GOM.
- What is the impact of explosives severing operations on the fish populations compared to other users of the OCS such as shrimpers?

Recommendation

1) The MMS, NMFS, and industry (OOC) need to meet to decide how to best spend research dollars. Some of the key research areas discussed during this session were improving fish scare techniques, understanding lethal impacts of explosives on fish, improving explosive technology, improving blast mitigative techniques, and determining the balance between explosive severing operations an other users of the OCS in regards to fish impacts.

1(d) The need to increase the flexibility on generic explosive amounts that the MMS has the right to approve.

Positions/Concerns

- The current 50 pound limit for a generic explosive permit was established before the need for removing larger structures requiring larger explosive amounts was addressed.
- The current permitting time (approximately six months) to get approval on a non-generic permit is a hindrance to the industry.

Recommendations

1) The MMS, NMFS, Industry (OOC), and explosive experts need to meet and develop a list of specific charge requirements for various piles and conductor configurations. The pre-determined amounts must consider the potential for re-shots. The MMS should have the flexibility to increase charge amounts if the first charge is not successful. This corresponds to recommendation #2 of the Marine Board study. The working group agrees with the Marine Board study recommendation.

1(e) Increase the flexibility on the use of exterior explosives

Positions/Concerns

- The impact to marine life from the use of exterior explosives is unknown
- Using exterior explosives may affect current NMFS requirements.
- There is a strong possibility that exterior explosives will be necessary for deep water removals.

Recommendations

1) The MMS and NMFS should continue to approve the use of exterior explosives on a case by case basis.
2) Research should be conducted to study the effects that exterior explosives have on marine life. See research for 1 (c).

1(f) Increase flexibility on aerial surveys.

Positions/Concerns

- NMFS data show that an aerial survey is the best survey technique; a majority of the turtles sightings have occurred during the aerial survey.

Recommendations

1) Continue aerial surveys for explosive severing operations.
2) The NMFS needs to increase the flexibility for the on-site observer. The observer should have the authority to make a call on whether an aerial survey is justified under the specific site conditions (i.e. rain, fog, time of day).

1(g) The viability of the eight (8) explosive shot limit during explosive removals.

Positions/Concerns

- There was consensus that there is no basis for the current eight shot limit.

Recommendations

1) Eliminate the eight (8) shot restriction, but retain the requirement of the 0.9 sec. delay. This corresponds to recommendation #4 of the Marine Board study. The working group agrees with this Marine Board study recommendation. The MMS and NMFS need to meet to revise the Section 7 Endangered Species Consultation. The time frame on completing this action should be between three (3) and six (6) months.

II. Pile and Conductor Severing

This session focused on the different types of severing methods for pile and conductors, specifically focusing on explosives, divers,and abrasive/ mechanical cutters. Key speakers for this session were from the oil industry, the diving industry, the abrasive cutting industry, and the explosives industry. The oil industry representative gave a cost comparison between the different severing techniques as well as pros and cons for each method. Next, the diving industry representative reviewed current diver burning techniques including types of applications and the limitations of diver burning. The next speaker, from the abrasive cutting industry, discussed the state of the art of the abrasive severing techniques as well as abrasive cutting limitations. Lastly, an explosives industry representative discussed innovations in explosive technology that will increase the efficiency of the explosives and minimize the impact on marine life.

The main topic of discussion in this session was the current pile and conductor cut-off depth of 15 feet below mudline. It was argued that the 15 feet below mudline requirement is a disincentive for operators to use severing techniques other than explosives due to the increased cost and safety risk. Below is a list of the issues raised, the positions and concerns discussed for each, and the recommendations developed from the discussions:

2.) Cut-off Depth

Current MMS regulations require that all pile and conductors be severed at 15 feet below mudline. Since there seems to be no basis for the 15 foot depth, should the cut-off depth be reduced for methods other than bulk explosives?

Positions/Concerns

- There was concern that three feet below mudline, as recommended by the Marine Board study, may be too shallow in certain areas of the GOM.
- There was a consensus that the current 15-foot depth was too deep for non-explosive methods and advanced explosive methods.
- The MMS should consider a flexible cut-off depth based on soil condition and/or severing methods. It may not be practical to make one cut-off depth fit all applications. However, the MMS should strive for consistency on variance requests based on soil conditions and erosion potential.

Recommendations

1) The MMS should reduce the current 15 feet below mudline cut-off depth for non-explosive or advanced explosive severing methods. This corresponds to recommendation #1. The working group does not agree that the three-foot limit

should be recommended across the board. More study is needed to determine the appropriate depth or a range of depths (See recommendation #2 below).

2) The MMS and industry (OOC) should put together a team to determine what the cut-off depth should be for various geographical locations, soil conditions, etc., and develop a standard procedure for requesting and granting variances. The work group felt that this should be done within the next one to three months.
3) In the interim, in the interest of safety, the MMS needs to be more flexible on cut-off variances when utilizing non-explosive severing techniques (i.e., diver burning).
4) The MMS needs to respond immediately to two (2) previous Association of Diving Contractors' inquiries concerning diver safety when trying to sever piles or conductors at the 15 feet below mudline cut-off depth.
5) Research is needed concerning soil effects on mitigating explosive blast for advanced severing techniques.

3.) Diver Burning

Can diver burning for severing piles (internally and externally) and conductors be done safely and under what conditions?

Positions/Concerns

- Burning can be performed safely with the proper personnel, equipment, and training.
- Safety risks associated with diver burning can be greatly reduced if the soil is jetted both internally and externally of a pile/conductor. The current 15 feet below mudline cut-off requirement makes external jetting unfeasible and adds additional safety risks (such as hole cave in) to divers.
- There are currently no diver burning standards in place.
- There are currently no consistent standardized training programs developed for all diving companies.
- The current 15 feet below mudline cut-off depth is a disincentive to using divers for burning because of increased safety risk and cost.
- There is currently no sharing of best practices among diving companies.

Recommendations

1) The Association of Diving Contractors (ADC) needs to develop burning standards. Industry should provide input and support ADC's recommendations.
2) These burning standards need to be incorporated into the ADC's consensus standards.
3) The recommendations for issue #2 (cut-off depth) should be followed to decrease diver risks when performing the burning operations.

4.) Abrasive/Mechanical Cutting

Are abrasive/mechanical cutters a cost-effective method of severing offshore piles and conductors?

Positions/Concerns

- Abrasive/Mechanical cutters are a viable option under certain conditions and configurations.
- Abrasive/Mechanical severing methods are limited by grouting configurations, eccentricity of the casing strings, and thickness and diameter of the casing strings. In most cases, abrasives cutters are more reliable, have more flexibility on configuration, and are faster than mechanical cutters.
- There is currently no cost-effective method to verify cuts made by these severing techniques.
- There is no funding from industry or regulatory agencies to help advance this technology.

Recommendations

1) The Abrasive/Mechanical cutting industry needs to develop a cost-effective cut verification method.
2) The technology in this severing method needs to advance to be able to cut large diameter piles and caissons in shallow and deep water.
3) The overall cost effectiveness and efficiency of these severing techniques needs to improve.
4) This industry should focus on research in the slurry cutting technique. Development of slurry cutting could potentially have a large positive impact to the industry.

5.) Explosive Severing

Can the amount of explosives used to sever piles, conductors, and large diameter caissons be reduced to decrease the environmental impact and still be as reliable as current techniques?

Positions/Concerns

- There are no funding or incentives from industry/regulatory to advance explosive technology.
- Technology exists that can be developed and applied.
- Current 5 lb explosive limit that industry is allowed to shoot without NMFS consultation needs to be reexamined to see if it can be increased.

Recommendations

1) The MMS and industry (OOC) need to help fund research to develop advanced explosive severing techniques. The meeting to develop an action plan for this research should take place within one to three months.
2) The NMFS and explosive experts need to define a minimum charge that can be detonated without an NMFS consultation. The current cap is five lbs.

III. Deep Water Removals

There are an increasing number of platforms being installed in water depths greater than 300 feet. Platforms in this water depth cannot be removed with shallow water removal methods. Advancement in technology and in regulations to deal with these deep water removals has not progressed as quickly as those to install these deep water structures. Key speakers for this session were representatives from the GOM oil industry, the MMS, and the North Sea oil industry. The GOM oil industry representative reviewed the current inventory of deep water platforms and the current thoughts regarding the direction the industry is going concerning the removal of these platforms. Next, the MMS representative reviewed regulations regarding deep water removals and avenues that industry may take to provide input to future regulation changes. Lastly, the North Sea representative reviewed current regulations in the North Sea regarding structure removals and the state of the art removal techniques that are currently being employed.

The major discussion for this session focused on the direction that industry and the MMS should take concerning deep water removals. Below is a list of the issues raised, the positions and concerns discussed for each, and the recommendations developed from the discussions:

6.) Deep Water Removals

What direction should the oil industry and regulatory agencies take regarding deep water removals?

Positions/Concerns

- Regulations and guidelines for deep water removals have not been addressed.
- Deep water structures will be unique based on the application, the regulations need to be flexible to allow for these differences, which may affect the removal technique needed.
- Are there concerns from the Defense Dept. when considering partial removals?
- Deep water structures need to be designed with removal in mind, but weak links are not recommended.
- The balance of all of the factors (i.e., human safety, energy consumption, positive and negative impacts of partial removals, marine life, etc.) that contribute to the overall impact of the removal option should be considered when addressing regulations. The MMS needs to consider and weigh all factors when determining the regulatory requirements for the deep water removals.
- What impact, if any, will partial removals have on marine habitat and fish stocks? Will deep water partial removals serve as an effective artificial reef?
- IMO guidelines need to be looked at as a starting point if partial removals provide no benefit for marine life.
- "Deep water" should be defined as 300 feet or deeper.
- What other solutions are available for deep water structures other than partial removals?
- All the stakeholders in deep water removals need to be identified.
- The environmental impact should be reexamined when considering deep water removals.
- Trawling in water depths greater than 200 ft. needs to be addressed. Is the fishing industry moving to deeper waters as the oil industry has? Other countries have a viable fishing industry in depths greater than 300'.

Recommendations

1) The MMS and industry (OOC) need to develop a task group to identify all major stakeholders in deep water.

2) Once the major stakeholders have been identified, a team made up of these stakeholders needs to be developed to establish regulations and guidelines, taking into account all concerns (establishing a balance of all impact factors as outlined in the above positions and concerns).
3) The MMS and industry need to be proactive in addressing deep water abandonment issues.
4) Research on the viability of deep water reefs needs to be conducted. Is there a limit below which a platform is not serving as an effective artificial reef?

Through the course of the three sessions, universal recommendations were identified. These recommendations were brought up in all sessions, therefore should be considered as *extremely* important. Below is a list of these universal recommendations:

Universal Recommendations

1) The conference steering committee should be responsible for initiating and communicating action on the working group recommendations. Working group participants put many long hours into the conference and would like to be kept abreast of the progress on the recommendations identified.
2) The MMS should establish and communicate a procedure for the receipt and handling of requests for changes to regulations.
3) The partnership between industry and regulators needs to be an evergreen process.

Some Preliminary Notes on Blast Wave and Fish Kill Estimation

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Editor's note: The following graphics are reproduced as submitted by the author. Please address comments or questions to him at the address given above.

Some tentative inferences
Needs for improved fish kill predictions
Fishkill criteria
In-water detonation—similarity
Removal detonations
Measurements at removal
Extended similarity method
Bottom attenuation
Height above bottom
Effect of burial depth
Constant blast pressure contours
Hypothetical fish survivability

Some tentative inferences

based on in-water peak press. criterion only

other criteria, in-mud – maybe sig. different results!

Negligible effect on fish kill by:

- changes (÷2) in effective charge weight

or • changes (× 2) in burial depth

Large changes (÷5) in charge weight
becoming effective

- depth increase then more effective
- fish scares more realistic
  – if they work well enough!

But, multiple shots likely significantly worse!

Fish kill might be reduced,
but cannot be entirely eliminated
–unless scares can be effectively used

Non-lethal effects

Soniferous fish may be deafened
by smaller blast pressures,
– possible effect on fish population

Needs for Improved Fish Kill Predictions

Lethality criteria

- Reassess existing criteria
  - select "best" criterion
- Modify for buried detonations (longer impulse)
  - carefully designed experiments
- Extend for multiple detonations
  - carefully designed experiments

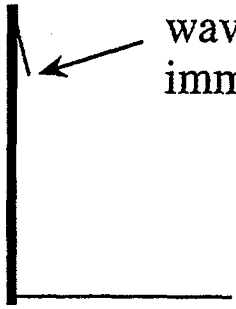
Blast wave estimation

- "simple" method(s) for kill parameter
  - extensions for different sound speeds
  - match with num. sim. or experiment
- Determine bottom attenuation etc.
  (significant variations in Gulf?)
- Further removal experiment for devel./validation of blast methods
  (also yeilds attenuation coeff't,
  – hard bottom site preferred)

Fishkill criteria

– swim bladder fish most vulnerable

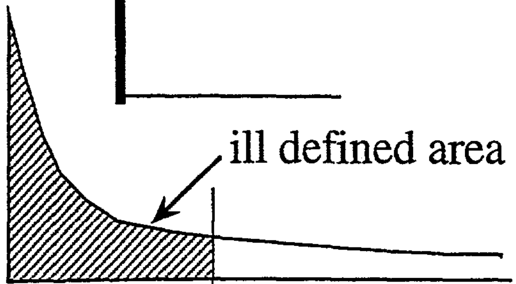
– empirical, based on experiments



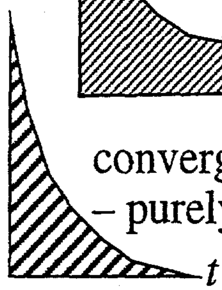
1. Peak blast pressure

   by far the simplest!

2. Blast impulse

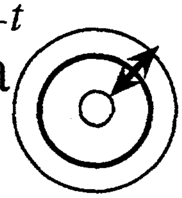


3. Blast energy



4. Bladder response extrema

   by far the most complex!



– #1, #2, #3 improved by normalising by

- local static pressure
- fish size (~ weight $^{1/3}$)

smaller fish most vulnerable

But still big scatter!

#3 Blast energy marginally best (?)

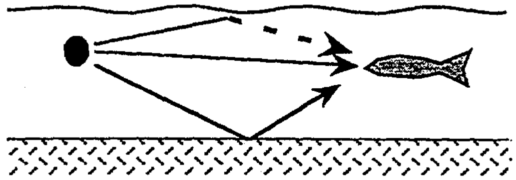
For the moment,

use (peak press./static press.)

Variables affecting kill criteria

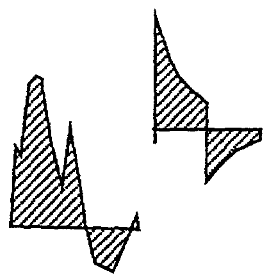
Scatter in kill criteria due to:

1. Different geometries



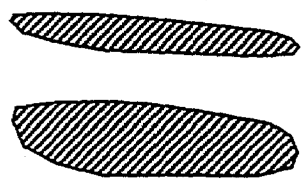
2. Non-ideal pressure histories

   including negative surface reflection



3. Initial bladder inflation?

   acclimatisation to changed depth?

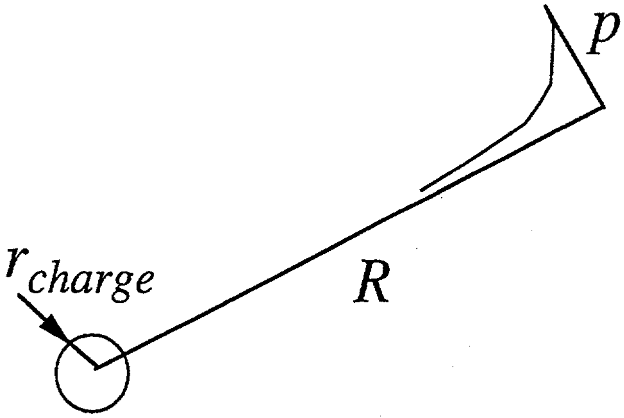


4. Fish orientation

   head-on, broadside

5. Different species

In-water detonation – Similarity



For given charge size
peak pressure p
depends only on
r_{charge}/R
or
$$\left(\frac{W^{1/3}}{R}\right)$$

In fact, *excellent correlation over wide range for*

$$p = \text{constant} \times \left(\frac{W^{1/3}}{R}\right)^{\alpha}$$

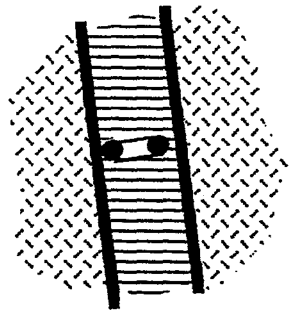
– constant depends on explosive:
energy & mass densities

For TNT in sea-water
$\alpha = 1.13$,
constant $= 21.6 \times 10^3$ (Cole 1948, Arons 1954)

for p in lbs/in^2, W in lbs, R in ft

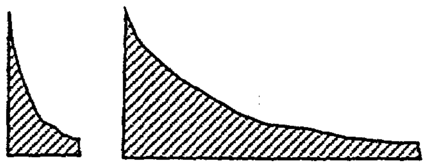
Removal detonations

1. In-pipe



2. Special charges
   - shaped, focussed

3. Buried in mud, ≥ 16 ft
   - longer blast
   - greater attenuation
   - non-uniform directionality
   - different scaling (inc. burial depth)



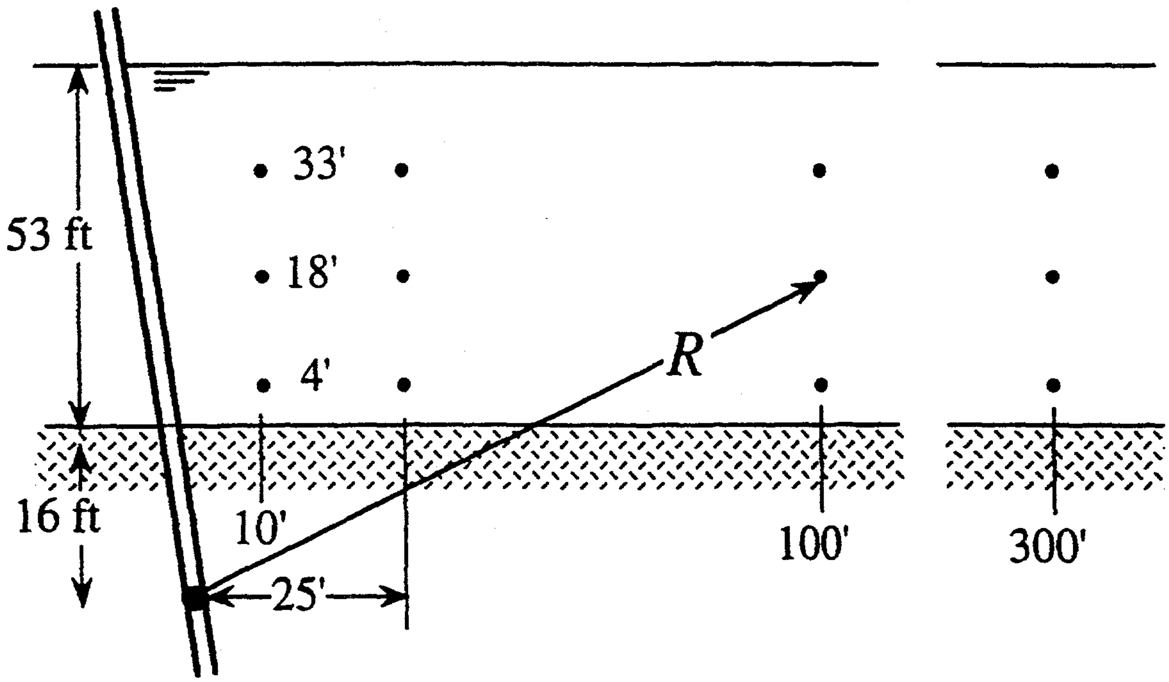
4. Present criteria suspect for in-mud detonations
   - pressure/impulse/energy changed
   - deeper water

5. Multiple detonations
   - greater lethality than single shot
   - fish mobility between shots

6. Fish exposure
   - density distribution under & around platform
   - large temporal population changes
   - species
   - size (weight) distribution

Measurements at Removal

–by Connor 1990 off Grand Isle, LA



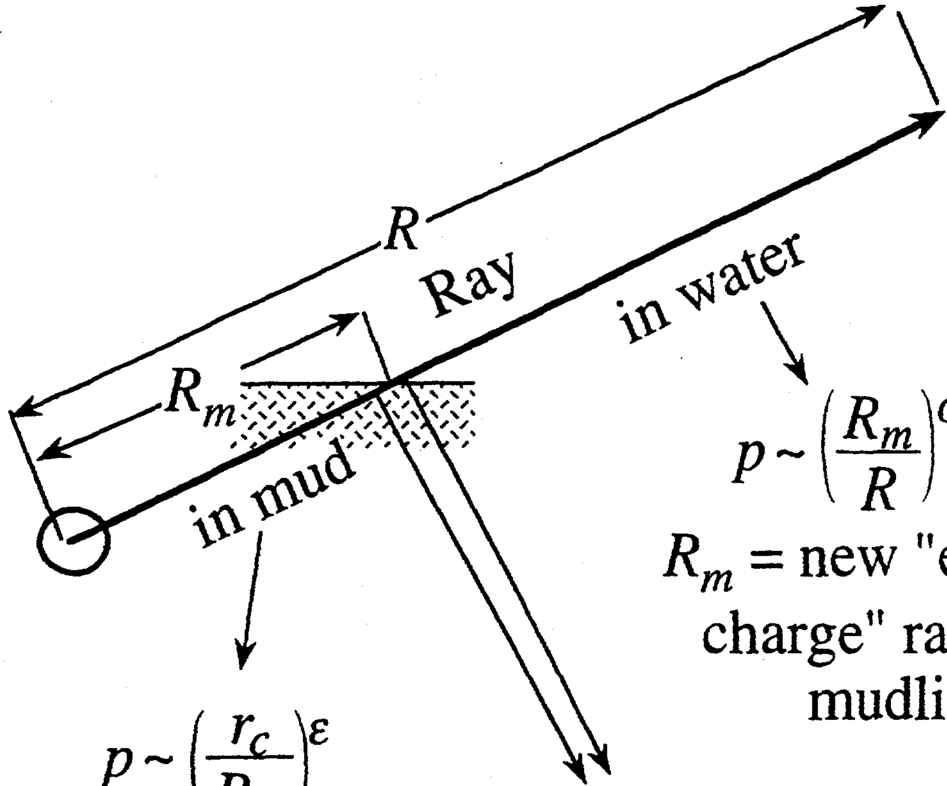
Main jacket piles, 38 lbs Composition B, 12 shots

Connor used in-water similarity relationship:

$$p = 75.16 \times 10^3 \left(\frac{W^{1/3}}{R}\right)^{1.93}$$

– but effects of burial depth & height above bottom appear only as scatter

Extended Similarity Method



$$p \sim \left(\frac{R_m}{R}\right)^{\alpha}$$

R_m = new "effective charge" radius at mudline

$$p \sim \left(\frac{r_c}{R_m}\right)^{\varepsilon}$$

r_c = effective spherical charge radius

__Transmission from mud to water:__

assume
- wavefronts locally spherical

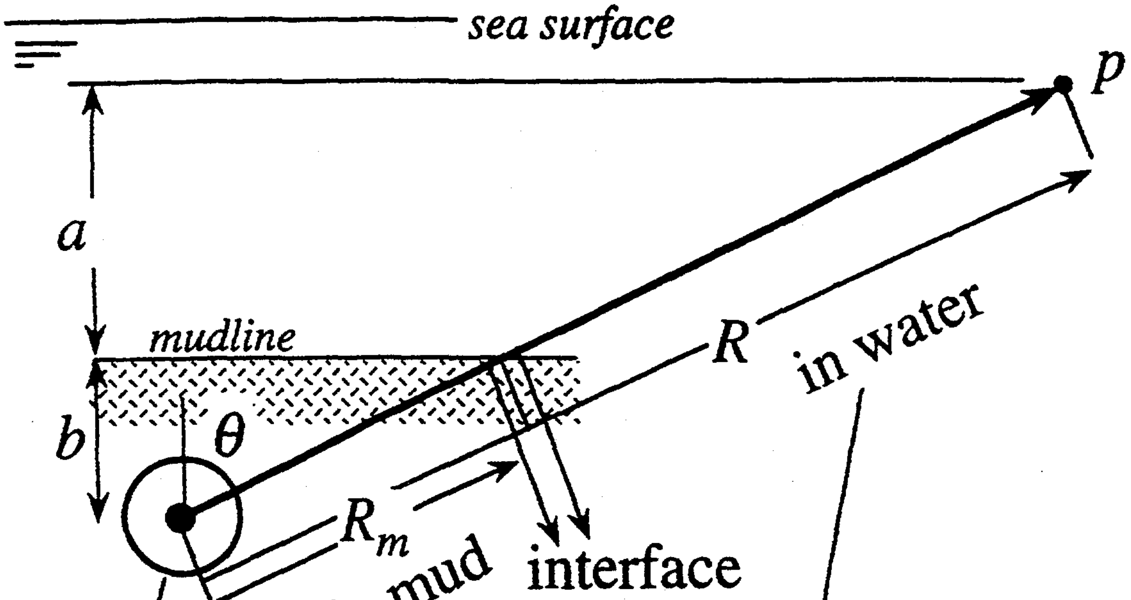
take $c_{mud} \approx c_{water}$
- rays nearly straight

in the acoustical approx
- transmission coeff't ≈ const

independent of angle!

Extended Similarity Method

for peak pressure, charge deeply buried in mud



in mud

interface transmission

attenuation coeff's

detonation directionality

$$p = K(\theta)\left(\frac{W^{1/3}}{R_m}\right)^{\varepsilon}\left(\frac{R_m}{R}\right)^{\alpha}$$

$$= K\left(\frac{W^{1/3}}{R}\right)^{\varepsilon}\left(\frac{(a+b)}{b}\right)^{\varepsilon-\alpha}$$

if $K(\theta) \doteq$ const., single constant from exp't or num. simulation (at small range OK)

new height/depth factor

not $W^{\alpha/3}$ ($\varepsilon > \alpha$!)

Bottom attenuation

$$p = K\left(\frac{W^{1/3}}{R}\right)^{\varepsilon}\left(\frac{(a+b)}{b}\right)^{\varepsilon-\alpha}$$

Assume spherical symmetry at inner boundary, $K(\theta) = K =$ constant

Then

$p =$ function $(W^{1/3}/R)$ only on horiz planes & at constant depth, $(a + b)/b =$ const, so ε ***can be found from in-water measurements***

Connor gives some plots w. const a,b:

$\varepsilon = 2.02; 2.04; 1.90$

– average $\varepsilon = 1.99$

– *compatible with* $K(\theta) = K =$ const.

(Hubbs & Rechnitzer found 2.6 off Calif.)

Correspondingly, $K = 50{,}303; 51{,}257; 51{,}512$

– average $K = 51.0 \times 10^3$

Height above bottom

$$p = K\left(\frac{W^{1/3}}{R}\right)^{\varepsilon}\left(\frac{(a+b)}{b}\right)^{\varepsilon-\alpha}$$

Connor's data:

Height above seabed	Ratio peak pressure*	Ratio $\left(\frac{(a+b)}{b}\right)^{\varepsilon-\alpha}$
4'	1	1
18'	1.66	1.58
33'	2.28	2.16

*at 18' pressure ≈ 1000 to 10 lb/in^2 with increasing range

given experimental scatter, agreement OK

Thus, Connor's observation of increasing blast pressure with height explained

(even tho' $K(\theta) = K$)

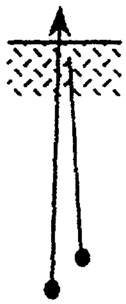
Effect of burial depth

$$p = K\left(\frac{W^{1/3}}{R}\right)^{\varepsilon}\left(\frac{(a+b)}{b}\right)^{\varepsilon-\alpha}$$

Connor's data not segregated: confused

Near bottom (a << b)

above charge



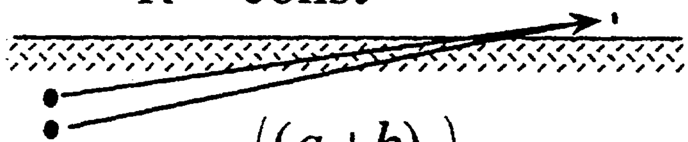
$R \approx b$

$$p \sim \left(\frac{1}{b}\right)^{\varepsilon}$$

strong effect

at shallow angle

$R \approx$ const



$$\left(\frac{(a+b)}{b}\right) \approx 1$$

very little effect

High above bottom (a >> b)

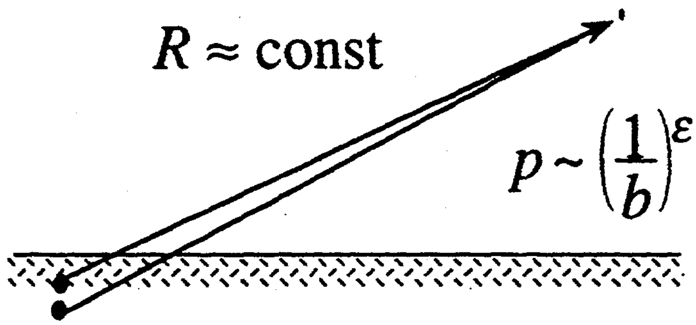
above charge

$R \approx$ const

$$p \sim \left(\frac{1}{b}\right)^{\varepsilon-\alpha}$$

at shallow angle

$R \approx$ const



$$p \sim \left(\frac{1}{b}\right)^{\varepsilon-\alpha}$$

moderate effects ($\varepsilon - \alpha \approx 0.86$)

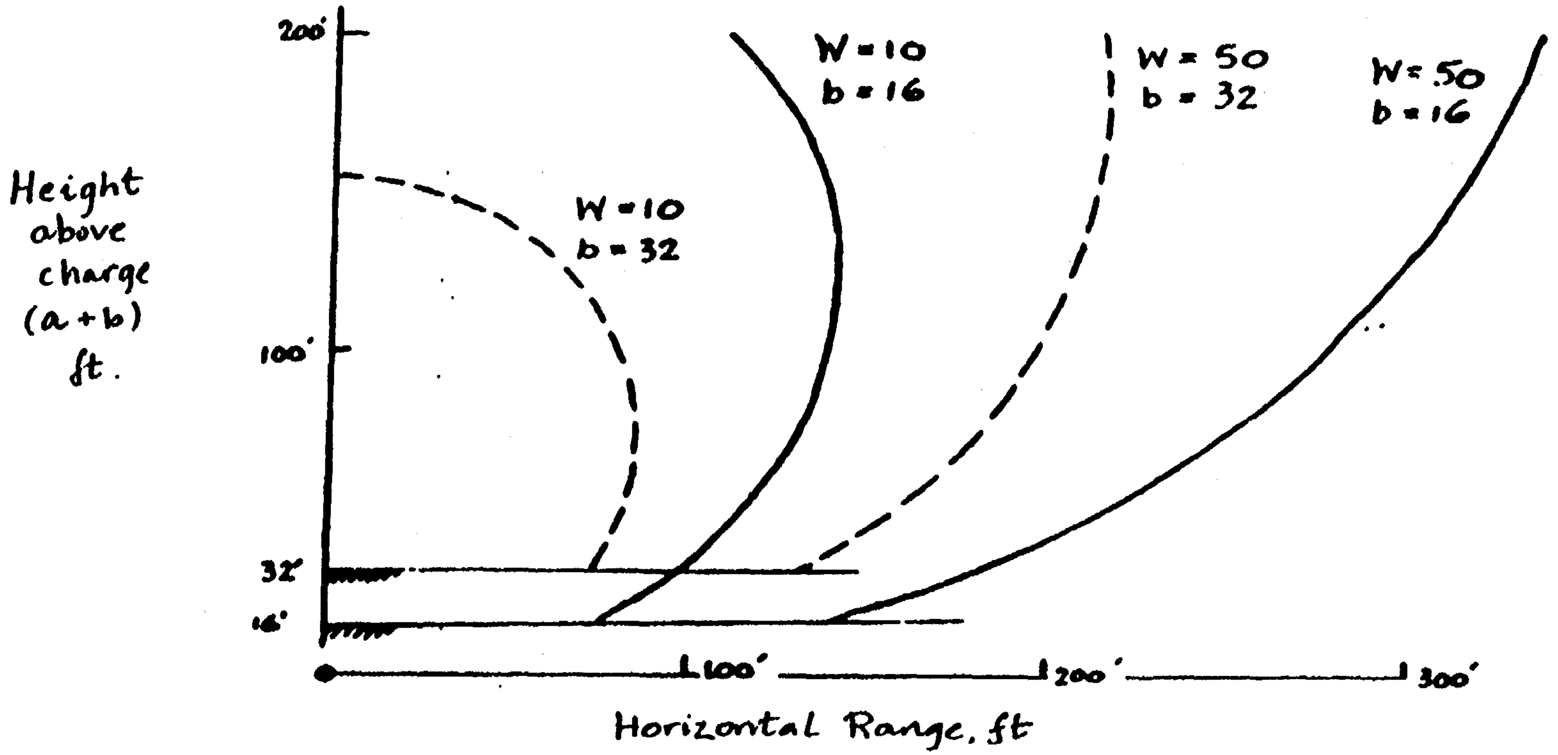
Constant blast pressure contours

$$R = \left(\frac{1}{p}\right)^{1/\alpha}\left[\frac{KW^{\varepsilon/3}}{b^{\varepsilon - a}}\right]^{1/\alpha}(\cos\theta)^{(\varepsilon-\alpha)/\alpha}$$

$$= \text{const} \times \left[\frac{W^{\varepsilon/3}}{p}\right]^{1/\alpha}(\cos\theta)^{(\varepsilon-\alpha)/\alpha}$$

40 lb/in^2 contours

$K = 51{,}000$, $\varepsilon = 1.99$, $\alpha = 1.13$



Hypothetical Fish Survivability

Illustration only, showing ***trends*** for

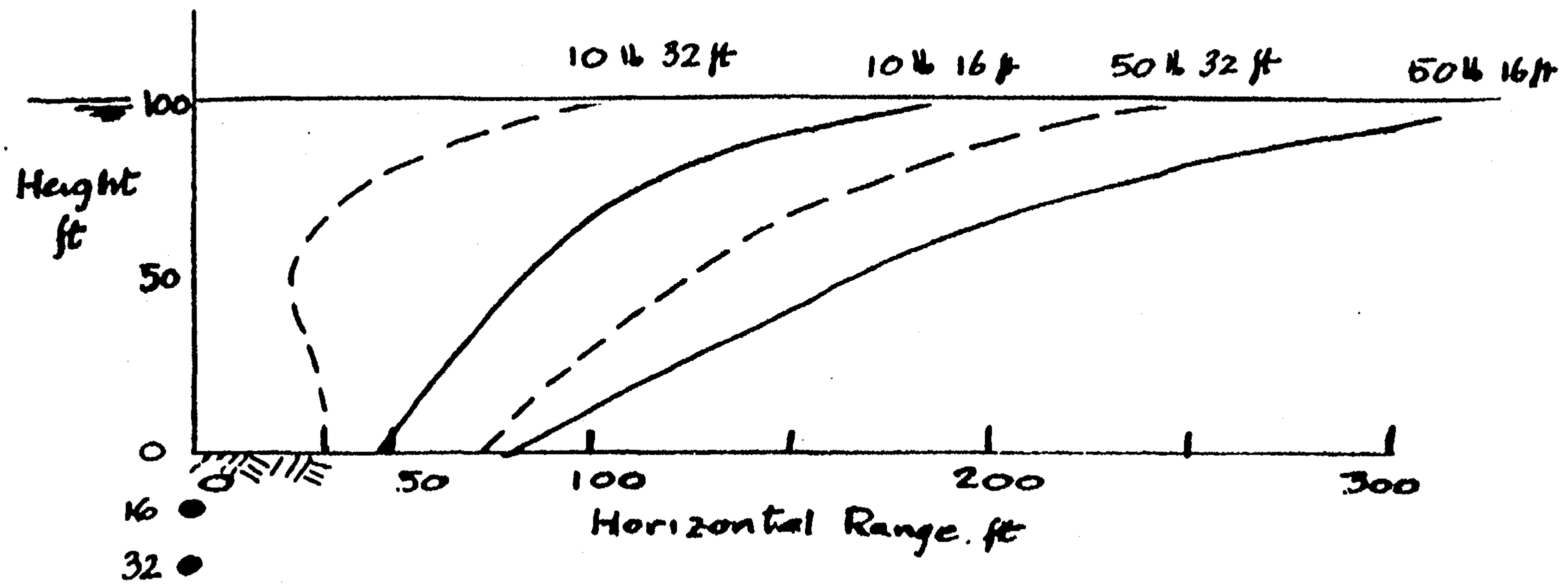
- reduced charge weight
- increased burial depth

Peak press. from Extended Similarity Method

— West Delta 30 mud characteristics

Single shot survivability assumption:

peak press./local static press. = 2



5

Working Group Four: Site Clearance

Chair: **John D. Rullman**, *Exxon*
Co-Chair: **Mariano Hinojosa**, *Louisiana Department of Natural Resources*

Panelists

Panel Moderator:	**Mariano Hinojosa** *Louisiana Department of Natural Resources*
Fishing and Shrimping:	**Rickey Mathern**
Oil and Gas:	**Mike Parker** *Exxon*
MMS:	**Arvind Shah** *Minerals Management Service*
DNR:	**Donald Hebert** *Louisiana Department of Natural Resources, Office of Conservation*
Salvage Industry:	**"Skipper" Strong** *Cal Dive International*
Verification Industry:	**Sidney Schexnayder** *Schexnayder Trawling Corporation*

AGENDA: SITE CLEARANCE GROUP

Day One - April 15, 1996

Session I: Introduction and Issues		3:30 - 4:45
Welcome, introductions and opening statements -John Rullman, *Exxon*, and Mariano Hinojosa, *La. DNR*	3:30 - 4:00	
Workgroup meeting agenda and procedures -John Rullman, *Exxon*	4:00 - 4:15	
Presentation of Site Clearance Issue Paper -John Rullman, *Exxon*	4:15 - 4:45	

Day Two - April 16, 1996

Session II: Site Clearance Focused Presentations, Part I		10:30 - 12:00
Site clearance and verification: *Issues 2, 3, 4, 9, 10, 11, and 12* -Butch Ventura, *CNG*	10:30 - 11:15	
Site clearance debris distribution and depth of verification trawling: *Issues 1, 7 and 8* -Ike Parker, *Exxon/OOC Fisheries Subcommittee*	11:15 - 12:00	
Lunch (Panel prepares their summary)	12:00 - 1:00	
Session III: Site Clearance Focused Presentations, Part II		1:00 - 2:15
Disposition of fish and shrimp caught during site clearance and verification: *Issue 5* - L. Brandt Savoie, *La. Dept. of Wildlife and Fisheries*	1:00 - 1:15	
Orphaned sites: *Issue 6* - Ernest Burguieres, *Former Commissioner of Conservation La. Dept. of Natural Resources*	1:15 - 1:30	
Site Clearance Panel Summary: *Issues 1-12* - Panel	1:30 - 2:15	
Session IV: Fisherman's Gear Compensation Focused Presentations		2:15 - 5:00
Snags - what is being snagged and where: *Issues 16 and 17* -Ronald Dufrene, *Shrimping Industry*	2:15 - 3:00	
Claims verification and hangs location: *Issues 13, 15 and 18* - Michael Warr, *La. DNR*	3:00 - 3:30	
Break (Panel prepares their summary)	3:30 - 4:00	
Proactive ideas to remove "hangs": *Issue 14* - Beau Martin, *B&J Martin, Inc.*	4:00 - 4:15	
Fisherman's Gear Compensation Panel Summary: *Issues 13 - 18*	4:15 - 5:00	
Adjourn - John Rullman, *Exxon*	5:00	

SITE CLEARANCE ISSUES

OCS and Louisiana Issues

1) *Should site clearance radii be reduced or increased?*
2) *What should be done to improve existing debris removal techniques and develop new, innovative techniques?*
3) *Are jack-up rig can holes on water bottoms obstructions that need mitigation?*
4) *Should heavier mesh net be used for site clearance verification?*
5) *Should marketable shrimp, crabs, and fish collected during site clearance verification be donated to charity or to the fisherman's contingency fund?*
6) *How should orphaned sites be handled?*

OCS Issues

7) *Should the depth required for trawling site clearance verification be reduced below 300'?*
8) *What are requirements for site clearance and verification in water depths greater than 300'?*
9) *Should MMS approve site clearance verification methods other than by trawling?*
10) *To what extent can MMS validate the site clearance process?*
11) *Should MMS issue a letter to operators indicating their agreement that the sites are clear for liability purposes?*
12) *How should situations be resolved where facilities are removed according to regulations but over time piles or conductors become exposed and snag shrimp trawls?*

FISHERMAN'S GEAR COMPENSATION ISSUES

OCS and Louisiana Issues

13) *Should claims be more closely verified?*
14) *Should all stake holders work cooperatively to proactively remove snags and obstructions related to oil and gas activities that are beyond the site clearance requirements?*
15) *Should government agencies regularly publish "hangs" data with up-to-date information to consolidate the Notices to Mariners information?*
16) *Are active pipelines and subsea valves snag concerns to the shrimping industry? If so, what are the remedies?*

Louisiana Issues

17) *Why is the number of Louisiana claims increasing given the fact that site clearance regulations now require removal of all obstructions and snags upon abandonment of an oil and gas facility?*
18) *Should claims on snags previously claimed be disallowed as is done in the NMFS OCS program?*

Site Clearance Working Group

Issues

Notes:
- Issues are numbered from 1 to 18 and these numbers are referred to in the working agenda for the workshop Site Clearance sessions.
- Site Clearance Issues are numbered 1 to 12.
- Fisherman's Gear Compensation Issues are numbered 13 to 18.

Abstract

In the 1970's the pace of oil and gas facility removal in United States' water bodies increased as mature reservoirs became depleted and operations ceased. The Gulf of Mexico and Louisiana continue to be areas with a high level of facility removal, and the pace of removal is projected to increase. Regulations were promulgated for the Gulf of Mexico and Louisiana requiring that abandoned sites be cleared of debris that could interfere with fishing and shrimping activities. The site clearance regulations also required verification that the sites were clear. Additionally, government programs were established to compensate fishermen for losses associated with snagging their equipment on oil and gas related objects that remained on the water bottoms in areas other than active producing sites and sites that had been verified as clear of obstructions and snags. The oil and gas industry funds the compensation programs.

This paper reviews the regulations and evolving operating practices in the Gulf of Mexico and Louisiana where site clearance and fisherman's gear compensation regulations have been in place for a number of years. Although regulations and guidelines may be in place elsewhere in the world, this paper focuses on the Gulf of Mexico and Louisiana. Workshop participants are encouraged to bring up international issues during the course of the workshop.

Additionally, this paper raises questions and focuses on issues that are of concern to the various Gulf of Mexico and Louisiana water surface and water bottom stakeholders. This paper does not have answers to the questions or issues. During the workshop participants will debate the questions and issues in an attempt to develop consensus opinions and/or make suggestions that can be provided to the appropriate organizations, both private and government, for possible future research or policy adjustments.

An accompanying paper will be developed at the conclusion of the workshop that describes the workshop deliberations with consensus opinions and recommendations where appropriate.

Site clearance and facility removal are different activities. Facility removal deals with removal of the structures used to produce oil and gas including platforms, wells, casing, piles, pipelines, well protection structures, etc. Facility removal and abandonment will be discussed by other workshop working groups (Abandoning Wells, Abandoning Pipelines, and Removing Facilities). Site clearance deals with removal of oil and gas related debris that has accumulated on the water bottom at the production site over the life of the oil and gas field due to storms, accidents, etc.

Introduction

Water surfaces and water bottoms throughout the world have many uses, and one activity, although it may temporarily preclude other uses, should not permanently preclude other uses unless conscious societal decisions are made for it to do so. The oil and gas industry began producing operations in Gulf of Mexico coastal waters of the United States (US) in the 1920's and in the US Outer Continental Shelf (OCS) in the 1940's. Oil and gas development operations temporarily preclude some competing activities while enhancing others. For example, while an oil and gas facility is operating, trawling and transportation activities must track a course that avoids the oil and gas structures. However, in the US Gulf of Mexico (GOM) the oil and gas structures provide temporary hard bottom artificial reefs that attract various fish that have significant commercial and recreational value.

Once the oil and gas reserves have been depleted and the operations cease, regulations for the OCS and the state of Louisiana require that the oil and gas structures be removed from the water bottoms. These regulations also require that the sites be cleared of debris that may have accumulated over the life of the development—more than 40 years in some cases. During the 1970's increasing numbers of fields were depleted and abandoned. In the early 1980s site clearance regulations for the OCS were promulgated to ensure that once oil and gas facilities were removed, the water bottom would be clear of obstructions, allowing renewed operations such as trawling and transportation that were temporarily precluded. (Designated permanent artificial reef development is an exception to the requirement to remove oil and gas structures completely and clear the water bottom.)

For various reasons some oil and gas related obstructions remain on the water bottoms, and in the late 1970's regulations were promulgated for OCS and Louisiana that established fisherman's gear compensation programs. These programs collect fees from oil and gas operators to compensate commercial fishermen who damage their gear on oil and gas related snags and obstructions.

Background

With the increasing frequency of platform removal during the 1970's, a multiple-use conflict was growing in OCS and Louisiana waters between the oil and gas industry and the fishing/shrimping industry regarding oil and gas related obstructions and snags that were damaging commercial fishing vessels and certain gear, primarily trawls. A short term solution established an oil and gas industry funded program managed by the respective federal and state agencies to compensate fishermen for gear that was damaged or lost because of oil and gas related snags and obstructions. A longer term solution established regulations to ensure that future oil and gas facilities were removed and their sites cleared of oil and gas related debris that could cause trawling obstructions and snags.

The Outer Continental Shelf Lands Act was amended in 1978 to include the Fishermen's Contingency Fund, and regulations were promulgated by the Department of Commerce National Marine Fisheries Service/National Oceanic and Atmospheric Administration in 1982. The Louisiana Revised Statutes of 1950 were amended in 1979 to add the Fisherman's Gear Compensation Fund, and regulations were promulgated by the Department of Natural Resources in 1979. Subsequent statutory and regulatory actions have changed some details of the original federal and state fishermen's gear compensation regulations.

Site clearance regulations were introduced into the Department of Interior's Minerals Management Service (MMS) OCS oil and gas operating regulations in 1981. In 1979 a Louisiana law added site clearance requirements, and a 1991 amendment requires the owner to verify site clearance. Louisiana regulations were promulgated by the Department of Natural Resources Office of Conservation in 1992. Subsequent statutory and regulatory actions have changed some details of the original federal and state site clearance regulations.

Additionally, regulations were promulgated requiring oil and gas equipment that could be dropped overboard to be marked with the owner's name. This could allow possible fishermen's gear damage recovery from the owner that dropped the equipment. The MMS also requires owners to document equipment dropped or lost overboard and report this information to the MMS. Regulations also evolved requiring snags to be listed on mariner's charts. Listing snags could reduce repeat damage by other fishermen, and in some cases compensation will not be made if damage occurs on a listed snag or obstruction.

As the site clearance regulations evolved and as fields in coastal Louisiana and the GOM OCS were depleted and abandoned, the oil and gas industry developed new technology and practices to survey their sites, remove oil and gas related snags and obstructions, and verify site clearance. Examples of technology and practices for initial site surveys and final verification include diver surveys, side scan sonar, sweep assemblies, and trawling. Examples of technology and practices to remove obstructions include diving salvage operations, dragging reinforced nets (followed by conventional trawling in some cases), bucket dredging salvage, grappling salvage, and electro-magnetic salvage operations.

Site Clearance and Verification

OCS Site Clearance Regulations - The MMS has jurisdiction for oil and gas activities in the OCS. MMS has regulated site clearance since 1981, and the

MMS GOM Region has issued several Notices to Lessees that further interpret the regulations and include requirements for site clearance and verification. Current GOM OCS site-clearance activities are performed in accordance with the MMS GOM Region Notice to Lessees (NTL) 92-02 which was distributed on March 28, 1992. The following is a brief synopsis of this NTL:

> All abandoned well and platform locations must be cleared of all obstructions present as a result of oil and gas activities. For clearance purposes, locations are defined as follows:
> 1. Exploratory or delineation wells drilled with a Mobile Offshore Drilling Unit (MODU) - 300 foot radius circle centered on the well.
> 2. Platforms - 1,320 foot radius circle centered on the platform geometric center.
> 3. Single well caissons - 600 foot radius circle centered on the well.
>
> A site-clearance verification plan must be submitted to MMS for approval.
>
> Platforms and single-well caissons in water depths less than 300 feet shall be trawled in two directions(e.g. North-South and East-West) over 100% of their area for site clearance verification. Industry standard shrimp trawling nets should be used without Turtle Excluder Devices (TEDs). Trawls should be picked up after 30 minutes drag time, and all shrimp caught in the trawl are to be released.
>
> Exploratory or delineation wells drilled with a MODU in water depths less than 300 feet may use sonar for site clearance verification.
>
> Special precautions for pipelines and shipwrecks must be followed when trawling the locations.
>
> All oil and gas related objects and snags encountered by the trawl shall be removed from the sea bed and reported to the MMS.

Platform removal and site clearance verification are significant activities in the GOM OCS. During the past several years, the oil and gas industry removed more platforms and structures than it installed. Figure 1 shows the GOM OCS platform/structure removal history as well as the platforms and structures in place at year end 1995. 225 platforms/structures in water depths less than 300 feet were removed prior to the 1981 site clearance regulations, and 1,184 platforms in that water depth have been removed since the site clearance regulations were promulgated. Since 1988 over 100 platforms and structures have been removed annually in that water depth, and the pace of removal will remain high as reserves are depleted in the mature OCS operating areas. At year end 1995 there were 3,801 platforms and structures in the GOM OCS, and 94% of these were in water depths less than 300 feet and will require site clearance and verification by trawling.

Louisiana Regulations

The Louisiana Department of Natural Resources (DNR) has jurisdiction over site clearance activities in state waters (territorial seas, coastal bays and estuaries, canals, bayous, rivers, etc.). DNR promulgated site clearance regulations on December 20, 1992. The DNR regulations are patterned after MMS NTL 92-02. A September 27, 1993, DNR letter addresses trawling procedures policy, and on February 5, 1996, DNR increased the filing fees. The following is a brief synopsis of the DNR regulations:

> All abandoned well and platform locations on state water bottoms shall be cleared of all obstructions present as a result of oil and gas activities unless otherwise approved by the Commissioner of Conservation. For clearance purposes, locations are defined as follows:
> 1. Exploratory, dry hole, delineation, or other wells that have not been produced for purposes other than productions tests:
>   - In open water (territorial seas and coastal waters) - 300 foot radius circle centered on the well.
>   - In a canal, bayou, river, or other similar restricted waterway - 100 feet upstream and downstream from the well.
> 2. Platforms:
>   - In territorial seas - 1,320 foot radius circle centered on the platform geometric center.
>   - In coastal waters - 400 foot radius circle centered on the platform geometric center.
>   - In a canal, bayou, river, or other restricted waterway - 400 feet

upstream and downstream from the platform geometric center.

3. Single- or multi-well caisson or template:
   - In open water (territorial seas and coastal waters) - 400 foot radius circle centered on the well.
   - In a canal, bayou, river, or other restricted waterway - 100 feet upstream and downstream from the well.

Lessee shall submit a plan for site clearance verification and a $630 application fee to the Commissioner of Conservation for approval.

Platforms and single- or multi-well caissons or templates in water depths between 5 and 200 feet shall have their locations verified as clear over 100% of their area preferably by trawling. However, alternative methods may be approved by the Commissioner of Conservation. Industry standard shrimp trawling nets should be used without TEDs. Trawls should be picked up after 30 minutes drag time, and all shrimp, crabs, and fish caught in the trawl must be released.

Exploratory, dry hole, delineation or other wells that have not been produced for purposes other than production tests need not be trawled provided approval is obtained from the Commissioner of Conservation.

Special precautions for pipelines and shipwrecks need to be followed when trawling the locations.

All oil and gas related objects and snags encountered by the trawl shall be removed from the sea bed and reported to the Commissioner of Conservation.

In Louisiana platform/structure removal and site clearance are significant activities. Site clearance activities prior to promulgation of regulations in December 1992 were not documented, but the number of structures removed by the oil and gas industry prior to regulations is very large. Since the promulgation of regulations the DNR has processed 177 site clearance applications (about 60 per year). The number of structures remaining in Louisiana waters that must be removed is also not documented, but it is very large.

Site Clearance and Verification Techniques

The site clearance and verification processes are similar for both the GOM OCS and Louisiana. An initial survey is performed to determine where the debris is located within the area required for site clearance. After the debris is located, salvage operations are performed to remove the debris so that trawling obstructions and snags are eliminated. Then a site clearance verification survey is performed to ensure that no obstructions and snags remain, and the verification survey is submitted to the regulatory agency.

Several different techniques have been used for the initial site survey. Each site is unique, and the characteristics of the site are considered to determine the most appropriate survey technique. The following are brief descriptions of several **initial survey techniques:**

Side scan sonar is performed by moving the sonar device across the site in a systematic pattern using a boat. The sonar interpretation hardware produces a hard copy chart that shows debris profile and location on the water bottom.

Divers move across the site in a systematic pattern and mark the debris with buoys.

Sweep assembly systems move a buoyed chain assembly across the site. Deflections in the natural shape of the buoys indicate snags which are then marked by divers.

Once the initial survey is completed, the salvage operations begin. Again each site is unique and may require different salvage techniques or a combination of techniques to remove the located debris. The following are brief descriptions of several **salvage techniques:**

Diver salvage uses divers to attach lift lines to the debris; a crane on the surface support vessel then lifts the debris from the water bottom and places it on deck for subsequent disposal on land.

Reinforced net trawling (Gorilla net) uses conventional trawling techniques with a reinforced net assembly that can pick up some debris during systematic coverage of the site.

Electro-magnetic salvage uses a surface support vessel and crane to lower a powerful electro-magnet to pick up steel objects on the water bottom.

Grappling devices use a surface support vessel and crane to pick up debris on the water bottom.

Dredge buckets use a surface support vessel and dredging equipment to pick up debris on the water bottom.

After all debris has been removed from the site, a verification survey must be performed and submitted to the regulatory agency. The agency preferred **site clearance verification technique** is to drag a standard trawl net across 100% of the site in two directions (e.g., North-South and East-West). However, in some cases operators can receive a variance to use alternate site clearance verification techniques such as side scan sonar or documentation of sweep assembly results.

Site Clearance and Verification Costs

Site clearance and verification costs vary significantly because of site specific situations. Many site clearance and verification activities are expensive. They may require a significant spread of offshore diving and salvage/construction equipment and weather-related downtime adds to the cost. Primary cost drivers are water depth; size of area to be cleared and verified; amount, size, and type of debris on bottom (often related to structure age); and weather. A shallow, small site with minimal debris in protected waters can be cleared and verified for several thousand dollars. A deep, large site with significant debris in open water may cost well over one million dollars for clearing and verification.

Site Clearance and Verification Issues

A number of issues were identified by various individuals and organizations during preparation of this paper. These issues along with others that may arise will be discussed during the Site Clearance workshop sessions. The following is a list of site-clearance issues identified during the preparation of this paper. They are divided into those pertinent to both OCS and Louisiana and those primarily of concern to OCS.

OCS and Louisiana Issues

1) Should site clearance radii be reduced or increased?
2) What needs to be done to improve existing debris removal techniques and develop new, innovative techniques?
3) Are jack-up rig can holes on water bottoms obstructions that need mitigation?
4) Should heavier mesh net be used for site clearance verification?
5) Should marketable shrimp, crabs, and fish collected during site clearance verification be donated to charity or to the fisherman's contingency fund?
6) How should orphaned sites be handled?

OCS Issues

7) Should the depth required for trawling site clearance verification be reduced below 300'?
8) What are requirements for site clearance and verification in water depths greater than 300'?
9) Should MMS approve site clearance verification methods other than by trawling?
10) To what extent can MMS validate the site clearance process?
11) Should MMS issue a letter to operators indicating their agreement that the sites are clear for liability purposes?
12) How should situations be resolved where facilities are removed according to regulations but over time piles or conductors become exposed and snag shrimp trawls?

Fisherman's Gear Compensation

OCS Fishermen's Contingency Fund Regulations - The National Marine Fisheries Service (NMFS) of the Department of Commerce is responsible for administering the OCS fishermen's contingency fund. NMFS promulgated the initial fishermen's contingency fund regulations on November 1, 1982, to compensate commercial fishermen for damage or loss caused by obstructions associated with oil and gas activities on the OCS. The following is a brief synopsis of these regulations:

> Each holder of an exploration permit, lease, easement, or pipeline right-of-way shall pay an assessment to the fund. The amount to be maintained in the fund is determined by NMFS. Based on information from NMFS, MMS charges the appropriate dollar amount of fees to oil and gas operators.

Commercial fishermen's claims are eligible for fund compensation if damage or loss was caused by oil and gas related activities on the OCS.

Fishermen's damage or loss claims are not eligible for fund compensation if damage or loss was caused by negligence or fault of claimant. Negligence or fault includes failure to remain outside of navigation safety zones around oil and gas platforms and failure to remain at least one-quarter mile away from obstructions recorded on nautical charts or in Notice to Mariners or marked by a buoy or other surface marker. Additionally, claims are not eligible for compensation if damage or loss was caused by an obstruction unrelated to the OCS oil and gas activities.

Fishermen must follow certain detailed verbal and written reporting requirements to file a claim with NMFS. An initial report must be filed with NMFS within 15 days of the date the vessel returned to port, and a claim must be filed with NMFS within 90 days of the incident. Claims can include actual damage to or loss of equipment as well as economic loss if continued fishing activity is not possible due to equipment loss. The claimant has the burden of proof to establish evidence including the identity of the item that caused the damage and the fact that the item was associated with OCS oil and gas activities.

When NMFS receives a claim, they send an abstract to MMS and the obstruction location to the National Ocean Survey. MMS advises NMFS if the obstruction location is in an area affected by OCS oil and gas activities. MMS also notifies operators with activities in the vicinity of the obstruction location to see if any operators admit responsibility for the claim. National Ocean Survey informs the Defense Mapping Agency Hydrographic/Topographic Center to update navigation charts and Notice to Mariners as appropriate.

Any person who files a fraudulent claim is subject to prosecution, which upon conviction imposes penalties up to a $10,000 fine and 5 years imprisonment.

The damage award will be either the repair cost or the replacement cost, whichever is lower, and it may include 50% of the economic loss. Additionally, reasonable consultant and attorney's fees will be included in the settlement.

In fiscal year 1985, after five years of operation, the NMFS contingency fund had paid 139 claims totaling $512,000 (average $3,700 per claim). In fiscal year 1990 the fund paid 120 claims for $668,000 (average $5,600 per claim), and in fiscal year 1995 the plan paid 42 claims for $268,000 (average $6,400 per claim). Approximately 95% of the claims paid were in the GOM OCS, and the remaining 5% were in California OCS. Additionally, it is believed that the number of claims in the OCS is declining because current oil and gas facility removals require site clearance and verification and because snags for which claims were paid are recorded in Notices to Mariners and additional claims on recorded snags are not paid. Historically on average 57% of the claims filed are paid. The right half of figure 2 graphically illustrates the NMFS OCS claims history.

Louisiana Fisherman's Gear Compensation Regulations - The DNR is responsible for administration of the Fisherman's Gear Compensation Fund in Louisiana state waters. DNR promulgated fisherman's gear compensation regulations in August 1980, and the regulations have changed only slightly since then, with the most recent changes in June 1989. The following is a brief synopsis of the DNR regulations:

> A claimant can file no more than two claims between July 1 and June 30 of each year. A single claim may not exceed $5,000.
>
> Claims can be filed for only incidents occurring in Louisiana state waters south of the northern boundary of the Louisiana Coastal Zone.
>
> The commercial fisherman must file an initial, general, written or oral report with the DNR within 30 days of encountering an obstruction for which a claim will eventually be filed.
>
> The commercial fisherman must file a detailed written claim by affidavit within 60 days of the initial report.

Upon receipt of the claim, DNR shall indicate the location of the obstruction on a map and provide to the claimant the identity of the oil and gas companies that operate in the vicinity of the obstruction, if that can be determined.

DNR may devise procedures for informing commercial fishermen of the location of all reported obstructions.

The claimant must send copies of its correspondence with DNR relating to reimbursement for the fishing gear damage or loss to the oil and gas companies that operate in the vicinity of the obstruction.

DNR will follow administrative procedures for handling the claim.

DNR will not pay claims if negligence of the claimant contributed to the damage. One example of negligence is hitting or snagging an obstruction previously encountered by the claimant.

The claimant can request a hearing with a court of proper jurisdiction if not satisfied with the settlement followed by an appeal.

Fraudulent claims shall be punishable pursuant to the provisions of the Louisiana Criminal Code.

DNR will assess fees not to exceed $1000 on each oil and gas lease and right-of-way in the coastal zone of Louisiana when this is necessary to maintain the Fisherman's Gear Compensation Fund balance above $250,000.

Since its beginning in 1980, the Louisiana Fisherman's Gear Compensation Fund has paid an increasing dollar amount of annual claims driven primarily by the increasing number of claims filed. Virtually all legitimate claims received by the DNR are paid. In fiscal year 1986, after six years of operation, the fund had paid 850 claims totaling $665,000 (average $800 per claim). In fiscal year 1991 the fund paid 330 claims for $825,000 (average $2,500 per claim), and last year (fiscal year 1995) the fund paid 701 claims for $1,754,000 (average $2,500 per claim). The highest claim payment fiscal year was 1994 in which 891 claims were paid totaling $2,227,000 (average $2,500 per claim). The left side of figure 2 graphically illustrates the fisherman's gear claims payment history in Louisiana.

The DNR was concerned about possible fraudulent claims and began a process in 1992 to evluate the claims more thoroughly. In 1995 the DNR, together with the Attorney General's office and District Attorneys of the various coastal parishes, began an investigation of suspicious claims which has resulted in the arrests of several Louisiana commercial fishermen. Additionally, the DNR is considering possible legislation to tighten the Fisherman's Gear Compensation program to preclude further fraudulent claims.

Fisherman's Gear Compensation Issues

A number of issues were identified by various individuals and organizations during preparation of this paper. These issues along with others that may arise will be discussed during the Site Clearance workshop sessions. The issues are grouped into those pertinent to both OCS and Louisiana and those primarily of concern to Louisiana. The numbering sequence continues with issue number 13 following the last issue in the site clearance part of this paper. Following are the fisherman's gear compensation issues that were identified during preparation of this paper:

OCS and Louisiana Issues

13) Should claims be more closely verified?

14) Should all stakeholders work cooperatively to proactively remove snags and obstructions related to oil and gas activities that are beyond the site clearance requirements?

15) Should government agencies regularly publish "hangs" data with up-to-date information to consolidate the Notices to Mariners information?

16) Are active pipelines and subsea valves snag concerns to the shrimping industry? If so, what are the remedies?

Louisiana Issues

17) Why is the number of Louisiana claims increasing, given the fact that site

clearance regulations now require removal of all obstructions and snags upon abandonment of an oil and gas facility?
18) Should claims on snags previously claimed be disallowed as is done in the NMFS OCS program?

Discussion, Summary and Recommendations

Additional Pertinent Data

During preparation for the workshop following completion of the Site Clearance Issue Paper several additional areas of information were pursued that have bearing on site clearance and fisherman's gear compensation, and these areas are worth mentioning here.

Attachment 1 shows the 1996 distribution of the approximately 7,000 installations offshore oil and gas structures or installations throughout the world. About 4,000 of these are in the Gulf of Mexico (GOM). Even more significant is that 1,420 structures have already been removed in the GOM. The GOM structures are significantly different and generally smaller than structures in the North Sea, but regardless, the volume of removal activity to date in GOM is noteworthy. Recognizing the significant structure removal history in the GOM, the Site Clearance workgroup focused on GOM. Although it is to be hoped that processes and approaches to site clearance discussed here are applicable to other areas of the world, the details of site clearance and verification and fisherman's gear compensation programs will be regional in nature.

Another interesting comparison is the 40 year GOM history of oil and gas production and fish/shrimp catch as shown in Attachment 2. The fishing and shrimping activities have been an active part of the GOM for a very long time. GOM oil and gas exploration began in the late 1940's and production began in the early 1950's. Attachment 2 shows that the GOM Outer Continental Shelf (OCS) oil and gas production increased steadily until the mid 1980's and plateaued around 1.0 billion barrels of oil equivalent per year. In 1994 the GOM OCS oil and gas production was 1.2 billion barrels of oil equivalent. The fish/shrimp catch was about 0.8 billion pounds per year in the mid 1950s and increased with some volatility to 2.5 billion pounds in the mid 1980's. The 1994 fish/shrimp catch was 2.1 billion pounds. The commercial value of GOM OCS oil and gas in 1994 was approximately $24 billion (assuming a price of $20 per barrel) and the 1994 value of the fish/shrimp catch was $544 million. Oil and gas and fish/shrimp are both significant commercial enterprises in the GOM, and multiple use of the GOM is an important issue.

Introduction

This paper is a follow-up to the Site Clearance Issue Paper and to the Site Clearance sessions at the April 1996 workshop. During the Site Clearance Sessions, we followed the agenda attached to the Site Clearance Issue Paper with only minor exceptions: Agenda item number 8, Orphaned Sites, was presented by Mr. Jim Welsh of the LA DNR instead of Mr. Ernest Burguieres. Also, due to the length of discussion on each individual topic, we eliminated the panel summaries, agenda items 9 and 14. The panel discussed their positions and reached consensus after the sessions were completed.

A brief summary of the recommendations was presented to workshop participants on April 17. Attachment 3 is a copy of the viewgraphs that were presented to workshop participants on April 17.

Issues and Recommendations

A discussion of the issues and recommendations follows. The issues are listed in priority order. The number for each issue is the number that was assigned to the issue in the Issue Paper. Following the issue is the short recommendation or conclusion as agreed by panel consensus. And following the recommendation or conclusion is a narrative by the workgroup chairman that further explains the rationale for the recommendation or conclusion based on the chairman's understanding of the debate that took place during the workgroup sessions. The chairman's comments represent the chairman's understanding of the debate and are not necessarily the opinion of the chairman. Additionally the chairman's comments are made without prejudice to other panel members having differing understandings of the debate. The **bold underlined** groups in the panel recommendation are the groups or organizations that the Site Clearance panel suggests take action on the recommendations.

The first group of issues has recommendations with action items. The second group of issues has conclusions to the issue questions but no specific recommended actions because the panel did not think additional action was necessary at this time.

Issues with recommended action:

Observation during site clearance sessions: There are diverse opinions from various users of waterbottoms in the Gulf of Mexico (GOM), and these groups seldom discuss mutual issues.

Recommendation: The Offshore Operators Committee (OOC) should take the lead to form a "coalition" of interested organizations to pursue cooperative efforts in GOM regarding site clearance and fisherman's gear compensation. Organizations include: OOC, shrimping industry, Louisiana and Texas Sea Grant, MMS, NMFS, LA DNR, LA DWF, LA Oil Spill Coordinator, Texas Railroad Commission, Texas Parks and Wildlife and possibly others.

Chairman's Comments: During the closing statements of the workshop one speaker indicated that he would expect resentment by some organizations to OOC's leading this coalition because of the potential biased un-level playing field. The Site Clearance Chairman clarified that it was not the panel's intent for OOC to lead the coalition but that OOC should facilitate forming the coalition and let the members select its leadership.

During the workshop sessions several examples of how the coalition could help were apparent. For example, the shrimping industry did not know who in MMS or USCG to call if they hung on an active pipeline or flowline. Also the LA DNR announced at the workshop that they planned to hire a person to work fisherman's gear claims verification, and the shrimping industry was totally unaware of that and disappointed that they had no opportunity for input into work description. It looks as if the coalition would do very well in eliminating the mistrust among the various stakeholders and fostering a cooperative approach to challenging multiple use issues.

Issue 14): Should all stake holders work cooperatively to proactively remove snags and obstructions related to oil and gas activities that are beyond the site clearance requirements?

Recommendation: Yes: Coalition should review proactive snag removal options and make recommendation. Major issues are funding and who is responsible for the debris.

Chairman's Comments: Primary positions that evolved during the workgroup discussions were that the shrimping industry wants relatively clean, hang-free bottoms in the GOM and that the oil and gas industry wants to minimize the ongoing, annually increasing, expenses of funding the fisherman's gear compensation programs that currently require over $2 million per year in contributions by oil and gas companies for the combined Louisiana and Federal OCS programs.

Site clearance regulations are effective at clearing current sites of snags and obstructions, and these regulations will work well on all future sites. However, the present regulations were promulgated after a number of platforms had already been removed according to previous regulations with little site clearance verification performed. In addition, for various reasons oil and gas debris has been spread throughout areas of the GOM beyond the radius stipulated for site clearance in the regulations.

The following are several possibilities for proactive GOM debris removal: Hold fisherman's gear compensation funding by the oil and gas industry flat at some level, but use some of the funds to proactively remove problem snags outside of the regulatory requirements. Shrimping industry could bring debris that is picked up during shrimping operations to shore and use some of the hangs fund money for land disposal. (Currently debris picked up during shrimping operations is returned to the GOM water bottoms due, in part, to high cost of onshore disposal and lack of infrastructure for disposal.) Oil and gas operators could voluntarily pick up debris located during verification trawl runs that are outside of the stipulated site clearance area.

There are plusses and minuses to all of these possibilities for proactive debris removal and the list is very initial and preliminary, but the message of this recommendation is that the various stake holders need to work together to come up with novel solutions that address the core problems instead of continuing existing programs that only peripherally address the problems.

Issue 12): How should situations be resolved where facilities are removed according to regulations but over time piles or conductors become exposed and snag shrimp trawls?

Recommendation: MMS should consider regulations or policies that address this. No problem has developed with facility removal at 15 feet below the mud line (BML), however exposure could become an issue if the regulation is changed to 3 feet BML. This ties to another Workgroup's issue.

Chairman's comments: Actually the Site Clearance workgroup was not aware of any situation where the structure was removed 15 feet below the mudline which later scoured or eroded to expose the pile or casing. However, if the regulations are changed to allow removal at 3 feet BML, this could become an issue. From a shrimping perspective, various site specific parameters should enter into the decision for depth BML of structure removal including soil stability, shrimping frequency in that area, water depth, etc.

Issue 6): How should Louisiana orphaned sites be handled?

Recommendation: Handled adequately by DNR regulations. Concern about speed of implementation. There are 2,800 orphaned wells in the state. 70 worked in last 4 years. **DNR** should assign additional resources to increase speed of implementation and determine if water sites are ranked appropriately recognizing shrimping impact.

Chairman's comments: OCS orphaned sites have not occurred, and current MMS OCS bonding requirements preclude orphan sites from becoming an issue on OCS. In Louisiana the current DNR regulations preclude future orphaned sites, but there is a significant inventory of existing sites that need to be addressed. Many of the 2,800 orphaned wells are on land; however, some of these are located in state waters.

Issue 11): Should MMS issue a letter to operators indicating their agreement that the sites are clear for liability purposes?

Recommendation: **MMS** should consider regulations or policy to clarify liability for hangs on sites that were previously verified clear. Who has liability for debris that moves onto cleared site?

Chairman's Comments: Once a site has been cleared and verified as clear to the government agency, the operator should no longer be responsible for snags that may occur on that site. For example these new snags could result from debris that moves onto the site during a hurricane or other storms, debris could be dragged onto the site by trawling activities, and new debris could result from river flood waters. Regardless of the source, the operator who cleared the site should not be responsible for re-clearing the site. The proactive program suggested previously could be used to subsequently re-clear these sites.

Issue 13): Should Louisiana claims be more closely verified?

Recommendation: Yes, DNR announced at the workshop that a claims investigator will be hired to more closely verify claims. **Coalition** should review claims verification implementation and offer upgrades as appropriate.

Chairman's comments: Historically in Louisiana all claims that were filed were paid with little verification. Adding staff is an important first step to tightening up the claims verification procedures. Claims verification is a difficult issue since the snag cannot easily be seen or identified. One suggestion at the workshop was to put buoys on snags; however, the shrimping industry generally disagreed with that approach since buoys in narrow waterways present additional navigation challenges and buoys are difficult to maintain. The suggested coalition would be an excellent forum to discuss implementation of the additional Louisiana claims verification programs.

Issue 15): Should government agencies regularly publish "hangs" data with up-to-date information to consolidate the Notice to Mariners information?

Recommendation: Yes, **NMFS and DNR/DWF** should publish regularly up-dated hangs documentation/charts as consolidation of USCG Notice to Mariners and other hang data inputs. **USCG** should improve accuracy of Notice to Mariners regarding snags.

Chairman's comments: Currently shrimpers do not trust the Notice to Mariners information on snags, and they maintain their individual hangs books. Additionally, the Notice to Mariners hangs information is not routinely consolidated into a chart. This is a very dynamic situation with snags being found, new snags from floods and so on being deposited, old snags being moved, etc. The coalition could address this and possibly tie future recommendations to proactive hangs removal programs.

Issue 16): Are active pipelines and subsea valves snag concerns to the shrimping industry? If so, what are the remedies?

Recommendation: Yes, pipelines should remain buried per regulations. **Shrimpers** should advise MMS/DNR of unburied pipelines for possible remedy by operator. **Sea Grant** organization should work with MMS and DNR to determine appropriate communication and get word to shrimpers on how to report unburied pipelines.

Chairman's comments: Once again the coalition could work this issue by ensuring that the appropriate parties understand how to communicate information about pipelines that are not buried through agencies to operators to rebury when required. Currently this communication is not understood and there is significant frustration that nothing is done, when in fact the wrong notifications are made in many cases, if any are made at all.

Issue 1): Should site clearance radii be reduced or increased?

AND

Issue 7): Should the depth required for trawling site clearance verification be reduced below 300'?

Recommendation: No, however **coalition** should look more closely at increasing or reducing this area and depth.

Chairman's comments: The current regulated areas to be trawled for site clearance verification are adequate for now.

The apparent background level of debris is reached at radii less than stipulated in the regulations, but there is still some small amount of debris on the water bottoms near the circumference. It is not known what this debris is. Some additional studies may be appropriate to determine what the general background level of debris is in various areas of the GOM and what that debris is. Then this information could be coupled with the proactive removal suggestion recognizing regional fishing areas, etc.

The shrimping and trawl bottom fishing activities are advancing into greater water depths. Twenty years ago shrimping primarily occurred in water less than 50 feet. Now shrimping occurs more frequently in 200 feet of water and deeper. Fishing and shrimping frequency in deep water should be factors in determining the depth of site clearance verification.

Issue 17): Why is the number of Louisiana claims increasing, recognizing that site clearance regulations now require removal of all obstructions and snags upon abandonment of an oil and gas facility?

Recommendation: Unknown, but **coalition** should address to reverse increasing number of claims. (See number 14)

Chairman's comments: It seems as if the number of claims in Louisiana should be flat or declining since new sites are cleared and verified and have been for the last four years. However, claims are increasing. Several factors may contribute to this increase: previous snags may have been moved and new snags may have been deposited due to recent flooding and these snags may not be oil and gas related, more shrimping activity may be taking place in areas where snags are located, etc. Additionally, claims in Louisiana are paid even if the snag was previously claimed by another shrimper.

Again proactive removal appears to be the right approach, because without that the oil and gas industry will continue to pay for damaged nets instead of removing the snag that damaged the net. For example, one small snag may have snagged 20 shrimp nets and caused $5,000 damage per snag or $100,000 in cumulative payments from the hangs fund when that snag could have been removed for a fraction of the cumulative payments.

Issue 18): (In Louisiana) Should claims on snags previously claimed be disallowed similar to the NMFS OCS program?

Recommendation: Undecided, but **coalition** should pursue possibility of proactive snags removal (See number 14) and then reconsider continuation of hangs fund. Would the hangs fund be better utilized picking up hangs instead of compensating fishermen for damaged gear?

Chairman's comments: The situation is different in Louisiana than in the GOM OCS. A properly documented hang in the GOM OCS can be avoided with relative ease; however, in coastal Louisiana that is difficult or impossible since many hangs are located in narrow bayous, streams, rivers, canals, etc. Louisiana DNR decided to allow multiple claims on the same snag, but not multiple claims from the same shrimper on a snag.

Again the best solution may be to proactively remove the snag as mentioned several times previously.

Issues and conclusions without specific recommended actions:

Issue 2): What needs to be done to improve existing debris removal techniques and develop new innovative techniques?

Conclusion: No coordinated action is needed. Contractors and oil and gas companies can develop new technologies at their own discretion. Oil and gas company associates are being educated about the high cost of site clearance and urged to take extra effort to keep debris off the GOM waterbottoms.

Chairman's comments: There is no compelling need to coordinate a research effort to develop new techniques for debris removal. Operators have a clear understanding of the high cost of site clearance now, and they are taking extra steps to keep debris out of the GOM. For the 4,000 structures that are currently in the GOM, commercial competition will provide sufficient incentive to develop new techniques for site clearance.

Issue 3): Are jack-up rig can holes on water bottoms obstructions that need mitigation?

Conclusion: No mitigation is required. Can holes will fill up with time.

Chairman's comments: The shrimping industry was not aware of instances where trawl nets hung on can holes, and can holes will fill in naturally over time.

Issue 4): Should heavier mesh net be used for site clearance verification?

Conclusion: No, the exact same type of trawl net that will actually be used for shrimping should be used for the site clearance verification.

Chairman's Comments: Different trawl nets have different bottom holding characteristics, and if a heavy net is used for verification it may in fact miss some snags that will hang conventional nets.

Issue 5): Should marketable shrimp, crabs, and fish collected during site clearance verification be donated to charity or to the fisherman's contingency fund?

Conclusion: No, primary concern is potential conflict between site clearance activity and shrimping activity. Verification contractor should focus on site clearance verification and not be distracted by shrimping activities. There are also additional enforcement challenges that would arise if catch could be kept such as out of season catch, catches in restricted areas, ensuring donations are actually accomplished, etc. Also catch during verification activities is generally very small.

Chairman's Comments: No one at the workshop session advocated shrimping during site clearance verification; however, the shrimpers had a related issue. They would like some way to be able to move from a shrimping activity far offshore to a site clearance verification activity offshore without having to return to the dock to unload their catch. Current policy does not allow any catch to be on board during verification activities.

Issue 8): What are requirements for site clearance and verification in water depths greater than 300'?

Conclusions: There is some flexibility per 30CFR250, and MMS approval is needed in advance.

Chairman's comments: The MMS NTL 92-02 outlines in detail requirements for site clearance in less than 300 feet water depth, but it does not mention how to verify site clearance in greater water depths. However, 30CFR250 mentions that site clearance verification should be performed for all removals. Additionally 30CFR250 requires MMS approval of the planned verification activities. Typically MMS has allowed relaxed verification activities in water deeper than 300 feet.

Issue 9): Should MMS approve site clearance verification methods other than by trawling?

Conclusion: No, not in water depth less than 300 feet. However, MMS may allow alternative site clearance verification techniques in water deeper than 300 feet.

Chairman's Comments: Some studies were performed in the early 1990's in which different site clearance verification techniques were compared by clearing the site to a level deemed clear by the alternative technique and then performing trawl verification. The trawl verification routinely found additional snags that required removal. If the issues of proactive snags removal and other coalition activities progress, it may be that certain local areas in the GOM have no or very limited shrimping potential. These areas could have relaxed site clearance requirements regardless of water depth.

Issue 10): To what extent can MMS validate the site clearance process?

Conclusions: Only to the extent that they receive documentation from operators and verification contractors. No additional verification is needed.

Chairman's Comments: There are sufficient checks and balances in the current program that biases should not enter into the verification documentation.

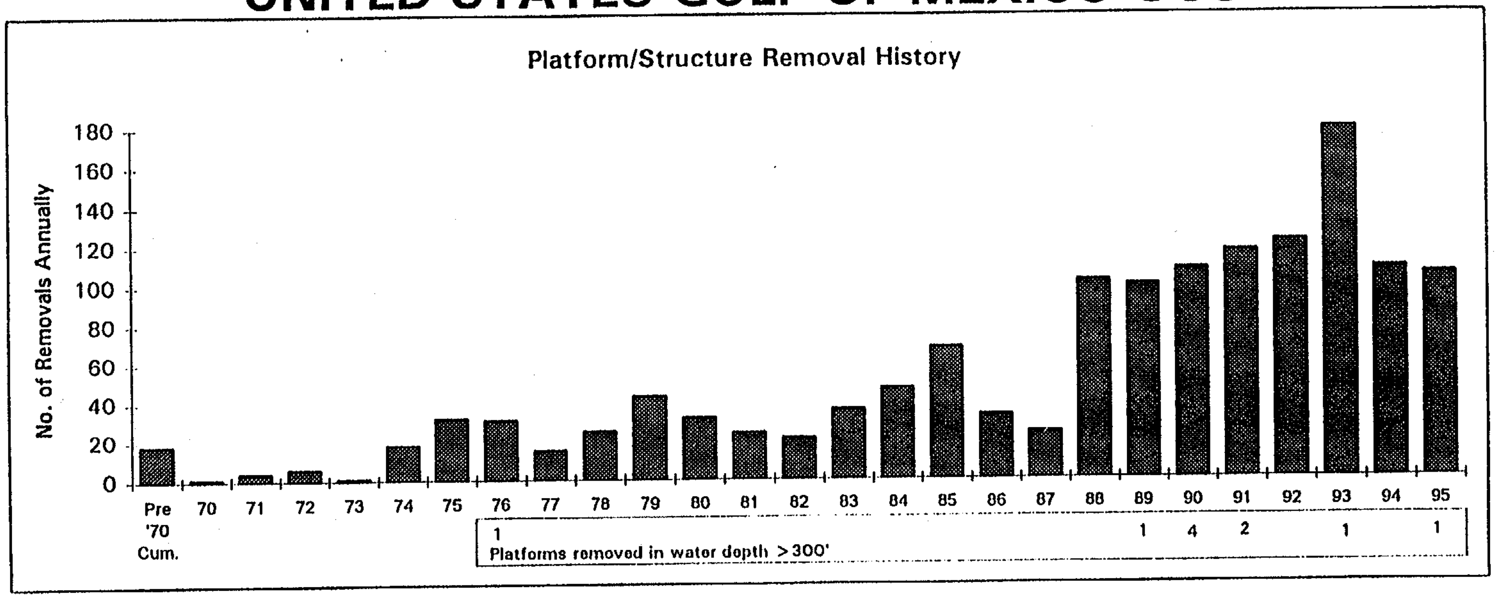
Additional issue identified during the workshop with no discussion:

Issue 19): Should regulations or policies be developed that require MODU rigs to be stacked in non-productive shrimping areas?

Chairman's Comments: Many times when MODU rigs are stacked, they are stacked near estuary outlets into the GOM. These locations are some of the most productive shrimping grounds in the GOM, and alternative sites many serve all parties better. Again, this is an issue that the coalition could resolve.

Figure 1

UNITED STATES GULF OF MEXICO OCS



YE 1995 Distribution of Platform/Structures by Water Depth

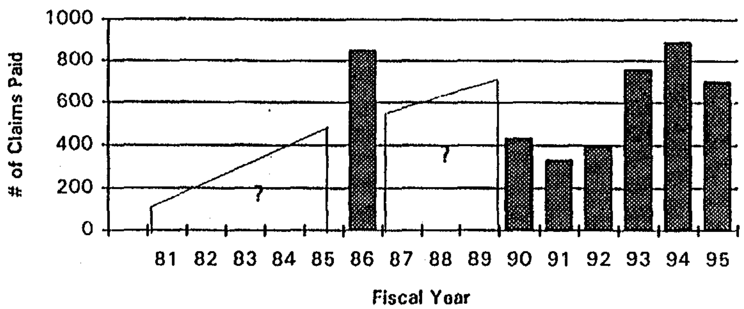
Water Depth (feet)	# Platforms/Structures
0-50	1669
51-100	997
101-200	715
201-300	307
301-400	67
401-900	36
>900	10
Total	3801

*Information from MMS

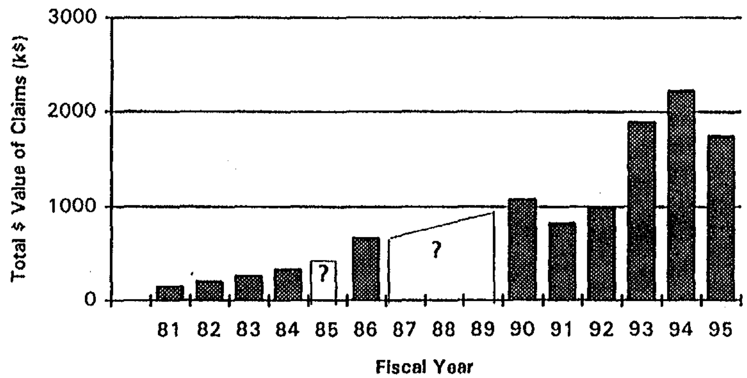
ANNUAL FISHERMEN'S CLAIMS SETTLEMENT HISTORY

Figure 2

Louisiana Fishermen's Gear Compensation

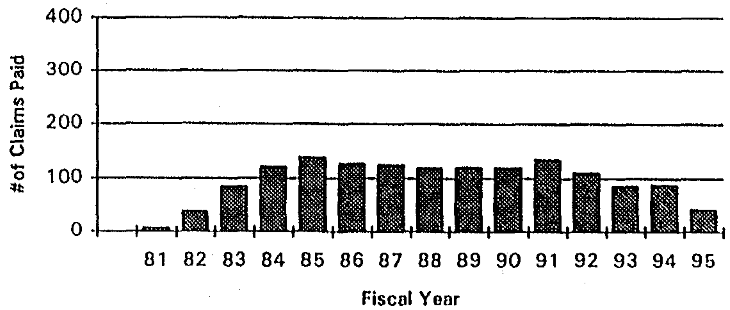


- Virtually all legitimate claims received were paid.
- Jan. 1, 1980 - Dec. 31, 1989 averaged 364 claims/yr. totaling $533,000/yr.

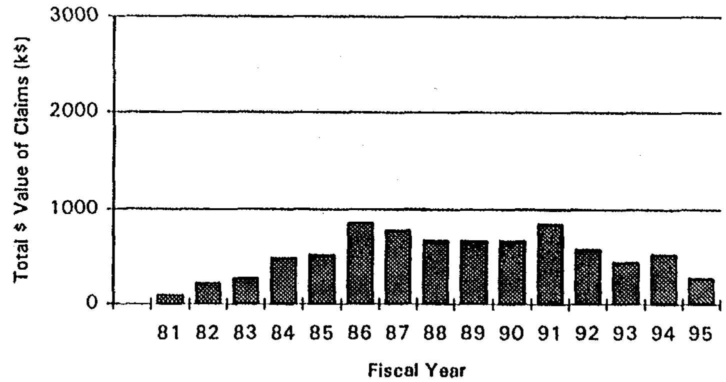


*Information from LA DNR and LMOGA

OCS Fishermen's Contingency



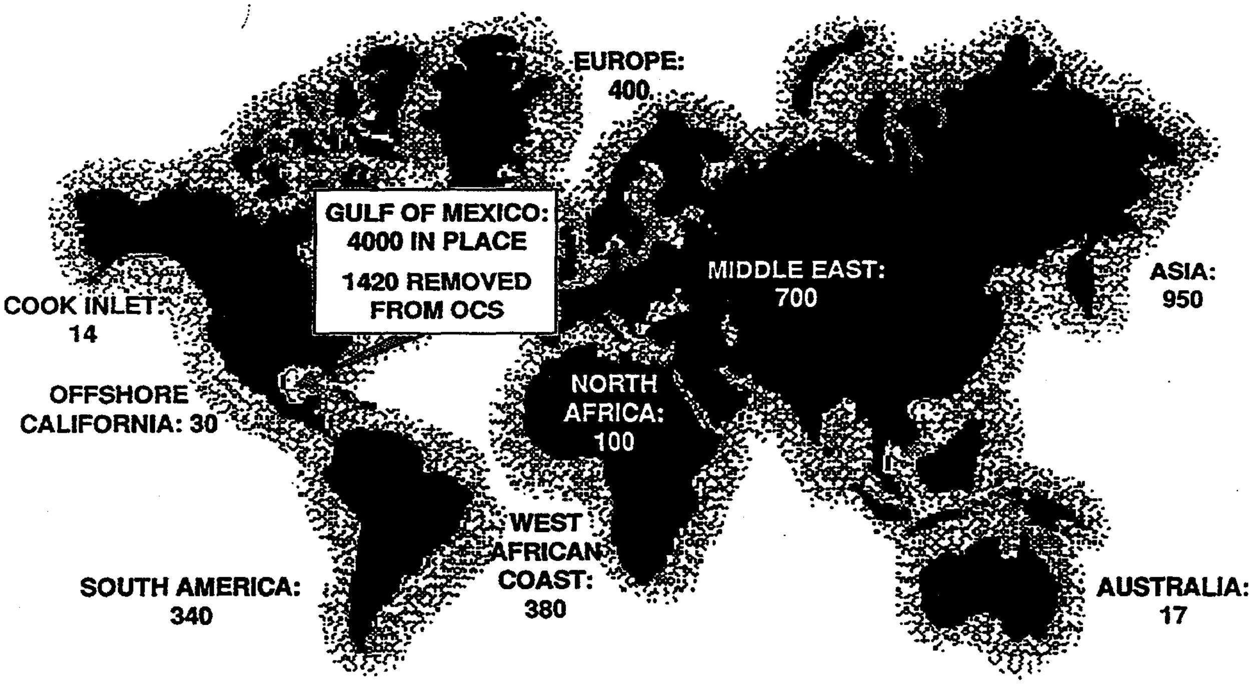
- Approximately 57% of claims received were paid.
- Approximately 95% of claims were GOM OCS and 5% were California OCS.



**Information from US NMFS

ATTACHMENT 1

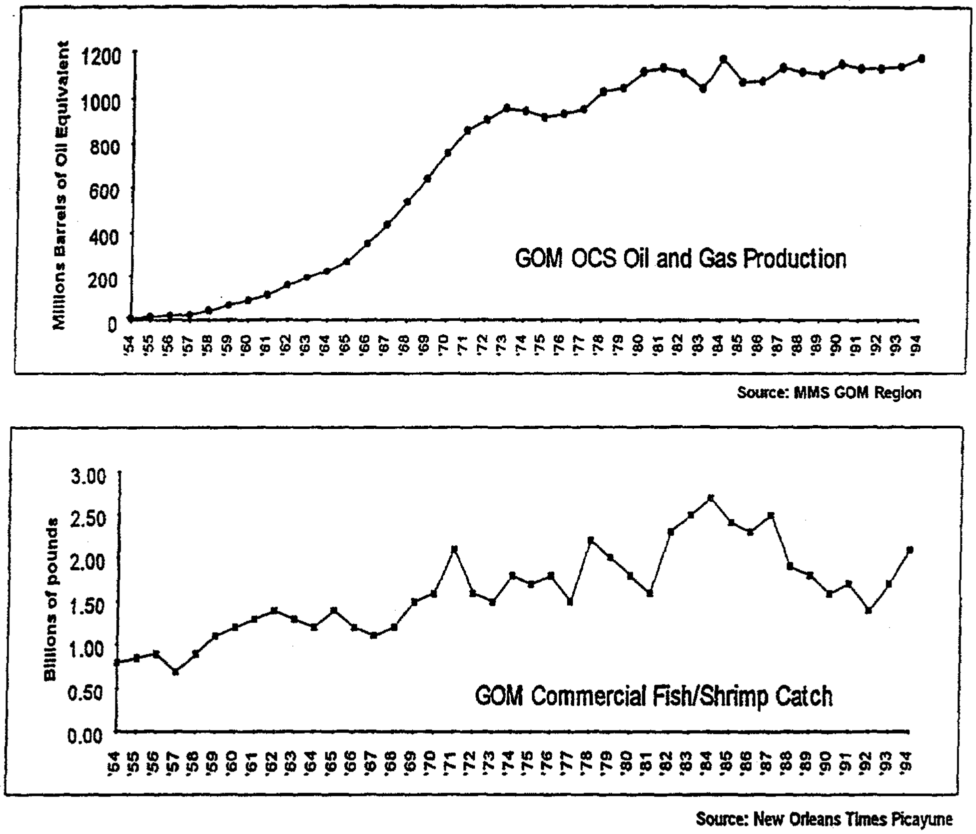
1996 DISTRIBUTION OF OFFSHORE INSTALLATIONS



Source: U.S. Manuals management Service and "Decommissioning Offshore Oil & Gas Installations: Finding the Right Balance" (A discussion paper from the international offshore oil and natural gas exploration and production industry)

ATTACHMENT 2

Oil/Gas and Fish/Shrimp Production in Gulf of Mexico 40 Year History (1954 - 1994)



ATTACHMENT 3

Workgroup 4 - Site Clearance

Two Primary Areas:

- **Site clearance**
- **Fisherman's gear compensation**

Continued on next slide

Observation:

Diverse opinions from various users of water bottoms in GOM and Louisiana and these groups seldom discuss mutual issues

General Recommendation:

Offshore Operators Committee should take lead to form a coalition of interested organizations to pursue cooperative efforts in GOM regarding site clearance and fisherman's gear compensation. Organizations include: OOC, Shrimping industry, MMS, NMFS, LA DNR, LA DWF, and possibly others.

Continued on next slide

14) ***Should all stake holders work cooperatively to proactively remove snags and obstructions related to oil and gas activities that are beyond the site clearance requirements?***

Yes: Coalition should review proactive snag removal options and make recommendation. Major issues are funding and who is responsible for the debris.

Continued on next slide

12) How should situations be resolved where facilities are removed according to regulations but over time piles or conductors become exposed and snag shrimp trawls?

MMS should consider regulations or policies that address this. No problem has developed with facility removal at 15 feet BML, however exposure could become an issue if change to 3 feet BML.......ties to other workgroup issue

Continued on next slide

6) How should Louisiana orphaned sites be handled?

Handled adequately by DNR regulations. Concern about speed of implementation.....2800 orphaned wells in state. 70 worked in last 4 years. DNR should assign additional resources to increase implementation and determine if water sites are prioritized appropriately recognizing shrimping impact.

Continued on next slide

11) Should MMS issue a letter to operators indicating their agreement that the sites are clear for liability purposes?

MMS should consider regulations or policy to clarify liability for hangs on sites that were previously verified clear.....whose liability for debris that moves onto cleared site?

Continued on next slide

13) Should Louisiana claims be more closely verified?

Yes, DNR announced that a claims investigator will be hired to more closely verify claims. Coalition should review claims verification implementation and offer upgrades as appropriate.

Continued on next slide

15) Should government agencies regularly publish "hangs" data with up to date information to consolidate the Notice to Mariners information?

Yes, NMFS and DNR/DWF should publish regularly up-dated hangs documentation/charts as consolidation of USCG Notice to Mariners and other hang data inputs. USCG should improve accuracy of Notice to Mariners regarding snags.

Continued on next slide

16) Are active pipelines and subsea valves snag concerns to the shrimping industry? If so, what are the remedies?

Yes, pipelines should remain buried per regulations. Shrimpers should advise MMS/DNR of unburied pipelines for possible remedy by operator. Sea Grant organization should work with MMS and DNR to determine appropriate communication and get word to shrimpers on how to report unburied pipelines.

Continued on next slide

1) Should site clearance radii be reduced or increased?

AND

7) Should the depth required for trawling site clearance verification be reduced below 300'?

No, however coalition should look more closely at increasing or reducing this area and depth.

Continued on next slide

17) Why are the number of Louisiana claims increasing recognizing that site clearance regulations now require removal of all obstructions and snags upon abandonment of an oil and gas facility?

Unknown, but coalition should address to reverse increasing number of claims. (See number 14)

Continued on next slide

18) Should claims on snags previously claimed be disallowed similar to the NMFS OCS program?

Undecided, but coalition should pursue possibility of proactive snags removal (See number 14) and then reconsider continuation of hangs fund.....would hangs fund be better utilized picking up hangs opposed to compensating fishermen for damaged gear?

6

Working Group Five: Habitat Planning, Maintenance, and Management

Chair: **Charles A. Wilson**, *LSU*
Co-Chairs: **Rick Kasprzak**, *Louisiana Department of Wildlife and Fisheries*
Hal Osburn, *Texas Parks and Wildlife*
Don Allen, *Chevron*

Committee:
Dave Stanley, *LSU*
Ann Bull, *MMS*
Les Dauterive, *MMS*
Villere Reggio, *MMS*
Gordon Picken, *Auris Environmental*
Richard F. Shaw, *LSU*

Habitat Planning, Maintenance, and Management Working Group

ISSUES

Introduction

The Gulf of Mexico (GOM), called "America's Sea," is actually a small ocean basin covering over 1.5 million square kilometers. The Gulf is characterized by an extensive continental shelf providing a relatively shallow habitat for a wide variety of marine organisms. This dynamic and productive ecosystem has attracted the attention of a growing number of commercial and recreational fishermen. The increasing demands and efficiencies of these harvesters have led to a recognition that maximum benefits from these natural resources can only be achieved through proper management.

Because of the multiple uses, diversity, and size of the Gulf's resources, management is shared by a number of governmental agencies including the Minerals Management Service, the Gulf of Mexico Fishery Management Council, the Gulf States Marine Fisheries Commission, National Marine Fisheries Service, the U.S. Coast Guard, the U.S. Army Corps of Engineers, and the five Gulf states fisheries agencies. All of these entities share a common goal of achieving optimum sustainable yield to maximize geological, biological, social, and economic benefits from these resources. These entities also share a common theme that the successful management of the northern GOM requires maintenance and enhancement of both the quantity and quality of habitats.

A closer look at the GOM shows the sediment to be clearly dominated by vast sand and mud plains. These soft bottom habitats are preferred by many groundfish and shrimp species and, thus, have given rise to large commercial fisheries on these stocks. Hard bottom and reef habitats, on the other hand, are limited to approximately 1.6% of the total area of the Gulf, so that, while there are high demands by commercial and recreational fishermen for reef associated species, the availability of habitat for these stocks is limited.

The thousands of oil and gas structures placed in the Gulf have added significant amounts of new hard substrate. The rigs-to-reefs concept was a common sense idea with support from environmental user groups and the petroleum industry for preserving a limited but valuable habitat type. As long as maximizing long-term benefits from the Gulf's resources for the greatest number of users remains the goal, then programs such as Rigs-to-Reefs will remain an important tool for fisheries and habitat managers in the Gulf.

Platforms as Reef Habitat

Oil and gas platforms have proven themselves to be excellent artificial reef material. The National Artificial Reef Plan cites five major characteristics or standards for artificial reef materials: compatibility with the environment, durability, stability, availability and function. Oil and gas platforms appear to possess all these characteristics. These standards, together with siting and management, generally determine the success or failure of an artificial reef project.

Platforms have proven themselves to be compatible with the marine environment since only the jacket of the structure or that portion of the platform that has not come into contact with hydrocarbons is generally used. When the deck portions are used in a reef project, all the processing equipment is either removed or flushed clean. The residue and contaminants are then placed in appropriate containers and shipped to shore for proper disposal.

Oil and gas platforms are also very durable and stable, rarely if ever moving from where they were placed. In August 1992 Hurricane Andrew, a class-four storm with over 140 mile/hour winds, entered the Gulf of Mexico and affected the leasing areas of Ship Shoal, South Timbalier and West Delta. The storm destroyed or damaged over 181 active platforms and caissons, five of which subsequently entered the Louisiana Artificial Reef Program. Side-scan surveys of two reefs in South Timbalier block 128, which were directly in the path of Hurricane Andrew, revealed no detectable movement or scouring. These platforms also appear to be relatively durable. It has been estimated, based on the average corrosion rate of steel immersed in saltwater, that these platforms may have life spans of approximately 300 years without biological encrustation.

Platforms are also readily available, with over 3,700 in the Gulf of Mexico alone. However, it is not always economical to convert a platform into an artificial reef. The size of the structure, water depth, distance from shore, proximity to final reef site, and potential resale value dictate whether or not an obsolete platform becomes a reef. From 1987-95, over 941 platforms were removed from Louisiana and Texas waters, but only 90 platforms (approximately 10%) became artificial reefs.

Artificial reefs require the selection of materials which are known to be effective substrata for encrusting organisms and providing habitat for the target species. It is well documented that oil and gas platforms function as artificial reefs by providing habitat for a variety of species which are associated exclusively with natural hard substrates. This fact is further emphasized by reports that over 70% of all recreational angler trips in the Exclusive Economic Zone of Louisiana are destined for one or more of these structures. The steel members of the platform provide the necessary hard substrate for many of the encrusting organisms crucially important in developing reef habitat. Fisheries studies of several operating platforms conducted by Louisiana State University between 1990 and 1995 showed that 12,000 to 30,000 fish per platform are associated with platforms in 75-700 feet of water.

Platform Faunal Studies

The study of platform-associated organisms has been sporadic. The first studies were from the 1950s and described the organisms that settled on the submerged structures off Louisiana. Little else occurred until work on biofouling at a U.S. Navy platform off Pensacola in the 1960's. Spurred by a new wave of environmental awareness and legislation in the 1970's, the offshore industry sponsored a comprehensive study series from 1972-1974 called the "Offshore Ecological Investigation" that involved 23 principal investigators and 30 graduate students who attempted to identify cumulative effects from oil and gas development and production. Results included comparison of benthic fish populations at different platforms to those at control sites off Louisiana. The first vertical profiles and description of fishes under and around platforms occurred in the mid-1970's, followed quickly by comparisons between fishes at platforms and those at natural reefs. The idea that platforms support a unique fauna became widely accepted, and the concept of platforms as artificial reefs was launched.

From 1976 to 1980, the Federal government sponsored a pioneering effort of cooperative science solely to determine the effects of a gas and oil field on the surrounding environment. Fortunately, the Buccaneer Gas and Oil Field (BGOF) study went beyond its primary mission and is considered a benchmark in the Gulf of Mexico. The BGOF proved that the abundance and diversity of organisms on and around platforms was higher than previously thought and showed that platforms served as artificial reefs and that associated fishes used the area for spawning, feeding and shelter. During the late 1970's and early 1980's, analysts continued to focus studies on fish communities at the platforms and natural reefs. Special attention was paid to economically important reef-fish species, including the theory that the communities at platforms could be delineated into three major assemblages by water depth.

The use or misuse of platforms as tools in fisheries management sparked another wave of studies beginning in 1990. These recent investigations have benefited from new technologies (e.g., hydroacoustics, light traps for juvenile fish) that are amenable to deployment from fixed structures and the application of visual survey by SCUBA, and remotely-operated underwater vehicles (ROV). These studies examine platform fauna from a Gulf-wide point of view, investigating a number of crucial elements from the recruitment of postlarval and juvenile fish to the residence time of adult fish. As lease abandonment and platform removal have become major industry concerns, the results of these scientific investigations on the role that offshore platforms play in the Gulf ecosystem are crucial in the justification and effective siting of these structures as artificial reefs.

Current Trends

With the increase in offshore petroleum production and the inevitable removal of these structures, the issues facing "Rigs-to-Reefs" programs now span several continents. These issues have been debated in the U.S. for at least 15 years, since Tenneco sited a retired platform off the Florida coast. The federal government (through the Minerals Management Service) has supported the "Rigs-to-Reefs" concept on the OCS. Louisiana and Texas now have active Artificial Reef Programs making use of petroleum platforms for which there has been a groundswell of support from user groups. However, this is not the case in other areas of the world. For example, there has been a very negative public perception of the issue in the North Sea, and petroleum platforms off the California coast are presently not viewed positively. In the North Sea this has resulted in both the oil companies and the Government taking stock of the way in which the consultative and decision-making processes regarding decommissioning are carried out. It is likely that in future there will be much more open dissemination of information and a broader discussion of the issues, before a decommissioning option is selected for a particular structure.

Minerals Management Service

Through research, environmental analysis, and publications, MMS brought regional and national attention to the value of oil and gas structures for fish and fishing in the Gulf of Mexico. In the early 1980s Exxon and Tenneco oil companies removed oil and gas structures from offshore Louisiana and donated them for successful and popular artificial reef developments off the east and west coasts of Florida. Growing encouragement from fishery conservation organizations, environmental groups, diving interests, commercial and recreational fishermen, and private industry led the Secretary of the Interior, in 1983, to form a special task force to seek ways to prolong the artificial reef benefits of oil and gas structures in the marine environment. As a result, a national policy encouraging responsible artificial reef developments was established which culminated in the National Fishing Enhancement Act of 1984 and called for the development of a National Artificial Reef Plan. Once completed under the leadership of the National Marine Fisheries Service, the national policy and plan:

- established general guidelines for artificial reef materials, siting, and design;
- identified oil and gas structures as excellent material for developing offshore reefs of opportunity;
- charged coastal states with the primary responsibility for developing and implementing site specific artificial reef plans;
- assigned the Corps of Engineers the responsibility of developing artificial reef regulations and for permitting artificial reef projects in the waters of the United States; and
- limited liability of approved reef sponsors who complied with the terms and conditions of artificial reef permits.

Recommendations resulting from the MMS-funded National Research Council Marine Board's investigation and 1985 report entitled "Disposal of Offshore Platforms" led the International Maritime Organization to amend its international "Guidelines and Standards for the Removal of Offshore Installations and Structures ..." to provide for an exception to its former requirement for total structure removal subsequent to termination of leases should a former production platform remain on the seabed as a sanctioned artificial reef.

Also in 1985, the MMS issued an artificial reef policy statement encouraging the conversion of selected obsolete oil and gas structures to artificial reefs on the Outer Continental Shelf. Through partnership agreements initiated between Gulf of Mexico coastal states and oil companies with the support and cooperation of all the Federal regulatory agencies, 35 oil and gas operators have donated approximately 100 structures for rigs to reef developments in less than 10 years, generating $10 million in cost-sharing savings dedicated for fisheries research and reef maintenance. The potential for continued public/private cooperation for fisheries enhancement and development is significant, especially off states with extensive offshore oil and gas development.

Louisiana

The Louisiana Artificial Reef Program was established in 1986 with the passage of the Louisiana Fishing Enhancement Act. The Program was launched to offset the loss of recreational and commercial fishing opportunities associated with the federally mandated removal of retired oil and gas platforms from the Gulf of Mexico. It has been recognized that offshore oil and gas platforms provide excellent fishing opportunities since 70% of all offshore, recreational fishing trips target one or more of these structures off the Louisiana coast.

Since these structures were so commonplace off Louisiana, many coastal residents came to think of them as being permanent. Since 1973, however, this has not been the case as over 1300 platforms have been permanently removed. At present there are 885 platforms in the Gulf of Mexico that are at least 25 years old, and it is anticipated they will be removed over the next 10 years, causing a major loss of habitat for Louisiana's reef-fish fisheries. This figure does not include those platforms that need to be removed because of damage, regulatory requirements due to lease abandonment, or economic circumstances.

To date, the Louisiana Program has converted the components of 58 obsolete platforms, which have been sited at 22 locations and contributed by 23 different operators. In addition to the platforms, the operators also donated over 7 million dollars to the Program, which represents 50% of their savings on offshore compared to onshore abandonments.

<u>Texas</u>

In 1989 the Texas Legislature directed the Parks and Wildlife Department (TPWD) to develop the artificial reef potential for enhancing fishery resources, fishing and diving opportunities off Texas. The legislation also created a dedicated Artificial Reef Fund to finance the program and an Artificial Reef Advisory Committee with representatives for all major stake holders.

To guide placement, TPWD produced the Texas Artificial Reef Plan, which followed an exclusion-mapping approach. The Plan also recommends that the state actively pursue offshore petroleum structures for use as artificial reefs because of their complex, durable, and stable nature. Each donation offer is considered by TPWD on a case by case basis to maximize flexibility. A General Permit has also been granted to TPWD by the Corps of Engineers for 6500 square kilometers of the High Island Area to facilitate the placement of jackets as artificial reefs in this active drilling zone.

Through early 1996, the Texas Artificial Reef Program has sited 36 obsolete platforms as well as several other materials of opportunity at 27 sites. In addition, the Artificial Reef Fund has received nearly $4 million in shared cost savings or donations from 19 different petroleum companies. The Texas Parks and Wildlife Department has taken the lead in maximizing the full habitat potential of the Rigs-to-Reefs Program by mechanically cutting only the upper portion of two jackets recently donated, leaving the remainder of the jackets standing in place. Additionally, Texas Parks and Wildlife Department has also created a number of nearshore artificial reefs to enhance fishing and diving opportunities for small boat owners.

<u>North Sea</u>

The North Sea has about 438 fixed oil and gas platforms weighing some 7.9 million metric tons. Under existing legislation and guidelines, the majority of these will need to be entirely removed at the end of their lives. The United Kingdom (UK) is presently engaged in a process of evaluating the range of decommissioning options that could be appropriate for different types of structures in varying locations. In particular, attention is focusing on the ways in which large bulky items, such as steel jackets, should be disposed of once they are removed from their present locations. The UK and Norway do not support the current moratorium on the disposal of such bulky structures in the northeast Atlantic. They wish to retain this option because they both possess large, heavy structures whose total removal to the shore for disposal may indeed be risky, expensive, and very difficult.

The abortive attempt by Shell in the summer of 1995 to dispose of the redundant oil storage and loading buoy <u>Brent Spar</u> focused attention on the environmental debate, and concerns were raised that the uncontrolled disposal of large numbers of platforms in the sea would cause significant environmental damage. Objective scientific assessment and more reasoned consideration of the issues post-<u>Brent Spar</u> has, however, confirmed that the potential ecological environmental consequences of disposing of any platform according to the existing guidelines would in fact be extremely small as well as localized. A recent independent study presented a review of data which supported this assertion and concluded that there was no urgent need, *from the point of view of securing significant environmental benefit,* for operators to undertake decommissioning options which were dangerous, difficult, and expensive. Furthermore, it has been made clear that there is no doubt about the removal option for 148 of the 200 fixed structures in the UK North Sea; they are in shallow water and would be entirely removed. If disposal at sea were to remain an option, it would not apply to all the platforms but only to the 70 or so very large platforms in deep water. The general conclusions of the 1995 AURIS report have been supported by the conclusions of a report undertaken by the Natural Environment Research Council on behalf of the UK Department of Trade and Industry. The first report of the "Scientific Group on Decommissioning Offshore Structures" examined the potential for Brent Spar to cause impact in the deep sea and concluded, "The available evidence indicates that the environmental impacts of deep sea disposal of structures such as Brent Spar are not likely to be large enough to be a crucial factor in the selection of the best disposal options, or for this option to be excluded from consideration."

While debate about decommissioning continues, the lives of several of the platforms likely to be abandoned in the near future are being extended through careful management and technical innovation. There is, therefore, still time in which to evaluate decommissioning options and, in particular, to examine the benefits that might be derived from using some of these materials of opportunity as components for artificial reefs. Studies of the biology of platforms in the North Sea and of the fish populations around them show that these structures are acting as *de facto* artificial reefs, as they do in other parts of the world. They have high concentrations of shoaling fish, which are neither tainted nor diseased and which appear to be growing faster than fish caught away from platforms. There is evidence to show that when oil-related structures are submerged onto the seabed they continue to attract fish and to act as reefs.

There are two artificial reefs around the UK at present. In Poole Bay off the south coast of England, there is a small reef made of fly-ash bricks and arranged in low-profile pyramids. It is an experimental/research site, funded originally by a regional electricity board.

The liability for this reef rests with a utility company. The reef is still being studied, and exploitation by fishermen is presently not allowed. In the Firth of Forth near Edinburgh, there is a large low-profile reef created from the rocky spoil excavated in the course of constructing a nearby nuclear power station. This, again, is an experimental/research site, developed at the request of Government marine scientists who, given the opportunity to license where and how the spoil may be disposed of at sea, wished to examine the ecology of a rocky artificial reef close to the shore. This reef attracts some fish and shellfish and is exploited occasionally by local inshore fishermen.

The belief therefore remains that decommissioned platforms would make good reefs and that, before North Sea decommissioning begins in earnest, a study should be carried out to ascertain whether the application of high profile steel reefs, either offshore in the North Sea or closer to shore off the coast of Scotland would be beneficial for inshore fishermen and coastal communities. With the support of industry and local government bodies, a one year study has been completed by AURIS at Aberdeen University to examine the feasibility of creating a pilot reef to examine artificial reefs in the North Sea; no such high profile reefs have yet been deliberately created in the North Sea. With the support of fishermen, a suitable site and reef components have been found, and a detailed programme for the building and study of an artificial reef has been submitted for approval.

A Sample of the Issues

There are several limitations in the use of oil and gas platforms as artificial reefs. In the U.S., individual Coast Guard districts are responsible for developing marking guidelines for obstructions to navigation under 33 CFR 64.30. For example, the 8th Coast Guard District with jurisdiction from Western Florida to the Texas/Mexican border requires that there be a minimum of 85 feet of clearance over the obstruction for it to be exempt from maintaining lighting requirements. However, an exemption from the lighting requirements may be granted on a case by case basis if at least a 50-foot clearance is maintained. In Louisiana's artificial reef program, all the exemption requests have been approved.

Because of the size of these structures, a minimum water depth of at least 100-120 feet is required to site and maintain oil and gas platforms properly as reefs. Unfortunately, due to the broad continental shelf off the Louisiana and Texas coasts, the 100-foot contour is found from 30 to 75 miles offshore, making some reefs inaccessible to fishermen.

Another limitation is the expense of removing these structures. Equipment required to remove these structures can cost between $50,000-100,000 a day depending on the size needed. The size of the structure to be removed determines the size of the barge required. (McDermott, Inc., 1994, oral communication).

A third and most recently debated limitation is the method of removal. Currently, the accepted method to sever these structures from the sea floor involves the use of explosives. The concern over the use of explosives includes their potential impact on endangered sea turtles and marine mammals. To address this issue MMS and NMFS required a review of the operator's abandonment plan that is required under Section 7 of the Endangered Species Act. Recently the Gulf of Mexico Fisheries Management Council became concerned about the impact of the use of explosives on associated fishes. The oil and gas industry has attempted to find alternatives to the use of explosives such as cryogenic cutting, hydraulic abrasive cutting, and mechanical torch cutting. Most of these techniques have proven to be either ineffective or successful only in limited situations. Thus far, the industry has concluded that the use of explosives is by far the safest, most reliable, and most cost-effective method of platform removal.

Objectives

The purpose of this paper is to put forward the current practices, regulations, and policies dealing with lease abandonment and platform disposition that affect the use of abandoned structures as reef habitat. We identify major, moderate, and minor economic, technical, and operational areas to establish a list of issues for discussion and deliberation by the working group during the Lease Abandonment Workshop. Our ultimate goal is to develop a set of recommendations for research, regulatory, or policy adjustments that will contribute to the resolution of identified issues.

The following pages highlight general issues of concern to the public regarding the "habitat" associated with oil and gas platforms. Topics for deliberation at the Removal Conference are numbered 1-42 and are in **bold.** Below each topic are some general background information and *italicized* text which summarizes workshop comments. This paper concludes with our conclusions and recommendations.

Issues of Concern to Rigs-to-Reefs Programs

Permitting

1. Standing, Toppled, Cut Off (major issue) - The issue of how a platform should remain in place is probably one of the highest priority issues in our deliberations. It affects oil and gas companies and artificial reef programs and is a major regulatory burden to federal agencies. It is a major issue in the Gulf of Mexico and in the North Sea and will likely become a major issue in other oil-producing areas that involve OCS activity.

Current Practice - The current practice is to sever the platform from the bottom with explosives and then either to topple it in place and move it to a new location or to remove it completely. Texas has been given permission in two (2) cases for partial removal to keep a platform on site and sever it at minus 85 feet.

Constraints - In the past, the Department of Defense (DOD) has held the position that all platforms must be severed from the bottom. This appears to have been relaxed, according to a letter that surfaced during the National Marine Board study on explosives' use in platform removal. The Minerals Management Service (MMS) has a policy of total removal based on OCS Lands Act 30 CFR part 250, lines 110-143, which states that an operator must "restore the floor to original state." Platform removal is a major expense to industry, and partial removal would save a significant amount of money. This is covered elsewhere in the Workshop.

The vertical profile (upper water column habitat) appears to be very important in maintaining fish productivity. The loss of this habitat is, in essence, a biological sacrifice and affects the efficiency of the use of structures as artificial reefs. There is also evidence that fish abundance is reduced around a toppled platform when compared to a standing platform. However, keeping a platform in place and having a high profile has a risk (liability) and cost for the program (see Clearance).

Demand for more trawlable bottom by the shrimp industry is still a high priority issue in Gulf state programs. The shrimp industry's perception is that rigs-to-reefs sitings reduce available trawl bottom, and this continues to be a constraint.

Issues for Deliberation

(Responses by Working Group are in italics)

(1) Is partial removal a viable option for the future? Is the Department of Defense mandate still an issue?

As the Corps of Engineers has issued permits to Texas for partial removal of platforms without objection by the Navy or Department of Defense, apparently the Department of Defense is not as concerned as it used to be about structures remaining on the sea bed.

Yes, partial removal is a viable option for the future. Texas has done two partial removal projects. COE does not represent DOD.

(2) The Minerals Management Service removal policy (30CRF part 250, lines 110-143) was established in the 1950s or 1960s. Is this law outdated, and should it be used?

To date, MMS has allowed a variance ("deviation from regulation"). In fact, MMS encourages operators to leave platforms in place as artificial reefs, if the industry is supportive and there is a satisfactory entity to accept liability. They also require consent from other Federal and State agencies.

Not discussed at the workshop.

(3) Is there a biological reason to maintain some of the critical vertical profile of rigs as reefs?

There are recent data to show that the photic zone occupied by the oil and gas platform harbors a significant number of fish. Recreational fishermen, divers, and commercial fishermen would benefit if this zone could be preserved.

Research has shown the majority of the productivity is in the upper 200 feet.

(4) Do rigs-to-reefs programs hamper any other industry?

In Texas, less than 0.1% of the trawlable bottom has been impacted by artificial reefs. In addition, less than one percent is taken up by oil and gas platform footprints in the Gulf of Mexico. Platforms actually serve as aids in navigation for many fishermen. It is also a fact that managers must manage for multiple users and uses and, in accordance with the National Fishing Enhancement Act of 1984, the Federal government has decided to allow for creation of artificial reefs.

Platforms do remove a small amount of trawlable bottom (<0.1%) based on actual footprint of the platform. In reality, trawlers cannot trawl up to the platform and must remain a significant distance away. Shrimpers have suffered many regulatory obstacles and this is perceived as one more hinderance by the shrimp industry. Actual interference by rigs-to-reefs program will be minimal, but changes or expansion of sites should be done openly through public hearings and with consideration to all user groups.

(5) Is deferred removal an option for oil and gas platforms? If so, who owns the platform and what are the maintenance costs? What is the liability associated with deferred removal?

This does not appear to be an option; many of the states would be unwilling to take on the responsibility and liability of maintaining a platform in place. In addition, the state would be responsible for its eventual removal. Industry also expressed reluctance to defer the removal of platforms, although a deviation from the MMS requirement of removal within one year after production on the lease stops may be desirable in certain situations. It is not the year that the platform ceases production, it is one year from the date the lease is terminated. There then can be platforms which have been shut in and not producing that are located on an active lease for many years.

2. Buoying and Water Clearance (major issue)

Current Practice - The Coast Guard requires an unlit reef buoy when clearance over the platform is 85-200 feet. In cases where the clearance is greater than 200 feet, no buoy is required. In some cases the Coast Guard will waive the buoy requirements once the reef site is on the Aids to Navigation charts. A reef site with less than 85 feet of clearance is required to have a lighted buoy. If there is at least a 50-foot clearance, a waiver of the lighting requirement may be granted by the Coast Guard on a case by case basis; an unlighted buoy is required. Additionally, a waiver of that unlit buoy may be requested once the site is on the Coast Guard Aids to Navigation chart. Currently, platforms are not left standing because of liability issues and the cost of maintaining aids to navigation.

Constraints - The cost of removal to industry and reef programs is a major constraint as is the cost of buoying to reefs programs. The navigation safety policy is important, and lack of an on-site buoy makes reefs hard for fishermen to locate. However, there is no mechanism (probably because of limited resources) for the Coast Guard to address site-by-site safety considerations for rigs-to-reefs. Coast Guard clearance requirements force programs into deeper water, limiting inshore sites (loss of opportunities). The liability to the programs if markers are lost or improperly placed is a major concern.

Issues for deliberation

(6) Can a case be made for leaving platforms standing for some period of time, provided funds are placed in escrow for removal (serious liability concerns - see permitting)?

See #5.

(7) The Coast Guard regulations are important for safety and liability reasons. Should there be an attempt to make more knowledgeable personnel available for comprehensive assessment of clearance by having these individuals work with rigs-to-reefs programs on a case by case basis? A possible recommendation could be funding for the Coast Guard to review current policy.

General consensus was that this would not be possible, in lieu of present government cutbacks, etc. The Coast Guard is being asked to do more with less.

(8) Would reef site use and public support of reef programs be improved by the use of mooring buoys?

Not discussed at the workshop.

(9) Should an allowance be made for divers to put their own mooring buoys on these platforms? In other words, should states encourage the increased use of mooring buoys by private individuals?

There is some concern by fishermen over hitting buoys. In Florida, the Sixth Coast Guard District discourages the use of buoys because of small boat traffic in the area. How and why were current regulations concerning buoying established? What new technology is available for keeping buoys in place?

There was very brief discussion centered on potential liability to the states.

3. Buoying Requirements

Coast Guard involvement, see above comments.

4. Future Site Use (moderate issue)

Current Practice - Both MMS and companies that lease the block being considered as a reef site are contacted regarding the potential reef site by the program(s). Some states have tried to establish special management zones regulating gear and types at reef sites.

Constraints - Reef site location or special management zone may interfere with future oil and gas development potential. Frequently new lessees are not aware of reef sites in the blocks they lease. Pipelines in reef siting areas must be considered in the siting process.

Issues for deliberation

(10) Is there a size or configuration that would be less likely to interfere with future mineral development?

Not discussed at the workshop.

(11) Should MMS do more to make future lessees aware of reef sites through the leasing office? MMS officially informs prospective lessees through a pre-lease Notice to Lessees that it is their responsibility to check with state reef administrators to determine location of existing artificial reefs.

MMS always maintains an option to develop any OCS minerals, regardless of any activities at the surface.

It was suggested potential lessees contact artificial reef coordinators prior to leasing. MMS was concerned if through an oversight they failed to inform a potential lease holder of a reef they may be held liable.

(12) What is a "safe" berth from pipelines when developing reef sites?

A suggestion was made to place reef seven times the water depth from active pipelines. This policy, however, would encourage reefs closer to the pipelines in shallower depths where the energy zone increases and make some reef sites in deeper water unusable.

5. General Permits (moderate issue)

Current Practice - Practices vary by region (Florida, Alabama, Mississippi, Louisiana, and Texas). Louisiana and Texas get permits on a case-by-case basis, although Texas has implemented a general permit, an effective tool for projects with short time horizons.

Constraints - General permits have had negative perceptions because they tend to be large and uncontrolled. They do, however, reduce the Corps of Engineers' public notice burden and speed up reef creation timelines. General permits may give other users access to placing materials (some undesirable) at a reef site.

Issues for deliberation

(13) Should Texas and Louisiana develop a modified approach to a general permit to expedite the process and reduce paperwork?

General permits have advantages in paperwork reduction if they are drafted to prevent abuse. Texas has a General Permit.

(14) If general permits are sought, they should contain within them alleviation of the negative perception by listing specific criteria for use of the permitted area. After a successful "probation" period for a reef program, should the COE then grant general permits?

Not discussed at the workshop.

Reef Program Operation

1. Fish Harvest Regulations (minor issue)

Current Practice - Harvest of fish around platforms falls under either state or federal jurisdiction and is managed accordingly. The Atlantic region (South Carolina) has special management zones on some of its reef sites to reduce competition between user groups and to prevent overfishing.

Constraints - Some states have created special management zones, and NMFS has set up sanctuaries that have specific harvest regulations, which may lead to public discontent and enforcement problems.

Issues for deliberation

(15) Would the use of special management zones help or hinder rigs-to-reefs programs?

Not discussed at the workshop.

2. Reef Site Location and Availability (major issue)

Current Practice - Louisiana has nine Planning Areas which contain permitted reef sites. Texas selects reef sites that conform to a set of siting criteria, but can be located anywhere that meets those criteria. Most sites are in water depths between 100 and 350 feet.

Constraints - The oil and gas industry and recreational users have suggested that Louisiana redistribute its planning areas to make better use of available platforms. Texas has been criticized by the shrimp industry for taking up too much trawlable bottom. There is a strong economic incentive to make platforms into reefs in deeper waters as the industry develops areas off the continental shelf; the biological evidence is not as convincing.

Issues for deliberation

(16) What would be the best way for rigs-to-reefs programs to add new sites safely and peacefully?

The shrimping industry objects to more sites. However, recreational fishermen and industry want more sites. The value of reefs to marine resources and the public needs to be documented scientifically. Redistributing areas targeted for reef development does not appear to significantly increase the number of platforms that would be *available to the Program, but it would make more reef sites available.*

(17) Where would industry like them to be?

Not discussed in detail, but recreational fishermen said make more accessible sites in the future.

(18) Is hypoxia an issue for site location?

Not an issue.

(19) Is there a point at which "rigs-to-reefs" program is no longer a valid designation for converting open ocean bottom to productive artificial reefs and such activities become ocean dumping programs?

It was discussed that the vertical profile of a reef maintains the platform's productivity. This is particularly important when consideration is given to deep-water platforms. Research has shown that there is very little fish productivity below 200 ft. in 700 ft. water depth. Toppling these structures in place in deep water such that the relief is only 100 feet or so off the bottom may not be artificial reef construction. However, if the platform could be cut 85 feet below the water line, it would provide reef habitat while insuring sufficient clearance to maintain safe navigation.

(20) Is there a maximum depth at which reef creation stops enhancing fish habitat and becomes dumping?

Yes - see above.

(21) In which cases would scientific and fishing communities cease to endorse artificial reef construction because the reef site is either too far from shore or too deep to be good habitat?

The chief complaint about the Louisiana program is that its artificial reef sites are already too far offshore. Putting reefs further offshore in deeper water may be construed as ocean dumping. However, an argument can be made we are still creating habitat to protect fish populations.

3. Monitoring (major issue) - Monitoring is the responsibility of individual state programs, and the National Fishing Enhancement Act recommended that some type of followup to reef construction be made in order to provide evidence for the utility of the program and to provide future improvement of the program's operation.

<u>Current Practice</u> - The Louisiana program conducts periodic side scan surveys and limited hydroacoustic surveys around standing and toppled rigs. MMS, LSU, and the Louisiana Department of Wildlife and Fisheries (LDWF) are cooperating on a large-scale, multi-platform, fish hydroacoustic survey to determine seasonal and spatial changes in the fish populations around operating platforms. In Texas, a creel survey has been conducted at Gulf boating access sites that monitor use and catch rates. Also in Texas, tagging of fish on reef sites has been conducted to follow movement and make population estimates. Recent mail surveys of some user groups has been undertaken in Texas to develop an understanding of attitudes and opinions about the Texas reef program. NMFS has preliminary data on natural reefs using video surveys and use pattern information from a diver-intercept survey. The MMS has an in-house scientific dive program that helps conduct visual surveys of reef sites both in Texas and Louisiana. The Gulf States Marine Fisheries Commission coordinates reef program interaction for the Gulf states and encourages the development of monitoring activities.

<u>Constraints</u> - Controversy still remains concerning the value of artificial reefs in general (production versus attraction) and the value of rigs-to-reefs programs. Long-term monitoring by state and federal governments will be crucial to providing future justification and improvement in reef programs. Unfortunately, public perception and data collection pursuant to this goal are not part of the National Marine Fisheries Service's fisher intercept survey program.

<u>Issues for deliberation</u> - The question of production versus attraction and the general value of reefs is no longer an issue in the GOM region, as it was resolved in favor of production. However, information is still needed to clarify our understanding of the quantity and quality of production.

(22) Given the fact that there are two strong rigs-to-reefs programs which have generated federal and public interest along

with industry support; should a systematic approach to research be developed that includes comparable project design, methodology, and analysis?

This was to be reviewed by the Gulf States Marine Fisheries Commission (GSMFC).

(23) Is there a need for standardized, dependable, inexpensive methodology for monitoring oil and gas platforms and reef sites?

Suggest GSMFC prepare a methodology manual similar to their materials manual.

(24) How do we maximize opportunity while assuring quality control and continued success?

Not discussed at the workshop.

(25) What is the best size reef complex (i.e., is bigger better)?

Not discussed at the workshop.

(26) What is the best location?

Choices will depend upon productivity, accessibility, and enforceability.

(27) Will recruitment sources dictate reef proximity to a larval source?

Unknown at this time.

(28) Who uses artificial reefs?

The vast majority of ocean fishermen.

(29) Is there a need to understand user groups and to maximize socioeconomic benefits?

Yes. Economic studies are sorely needed to assess user and state benefits. Funding, however, is a problem.

4. **Legal Issues** (from a liability standpoint) (major issue)

Current Practice - Louisiana and Texas have both established deeds of donation that are acceptable to industry. In both cases the donee is relieving the donor of ownership.

Constraints - The issue of liability has not been tested in court. Our understanding based on the National Fishing Enhancement Act is that as long as the terms and conditions of the reef permit are met and maintained there is no liability. However, perceptions of the magnitude of this liability effectively prohibit smaller independents from taking over leases and private groups from acquiring permits for reef sites.

Issues for deliberation

(30) Have there been cases where structures on Aids to Navigation charts were involved in accidents?

Not discussed at the workshop.

(31) Should private parties be allowed or encouraged to develop reef sites under the Texas or Louisiana programs (or similar programs)?

No. The state ultimately will be held responsible; the private sector could operate with very little or no quality control.

Environmental Issues

1. **Explosives Removals** (major issue) - Explosives are of concern to the Minerals Management Service and to the National Marine Fisheries Service and user groups because of the number of fish, endangered marine mammals and, potentially, turtles that are killed.

Current Practice - Explosives are used in most cases to remove platforms. There is some effort to move towards mechanical cutting.

Constraints - Alternate methods are very expensive and can be dangerous and cost prohibitive. Pre-explosive "watches" are costly.

Issues for Deliberation

(32) Do we agree with the recommendations by the National Marine Board?

See Summary.

(33) Is there a need for clarification of the recommendation of cutoff and buoying that was made by the study?

See Summary.

(34) Does the impact of explosives on a reef community permanently alter the community?

The evidence that has been collected says it does.

(35) Does structure age, location, size, or time of year affect the fish kill caused by explosives? If not, what is the duration of the impact's effect?

Not known.

(36) Does explosive removal have a cumulative effect on fish stocks?

Not known.

(37) What can be done to maximize the impacts of explosives on fish populations and to encourage the use of non-explosive techniques?

See Summary and other Working Group reports.

2. Bottom Cleanup

(see Site Clearance Working Group)

This issue is of concern as regulated by the Corps of Engineers and MMS. It is of concern to industry and the public.

Current Practice - Following removal, the industry must conform to some bottom evaluation standards that involve trawling over the site by a contracted shrimper. In the case of a site being toppled as a reef, there is no cleanup requirement.

Constraints - Excessive cost to industry. Is there a safety concern in cases where the bottom is not inspected but may be accessible by divers?

Issues for deliberation

(38) Are state program, environmental, and industry leaders satisfied with the current practice?

Not discussed at the workshop.

Issues that Concern other Activities

Mariculture (minor issue)

Recently, entrepreneurs have approached industry and State artificial reef programs about using platforms as mariculture sites. This activity falls under the purview of the Corps of Engineers and is of concern and interest to MMS and industry as an opportunity and perhaps a problem. There is some private sector interest in mariculture.

Current Practice - There has been one pilot project in Texas, a proposed project in Alabama, and a mussel harvesting operation in California. Several entrepreneurs have approached the Reef Programs of Louisiana and Texas, industry representatives, and MMS in the Gulf region exploring the possibility of mariculture on platforms. MMS is interested in guidance.

Constraints - Permitting of such a project is unclear. The reef fish populations-associated resource is common property and falls under NMFS and state jurisdiction. Assumption of liability by a "small business" is unlikely with current bonding requirements unless funds are placed in escrow. The economics are uncertain. Net pen culture operations have a track record of local biological pollution to the surrounding water.

Issues for deliberation

(39) Does MMS have the authority to permit a structure for anything other than oil and gas development? Who else would be responsible for permitting such an effort in such a way that ownership of the resource and structure is clarified?

No, not known.

(40) Is industry aware of the track record of aquaculture in the U. S.?

Some are - little discussion.

(41) Can public resources be privatized to allow harvest of natural stocks?

No, not under current law.

SUMMARY

The Habitat Working Group had a long and arduous series of discussions. The Committee, Panel Members, and attendees focused on the Marine Board recommendations and our high priority issues. During our discussions, we identified 41 issues that were boiled down to 12 desired outcomes, which is the issue paper.

The Committee wants to emphasize that we need to maintain and enhance the habitat afforded by oil and gas platforms, as man should seek to enhance the ecological diversity and productivity, particularly in areas where hard substrate is limited, such as the Gulf of Mexico and southern California, and in fact, in many deltaic areas. Platforms do this very well. Quality control and determination of success as a reef requires the evaluation of socioeconomic factors and, especially, user group needs, with the ultimate objective of achieving proper and effective management of our natural resources. In that context, we find that the vertical profile of oil and gas platforms is a particularly important part of the equation.

Another debate that surfaced several times during our discussion concerns how to identify the line between ocean dumping and habitat creation to differentiate ocean deepwater abandonment from artificial reef creation. We offer that it is not a reef when the material placement is not done with the intent of providing positive biological habitat value, and when not done within the guidelines of a recognized artificial reef program.

The Committee members and the Panel members worked very hard, and the audience participated in active debate to help us evolve our recommendations. Our collective evaluation of those recommendations that are related to the committee's charge follow. We have also included a list of six additional recommendations that we believe MMS and the workshop participants should follow.

RECOMMENDATIONS

Marine Board Recommendation #1 - **Change the minimum depth at which structures or well conductors must be severed from the current depth of 15 feet below the mudline to 3 feet below the mudline, provided that platform removal measures are employed that do not increase adverse environmental effects. Such measures include nonexplosive techniques, reduced charges, fish scare devices, or other effective mitigating methods. A 3-foot requirement would be consistent with regulations for the burial of pipelines as well as extensive research indicating that a 3-foot limit would provide ample protection against exposure of the remaining structural elements by erosion or scouring of the seabed.**

The Committee agrees with the emphasis on no increased environmental effects. Anything to encourage advanced or nonexplosive use should be pursued.

Marine Board Recommendation #3 - **Allow partial removal of structures in 300 (or more) feet of water, with a cut at least 85 feet below the water surface when nonexplosive or advanced explosive techniques are used.**

This is a generic recommendation concerning partial removal. When such an activity is part of a certified artificial reef program, the Minerals Management Service and reef program sponsors should pursue partial removal of structures even if the structure is in less than 300 feet. Other partial removals should be consistent with the international maritime organization and state regulations and should comply with federal regulations when not part of a reef program.

Marine Board Recommendation #4 - **Remove the limit of a maximum of eight detonations at any one time during the removal process, but retain the requirement of a 0.9-second delay between individual detonations.**

Concur.

Marine Board Recommendation #5 - **Incorporate into the permit process the flexibility, including necessary request procedures, to encourage testing of removal techniques that could reduce the risks to living marine resources.**

Concur. The Habitat Working Group supports the National Research Council recommendation for flexibility in permitting to allow alternate removal techniques.

Marine Board Recommendation #6 - **Maintain the procedures of the existing Marine Mammal and Sea Turtle Observer Program, including the ban on night-time detonations, but shorten the required period of observation from 48 to 24 hours prior to detonation. The 48-hour timeframe is costly in terms of**

human resources and support equipment and does not produce any additional benefits over a 24-hour timeframe.
Concur.

Marine Board Recommendation #7 - **Systematically gather more information to augment available information about the species, numbers, and age distribution of fish killed and fish surviving when platforms are removed by explosives. Topics of particular importance include the following:**

- **experimentally determine the fish kill for species of interest at various depths and horizontal ranges for typical single explosion removal detonations**
- **experimentally determine the effectiveness of acoustic systems, tailored for the species of interest, in scaring fish away from the sound source to a safe distance.**

This was a several-part recommendation which is designed to encourage the use of smaller charges. We concur with the first part of the recommendation; however, we believe that the first bullet concerning the 0.9 second delay in charge detonation is not an issue. Based on a majority of explosives data, most of the fish are killed during the first blast, so the effect of subsequent blasts is not as crucial to understand. In addition, in a removal the loss of habitat alone may negatively impact the associated fish populations. We concur with the second bullet and the third bullet, except that we would like to see evaluation of acoustic systems be expanded to other deterrent systems.

Marine Board Recommendation #9 - **Sponsor and support programs to explore the feasibility and cost effectiveness of acoustic means of keeping fish, including the grouper/snapper complex, at a relatively safe distance from removal operations.**
Study the feasibility where practical, but realize it would probably be impractical because the fish would need to be moved out of the blast zone > 1000 yds. More emphasis should be placed on attenuating the blast.

Marine Board Recommendation #10 - **Investigate means of incorporating safe removal techniques and the reduction of environmental damage into the initial design.**
Concur and maintain current regulations.

Marine Board Recommendation #11 - **Evaluate existing state-administered, artificial reef programs to enhance their potential for accommodating more platforms (by increasing the number of sites, for example) as well as their potential for providing commercial, recreational, or environmental benefits to other ocean users. The evaluation should include considerations of potential liability as well as the longer-term issues raised by the eventual loss of marine habitat.**
We concur with the spirit of this recommendation, but emphasize that site selection should be consistent with good reef planning practices and be driven by habitat need and value, materials opportunity, while minimizing the negative effects on all user groups. We recommend that state programs (particularly Texas and Louisiana) conduct a review and, if appropriate, revise their state plans to maximize reef creation opportunities.

Additional Recommendations:

1) *There is recent evidence of the ecological importance of vertical profile of platforms which ncreases with water depth. The Minerals Management Service should continue to support resolution of the habitat value of platforms across the continental shelf and beyond.*
2) *We recognize that there is a need for continuity of monitoring programs. We therefore recommend that the Gulf State Marine Fisheries Commission, which is currently revising the National Artificial Reef Plan, review and recommend standard, dependable, and cost-effective methodologies for evaluating material value as artificial reefs. There was significant debate about monitoring methods, and this is an ongoing saga throughout theworld.*

3) *Recognizing that we have only begun to understand the biological value of platforms, State programs, oil companies, and the Minerals Management Service should continue to work together and identify the funding necessary to determine how platform location, water depth, and platform configuration and complexity (e.g., priority) affect the resultant habitat quality.*
4) *Concerning the issue of deferred removal, the States of Louisiana and Texas should determine (via legal counsel) if they would be willing to accept liability for a standing platform. In addition, the Offshore Operators Committee should confer with representative members to determine if oil and gas companies would be willing to defer removal for some period of time (e.g., until several platform in the same vicinity could be removed at the same time) while maintaining liability if a prior agreement was in place to transfer ownership to a State reef program once the platform was converted to an artificial reef.*
5) *The Habitat Committee would like to see the Minerals Management Service encourage the Coast Guard to focus more time and attention to artificial reef permitting requests, especially in light of anticipated proposals for partial removal. The Coast Guard should be given additional funding and resources to allow them more opportunity to provide in-depth site specific guidelines for buoying requirements on artificial reefs. Special emphasis is needed to assure that minimum clearance requirements are not necessarily restrictive so that higher profile artificial reefs can be considered.*
6) *The Habitat Working Group believes partial removal in place is biologically and environmentally superior to explosives sub-bottom toppling. The Committee recommends that the Minerals Management Service guidelines recognize and support partial removal when feasible and when associated with a recognized artificial reef program.*

7

Working Group Six: Regulation and Policy

Chair: **W. L. (Win) Thornton**,
Twachtman, Snyder & Thornton, Inc.
Co-Chairs: **R. Scott Farrow, Ph.D.**, *Dames & Moore, Inc.*
Wyndylyn M. Von Zharen, Ph.D.,
Texas A&M University, Galveston
David J. Wisch, P.E., *Texaco, Inc.*

Comments:

R. C. Visser, "Abandonment Conference Comments"

Michael De Alessi, "Oil Rig Decommissioning: A Property Rights Approach"

Brian E. Shannon, "Globalization of Environmental Regulations"

Scott Farrow, "The Potential Contributions of Economics"

AGENDA: REGULATION AND POLICY GROUP

Monday, April 15, 1996

1:45 - 3:00 Summary of Working Group Agenda and Issue Paper (10 minutes)
Win Thornton, Twachtman Snyder & Thornton, Inc., Chair: Regulation and Policy Working Group

3:30 - 4:00 Introductions - Regulation and Policy Working Group
Win Thornton, Twachtman Snyder & Thornton, Inc., Chair: Regulation and Policy Working Group

4:00 - 5:30 Session: Policy Issues
Mark Rubin, American Petroleum Institute, Session Chair and Moderator

Panel on Policy Issues

- Bud Danenberger, MMS
  - Historical perspective on formulation of MMS abandonment regulations. Views on future direction of MMS abandonment policy/regulations.
- Bill Griffin, Phillips, representing E&P Forum
  - Views on international policy drivers and discussion of what the E&P Forum is doing to educate policy makers and shape public opinion on offshore platform disposal options.
- Brian Shannon, Arco, representing API
  - Industry perspective on international and U.S. abandonment policy direction.
- Maureen Walker, U.S. State Department
  - What are international political realities? U.S. views on international efforts to regulate platform disposal? What does State Department recommend for industry proactive efforts?

Tuesday, April 16, 1996

10:30 - 12:00 Session: Regulatory Issues
Dave J. Wisch, P.E., Texaco Inc., Session Chair and Moderator

Panel on Regulatory Issues

- Mark Carr, University of California at Santa Barbara
- Mike Craig, Unocal
- Brian Twomey, Reverse Engineering Limited

1:00 - 3:00 Session: Environmental Issues
Wyndylyn M. von Zharen, Ph. D., Texas A&M University, Galveston, Session Chair
William E. Evans, Ph.D., Texas A&M University, Galveston, Session Chair

3:30 - 5:00 Session: Economic Issues
R. Scott Farrow, Ph.D., Dames & Moore, Inc., Session Chair and Moderator

Panel on Benefit-Cost of Regulatory Alternatives and Liability and Bonding

- Dr. Walter Keithly, LSU, Coastal Fisheries Institute
- Professor Tracy Lewis, University of Florida
- Dr. Rodney Weiher, chief economist, NOAA

Regulation and Policy Working Group

ISSUES

Overview

The potential environmental impact of offshore platform disposal can be illustrated by both the numbers of platforms and the complexity of their abandonment options. Some 7,000 platforms are in place worldwide. In the U.S., approximately a quarter of the platforms are more than 25 years old and in sight of their end of service. In addition, 22,000 miles of pipeline are located on the Outer Continental Shelf (OCS) in the United States. There are more offshore platforms in the U.S. Gulf of Mexico than in any other single area in the world. It is estimated that between October 1995 and December 2000, approximately 665 of the nearly 3,800 existing structures will be removed. Couple this with the mammoth size, the vagaries of the ocean, and the levels of sometimes conflicting international and federal laws, and the magnitude of the challenge to protect the environment becomes clear.

The Offshore International Newsletter (11/06/95) stated, "In three of the last four years, annual Gulf of Mexico platform removals have exceeded installations, a trend that will likely continue." Between 100 and 150 platforms have been removed from the OCS each year for the past six or seven years. As increasing numbers of wells, pipelines, and platforms are decommissioned and disposed of, it is important that the relevant techniques, policies, and regulations be discussed and evaluated.

The goal of this workshop is to facilitate and document this discussion in an open, objective, and inclusive way. Since U.S. practices and policies provide precedents for other countries, international participation is encouraged and anticipated.

Introduction

The decommissioning and disposal of offshore platforms are the primary focus of this international workshop sponsored by the Minerals Management Service of the U.S. Department of Interior and the Center for Energy Studies at Louisiana State University. The technology, regulation, and environmental impact related to platform removal are broad areas to be addressed.

Working groups have been designated to identify issues for debate in key areas:

I. Abandoning Wells
II. Abandoning Pipelines
III. Facilities Removal
IV. Site Clearance
V. Habitat Planning, Maintenance, and Management
VI. Regulation and Policy

The Regulation and Policy working group is charged with reviewing broad domestic and international issues. Each working group has technical, environmental, economic, and regulatory concerns related to its primary topic that frequently overlap with other working groups. Some concerns, as in environmental matters, are common to any of all of the other working groups. Other issues, as in how abandonment policy is implemented into regulation, may not be covered directly in any of the other working groups.

Workshop Plenary Sessions

Moreover, it appears that the workshop presentations and panels in the plenary sessions address primarily those topics with which the Regulation and Policy working group is charged. While most of the working groups will address technical aspects of abandonment, the workshop focus is largely about regulation and policy. It is incumbent upon the workshop attendees—particularly the members of the Regulation and Policy working group—to consider the material presented during the plenary sessions as a foundation for the discussions that ensue.

Because workshop presentations and panels in the plenary sessions provide a common understanding of the history and trends of abandonment and thereby form a frame of reference within which to discuss issues, Regulation and Policy working group attendees should consider these materials as the foundation for discussion.

Understanding the players is essential. There is a diverse mix of stakeholders participating in the workshop. Efforts will be made by the panelists to balance the perspectives of this broad-based constituency.

Among the presenters during the workshop sessions are the foremost representatives of:

- government: MMS, Department of Interior, Department of State
- non-governmental organizations: API, E&P Forum, Greenpeace, Sierra Club
- industry: Chevron, Exxon, Phillips, Shell, Unocal, contractors
- academia: LSU, Texas A&M, University of California-Santa Barbara

In addition to the remarks presented, of primary benefit are the published materials and publications to be distributed during the workshop, some of which will be reviewed during the plenary sessions.

We encourage attendees to the Regulation and Policy working group sessions to become familiar with the following, among other resources, as sources of law:

- F. Pat Dunn will present on Monday morning the results of the Marine Board report, "An Assessment of Techniques for Removing Offshore Structures," which provides an overview of the regulations, laws, and permits as well as an appendix of regulations governing removal of offshore structures; it also contains an environmental assessment of present removal techniques.
- Robert B. Wiygul, a panelist in the plenary session on Tuesday morning, authored a paper, "The Structure of Environmental Regulation on the Outer Continental Shelf: Sources, Problems and the Opportunity for Change," that provides the general statutory and regulatory framework for each phase of offshore leasing and operations.
- R. Scott Farrow, Regulation and Policy session chair on economic issues, published a book entitled, *Managing the Outer Continental Shelf Lands: Oceans of Controversy* (Taylor & Francis, 1990) that thoroughly documents emerging policy issues.
- W. M. von Zharen, Regulation and Policy session chair on environmental issues, published a book entitled, *ISO 14000: Understanding the Environmental Standards* (Government Institutes Press, 1996).

Working Group Sessions

The working group will take a hard look at the process of setting policy while endeavoring to maintain realistic expectations. During the plenary sessions, a number of presentations and panels will address policy matters. Of international concern is whether or not it is possible or practicable to have global policy. And, if so, how should it be enforced? What of our self interest? What would be gained and what would be lost?

For discussion purposes, a distinction has been made between policy and regulatory areas based on the application of each. Policy issues encompass the theory and process of establishing regulations. Regulatory issues are those related to implementation and monitoring compliance, and present contrasts among existing guidelines, with the end being to determine uniform standards.

The sessions for Regulation and Policy are grouped under four main topics, with session chairs noted:

- Policy Issues: Mark Rubin
- Regulatory Issues: David J. Wisch
- Environmental Issues: Wyndylyn M. von Zharen and William E. Evans
- Economic Issues: R. Scott Farrow

Policy Issues

International and U.S. policies regarding the decommissioning and disposal of offshore structures have become more important because of the increasing number of platform decommissionings worldwide, and especially in the United States. Industry, regulators, and international organizations, such as IMO, have historically focused on the technical aspects of platform decommissioning, including engineering and environmental considerations.

Policies regarding structural platform decommissioning have attained a higher profile, especially in the North Sea, because of the Brent Spar incident. A complete ban on disposal of platforms at sea has been considered by some of the parties to the London Convention and the Oslo Paris Convention. In order to maintain an environment where policy is driven by technical considerations, industry must be more cognizant of public perceptions and communicate with a broader set of policy makers as well as the general public.

The session will cover policy issues which will have been raised in the workshop plenary session, allowing for interaction with the panel and workshop participants. The panel will include representatives from the U.S. State Department, Minerals

Management Service, International E&P Forum, and American Petroleum Institute.

Potential issues for discussion include:

1) Discuss long-term international and U.S. policy/political trends affecting offshore E&P. How can industry work proactively to ensure that environmentally sound, cost-effective regulations are adopted in the United States and internationally?

2) How is decommissioning policy developed and implemented, internationally and in the United States? What are the drivers for platform decommissioning policy in the United States and worldwide?

3) What is the historic background on formulation of international and domestic decommissioning policies and regulations? What insight can this provide in the formulation of future decommissioning policies?

4) How do we take precedents that have been set with the two partial abandonments in Texas, the rigs-to-reefs programs, and any similar situations worldwide and extend them through international and domestic policies on platform decommissioning?

Regulatory Issues

This session will outline the regulations on abandonment by region. Understanding what is being done in various regions domestically and internationally and where there may be differences will facilitate identification and discussion of contrasts.

Monies spent on decommissioning have little impact on future economy, whereas monies spent on capital projects provide a means for continued cash flow, employment, and other economic gains.

In reviewing regulations governing disposal of offshore platforms, there is a need for a distinction in environmental impact between NORM and sludge contained in vessels and piping versus plain steel as in jackets, piles, and topside.

Potential issues for discussion include:

5) What are the differences in abandonment regulations by region? What are the reasons for the differences?

6) Can the abandonment regulations be made more uniform? Or is flexibility a better approach? What recommendations do we have to resolve these differences?

7) How can we balance the role of regulation in the deployment of private capital and economic growth?

8) Should regulation be a tool to implement policy, or should regulations be developed to set policy?

Environmental Issues

You dump your car into a lake and you get fined. What's the difference? The process of removing an offshore structure has an effect on the environment, a fact that is reflected in rules governing platform abandonment. In this session, the Regulation and Policy working group will look at existing environmental policies and regulations currently in place. From this vantage point, the issues will be addressed.

Through a format involving the presentation and analysis of a hypothetical situation, the application of these laws will be presented. Because it is impossible to separate environmental and economic issues, economics will be considered. As may be evident with such events as the Exxon Valdez and the Brent Spar, economic warfare, for some, has been the preferred method to wage ecology warfare.

The format will include review of provisions found within the:

- 1958 Geneva Convention
- London Convention
- Customary International Law
- International Maritime Organization Recommendations
- National Environmental Protection Act
- Marine Mammal Protection Act
- Endangered Species Act
- Outer Continental Shelf Lands Act
- Minerals Management Service Regulations
- Notice to Lessees
- Magnuson Fishery Conservation and Management Act
- Clean Water Act
- National Fishing Enhancement Act
- U.S. Coast Guard Regulations

- Marine Protection, Research and Sanctuaries Act
- State Law

Potential issues for discussion include:

9) What are the environmental issues regarding abandonment (wells/platforms/pipelines)? How do these issues impact formulation of existing and future abandonment regulations? What recommendations do we have to resolve these issues?

10) What are the current disposal options and the regulations that affect them? What are the benefits of rigs-to-reefs? What about ocean disposal? Under what conditions is ocean disposal a viable option?

11) What are the species and habitat issues that are affected by abandonment activities? How do these issues impact formulation of existing and future abandonment regulations? What recommendations do we have to resolve these issues?

Economic Issues

Clearly, the issue of economics is central to any discussion of abandonment, given the magnitude of the costs for platform removal. The intent of this session is to explore the interplay of costs to the operator versus costs to the public in the form of environmental impact. The resulting recommendations will address the necessity to balance economics and ecology.

Background: Regulatory reform efforts ask two types of questions that can be informed by economics. The first question is whether a regulation, or a proposed change to a regulation, has benefits to society that exceed the costs. Some people ask about the balance between cost and environmental issues in removals activities. Benefit-cost analysis is a method to address the question of balance. the second question with whether market-based approaches can more effectively implement the purpose of a regulation than can detailed regulatory requirements of a command and control type. The regulatory debate about platform, pipeline, and well abandonment can be evaluated in light of these two concerns. The conference panel will start to structure some of the issues in this way, seeking modification and direction from participants, in order to recommend actions that industry, the MMS, environmental groups, or other organizations might pursue.

Benefit-Cost Analysis of Abandonment Issues: The existing regulatory review process for the federal government requires a regulatory impact analysis for major regulations. If significant changes are proposed to platform abandonment regulations, it is possible that a benefit-cost analysis will be performed as part of the regulatory review. In addition, new regulatory reform efforts, whether at the federal or the state level, would increase the emphasis on benefit-cost analysis. The 1994 GAO report on removal operations specifically mentioned that the benefits and costs of one alternative, non-explosive technology, had not been adequately studied. However, it is not clear that the benefits and costs of using explosive technology have been adequately studied either.

Any type of benefit-cost analysis, including cost effectiveness, considers both private costs and benefits, such as those reported by industry, and social costs and benefits that incorporate private costs but which may include environmental or other effects. Although the major issue for removal seems to be the potential for additional social costs due to harm to sea life, there may also be additional social benefits depending on the method of disposal of the platform or other issues. Part one of the panel will try to summarize some ways in which such comparisons might be made, some existing information, and the work that could be necessary to generate credible benefit-cost studies.

Potential issues for discussion include:

12) The applicability of benefit-cost and cost-effectiveness studies to regulatory issues affecting platform removal.

13) If applicable, what type of analysis for what alternatives are the most important to carry out?

14) What are the most controversial aspects of valuation for removal activities?

15) What organizations or set of organizations should carry out such analyses?

Market Approaches to Regulation—The Role of Bonding and Liability: The auction process, bonding, and liability provisions can be viewed as key elements in an economic contract whereby the government procures a service, the extraction of natural resources subject to contractual conditions. Economics investigates the compatibility of incentives inherent in such procurements. In some cases, it is economically desirable for the government to merely identify performance criteria and penalties for non-compliance in place of regulations that restrict the process of carrying out an activity such as removal of platforms. In other cases, including when direct monitoring is difficult or impacts are not revealed for a long period, more direct controls may be desirable. This short part of the session will try to characterize the bonding, liability, and regulatory requirements in the context of contracts and procurements.

<u>Potential issues for discussion include</u>:

16) What incentive exists between regulations, bonding, liability, and the auction process to remove platforms privately and in a socially efficient manner?

17) Is there duplication in the incentives?

18) Is there an incentive to promote technological change in platform removal?

19) What exists regarding the transferability of liability? What are the incentive impacts of the existing approach?

RECOMMENDATIONS

Policy

1. Recognize the "Law of the Sea Treaty" as the international authority on decommissioning.
2. Recommend U.S. Ratification of the "Law of the Sea Treaty."
3. Recommend development of regional guidelines recognizing cas by case considerations.
4. Consider regional sea initiatives such as the Cartagena Convention.

Regulation

1. Support exploration of the widest variety of final disposal options such as partial abandonment and alternate uses.

Environmental

1. Initiate a dialogue on offshore issues, including decommissioning, among stakeholders and interested parties.
2. Encourage follow-up workshops with the widest possible representation of stakeholders.
3. Support advancement of scientific knowledge to identify the biological, physical, and economic impacts of deepwater disposal of offshore installations.

Economics

1. Perform a cost-benefit analysis supported by adequate scientific data on a partial abandonment of a deepwater structure.

Abandonment Conference Comments

R. C. Visser

1. Regional Regulations

Regulations should be regional. For instance, in the Gulf of Mexico, the 15-foot below mudline removal requirement is no great problem as long as explosives can be used. Because of the soft bottom, it is sometimes difficult to determine where the "mudline," differentiating between water and soil, is actually located. Offshore California and in Cook Inlet, in places where platforms are located on hard bottom, the 15-foot removal requirement makes no sense. In certain cases, where there is no possibility of scour, a cut off flush with the ocean bottom may be perfectly acceptable.

Likewise, there are great differences between the procedures under which platform removal moves through the regulatory process. In the Gulf of Mexico the application for platform removal and its subsequent approval are fairly routine. This is not so in California where it is a fact of life that each offshore platform removal will need to go through an environmental assessment as a minimum and where the execution and mitigation measures proposed will need to satisfy many interest groups. In Cook Inlet the industry is working with the regulators to develop a set of removal criteria that are unique to that particular area.

What this means is that there is a significant disadvantage in having generalized regulations. In fact, it can be argued that the IMO should abandon its specific requirements for cut-off depths. The 55-meter requirement may be perfectly acceptable for certain areas but make no sense for other areas, such as Cook Inlet, where it is impossible for any ship with a draft greater than 35 feet to navigate. The argument is made that the 55-meter requirement does not apply to state waters. Regulators, however, will not understand the difference, and if one is not careful, the 55-meter, like the 15 feet below mudline, requirement will become a standard whether or not it makes any sense.

The IMO, therefore, should revise its requirements to a more site-specific requirement wherein the 55-meter requirement is modified to a cut-off depth that will permit unrestricted passage of vessels that are using, or are expected to use, the specific area in question.

2. Habitats

More than 25 years ago I heard for the first time a debate on whether or not the addition of artificial reefs creates new life or just provides a haven for transient fish. I would encourage everyone involved to get this controversy resolved. Without resolution of this scientific controversy, it will be difficult to initiate the installation of offshore platform-related artificial reefs outside the Gulf of Mexico.

In this connection, a very interesting issue was brought up by Mr. Daniel Frumkes of the American Sport Fishing Association. The issue is whether or not a man-made ecosystem can be removed. Apparently the courts, at least so far, have determined that a man-made ecosystem can be removed. Contemplate, however, the implications to offshore platforms removal if the courts had ruled otherwise. Let's face it, is it any different than the fact that in the community where I live I am not free to remove the 69 cent, one gallon, pine tree that I planted 20 years ago and that is now 40 feet tall?

This is potentially a very serious area, and it should be addressed.

3. Pipelines

I was surprised to learn that a number of pipelines had actually been removed in the Gulf of Mexico. In my mind it has been a given that pipelines can be decommissioned in place. The Pipeline Task Group did not address this issue, and the question of under what conditions there is or should be a requirement to remove pipelines should be addressed in a future workshop.

4. Use of Explosives

Various explanations, none of which makes too much sense, have been given to me as to why the well abandonment people have no problem with non-explosive casing cutting and the piling people cannot seem to make it work. The concern about total severance is the same in both cases. From my perspective, explosive cutting is the cleanest, safest, and most economical method. Not being a biologist, I fail to understand the concern about killing a number of resident fish using explosives when the objective of the exercise is the removal of their habitat which, presumably, will cause the remaining fish to die of starvation.

R. C. Visser
April 21, 1996

Oil Rig Decommissioning: A Property Rights Approach

Michael De Alessi
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and
Coordinator of the Center for Private Conservation in Washington, D.C.

In 1995 the Brent Spar controversy grabbed headlines around the world and caused a major stir within the offshore oil industry. Greenpeace's public relations barrage left almost everyone involved feeling defeated—from the oil industry to government to the media.

Not surprisingly, the lesson taken away from the experience seems to be a reverence for the power of public perception and the importance of good public relations. While a step in the right direction, this analysis ignores the institutional arrangements that underlie public opinion. The crucial lesson from the Brent Spar should be that as long as the tragedy of the commons remains, another Brent Spar could surface anytime.

The tragedy of the commons describes what happens to unowned resources—they are uncared for. Without ownership there can be no real stewardship in the oceans. A savvy public realizes that the temptation is to ignore the environmental effects of exploitation. Corporations have their images to worry about, but on the strict bottom line, costs to the environment are not included. In the Brent Spar debacle, Shell and the UK government cared most about the cost savings from disposal. Real environmental concern was not at the top of anyone's list.

Groups like Greenpeace recognize this and play off of it, billing themselves as the guardians of the seas. Unfortunately, the public is less savvy when it comes to Greenpeace's motivations (which include fund raising and membership). When the game is public perception and the ocean commons is the playing field, Greenpeace will invariably win.

Eliminating the ocean commons would make tangible ecological effects a crucial element in any decommissioning decision. Owners would bear the costs of not taking advantage of any opportunities to mitigate damage or to create habitat. Oil companies (and others) would benefit directly from environmental enhancement, whether for increasing sport fishing, providing attractive dive sites, conducting scientific research, serving as a nursery for a commercial fishery or merely enhancing biodiversity.

In Japan, the nearshore seabed is often the *bona fide* property of Fishery Cooperative Associations (FCAs). FCAs are actively involved in artificial reef creation and work diligently to enhance and protect their reefs from development and pollution.

Many of the problems faced by the oil industry stem from the leasing arrangements that dictate offshore oil exploration. These arrangements discourage stewardship and tend to rule out compromise. Logging companies (in a similarly vilified industry) face a similar situation. On their own lands they tend to be sound stewards and often explore alternative sources of revenue such as hiking and camping. But on public lands with short-term timber leases, clearcutting is much more likely.

Lease arrangements on public lands (submerged and otherwise) encourage divisive battles over their management. Environmentalists demand no intervention, and industry clamors for more opportunities to exploit resources. On the other hand, when private property is involved, opportunity costs suddenly become meaningful and compromises attainable. The National Audubon Society often strongly opposes oil exploration. Yet in the Rainey Wildlife preserve in Louisiana, which is owned by Audubon, drilling has been going on for years. Audubon does not allow birdwatchers into the sanctuary, but because it can ensure that the oil is extracted responsibly, drilling continues.

Offshore leases specify that they are for oil exploration only; even if a lessee wanted to consider an alternative such as aquaculture or recreation, it would not be possible. Such leases mandate that simple drilling economics will rule the day and that ecological concerns will be underrated.

One of the attractions of leasing to the oil industry is that the government accepts most of the liability and the long term environmental effects of drilling. So far the arrangement has been good for the oil companies, but the problems it can cause are becoming apparent. If the reaction of the German and Dutch governments to the Brent Spar situation is any indication, the worst is yet to come.

Liability is a major impediment to artificial reef creation, but under an ownership scheme it could be assumed by the groups creating the reefs. Divers and fishermen could probably work out an arrangement similar to the one between a company called Eco-Mar and owners of oil rigs off the coast of Santa Barbara, California. The rigs allow Eco-Mar to harvest mussels from their platforms and in return get a free cleaning service (the mussels create drag and have to be removed anyway). Giving lessees more control would lead to more creative opportunities like this one, especially in the area of artificial reef creation.

At present offshore oil exploration and rig decommissioning are controlled by government institutions which maintain the seabed as a commons. Just as the commons encourages fishermen to shy away from conservation and to overfish stocks, it also creates perverse incentives for those exploiting the sea bed. These incentives underlie a general public mistrust for the environmental concerns of governments and oil companies, and to combat this perception, the incentives must change. Under a system of ownership, the health of the oceans is a bottom line concern for everyone, environmentalists, oil companies, SCUBA divers, and fishermen alike.

Globalization of Environmental Regulations for Offshore E & P Operations

Brian E. Shannon
ARCO Exploration & Production Technology

Abstract

One of the enduring legacies of the Rio Environmental Summit of 1992 (United Nations Conference on Environment and Development, UNCED) is Agenda 21 (Chapter 17 - Protection of the Oceans) which, among other things, called for the assessment of the need for a global authority to regulate offshore Exploration & Production (E & P) discharges, emissions and safety. Despite advice to the contrary from the International Maritime Organization (IMO), interest is building within the European community for the standardization of regulations for offshore E & P activities. Several international frameworks or forums have been mentioned as possible candidates. These include the United Nations Convention on the Law of the Sea, 1982 (UNCLOS); London Convention 1972 (LC 1972) and the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (MARPOL 73/78). International offshore oil and gas operators operate within requirements of regional conventions under the United Nations Environmental Program's (UNEP) Regional Seas Program. Domestic offshore operations are undertaken under the auspices of the U. S. Environmental Protection Agency and Minerals Management Service.

Impetus for International Regulation of the Offshore E & P Industry

Is there a regulatory driver or perceived public need for worldwide regulation of the offshore oil and gas E & P industry? This issue is not of contemporary origin; it has been discussed at the United Nations for more than 35 years.

The United Nations Convention on the Law of the Sea, 1982 (UNCLOS),[1] imposes a specific obligation on state parties to protect and preserve the marine environment. Article 208 requires coastal states to adopt laws and regulations for seabed activities subject to their national jurisdiction. This Article is found under Section 5 entitled "International Rules and National Legislation to Prevent, Reduce and Control Pollution of the Marine Environment."

The United States decided not to sign UNCLOS in 1982 because of problems with Part XI that deals with mining of the deep seabed beyond the limits of national jurisdiction, i. e., beyond the Continental Shelf or National Exclusive Economic Zone (EEZ, 200 nautical miles). Those problems have been mitigated; and, with the 1994 ratification of UNCLOS by Guyana, the required 60 ratifications were reached. The new international law began governing ownership of the seas, their economic exploitation, pollution, and division in November 1994. President Clinton has submitted the amended Convention to the Senate for accession. In May 1996 a Commission on the Limits of the Continental Shelf will be convened to set limits for continental shelves that extend beyond the 200 nautical mile limits. The United States is one of 30 such coastal states.

An International Seabed Authority, headquartered in Jamaica, will oversee the Common Heritage Area beyond the National EEZ. This area of the world will be held in common by the nations of the world, to be conserved and profited from equally. Under UNCLOS coastal states are required to regulate offshore oil and gas activity within the EEZ, and the International Seabed Authority will regulate the Common Heritage Area. It has been estimated that about 87% of all known offshore hydrocarbon reserves are within nations' EEZ, with 150 countries holding offshore jurisdictions.[2] It is unlikely that all 150 coastal states will become signatories to the International Law of the Sea. The Law of the Sea Convention will create a global regulatory authority for the Common Heritage Area; however, nonsignatory nations do not have to abide by its regulatory decisions.

Another call for a single global regulatory proposal developed out of the June 3-14, 1992, United Nations Conference on Environment and Development (UNCED)[3] held in Rio de Janeiro, Brazil. The "Rio Environmental Summit" developed three products:

Global Climate Change Convention,
Biodiversity Convention, and
Agenda 21 recommendation.

Agenda 21 proposals are contained in a 600-page report described as "A Programme for Sustainable Development." Chapter 17 (Protection of the Oceans), Section 30, contains eleven recommendations for regulatory activities to prevent degradation of the marine environment from sea-based activities. It says:

> States, acting individually, bilaterally, or regionally or multilaterally and within the framework of IMO and other relevant international organizations, whether subregional, regional, or global, as appropriate, should assess the need for additional measures to address degradation of the marine environment.

Only one recommendation refers to offshore oil and gas E & P activities. Paragraph 17.30(c) states that there is a need to address the adequacy of existing regulations to deal with discharges, emissions, and worker safety on offshore platforms.

A United Nations Commission on Sustainable Development (CSD) was created in 1993 to oversee the carrying out of the Rio Environmental Summit recommendations. National governments will meet annually to report their progress in meeting the stated goals. The work is expected to be completed in 1997.

It is interesting to note that in calling for the need to assess offshore E & P's degradation of the marine environment, UNCED Agenda 21 paragraph 17.20 states that:

> Marine pollution is also caused by shipping and sea-based activities. Approximately 600,000 tons of oil enter the oceans each year as a result of normal shipping operations, accidents and illegal discharges. With respect to offshore oil and gas activities, currently machinery space discharges are regulated internationally and six regional conventions to control platform discharges have been under consideration. The nature and extent of environmental impacts from offshore oil exploration and production activities generally account for a very small proportion of marine pollution.

Similar findings are also found in the 1990 Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP) report entitled "State of the Marine Environment"[4] and later GESAMP Reviews and Studies. GESAMP is an UN advisory body on marine pollution.

International Maritime Organization (IMO) Advice to the United Nations Commission on Sustainable Development (CSD)

In 1993 the United Nations Commission on Sustainable Development (CSD) asked the International Maritime Organization (IMO) to review UNCED recommendation 17.30 in light of MARPOL 73/78. IMO's Marine Environment Protection Committee (MEPC) undertook the task and, after three sessions of deliberation, approved a final report in November 1994.[5] Regarding offshore oil and gas platforms, it said:

> IMO sees no compelling need at this time to develop further globally applicable environmental regulations in respect of the exploitation and exploration aspects of these activities.

Further,

> Harmonized environmental regulations have been and are being developed within specific regional programmes and this is proving successful in some areas. After due examination of the issues, IMO supports this approach and encourages its wider adoption. IMO could provide useful contributions in certain aspects of such activities.

IMO did frame their finding with a statement that should CSD find that global regulations should be developed, IMO could provide some needed expertise, adding that it would need expertise on oil and gas exploration and exploitation practices. While IMO is a recognized leader in developing international rules on marine safety, prevention of pollution from ships (oil and garbage), navigation safety, personnel safety and oil-spill contingency planning, they do not embody such expertise in "on-platform" E & P activities.

UNCED Agenda 21 Recommendations and the London Convention 1972

Another international framework discussed as a platform for the global regulation of offshore E & P activities is the London Convention 1972. LC 1972 was originally known as "The Convention on The Prevention of Marine Pollution by Dumping of Wastes and Other Matter" (1972, Amended 1978, 1980 and 1989).[6] LC 1972 entered into force in 1975, and the IMO is the Secretariat of the Convention. It is composed of 22 Articles and 33 Annexes. Article I states the purpose of LC 1972:

> Contracting Parties shall individually and collectively promote the effective control of all sources of pollution of the marine environment, and pledge themselves especially to take all practicable steps to prevent the pollution of the sea by dumping of waste and other matter that is liable to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea.

LC 1972 has focused on the marine disposal of "land-based" waste materials. Particular attention has addressed the disposal of low and highly radioactive materials and the practice of waste incineration at sea. Offshore E & P activities are not covered by the Convention, Article 111(l)(c) states:

> The disposal of wastes or other matter directly arising from, or related to the exploration, exploitation and associated offshore processing of seabed mineral resources will not be covered by the provisions of this Convention.

Further, Article 111(l)(b)(1) states the "Dumping" does not include:

> the disposal at sea of wastes or other matter incidental to, or derived from the normal operations of vessels, aircraft, platforms, or other manmade structures at sea and their equipment, other than wastes or other matter transported by or to vessels, aircraft, platforms, or other manmade structures at sea, operating for the purpose of disposal of such matter or derived from the treatment of such wastes or other matter on, such vessels, aircraft, platforms or structures;

The development of the MARPOL Convention took place concurrent with the framing of LC 1972. MARPOL 73/78 regulates the discharge of oil and hazardous substances from fixed and floating offshore platforms and vessels. There was no need for the LC 1972 to also regulate these discharges, therefore the Article III exemption language.

Because of the exemption language, LC 1972 cannot be used a framework for global regulation of the offshore oil and gas E & P Industry, at least as presently worded.

Proposed Amendments to LC 1972

During the 15th Consultative Meeting (November 9 - 13, 1992), the contracting parties to the Convention formed a LC 1972 Amendment Group that had its first meeting from July 19 - 23, 1993. During this initial meeting, the Netherlands submitted a proposal for amending and restructuring the Convention.[7] Included was a proposal to delete Article 111(l)(c) to satisfy UNCED's Agenda 21 recommendations, relevant provisions of LC 1972, and UNCLOS. The Netherlands wanted to remove a legal barrier for future regulations that may be adopted by the Contracting Parties to the Convention. After considerable debate, the Amendment Group decided that deleting the subject Article would be premature but left the issue open to further consideration.

The third meeting of the LC 1972 Amendment Group was held at IMO Headquarters, in London, on April 24 - 28, 1995. Again the Netherlands, supported by Germany/Finland/Spain, proposed to delete Article 111(l)(c).[8] After considerable debate, the majority, including the United States, preferred to retain the Article, possibly with minor amendments. It was agreed that the LC 1972 was not the most appropriate global forum for regulating the disposal of offshore E & P wastes, They added that such global regulation may not be necessary at all. Nevertheless, the Amendment Group established a drafting group to review interpretations of Article III regarding offshore E & P discharges. The option for deletion of Article 111(l)(c) and the option to retain the Article, as amended, were left for future consideration.

Since the third meeting of the LC 1972 Amendment Group, the issue of the planned North Sea disposal of Shell U. K. Exploration and Production's decommissioned Brent Spar platform has instigated further proposals to amend the Convention.

Greenpeace International, acting as a non-governmental observer, has proposed an "amendment consideration" to the Convention to amend Article 111(l)(c) to regulate, control and restrict operational discharges from offshore oil and gas installations.[9] The proposal will be discussed as Agenda Item 5 at the December 4-8, 1996, 18th Consultative Meeting of the Contracting Parties to the Convention. Greenpeace International is asking that agreement on the proposal be reached at the 18th Consultative Meeting and that it be formally adopted at the Amendment Conference in 1996.

Denmark has proposed a draft resolution on the ocean disposal of offshore installations.[10] Their proposal requests that the Convention adopt a moratorium on the disposal at sea of decommissioned offshore installations, until the Convention can be amended to address the issue. Denmark proposes more "environmentally acceptable and controllable land based solutions." Their proposal will be discussed at Agenda item 3 at the 18th Consultative Meeting.

Both recent proposals have been items of discussion within the Convention for many years, and the Contracting Parties have thus far agreed there is no need to amend the Convention given the UNEP's Regional Seas Program.

Global Regulation of Offshore E & P Industry through UNEP's Regional Seas Program

UNEP's Regional Seas Program was introduced in 1974 as a global program carried out through regional components or conventions. The program is under the overall coordination of the Oceans and Coastal Areas Program Activity Center (OCA/PAC) of UNEP. The first region to adopt a regional program or Action Plan was the Mediterranean Sea. In 1975 the Barcelona Convention was formally adopted. Today the program consists of 12 regions and some 140 coastal States and Territories.[11]

The objectives of UNCED Agenda 21, Chapter 17, are well addressed in the UNEP Regional Seas Program. Each regional action plan is developed and structured in the same manner by the cooperation of individual Governments, UN agencies and other appropriate international organizations, The Regional Seas Program consists of the following interrelated components:

Environmental Assessment
Environmental Management
Environmental Legislation
Institutional Arrangements
Financial Arrangements

Adopted Action Plans later become signed Conventions from which specific technical protocols to address individual issues are developed. Regional Seas Conventions contain more than 30 Articles, one of which is usually entitled "Pollution Resulting from Exploration and Exploitation of the Continental Shelf and the Seabed and its Subsoil."

It should be noted that the Regional Seas Program is very dependent upon the needs and resources of the regional governments to complete the process. The Environmental Assessment component alone is rigorously detailed in its information requirements. However, without regional knowledge of the coastal and ocean environment, decisions about its management are logically suspect. Various UNEP Regional Seas Program Conventions have been signed and are in force (Barcelona - Mediterranean; Kuwait - Arabian Gulf; Abidjan - West and Central Africa, Cartagena Caribbean; Jeddah - Red Sea and Gulf of Aden, Lima - Southeast Pacific and South Pacific), while others are not yet in force or are still developing Action Plans. Offshore E & P Protocols have been developed and in force for the Barcelona and Kuwait Conventions and the non-UNEP Helsinki-Baltic Convention.

Previously discussed proposed amendments to the LC 1972 are critical of the UNEP Regional Seas Program to act as a global regulatory authority for E & P offshore operations. They note the incomplete coverage of the world's oceans by Regional Seas Conventions. They fail to mention that the program has developed Conventions for the vast majority of coastal states where offshore E & P activities are taking place. While it is true that E & P protocols have not been developed for all Conventions, the process of development is ongoing or decisions have been made that such protocols are not required.

Over half the worldwide offshore E & P platforms are found in the Gulf of Mexico. The Convention for the Protection of the Marine Environment of the Wider Caribbean Region (Cartagena Convention) adopted an Action Plan in 1981, and the Convention was ratified on March 23, 1981. The Convention came into force in 1986 and has 33 member States and Territories. Article 8 - Pollution From Seabed Activities states:

The Contracting Parties shall take all appropriate measures to prevent, reduce and control pollution of the Convention area resulting directly or indirectly from exploration and exploitation of the seabed and its subsoil,

The Cartagena Convention has not developed any E & P Protocols, yet greater than 3,000 platforms are within its geographical extent. Protocols have been developed to respond to oil spills in a cooperative manner and to protect special environmentally sensitive areas. No other coastal and ocean environment has been studied in greater detail then the EEZ of the United States in the Gulf of Mexico. This area has also seen the highest level of E & P offshore activity, yet the signatories to the Convention have not seen the need to develop E & P protocols.

The majority of the platforms covered by the Cartagena Convention are located on the continental shelf of the United States in the central and western Gulf of Mexico. These operations are regulated by the Department of Interior's Minerals Management Service (MMS) and the U.S. Environmental Protection Agency (EPA). These regulatory programs have been partially adopted into many Regional Seas Programs.

Conclusions

UNCLOS and UNCED Agenda 21 (Chapter 17) call for the protection of the marine environment from sea-based activities. Both call for coastal states to adopt laws and regulations to prevent degradation of the marine environment. UNCLOS has set up a global regulatory authority, the International Seabed Authority, which will oversee the Common Heritage Area beyond the National EEZs. UNCED Agenda 21 asks that IMO and other international organizations assess the need for global regulation of the offshore E & P Industry. Those assessments, to date, have not recommended global regulation. Instead, they have endorsed UNEP's Regional Seas Program.

Proposed amendments to the LC 1972 from the Netherlands, Denmark and Greenpeace International are keeping the global regulation debate open. The worldwide oil and gas industry needs to work with the Regional Seas Program to develop E & P Protocols where they are needed.

Notes

1. The United Nations Convention on the Law of the Sea (UNCLOS), U.N. Document A/CONF.62/122, October 7, 1982.
2. D. George, "Law of the Sea Enactment Will Impact Petroleum Rights," *Offshore,* pp. 41-44, October, 1994.
3. United Nations Conference on Environment and Development (UNCED), Rio de Janeiro, Brazil, June 3-14, 1992, U.N., Document A/CONF.151/26 (Vol. II), August 13, 1992.
4. IMO/FAO/UNESCO/WMO/WHO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP), "State of the Marine Environment," GESAMP Rep. Stud. 39, 1990.
5. IMO Marine Environment Protection Committee, "Follow-up Action to UNCED," MEPC 34/6, March 24, 1993.
6. International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73178)
7. LC 72 Amendment Group - I 'It Meeting, "Report of the First Meeting of the LC 1972 Amendment Group," LC/AM 1/9, p. 27, August 5, 1993.
8. LC 72 Amendment Group, 'The LC '72 Amendment Process and the Control of Pollution from Offshore Oil and Gas Activities (i.e. Exploration, Exploitation and Associated Offshore Processing of Seabed, Liquid or Gaseous Mineral Resources)," LC/AM 3/2/7, March 13, 1995.
9. LC 72 18th Consultative Meeting of Contracting Parties to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, "Discharges from the Offshore Industry." LC 18/5/1, August 9, 1995.
10. LC 72 18th Consultative Meeting of Contracting Parties to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 'Disposal of Offshore Installations," LC 18/3, August 9, 1995.
11. M. A. Gerges, "Marine Pollution Monitoring, Assessment and Control: UNEP's Approach and Strategy," *Marine Pollution Bulletin,* Vol. 28, No. 4, pp 199-210, 1994

The Potential Contribution of Economics

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Prepared for the Workshop on
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New Orleans, April 15-17, 1996

1.0 Background

The design of regulations can be informed by two types of economic questions. The first question is whether a regulation or a change to a regulation has benefits to society that exceed the costs. This question responds to concerns about the balance between cost and environmental issues in abandonment and disposal activities and is addressed through benefit-cost analysis. The second question is whether market based approaches can more effectively implement the purpose of abandonment and disposal regulations than can detailed regulatory requirements of a command and control type. The regulatory debate about platform, pipeline, and well abandonment can be evaluated in light of these two questions.

2.0 Benefit-Cost Analysis of Abandonment Issues

The existing regulatory review process for the U.S. Federal Government requires a regulatory impact analysis for major regulations. If significant changes are proposed to platform abandonment regulations, it is possible that a benefit-cost analysis would be performed as part of the regulatory review. In addition, new regulatory reform efforts, whether at the Federal or the State level, could increase the emphasis on benefit-cost analysis to aid in the evaluation of regulations. In addition, specific mention was also made in the 1994 GAO report on removal operations that,

> Neither MMS nor the oil companies that we (GAO) contacted had documented the relative costs and benefits of different technologies. Such cost-benefit studies of using alternative technologies should, among other things, consider the effects of water depth, structure size and configuration, environmental effects, and human safety. Anecdotal evidence provide by oil companies and MMS and the results of our analysis of how structures have been removed were both inconclusive and contradictory.

While the Marine Board report on "An Assessment of Techniques for Removing Offshore Structures" contained some cost elements, the report did not address the broader context of social costs as well as private costs. Finally, economic analysis provides both important information to some stakeholders and also allows impacts to be compared in common terms and aggregated.

The sections below summarize some elements of such analyses and provide a short summary of some publicly available information. The intents of this paper are to convey the feasibility of economic analysis and to suggest areas for further work.

2.1 Background concepts and their Application to Removal

Benefit-cost analysis is intended to develop a bottom line for a social decision-maker who is concerned about all impacts, good and bad, to whoever might be affected. It is an extension to the public sector of the financial analysis typically conducted by a private company. The result is a "social" bottom line which, given the assumptions of the analysis, can be used to identify a preferred action. Some key concepts are summarized below.

<u>2.1.1 Cost Effectiveness</u>

Cost effectiveness is the determination of the least expensive way of achieving a given objective. This is the simplest type of determination to make when the objective (for instance, the removal of the platform to a given depth) can be agreed upon. In that case the benefit-cost question is reduced to choosing the option with the lowest social cost (see 2.1.3 below on social measures.) Thus, issues about the method of platform removal or well plugging become basically issues of cost effectiveness.

2.1.2 Benefit-cost Analysis

Benefit-cost analysis is more complex than cost effectiveness as the objective of the action can be changed. For instance, the benefits may differ between platform disposal to a Rigs-to-Reef site or to onshore disposal. Even cutting to different mud depths may change the benefits of the problem. In that case the analysis must compare both benefits and costs, not just cost effectiveness.

2.1.3 Private Versus Social Measures

Either benefit-cost or cost effectiveness analysis considers both private costs and benefits, such as those reported by industry, and social costs and benefits that incorporate private costs but which also include "external" effects such as environmental impacts. Although a major issue for removal is the potential for additional social costs due to harm to sea-life, there may also be additional social benefits depending on the method of disposal of the platform or other issues.

2.1.4 Monetization (Valuation)

Some "line items" in a benefit-cost analysis may be relatively easily determined according to their market value. Direct labor costs are likely to be one example. Other items such as the risk of accidents to human or marine life are more difficult to value. There are often, however, accepted methods and ranges. One accepted approach to valuing activities is to estimate the value of avoidance behavior. This is frequently used with health. In practice, in the Gulf of Mexico, certain measures are agreed upon to avoid certain types of incidental takings, whether through turtle excluders in fishing or through NMFS observations and avoidance activities during removal. Such efforts might form one starting place for valuing actions based on observed behavior.

Finally, issues of abandonment involve risks and may take place over time. In general, the standard practice is to include risks by including the expected value (probability weighted outcomes) and to account for time by measuring money in today's dollars, the present value. The preferred outcome is then chosen on the basis of the largest expected net present value. Deviations from this standard practice can occur based on risk preferences, irreversibility, and other special cases.

2.1.5 Time Frame

There can be different analyses if the decision concerns the installation and future abandonment at a site or if one is studying the abandonment and removal of an existing structure. In the long run—the time period when even the construction of the platform is being considered—one might conduct a benefit-cost analysis on a "life-cycle" basis. For instance, over the long run there may be substantial beneficial impacts on marine life which are in part paid for by a period of negative impacts when the platform is removed. Such an analysis would be a long-run analysis. This conference seems to be more focused on the short run—what are the costs and benefits of removing a platform or pipeline that is already in place. In that case the previous impacts, positive or negative, are in the past (sunk costs). The decision should only be affected by costs and benefits to follow from the current decision, although fairness concerns may address issues of historical benefits and costs.

2.1.6 Baseline

If the main concern is the removal of existing structures, the typical analysis in the absence of existing regulations would be to consider a "do nothing" alternative. The costs and benefits of various alternatives would be measured as departures from the costs and benefits of the "do nothing" alternative. In place of a "do nothing" baseline, one could define the baseline as current practice conforming to existing regulations as to timing and methods of removal. In any case, the baseline of the evaluation incorporates what will happen in future years.

2.2 Platform Removal Alternatives: A Potential Study in Cost Effectiveness

Consider that a regulation defines the preferred method of severing a platform. An economic way to integrate arguments about industry costs and environmental damages is to compare the costs for a given type of removal, say removal at the mud-line plus or minus some feet. Table 1 below, lists some of the line items that are involved in both the private and the social costs.[1]

Table 1: Costs of Alternative Removal Methods

8-Pile Production/drill Platform
(150 feet Water Depth, 6 wells,
no problem removal, see footnote 1)

Line Items	Bulk Explosives $	Mechanical Cutting $	Abrasive Cutting $
PRIVATE COST Decommissioning	100000	150000	140000
Derrick barge removal	616000	859000	714000
Direct severing cost	12000	N/A	N/A
Pipeline abandonment	43000	43000	43000
Site clearance	180000	180000	180000
Positioning	16000	20000	18000
Miscellaneous support	50000	65000	65000
Total Private	1017000	1497000	1270000
EXTERNAL COST			
Human accident	Probability* Value= 0	Probability * Value= 50,000-150,000	Probability * Value= 50,000-150,000
Turtle accident	13000	N/A	N/A
Fish accident	Value	Value	Value
Gear loss	Value	Value	Value
Air Emissions	Value	Value	Value
Total External			
TOTAL COST			

Private cost data: Marine Board, op. cit.

Several items are worth highlighting.

- Costs which are the same across options do not affect the choice but do affect the level of economic impact.
- While the focus among removal methods might be on direct severing costs, such costs are only about 1/3 of the total difference reported between the bulk explosive and mechanical cutting option. Unexplained differences in decommissioning cost and derrick barge removal cost account for a larger part of the difference in cost.
- The Marine Board study listed as a private cost the cost of NMFS observers and activities to reduce incidental take of turtles. In this preliminary table such costs are used to represent the avoidance costs that reduce the cost of accidents to turtles. In the absence of such activities, an economic measure of turtle accidents may be higher (or lower). However, the cost to society may be approximated by the costs that are sufficient to avoid the potential cost.
- The cost of human accidents was not explicitly addressed in the original material. One could, at a minimum, consider the added risks of dive time based on historical data and use a professionally accepted range of values for the loss of life or lessor accidents.[2] For instance, unverified responses at the workshop indicated that 3 diver fatalities had occurred during the non-explosive removal of about 300 platforms in shallow water (compared to no fatalities with explosives.) Other verbal reports indicated that perhaps as many as 9 fatalities had occurred. If these data are correct, they suggest a fatality rate of 1 to 3 percent. On a per platform basis, and assuming a value of $5 million per life lost, the expected human accident cost per shallow platform removed by non-explosive means is about $50,000 to $150,000. Some of this cost may be offset by a potential liability entry in the private costs of a company.
- Point estimates for some categories may be particularly poor. In addition, few decommissioning jobs may be "typical." It is relatively straightforward to extend the point estimates of the above analysis to include a distribution of costs and probabilities (a range of costs is a simple example). Simulation methods combined with a spreadsheet can be used to produce an estimate of the cumulative distribution.

In order to implement a credible analysis, researchers must ask additional questions such as:

1. What additional line items should be included?
2. How large must omitted items be to change a decision about the preferred method?
3. If one or two items might change the decision, then there may be a "value of information" from investigating that item more intensively.

2.3 Benefit-Cost Analysis of Abandonment Alternatives

Alternative abandonment strategies such as shore based dismantling, Rigs-to-Reef programs or toppling in place can be viewed as changing the fundamental outcome of the removal process. In this case a full benefit-cost analysis is more likely to be necessary to capture the differences in the benefits (including damages avoided) that depend on the type of abandonment procedure.

The process is little different than the cost-effectiveness analysis described above. The primary difference is that specific line items are added to represent the benefits of each alternative. For instance, a Rigs-to-Reefs disposal may result in some (incremental) fishery benefits which may depend on where disposal occurs. The value of recycled material is foregone, but other labor and transportation costs may be avoided.

Work by AURIS Environmental for the United Kingdom Offshore Operators Association has looked at some of these issues for North Sea abandonment alternatives including:

> 1) Disposal of naturally occurring radioactive material on land and at sea; 2) disposal of other wastes in landfill sites, 3) onshore recycling of scrap steel or leaving it in the sea, 4) the beneficial impacts associated with artificial reef effect of steel structures left in the sea, 5) CO2 emissions from decommissioning operations and from steel manufacture to replace steel which is left in the sea rather than recycled, 6) impact of any heavy metals left in the sea rather than recycled, and finally 7) interactions of materials left in the sea with fishing activities.[3]

Although some have referred to a recent report to UKOOA as a benefit-cost assessment, it is in fact an environmental impact analysis on a limited number of factors, some of which might indeed eventually be a part of a benefit-cost analysis. The report analyzed, in fairly great detail, some of the engineering options for disposal, even breaking down options separately for the topside, steel jacket, for a pile of drill cuttings, for a pipeline and so on. However, the design of the study intentionally omitted:

1. Discharges associated with the final shutdown of a platform,
2. The effects of explosive use,
3. The potential for creation of debris from material left in the sea.

The reason given for these exclusions was primarily that the issues had been sufficiently studied in themselves but their omission means that the study cannot be taken even to represent what seem to be the environmental impacts that are driving public perception.

Finally, although focusing on environmental impacts, the study explicitly excludes issues of cost, technical, and safety issues. The document is useful as input into a benefit-cost analysis, perhaps as one of several documents for understanding some of the technical and environmental science issues underlying abandonment and disposal. A benefit-cost analysis would need to include the cost, technical and safety issues. It would need to include all relevant environmental impacts. It would need to quantify the impacts in economic terms.

What might a benefit-cost analysis include that the cost effectiveness studies do not? Some initial items for the benefits portion of a study are presented in Table 2.

The time is ripe to integrate industry and environmental concerns into one analysis. Although numerous issues remain to be addressed by anyone seeking to conduct a benefit-cost analysis, a substantial body of information on both private and social costs exists to bring into focus the full economic implications of management choices.

3.0 Alternative Approaches to Regulation

The existing auction process, removal regulations, and bonding can be viewed as key elements in an economic contract whereby the government procures a service, the extraction of natural resources subject to contractual conditions. As offshore production continues to expand, it may be worthwhile to consider whether the existing system adequately shares different kinds of risks between government and industry. A variety of alternatives exist worldwide including the explicit sharing of disposal costs. This section briefly characterizes some of the economic issues surrounding the contract for removal of offshore platforms in U.S. waters.

3.1 Is There Any Uncertainty?

Numerous economics articles study the trade-offs between direct regulation, contractual incentives, and different types of liability.[4] The key issue is the nature of what is uncertain. If the industry operator or owner has access to better information than the government, or if performance of industry is hard to monitor, then in general it is appropriate to offer some incentive to industry to adequately protect human and environmental health and safety. First, it is useful to summarize the existing process and to characterize what is uncertain to each of the parties, the government and industry.

Subject to various steps, the current process can be summarized as selling the right to extract a natural resource subject to royalty (or rental) payments and a commitment to remove facilities at the end of the lease period. It is fully expected that the bonus bid by industry incorporates an estimate of the disposal cost necessary to removal the facilities. The government accepts less money in exchange for the commitment to remove a facility if the lease actually results in production. Consequently, some insurance companies tend not look at removal costs as an insurable item; instead it is a cost that is expected to be incurred and for which reserve accounts can be established. However, from the government's point of view the actual removal of the facilities may be an uncertain event depending, among other factors, on the financial assets of the responsible party. Consequently, the government has required demonstration of financial capacity if responsible parties are to obtain bonding only at the general level for OCS operations or to obtain supplemental bonding if financial capacity cannot be demonstrated.[5] This is an additional regulation that is intended to maintain the risk entirely on the shoulders of industry although concern has existed that the government remains exposed to potentially large risks if abandonment responsibilities are not met by industry. In addition to this uncertainty about removal, there is the possibility that the quality of closure and abandonment may be difficult to monitor by the government. There may be additional uncertainties about future damage to the environment or the natural resource if closure and abandonment is improperly done.

Table 2: Potential Benefits

Line Item	Full Removal	Partial Removal	Topple in Place	Leave in Place
Private Benefits				
Reduced liability				
Revenue from scrap				
Timeliness of removal				
Social Benefits				
Fishery value				
Recreation value				
Scientific value				

Table 3: Uncertainties by Sector

Uncertainties to Government	Response by Government	Uncertainties to Industry	Response by Industry
Facility removal	Accept lower bid	Financial capability	Reserve Account Bond
Financial capability	Require bond	Cost of removal	
Quality of removal	Monitor observable actions	Regulatory requirements	
		Future liability	Quality of lessee and quality of abandonment

In contrast to this uncertainty from the government's perspective, industry also faces uncertainty. The costs of removal are uncertain (although probably known better to industry than to government) and the exact regulations governing removal may change. Each of the parties, government and industry, may also have different risk preferences. Some of these uncertainties are listed above in Table 3.

Existing economic studies may be too general in the absence of tailoring advice to the specifics of the offshore situation. None-the-less, among the general advice offered in the literature are the following:

> As long as the polluter has unobservable actions that affect the probabilities of different states of nature occurring, then an efficient policy includes some ex-post liability.....A system of regulation plus partial ex-post liability is preferred. Segerson, p. 1264.

> ...regulatory efforts or sheer competition inducing a greater focus on cost minimization may tilt the agents' *(industries)* trade-off towards taking too much risk....The insurance of these large environmental risks cannot be left to the market. A high level of coordintion is needed between the regulation of firms and the provision of insurance." Laffont, p. 331.

> ...regulation does not result in the appropriate reduction or risk—because the regulator lacks perfect information--nor does liability result in that outcome—because the incentives it creates are diluted by the chance that parties would not be sued for harm done or would not be able to fully pay for it. Thus neither liability nor regulation is necessarily better than the other, and as is stressed, their joint use is generally socially advantageous. Shavell, p. 271.

> One of our strongest conclusions, and a startling one, is that when ex-ante (standards) and ex-post (liability) policies should be used jointly, efficiency generally requires that the ex-ante regulatory standard be set on a level that, if regulations were used alone, would provide a socially suboptimal level of safety or precaution. Kolstad, et. al., p. 889.

Future reviews of regulations for decommissioning may wish to consider clarifying the role of post-decommissioning liability when used in conjunction with standards for decommissioning. Such a review could investigate the balance between prescriptive ex-ante regulations for removal and the incentives created by liability damages which may occur after the fact.

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[1] The basic scenario and the private costs are from "An Assessment of Techniques for Removing Offshore Structures," National Research Council, 1996, Table 3-6.

[2] A range of 2.5 to 5 million dollars as a best estimate is suggested in Gramlich, E. "A Guide to Benefit-Cost Analysis," Second Edition, Prentice-Hall, Inc., 1990, p. 68. Other values could be obtained from *Valuing Health for Policy: An Economic Approach*, ed., G. Tolley, D. Kenkel, and R. Fabian, University of Chicago Press, 1994.

[3] As summarized in P.H. Prasthofer, "Offshore Decommissioning and Disposal: Background Issues and Facts," Report No. 10.12/232, E&P Forum, December, 1995.

[4] See for example, Shavell, S., "A Model of the Optimal Use of Liability and Safety Regulation," Rand Journal of Economics, 1984; Laffont, J-J., "Regulation, Moral Hazard and Insurance of Environmental Risk," Journal of Public Economics, 1995; Segerson, K., "Risk Sharing in the Design of Environmental Policy," American Journal of Agricultural Economics, 1986; Shavell, S., "Risk Sharing and Incentives in the Principal and Agent Relationship," Bell Journal of Economics, 1979. Kolstad, C., et. al., "Ex Post Liability for Harm vs. Ex Ante Safety Regulation," American Economic Review, September, 1990.

[5] For a summary to 1993, see USGAO, "Offshore Oil and Gas Resources: Interior Can Improve Its Management of Lease Abandonment," GAO/RCED-94-82, May, 1994.

AFTERWORD

Abandonment of (the Syntax of) Abandonment

John Lohrenz

[Editor's note: John Lohrenz, who teaches at Louisiana Tech and was a co-chair of the Well Abandonment Working Group, published a slightly longer version of the following in his personal newsletter Certain Uncertainties. This slightly edited version is reprinted with his permission.]

Abandonments, like it or not, are a booming, growth business. But when Bill Griffin spoke to the workshop, he got no disagreement when he said that one should not call abandonments "abandonments." I, too, have found the term "abandonments," applied to oil and gas production, misleading. Key decision options are glossed over and often completely submerged.

The bard wrote, "To be or not to be...," but one hopes desperately to avoid any situation when that is the question—when those are the only options left. Just so, the decisions are far more complicated than "to abandon or not to abandon." So I embarked on word sorties to change the syntax of abandonments.

Descriptor: Eschatological.

About 5 years ago, I started pushing the view that decisions surrounding abandonments were an issue in "eschatological" economics. "Eschatology," my dictionary told me, deals with the transformation of one form of life to another life or form.

You can see how the notion rationally describes abandonments. When one abandons a well, platform, or field, nothing completely disappears. Instead, one or more new entities appear. What was used for producing oil and gas becomes available for some other purpose(s).

The "new" life of an abandoned facility may be mundane. In the 1960's, I lived in northern Oklahoma near the once fabled, long ago abandoned, Three Sands oil field. Three Sands was once a city as well as an oil field. Tromping those environs at the time, one found old oil field concrete abutments amid a lush growth of abundant wheat awaiting harvest.

An offshore example has more pizazz. Abandoned offshore platforms are good hunting grounds for fishermen. Yet sometimes they snag shrimpers' nets. This proves, I guess, that just as no life as an oil and gas production facility is trouble free, neither is "new life" after an abandonment trouble free. The harvest combines and other agricultural implements in the abandoned Three Sands field have to detour around the abutments. Efficient ways to recompense shrimpers for snagged nets was a hot subject at the New Orleans meeting.

But "eschatological" as a descriptor to supplant "abandonment" just didn't attract a following, and that's a charitable assessment. I see two reasons why it didn't. First, the word's etymology is from, and the preponderant prior uses are in, the always contentious realm of theology. "Eschatological" likely carries too many burdens from the theological wars, past and present, to serve as an unbiased descriptor here. A second reason? "Eschatological" also carries the burden of a passel of syllables for a pragmatic, "deep," down-to-earth audience. Impressive word though, isn't it?

Descriptor: Geriatric.

The campaign of the next candidate to alter the syntax of abandonments was triggered by the word's use by John Calhoun, TAMU. He wanted an adjective to differentiate "younger" producing properties—still being developed or developable—from "older" properties. He properly sought to emphasize the fact that the decision algebra for such older properties differs fundamentally from that of their more sprite siblings. And so he chose the descriptor, "geriatric."

In fact, the paper I prepared for the workshop group, Abandoning Wells, at the New Orleans meeting was entitled, "The Decision Economics of Geriatric Oil and Gas Production." (That paper and a supporting literature survey are available. The paper is a more complete, updated version of "Shut-In and Abandonment Decision Economics" given at and in the Proceedings of the 1991 HEES.)

Why all this effort on my part and others' to abandon the syntax of abandonments for some other descriptor(s)? It isn't just that abandonments are not PC. The simple, but often overlooked, truth is that, as oil and gas producing properties age, a complex of different decision options evolves. Considering only a to-abandon-or-not option not only does not describe those options extant, but also can lead to foolish, i.e., value decreasing, decisions. The papers mentioned (and others, mostly in economics journals, in the literature survey) treat many of these options far beyond to-abandon-or-not mathematically. By seeking to change the syntax, we're deftly trying to shift the decision making to the real world arena and beyond the simplistic to-abandon-or-not decision option.

Certainly, there does come a time when all future anticipated production from an oil and gas facility is forever foreclosed. And at that time, one hopefully bids a "fond adieu" to the now "old," but once "young" property, which then continues to exist for some other purpose(s). A robust gamut of decision options arises in the transformation of an "old" producing property to its subsequent existence. The options aren't considered by the to-abandon-or-not syntax.

Further, the transformation from "old" to the next existence, whatever it is, is usually long—it takes time. In that usually long transformation, except possibly for regulatory record-keeping purposes, it's usually quite impossible to pinpoint a precise moment when a once-producing property should now be dubbed formally abandoned or "dead." (I'm told the situation is frequently the same when old specimens of the genus, *homo sapiens,* go through a similar transformation.)

Descriptor: Oil and Gas Production Facility Mortuaries.

You can already see what I'm getting at, can't you? There is a worldwide business splendidly dubbed the mortuary business, which provides an array of services for, hopefully, "old" specimens of the *homo sapiens* clan. The business arose because of the necessity, for a variety of reasons including sanitation and esthetics, of disposing of dead bodies of formerly living members of the genus. But the business did not prosper to its current status by calling itself a dead-body-disposal business. The morticians had to select a more euphemistic syntax to describe their business, and so do the entrepreneurs of the abandonment business.

Don't like this descriptor? Neither do I. But I cannot help but recognize the similarities.

Descriptor: Decommissioning.

"Decommissioning" was the descriptor of consensus choice at the New Orleans meeting. Even before the meeting, one could perceive increasing use of "decommissioning" as the descriptor supplanting "abandoning." It has one less syllable than "eschatological." Its etymology is nautical/military, not theological.

Well, all right, I'll go along with that or with any new syntax that implies that we are dealing with a sequence of decision options that is far more complicated than just burying "dead" (ex-producing) properties so they can forthwith be forgotten and not bother anyone.

APPENDICES

APPENDIX A

Biographical Information on Speakers, Organizers, and Chairpersons

International Workshop on Lease Abandonment and Platform Disposal: Technology, Regulation and Environmental Effects
April 15 - 17, 1996
New Orleans, Louisiana

J.D. Allen: Dan Allen is the Senior Ecologist for Chevron Production Company's Gulf of Mexico operations. Chevron is a major oil and gas producer in the Gulf and has made significant contributions to the Florida and Louisiana artificial reef programs. Over the past 20 years Mr. Allen has designed and constructed wildlife and fisheries habitats from Alaska to Florida. He is active in a number of state and federal agency advisory committees and working groups dealing with wildlife, fisheries, habitat and oil spill issues. He has served on the National Research Council Water Science and Technology Board and on several of its committees. Prior to joining Chevron he was a Senior Scientist for an environmental consulting firm in Florida. Mr. Allen holds B.S. and M.S. degrees in biology from Auburn University and conducted graduate research at the University of Georgia.

Bob Armstrong: Bob Armstrong is Assistant Secretary for Land and Minerals Management at the U.S. Department of Interior and is responsible for the Bureau of Land Management, the Minerals Management Service and the Office of Surface Mining. Mr. Armstrong is a Texan and been involved in land management and environmental issues throughout his career. He was instrumental in creating the Texas Interagency Council on Natural Resources and Texas' Coastal Zone Management Program. He has served in the Texas House of Representatives, as Commissioner of the Texas Parks and Wildlife Commission, where he doubled the acreage in Texas State Parks, and as the Natural Resources and Energy advisor to Governor Ann Richards. Mr. Armstrong is a founding board member of the Texas Parks and Wildlife Foundation and board member of the Trust for Public Land. He is the recipient of the Field and Stream Conservation Award, the Nature Conservancy President's Public Service Award and the Chevron Conservation Award. He received both his B.A. and L.L.B. from the University of Texas, Austin and served at sea as an Ensign with the U.S. Navy.

Charles A. Bedell: Chuck Bedell is Manager of Environmental and Government Affairs for the world-wide operations of Murphy Exploration & Production Company in New Orleans. He spent twelve years as Legislative and General Counsel (Offshore) for the International Association of Drilling Contractors. In addition to working on Endangered Species, NEPA, Law of the Sea, Coastal Zone Management, Marine Protection, Research & Sanctuaries and Marine Mammal Protection legislation, Chuck was Congressional Advisor to the United States' delegation to the International Whaling Commission when commercial whaling was stopped. He is Co-Chair of the Environmental Auditing Roundtable's Legislative Committee and secretary of the Lincoln Heritage Institute. Chuck graduated from Kenyon College with a degree in Biology and holds a JD degree from the University of Kentucky College of Law.

Kenneth E. Breaux: Ken Breaux is Vice President and Manager of Engineering Services at Project Consulting Services, Inc. He has extensive experience in the marine construction industry, working in areas of fabrication and installation of offshore pipelines and platforms, including design, planning and construction coordination. Prior to joining Project Consulting, Mr. Breaux worked for many years as a project engineer for McDermott Inc. He attended Louisiana State University graduating with a degree in civil engineering.

Paul Brouha: Paul Brouha is the executive director of the American Fisheries Society. After serving as a pilot with the U.S. Air Force, he began his career in fisheries with the Wisconsin Department of Natural Resources. In 1977 he joined the U.S. Forest Service as a fisheries biologist and in 1981 became manager of the regional fisheries program in Missoula Montana. He became manager of the national fisheries program for the U.S. Forest Service in 1984 and in 1986 joined the American Fisheries Society as Deputy Director. He has served on or directed a large number of professional fisheries programs and is currently chair of the American League of Anglers and Boaters. Mr. Brouha received is B.S. degree from Penn State and his M.S. degree from Virginia Tech.

Lori Cameron: Lori Cameron is Executive Director of the Energy Council, an organization of state legislators from Alabama, Alaska, Arkansas, Colorado, Louisiana, Mississippi, New Mexico, Oklahoma, Texas, Wyoming and the Canadian province of Alberta. Ms. Cameron is also administrator of the Energy Council's research affiliate, the Center for Legislative Energy and Environmental Research (CLEER). Formed in 1975, the Energy Council has as a primary purpose to participate in the formation of federal energy and related environmental policies. Prior to joining the Energy Council, Ms. Cameron practiced energy and environmental law in Louisiana with the law firm Adams and Reese. During this period, she drafted the South/West Energy Council's National Energy Strategy proposal, as well as an energy policy proposal for the Louisiana Governor's Energy Commission. Ms. Cameron also served for more than five years as Energy Counsel and Assistant to the President of the Louisiana Senate. Lori Cameron holds B.S., MPA and JD degrees from Louisiana State University.

Robert S. Carney: Robert Carney is a biological oceanographer specializing in benthic ecology. In his tenth year at LSU, he serves as director of the joint MMS-LSU Coastal Marine Institute program, faculty in the Dept. of Oceanography and Coastal Sciences, and senior researcher in the Coastal Ecology Institute. Dr. Carney directed CEI from 1986 to 1995. Current research activities focus upon chemosynthetic communities at deep oil seeps in the Gulf of Mexico, and the ecology of offshore platforms. In the area of ocean policy, he is active in the general areas of ocean monitoring and deep-ocean resource development. Dr Carney was educated at Duke, Texas A&M, and Oregon State Universities for B. S., M. S. and Ph. D. respectively. Previous positions include work at Moss Landing Marine Lab, the National Science Foundation and the Smithsonian Institution's Museum of Natural History.

Mark H. Carr: Mark Carr is a research biologist with the Coastal Research Center, Marine Science Institute and a lecturer in the Department of Ecology, Evolution and Marine Biology, University of California at Santa Barbara. He is also Deputy Program Director for the UC-MMS Coastal Marine Institute and the Southern California Educational Initiative. His current research involves experimental studies of recruitment and population dynamics of reef fishes in the Bahamas and the ecological role of oil/gas production facilities in the Santa Barbara Channel. He received his B.A. at U.C. Santa Cruz, an M.S. from San Francisco State University and Moss Landing Marine Laboratories and a Ph.D. from U.C. Santa Barbara, all of which are in Biology with an emphasis on Aquatic Ecology.

Kurt J. Cheramie: Kurt Cheramie has been a right of way agent with Tennessee Gas Pipeline Company for over fifteen years. He specializes in project and maintenance permitting—dealing with MMS, the COE, CMD and state and local authorities—as well as right of way and land acquisition. Mr. Cheramie is a 1980 accounting graduate of Nicholls State University.

James M. Coleman: James Coleman is the executive vice chancellor of Louisiana State University, and a professor in the Department of Oceanography and Coastal Sciences. Dr Coleman's research focuses on continental shelf, slope and deltaic sedimentation. He has authored over 180 papers in the field of geomorphology. Dr. Coleman has received several honors for contributions to the field, including election as a member of the National Academy of Engineering and a fellow to the Geological Society of America. He was appointed a member of the Marine Board in 1993 and was a member of the Marine Board committee responsible for *An Assessment of Techniques for Removing Offshore Structures*. Dr. Coleman received his B. S., M. S., and Ph. D. degrees in geology from Louisiana State University.

David A. Colson: David A. Colson is Deputy Assistant Secretary for Oceans in the Bureau of Oceans and International Environmental and Scientific Affairs, U.S. Department of State and has had the rank of Ambassador since 1991. After serving as a Peace Corps volunteer in Liberia and as a Sergeant in the Marine Corps Artillery, Mr. Colson joined the Legal Affairs Office of the Department of State in 1975. He was appointed to the Senior Executive Service in 1981 and has served on, or been the leader of, U.S. delegations to numerous bilateral and multilateral negotiations, relating to fisheries and other ocean and environmental issues, including the Law of the Sea Conference and Antarctic Treaty meetings. He has written numerous articles on ocean and legal topics and received several awards, including three Senior Executive Service Presidential Rank Awards—Meritorious Executive and one Senior Executive Service Presidential Rank Award, Distinguished Executive. He received a BA degree from California State College, Hayward, and a JD from the University of California, Berkeley and is a member of the Bar of California and the District of Columbia.

Michael Craig: Michael Craig manages projects for Unocal's asset teams in the Gulf of Mexico. He is responsible for onshore and offshore platform designs, fabrication, installation; and subsea and topsides inspections, repairs, and fitness-for-purpose assessments. He is responsible for Gulf of Mexico platform abandonments and site clearances. He is also responsible for deepwater Gulf of Mexico development scenarios and costs. Mike Craig also acts as internal consultant on new construction, abandonment and loss control projects to other Unocal upstream asset and growth teams outside the Gulf of Mexico. Mike Craig has a MS in Civil Engineering from the California Institute of Technology. He is a registered engineer in the states of California, Alaska, Texas and Louisiana. He is an active member of ISO/API. He has published numerous technical papers and articles. In the Gulf of Mexico in 1995, Unocal installed 12 offshore and inshore platforms, removed 21 offshore platforms, and acquired 11 deepwater leases.

John Cullen: John Cullen has worked as a policy administrator in a number of UK Government Departments, mostly concerned with employment and training issues. For the past three years he has been responsible for the Health and Safety Executive's policy on a range of offshore oil and gas safety matters, including the Safety Case Regulations and their evaluation, and the decommissioning of offshore installations. He is a member of the an inter-departmental committee of officials which advises the UK government policy and procedures related to the decommissioning, dismantling and disposal of offshore installations. He has represented the UK's health and safety interests in a number of European Union fora, and was Chairman of the Planning Committee for the European Year of Health and Safety in 1992-93.

Clifton Curtis: Since 1991, Mr. Curtis has been Greenpeace International's Political Advisor for oceans-related issues work, assisting international campaigners, as well as campaigners from among its 30 national offices. While not involved in Greenpeace's North Sea activities surrounding the Brent Spar or other oil and gas facilities, he has worked on a wide array of oil and other international marine environmental issues. His work includes oversight of Greenpeace's involvement in International Maritime Organization activities dealing with vessel-source pollution, and he has been or is directly involved in, among other issues, 1) ocean dumping reforms under the London Convention, 2) land-based sources of marine pollution, including the November 1995 UNEP conference in Washington, 3) fisheries conservation initiatives, including negotiation of a UN global fisheries treaty during 1993-95, and 4) enhanced protection of Antarctica, pursuant to a new environmental protocol. He also is the US environmental community's lead spokesperson on Law of the Sea treaty matters, and is Greenpeace's principal liaison to the UN's Commission on Sustainable Development. In 1990-91, Mr. Curtis worked at the UN Economic Commission for Latin America and the Caribbean, in Santiago, Chile, on ocean issues related to the 1992 Earth Summit. From 1978-1990, including a 5-year tenure as President of the Oceanic Society, he worked almost exclusively on marine environmental issues, testifying before the US Congress on more than 50 occasions. Following the Exxon Valdez oil spill in March 1989, he coordinated the US environmental community's lobby efforts prior to enactment of the US Oil Pollution Act (OPA90). Mr. Curtis is a lawyer, having graduated from George Washington University's National Law Center in 1971. Among other activities, he has been an advisor on several delegations, including the IMO oil spill liability and compensation CLC/Fund Protocol Conference in 1984; a member of the NRC's Marine Board from 1982-85; a member of the Department of Interior's OCS Policy Committee (1990-91); and on the Board of Directors, Council on Ocean Law (1988-present).

Sean Daly: Sean Daly is an audit partner with Arthur Andersen. He has served as engagement partner on numerous publicly and privately held businesses covering a variety of industries. He currently serves as engagement partner on Freeport-McMoRan Inc., Stone Energy Corporation and J. P. Oil Company Inc. Mr. Daly is also a member of the Board of Directors of the University of New Orleans Energy Accounting and Tax Conference. He received his B.S. and M.S. degrees from Colorado State University at Fort Collins. He worked in Arthur Andersen's Denver office until 1987 when he transferred to the New Orleans office. He was admitted to the partnership in 1989.

Elmer P. Danenberger: Mr. Danenberger earned a B.S. degree in petroleum and natural gas engineering and a masters degree in environmental pollution control, both from Pennsylvania State University. He has been employed as an engineer in the Department of Interior's offshore oil and gas program since 1971. He has served as District Supervisor for the Minerals Management Service (MMS) field offices in Santa Maria, California, and Hyannis, Massachusetts, and as a Chief of the Technical Advisory Section at headquarters office of the U.S. Geological Survey. He is currently the Chief of MMS's Engineering and Technology Division with responsibilities for safety and pollution-prevention research, engineering support, and offshore operating regulations.

Donald W. Davis: Donald Davis is Administrator of the Louisiana Applied and Educational Oil Spill Research and Development Program. Since completing his Ph.D. at LSU, he has spent more than 20 years investigating various human/land issues in Louisiana's wetlands. He has written or coauthored more than 70 articles. He is currently working on number of problems related to the oil and gas industry in south Louisiana and projects that will help restore Louisiana's wetlands. Recently he contributed two chapters to *Atlas of Shoreline Changes in Louisiana from 1853 to 1989* and helped write several reports dealing with the Louisiana coastline and the impact of oil and gas activities. In all of his writing and public speaking, Dr. Davis emphasizes the human as well as the physical aspects of Louisiana's coastal zone.

Roy C. Die: Roy Die is Vice President, Secretary and Surety Manager of Underwriters Indemnity Company, a Houston based property and casualty insurance company underwriting oil and gas related risks. Previous positions include vice president Lone Star Exploration Company, vice president Chambers Oil and Gas, and Senior Accountant Ernst and Whinney. Mr. Die has a B.A. in economics and M.A. in accounting from Rice University and is a Certified Public Accountant.

Kris A. Digre: Kris Digre has been with Shell for 27 years working in locations around the world. He presently works in SOI Deepwater Division, E&P Civil Engineering group, with main responsibility as the Design/Project Engineer for the installation of the Ursa TLP in 3,950 feet of water. He has designed or been involved with the design of platforms located off the coast of Africa, Alaska, Australia, Brazil, Borneo, California, China, Egypt, Gulf of Mexico and the North Sea. He was lead designer and engineer of record for Bullwinkle, the largest fixed platform built to date (412 m water) in the Gulf of Mexico. Kris is the chairman of the API Task Group 92-5, responsible for writing the recommended practices for the assessment of existing platforms, to be published with API Supplement 1 to RP 2A in April 1996. Kris received a B.S. from Illinois Institute of Technology.

F. Pat Dunn: Pat Dunn is retired from Shell Oil Company. He served as a member of the Marine Board Committee on Disposition of Offshore Platforms in 1985 and as a member of the Marine Board form 1986 to 1989. At Shell, Mr. Dunn was a manager of civil engineering in the Offshore Productions Division, where his group designed and supervised construction of more than 100 major platforms and numerous minor structures. He also was involved in an industry group that played a major role in setting industry practices and guidelines for offshore platform design. Mr Dunn chaired the Marine Board committee responsible for *An Assessment of Techniques for Removing Offshore Structures*. He received both bachelor's and master's degrees in civil engineering from the Ohio State University.

Len Ellis: Len Ellis has been an evaluator with the U.S. General Accounting Office from 1969 to the present. Currently, as a senior evaluator, he conducts reviews of federal programs that deal with energy, resources, and science issues. Mr. Ellis managed GAO's review of offshore oil and gas lease abandonment which culminated in the May 1994 report, *Offshore Oil and Gas Resources: Interior Can Improve Its Management of Lease Abandonment*. Mr Ellis has a B.A. from Muhlenberg College, Allentown Pennsylvania.

William E. Evans: Bill Evans is president of the Texas Institute of Oceanography of Texas A&M University, where he previously served as dean and the superintendent of the Texas State Maritime Program. He served as the Under Secretary of Commerce for Oceans and Atmosphere (Administrator of NOAA) from 1988 to 1989, assistant administrator of NOAA for Fisheries from 1986 to 1988, and as chair of the Marine Mammal Commission from 1983 to 1986. He was responsible for directing the conservation, management, and development of living marine resources for commercial and recreational use and developing and implementing national policy for the nation's marine waters and resources. Dr Evans' special area of research is the effects of noise on marine mammals. He was a member of the Marine Board committee responsible for *An Assessment of Techniques for Removing Offshore Structures*.

R. Scott Farrow: Scott Farrow is an environmental and resource economist with Dames & Moore, an international environmental consulting firm. Dames & Moore is active worldwide in assessing the impacts of platform removal including decommissioning methods and protocols for over 20 platforms in all sectors of the North Sea, participating in environmental regulatory development and providing a full range of environmental consulting services. Scott has over 12 years experience as an economist in government, academia and the private sector. He was an associate director of the White House Council on Environmental Quality in the Bush Administration, served in the Branch of Economic Studies of the MMS, chaired the socioeconomic panel of the OCS Scientific Advisory Committee and has written a book titled, *Managing the Outer Continental Shelf Lands*. Scott holds a Ph.D. in economics from Washington State University and currently focuses on the economic analysis and design of regulations and the analysis of major development projects.

Era N. Ford: Era N. Ford is senior consultant with Twachtman Snyder & Thornton, Inc., a firm involved in construction management, engineering and inspection for offshore oil and gas operators. TST specializes in the abandonment of offshore platforms and production facilities, pipelines and wells, with primary focus on reuse and artificial reef initiatives. Consulting services include providing abandonment liability and replacement cost estimates for risk management purposes. Era has over fifteen years experience in finance and business development. Prior to joining TST as senior consultant, she worked three years as an independent consultant to general contractors and engineering firms in Texas and Alaska on proposals that resulted in substantial successful bids on major projects. Era holds BA and MBA degrees from the University of Texas at Austin.

Thomas M. Gernhofer: Mr. Gemhofer began his career with the U.S. Government in 1970 when he was appointed to the Department of Interior's Bureau of Mines. He worked as a personal specialist in the Bureau of Mines until 1973 when he moved to the Office of the Secretary of Interior. In this office, he progressed to the position of Chief, Branch of Personnel Operations, in 1975 and later Chief, Branch of Policy and Programs, with primary responsibility for the implementation of the Civil Service Reform Act. In 1981, he was promoted to serve as Assistant to the Assistant Secretary for Policy, Budget and Administration, with primary responsibility in the administrative area. In 1982, he became the Assistant Director for Administration for the newly created bureau, Minerals Management Service, and was promoted into the Senior Executive Service in 1983. He served as the Assistant Director for Administration until 1988 when he was named Acting Deputy Director, MMS. In 1989, he was appointed the Associate Director for Management Budget, MMS, responsible for all administrative, budgetary, and appeals activities. In 1990, he was appointed Associate Director for Offshore Minerals Management, MMS. Mr. Gemhofer has received numerous awards, including the Department of Interior's Meritorious Service Award in 1986, the

Meritorious Presidential Rank Award in 1989, and the Department 's Distinguished Award in 1990. A native of Washington, D.C., Mr. Gemhofer graduated from the University of Virginia in 1969.

Thomas G. Gorman: Tom Gorman is a Senior Workover Coordinator for the West Cameron Profit Center of Chevron. He has worked for Chevron as a field engineer, and prior to their merger with Chevron, was Workover Superintendent for the Central Gulf area for Tennaco. He has 20 years experience in the oil industry. He was graduated from Mississippi State University with a B.S. in petroleum engineering with a minor in chemical engineering.

W. S. Griffin: Bill Griffin is Director of Special Projects for Worldwide Drilling and Production at Phillips Petroleum Company. He began his work for Phillips in 1961, after receiving a B.S. Degree in Petroleum Engineering from the University of Oklahoma. His first assignment involving the decommissioning of offshore installations was in 1972. Bill was asked to determine the future financial liability involved in the removal of all offshore structures, on a worldwide basis, in which Phillips had an interest. He has subsequently held the position of Project Manager or Advisor on every decommissioning study carried out by Phillips. He has served on numerous industry committees related to decommissioning and has consulted with host governments. From 1987 until 1989 he was the industry Advisor for the US Delegation during the IMO Guideline negotiations. Bill is currently assigned to the London office of the E&P Forum, working as a member of the industry Decommissioning Task Force.

Mariano G. Hinojosa: Mariano G. Hinojosa attended Texas A&M University where he received a B.S. in natural gas engineering. Mr. Hinojosa's professional experience includes four years with Continental Oil Company in Corpus Christi, Texas and Lafayette, Louisiana, as a drilling and production engineer. For the past twenty-one years, he has been employed by the Office of Conservation within the Louisiana Department of Natural Resources. He has worked for the state in various technical capacities and presently serves as Director of Pipelines. His responsibilities include the regulation of interstate natural gas pipelines, the state's pipeline safety program, and the underwater obstructions program. He is registered as a Petroleum Engineer and an Environmental Engineer in Louisiana and is a member of Louisiana Engineering Society and Society of Petroleum Engineers of AIME.

Kent Jeffreys: Mr. Jeffreys is an independent environmental consultant in Washington DC. During the past ten years he has been a Senior Fellow with the National Center for Policy Analysis; the Director of Environmental Studies at the Competitive Enterprise Institute; and the Energy and Environmental Policy Analyst with the Republican Study Committee of the U.S. House of Representatives. Mr Jeffreys' experience includes working on such topics as risk and regulation, property rights, clean air proposals and environmental racism. He has testified before the Congress on numerous occasions and been a participant on many radio and TV broadcasts, including MacNeil-Lehrer, Crossfire, C-SPAN and the BBC. Mr. Jeffreys holds a law degree from the University of Mississippi and a degree in Political Science from Mississippi State University.

J. A. (John) Jones: John is an Engineering Associate with Exxon Production Research Company. He has 24 years experience with Exxon working mainly in the area of design of offshore drilling platforms. John has designed or led the design of many of Exxon's platforms in Malaysia and Australia. He has also been involved in many engineering studies related to platform abandonment for Exxon's platforms worldwide. In addition to his design related experience at Exxon Production Research, John has held operational positions with Esso Production Malaysia and Esso Exploration and Production UK. He holds B.S. and MS degrees in civil engineering from Oklahoma State University.

Richard A. Kasprzak: Rick Kasprzak is the coordinator of the Artificial Reef Program for the State of Louisiana Department of Wildlife and Fisheries. The focus of this program is to coordinate the conversion of decommissioned oil platforms into fish habitats. Mr. Kasprzak previously was a biologist with the Department of Wildlife and Fisheries, focusing on population dynamics of finfish and shrimp. He has also worked for the National Marine Fisheries Service. He was a member of the Marine Board committee responsible for *An*

Assessment of Techniques for Removing Offshore Structures. Mr. Kasprzak has a B.S. in biology from Loyola College and pursued graduate studies at the University of Alabama and Louisiana State University.

Charles H. Kelm: Charles Kelm is the Lead Well Engineer with Halliburton Energy Services. He has worked in the oil industry for over 24 years. He started with Humble Oil and Refining in 1971 after receiving his M.S. in electrical engineering from the University of Florida. He has worked for Exxon in Texas, Florida, Malaysia and Louisiana. After leaving Exxon, Mr. Kelm worked as a consultant and as an operations engineer for Blake Workover and Drilling. Mr. Kelm has extensive experience in reservoir and production engineering and technical supervision. He currently works for Halliburton Energy Service' Integrated Solutions Group in New Orleans and is assigned to TAS.

Paul L. Kelly: Paul L. Kelly is vice president of Rowan Companies, Inc., with responsibility for special projects and government and industry affairs. Mr. Kelly represents the oil service/supply industry on the U.S. Secretary of Interior's Outer Continental Shelf Policy Committee, and in April 1994 he was elected to a two-year term as chairman of that Committee. He also serves as a member of the National Offshore Safety Advisory Committee (NOSAC), sponsored by the U.S. Coast Guard. From 1985 to 1987 Mr. Kelly served as managing director of British American Offshore Ltd., London, Rowan's main contracting entity in the North Sea. Mr. Kelly has written widely on the subject of energy policy and is a member of the Editorial Board of World Oil. He has appeared on behalf of industry in numerous Congressional and federal agency hearings dealing with offshore oil and gas issues. He chaired a subcommittee of the OCS Policy Committee which did a landmark study of the federal OCS oil and gas program and sent findings and recommendations to revitalize the program to the Secretary of Interior, Bruce Babbit, in October 1993. In 1993-1994 Mr. Kelly served on the National Petroleum Council's Subcommittee on the Oil Pollution Act of 1990 (OPA) which wrote a report for U.S. Energy Secretary Hazel O'Lzary assessing from an energy production perspective the implications of a proposal by the Department of Interior's Minerals Management Service (MMS) to implement the financial responsibility requirements of OPA. In November 1994 he was asked by Assistant Secretary of Interior, Bob Armstrong, to appoint a subcommittee of the OCS Policy Committee to assist MMS in resolving several issues associated with OPA's implementation. The subcommittee 's findings and recommendations were forwarded to the Policy Committee, approved and forwarded to the Secretary of Interior in May 1995, and have significantly influenced amending legislation working its way through Congress this year. Mr. Kelly holds a B.A. (Political Science) and law degrees from Yale University.

James E. Kiesler: James E. Kiesler has 27 years experience in the offshore construction industry and has been involved in the installation of over 500 platforms and the removal of more than 200. He is a freelance consultant in the project management, engineering, and inspection of platform installation and removal. He has been Offshore Manager and Construction Division Manager for Teledyne Movible Offshore, General Manager of Global Movible Offshore, and most recently, Operations Manager of Total Abandonment Services (TAS)--an alliance for Teledyne Movible Offshore, General Manager of Global Movible Offshore, and most recently, Operations Manager of Total Abandorunent Services (TAS)--an alliance of Halliburton and Global for the abandonment of offshore wells and facilities. Mr Kiesler was a member of the Marine Board committee responsible for *An Assessment of Techniques for Removing Offshore Structures*. He has a B.S. in civil engineering from Purdue University.

Randy Lanctot: Randy Lanctot has been the executive director for the Louisiana Wildlife Federation, Louisiana's largest non-governmental conservation organization, since 1980. He edits and publishes the Federation's newspaper, *Louisiana Out-of-Doors*, and has served on a large number of task forces and commissions. Among others, currently he serves on the Oilfield Site Restoration Commission, the Governor's Task Force on Environmental Quality, Louisiana/Mississippi Habitat Advisory Panel of the Gulf of Mexico Fisheries Management Council. He is a graduate of the University of Wisconsin (Madison) and did graduate work at LSU's School of Forestry and Wildlife Management.

James R. Lehman: James R. Lehman has worked in the natural gas industry for 30 years with a number of companies including Panhandle Eastern Pipeline, Kansas Power and Light, Panhandle Eastern, Texas Eastern Pipeline and Trunkline Gas. His current position is principal engineer for Trunkline Gas. He is a professional engineer and a member of ASME, SGA, NSPE, and TES. Mr Lehman has served on numerous professional and technical committees and conferences. He received a bachelor of science in mechanical engineering degree from the University of Kansas.

John Lohrenz: John Lohrenz is Associate Professor in the Department of Chemical Engineering at Louisiana Tech University in Ruston, Louisiana. Previously, he held staff positions with three large oil companies and a company developing and installing geological computerized data bases worldwide. John was elevated to a Distinguished Member of the Society of Petroleum Engineers in 1986 and he was an inaugural recipient of the J.J. Arps Award from the Society for distinguished contributions to the fields of hydrocarbon economics and evaluation. He is a Registered Professional Engineer and serves as a consultant and as instructor for specialized adult courses in oil and gas project decision-making, offshore economics and applied statistics. John received B.S., M.S. and Ph.D. degrees, all in chemical engineering, from Kansas State, Oklahoma, and Kansas Universities, respectively.

Vance Mackey III: Vance Mackey is a design and construction engineer with Chevron Petroleum Technology Company where he is a member of a team which coordinates Chevron's Gulf of Mexico abandonment program. Previously he was a facilities engineer with Chevron U.S.A. Mr Mackey served on a subgroup of the API/NOIA ad hoc OCS lease abandonment group, which developed a template of abandonment cost ranges used by MMS for estimating future bonding requirements. He has been a project manager or consultant on over 40 abandonment projects. He received a B. S. in civil engineering from the University of Southwestern Louisiana.

R. Gary Magnuson: Mr. Magnuson joined the staff of the Center for Coastal Physical Oceanography to promote the application of CCPO research to the coastal and maritime community. Comprising his 18 years of experience in the development and advocacy of ocean and coastal policy and program initiatives, he has held senior positions with California Governor Edmund G. Brown, Jr., the Coastal States Organization, the Center for Marine Conservation and the National Ocean Service. He has also worked for a Member of Congress and held administrative positions with the Council of Governments in Fresno, California, and Denver, Colorado. Mr. Magnuson has served as a Board Member for the Coastal Society, Women's Aquatic Network, the American Shore and Beach Preservation Association and the Ocean Coalition; as a delegate to the Department of Interior's Outer Continental Shelf Policy Committee; as a member of the National Oceanic and Atmospheric Administration's Coastal Ocean Policy Roundtable; and as an advisor to the National Petroleum Council. Mr Magnuson received a B.A. from Wittenberg University and an MPA from the University of Colorado.

Charles M. McKinney III: Charles McKinney is an Environmental Scientist with the Minerals Management Service's Office of Environmental Policy and Programs. He joined the Department of the Interior in 1972 as a staff archeologist. From 1973 to 1984, Mr. McKinney served as Manager of the Department's Federal Antiquities Program. From 1984 through 1991, he served as coordinator for the National Natural Landmarks Program in the National Park Service. He served in the United States Marine Corps from 1961 through 1966. Mr. McKinney earned an M.A. degree in Anthropology/Old World Prehistory from American University.

Rex Mars: Rex Mars has worked in the oil and gas industry for 25 years. He is vice-president for sales with BIG INCH MARINE SYSTEMS, INC. He has also worked as an independent pipeline consultant. Mr. Mars is past chairman of the Petroleum Committee of the New Orleans and River Region Chamber of Commerce, a past chairman and permanent board member of the Oilfield Chili Appreciation Society, and a member of the API Pipelines Club of Houston and Offshore Operators Committee. He is a graduate of Northwestern State University.

Hal Osburn: Hal Osburn has 20 years experience with the Texas Parks and Wildlife Department, Coastal Fisheries Department, as a fisheries scientist and manager. He has conducted extensive research throughout the bays and the Gulf of Mexico. He is the Coastal Fisheries Policy Director and the Artificial Reef Program Director in Austin. Mr. Osbum is a coauthor of the Texas Artificial Reef Plan. He has a B.A. in zoology from the University of Texas at Austin and an M.S. in marine biology from Texas A&M University.

Chris C. Oynes: Mr. Oynes is the Regional Director for the Gulf of Mexico OCS Region of the Minerals Management Service (MMS). As the Regional Director, he manages the leasing of the OCS lands for oil, gas, and other mineral development, and supervises the regulation of operations and protection of the environment on those leases involving over 3,700 platforms and accounting for over 90 percent of domestic acreage under lease in the federal OCS. Since 1954, over $100 billion has been collected for federal offshore leasing and production activities. Mr. Oynes holds a Juris Doctor degree from George Washington University and has 20 years federal government experience related to developmental and operational activities associated with energy matters.

Allan Pulsipher: Allan G. Pulsipher is the Director of the Policy Analysis Program and the Interim Executive Director at the Center for Energy Studies at Louisiana State University. He has been a Program Officer with the Ford Foundation, a Senior Staff Economist with the President's Council of Economic Advisers, and the Chief Economist for the Tennessee Valley Authority. He was a member of the Marine Board committee responsible for *An Assessment of Techniques for Removing Offshore Structures*. He has a B.A. from the University of Colorado and a Ph.D. from Tulane University, both in economics.

Cynthia L. Quarterman: Ms. Quarterman was sworn in as Director of the Minerals Management Service (MMS) by the Secretary of Interior on March 22, 1995. In this capacity, Ms. Quartennan administers the programs to manage the mineral resources located on the nation's Outer Continental Shelf, including exploration, development and production of oil, natural gas, and to collect and distribute revenues for mineral development on Federal and Indian lands. Ms. Quarterman served as Acting Director of MMS since August 10, 1994 and as Deputy Director of MMS between September 1, 1993, and August 10, 1994. Prior to her appointment to Federal service, Ms. Quarterinan was an attorney in the Washington, DC firm of Steptoe and Johnson, where her practice centered on the regulation of energy-related commodities. She was also involved in transportation regulation, oil income tax and royalty litigation and general civil litigation. Aspects of her practice included issues relating to chemical commodities, oil pipelines and the crude oil market. Ms. Quarterman previously had served with law firms in Kansas City, Missouri, and New York City. She received an Industrial Engineering degree from Northwestern University, and obtained her Juris Doctor degree from the Columbia University School of Law. While at Columbia, she also served as Executive Editor of the *Columbia Journal of Environmental Law*. Prior to law school, she worked as an engineer for IBM. Ms. Quartennan is a native of Savannah, Georgia.

John D. Rullman: John Rullman is the Government and Regulatory Liaison for Exxon Company USA Production Department, New Orleans Operations with activities in the Gulf of Mexico, Louisiana, Mississippi, Alabama and Florida. He began is career with Exxon in California developing Exxon's prototype subsea production system. He served in operations, supervision and management assignments in Florida and California and, most recently, as Southeastern Division Environmental and Regulatory Affairs Manager. He is active in the Offshore Operators Committee, API and Louisiana Mid-Continent Oil and Gas Association. Mr. Rullman has a B.S. in Civil Engineering from Purdue University and a M.S. in Civil Engineering from the University of Illinois.

Mark Rubin: Mark Rubin is the Exploration & Production Environmental Coordinator for the American Petroleum Institute. API Exploration & Production serves the petroleum industry through the development and advocacy of industry positions on public issues and the sponsorship of administration of programs and projects that include technical research, development of standards for petroleum equipment and materials, the development of training materials and programs and coordination of local API chapters in oil and gas producing areas throughout the United States. Mark holds a Bachelor of Science Degree in Petroleum Engineering from Texas A&M University and an MBA from Southern Methodist University. Mark joined API in 1988 after working for six years as a petroleum engineer with Unocal in Texas. His career with API has included assignments in the development of standards for offshore safety and anti-pollution equipment and offshore platforms. In his current assignment with API he is responsible for research and advocacy on environmental issues affecting the oil and gas exploration and production industry.

Greg Schulte: Greg Schulte is a facilities engineer in Chevron's Design and Construction Group. He is a member of Chevron's platform abandonment team where he has removed over 40 structures and served as Chevron's "Rigs-to-Reefs" Coordinator for the last three years. In this capacity, Greg has been involved in eight platform reefings off the Louisiana Coast. Greg graduated in 1991 from the University of Missouri-Rolla with a B.S. in civil engineering.

Tom Slocum: A native of Galveston, Texas, Tom attended Texas A&M University and graduated with a B.S. degree in Chemical Engineering in 1970. After graduation he was employed by Halliburton Services in Dallas, Texas. Mr. Slocum was then transferred to the Houston Division for Halliburton Services and trained as an EIT in El Campo, Texas. He was then promoted to Field Engineer and later transferred to the Houston District as District Engineer. Mr. Slocum has served over twenty-five years in various operations, engineering, and management positions in Texas, New Mexico, and Louisiana for the Halliburton Company. Currently, Mr. Slocum is Program Manager in New Orleans for Total Abandonment Services (TAS) which is a strategic alliance between Halliburton Energy Services and Global Industries, Ltd., focusing primarily on offshore well abandonment and platform removal.

Charles Smith: Charles Smith is research program manager in the Technology Assessment and Research Branch of the Minerals Management Service. Prior to joining MMS, he was Chief of the Engineering Section, Civil Engineering Division, U.S. Coast Guard. He is a registered professional engineer and has published many technical papers pertaining to offshore structures. He received a B.S. in Civil Engineering from Virginia Military Institute, an M.S. in Structural Engineering from Georgia Tech, a Master of Engineering Degree in Applied Mechanics from the University of Virginia and a Doctorate in Structures and Dynamics at the George Washington University.

Berry St. John: Berry St. John is a shareholder in the New Orleans office of Liskow & Lewis, and heads the firm's environmental section. He received his J. D. degree from Tulane Law School in 1970, and was Managing Editor of the Tulane Law Review. Since joining Liskow & Lewis in 1970, he has concentrated his practice in the environmental and natural resources law fields, handling cases involving the Clean Water Act, the Clean Air Act, CERCLA, and the Outer Continental Shelf Lands Act. He has represented the offshore oil and gas industry in several national Clean Water Act cases. Mr. St. John has been active in the American Bar Association and has served as the Chairman of the ABA Section of Natural Resources, Energy and Environmental Law. He is on the adjunct faculty at Tulane University School of Law, where he teaches a course in Louisiana environmental law.

Robert B. Stewart: Robert B. Stewart is President of National Ocean Industries Association. Stewart joined the Association in 1987 to direct its government affairs program. He held the positions of Vice President and Executive Vice President before assuming his current position on May 1, 1990. He began his career in the petroleum industry with Skelly Oil in 1969 as a Regional Attorney with responsibility for a seven-state petroleum marketing region. In 1974, he established Skelly's government relations office in Washington. With the merger of Skelly Oil into Getty Oil in 1977, Bob became Manager, Federal Affairs in Washington for Getty Oil Company and was promoted in 1982 to Manager, Government Affairs in Getty's home office in Los Angeles. Bob was born in Oak Park, Illinois. He served in the United States Air Force as a Staff Judge Advocate, leaving the military in 1964 with the rank of Captain. He holds a B.A. degree from the University of Iowa and a Juris Doctor from the University's College of Law.

Daniel J. Sullivan: Dan Sullivan is manager of marine operations of J. Ray McDermott, Inc., a major offshore construction company operating in the Gulf of Mexico. He has 22 years of field experience in all aspects of offshore construction, including the removal of platforms. In his present position, Mr. Sullivan is responsible for all of McDermott's offshore operations in the Gulf of Mexico. He was a member of the Marine Board committee responsible for *An Assessment of Techniques for Removing Offshore Structures*. He received a B.S. in civil engineering from Tulane University.

W. L. (Win) Thornton: Win Thornton is a principal with Twachtman Snyder & Thornton, Inc. (TST), a consulting firm providing construction management, engineering and inspection services to the energy industry. TST is considered a leader in managing the abandonment of offshore platforms, production facilities and pipelines. Win has 20 years experience in offshore platform construction in the Gulf of Mexico previously with Oxy, Cities Service and Brown & Root. He holds B.S. and M.S. degrees in civil engineering from Georgia Institute of Technology and the University of Houston, respectively. Win is a member of the Artificial Reef Advisory Board of the Texas Parks and Wildlife Department.

Mary Ann Turner: Mary Ann Turner is a Senior Environmental Scientist with the Minerals Management Service, Branch of Environmental Operations and Analysis. She joined the Department of the Interior in 1964 with the Bureau of Outdoor Recreation, worked with the U.S. Geological Survey in 1974 as an Environmental Analyst and became a charter member of the Minerals Management Service. She holds degrees from Trenton State University and the University of Michigan.

Peter K. Veléz: P.K. (Peter) Veléz is Manager of Regulatory Affairs for Shell Offshore, Inc., a subsidiary of Shell Oil Company. Peter received a B.S. and M.S. in Civil Engineering from Rensselaer Polytechnic Institute in Troy, New York. He joined Shell's Midland Texas office in 1975. His assignments have included Civil Engineering, Operations Superintendent, Production Superintendent, Manager Production Engineering and Manager Health, Safety and Environment. He is active in trade association groups including: Chairman of the Louisiana Mid-Continent Oil and Gas Environmental Conservation Council, API ECEC - Water Issue Manager, Chairs the USCG National Offshore Safety Advisory Committee and Chairs the RP 75 Development Task Force. He was a member of the National Research Council's Marine Board Committee that studies Platform Abandonment issues.

Paul Versowsky: Paul E. Versowsky is presently an Engineering Advisor in the team based Offshore Facilities Services Group of Chevron Petroleum Technology Company. His team is responsible for the design, fabrication, and installation of Chevron platforms. The team also has the responsibility for the underwater inspection, maintenance and repair; and the abandonment of Chevron's Gulf of Mexico fleet of over 800 platforms. Paul is chairman of API C2/SC2 Offshore Structures and also serves as chairman of OOC's Technical Subcommittee on Offshore Platforms. Paul holds an M.S. degree in Civil Engineering from Texas A&M University and a B.S. degree in Engineering Sciences from LSU-NO (now the University of New Orleans). He is a registered professional engineer in the state of Louisiana.

Robert C. Visser: Robert Visser is a private consultant in Redondo Beach California and is active in all aspects of offshore oil and gas field development. Prior to forming Belmar Engineering he was with Shell Oil Company where he was involved in offshore development, transportation and production operations in the Gulf of Mexico, Cook Inlet, the Gulf of Alaska, offshore California, offshore Canada, and the in the Far East. Mr. Visser holds and M.S. degree in civil engineering from Delft Technical University in the Netherlands. He is the author of several published papers dealing with offshore technology and operations and holds a number of patents.

Mandy S. Williams: Ms. Williams joined Global Industries in October 1993 as Manager, Strategic Projects and in January 1994 was promoted to Vice President, Business Development. From 1991 to October 1993, Ms. Williams was President of the CEA Group, Inc., an energy and management consulting organization. From 1985 to 1991, she was employed by Transco Energy Company. Ms. Williams has over 15 years of oil and gas industry experience and is a member of NOSAC. Ms. Williams has a Masters in Business Administration from NYU/London Graduate School of Business with a major in Finance and a minor in International Business.

Charles A. Wilson: Chuck Wilson is a Professor in the Coastal Fisheries Institute and Chairman of the Department of Oceanography and Coastal Sciences at

Louisiana State University. He has authored over 100 publications and reports dealing with artificial reef development, fish life history, mariculture, and most recently the relationship between oil and gas platforms and associated fish communities. In 1985 he established the Louisiana Artificial Reef Initiative which explored and led to the development of the Louisiana Artificial Reef Program (The Louisiana Fishing Enhancement Act of 1986). Over the past 11 years he has served on a number of State and Federal Advisory boards, panels, and committees concerned with fishery management and habitat issues.

Robert Wiygul: Robert Wiygul was born in Jackson, Mississippi. He was graduated from Millsaps College, and the University of Mississippi School of Law where he was the Editor in Chief of the Mississippi Law Journal. After graduation he clerked for Judge W. Eugene Davis, U.S. Court of Appeals for the Fifth Circuit, and later practiced law with the firm of Gordon, Arata, McCollam and Duplantis in New Orleans, specializing in natural resources and commercial litigation. In 1990 he was the Burlington Northern Fellow in Natural Resources Law at the University of Colorado in Boulder. From 1990 to the present he has been employed by the Sierra Club Legal Defense Fund, most recently as the managing attorney of its Rocky Mountain office in Denver. He has served as lead counsel in cases involving the National Environmental Policy Act, the Clean Water Act, the Endangered Species Act, and numerous other state and federal environmental laws.

W. M. von Zharen: Wyndylyn M. von Zharen holds a dual appointment as graduate faculty for both the College of Geosciences and Maritime Studies and the College of Wildlife and Fisheries and is an associate professor of maritime, corporate and environmental law at Texas A&M University, Galveston. She is Coordinator of Maritime Policies and Management for the Texas Institute of Oceanography (TIO) and the University's International Environmental and Business Transaction Option Program which includes cooperative international environmental management programs with Latin America, Asia, Europe and Russia. She also serves as legal counsel for environmental affairs to the American Bureau of Shipping's Marine Services and is a lecturer for the American Association of Petroleum Geologists. Dr. von Zharen holds graduate degrees from the University of Florida, the University of Texas, and the University of South Carolina and has published numerous articles, chapters and several books in the area of law, particularly marine resources law. Her most recent publication is a book on the international environmental standard, *ISO 14000: Understanding the Environmental Standards.*

David J. Wisch: Dave Wisch has nearly twenty years experience with Texaco in offshore engineering in design and project management of both domestic and international offshore facilities. He is currently a specialist within the Offshore Engineering Department with responsibility for structural engineering, core technical, standards, administrative and budget functions. He has been active in both API and Offshore and Subsea Committee on Standardization, is the head of the U.S. delegation to SC 7 - Offshore Structures within ISO TC 67 and is Work Group Convener for ISO TC 67/8C 7/WG3 - Fixed Steel Offshore Structures. Dave holds B.S. and M.S. degrees in Civil Engineering from the University of Missouri-Rolla followed by postgraduate work at Tulane University.

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APPENDIX C

The Marine Board Report

An Assessment of Techniques for Removing Offshore Structures

AN ASSESSMENT OF TECHNIQUES FOR REMOVING OFFSHORE STRUCTURES

Committee on Techniques for Removing
Fixed Offshore Structures

Marine Board
Commission on Engineering and Technical Systems
National Research Council

NATIONAL ACADEMY PRESS
Washington, D.C. 1996

NOTICE: The project that is the subject of this report was approved by the Governing Board of the National Research Council, whose members are drawn from the councils of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The members of the panel responsible for the report were chosen for their special competencies and with regard for appropriate balance.

This report has been reviewed by a group other than the authors according to procedures approved by a Report Review Committee consisting of members of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

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The program described in this report is supported by cooperative agreement No. 14-35-0001-30475 between the Minerals Management Service of the U.S. Department of the Interior and the National Academy of Sciences and by interagency Cooperative Agreement No. DTMA91-94-G-00003 between the Maritime Administration of the U.S. Department of Transportation and the National Academy of Sciences.

Limited copies are available from:

Marine Board
Commission on Engineering and
Technical Systems
National Research Council
2101 Constitution Avenue, N.W.
Washington, D.C. 20418

Printed in the United States of America

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Preface

BACKGROUND

Nearly 3,800 platforms populate the U.S. federal outer continental shelf. Most of these are off the coast of Louisiana and Texas (MMS, 1995). The Minerals Management Service (MMS) of the U.S. Department of the Interior requires removal of platforms within one year after termination of the lease. Lease operators may remove platforms when the costs of operating and maintaining structures exceed revenues or when structures are obsolete or damaged. The options for disposing of offshore structures include complete removal with disposal ashore, placement in an approved ocean disposal site, conversion to a fishing reef, or removal for refurbishing and replacement elsewhere. In approved cases, maintenance in place is an alternative to removal. Removal must be to a depth that safeguards ocean shipping, that does not obstruct shrimp-trawling operations, or that allows for submarine passage and minimizes the threat of seabed obstructions.

The pace of platform removals continues to accelerate as aging platforms built in the boom years of the late 1960s and 1970s are taken out of service. More than 100 platforms have been removed from service in each of the last several years (181 were removed in 1993).

The most common procedure for removing fixed offshore structures is by cutting them into sections and removing them by lifting. The necessary submarine cutting is most often accomplished by submarine explosives, which can harm fish, turtles, and marine mammals. Damage from explosives can be mitigated by careful timing and operational procedures, but the extent of damage and the potential for mitigation have not been well documented. An alternative to explosives is cutting with jetting tools and torches or with mechanical cutting devices.

Many operators prefer using explosives because they cost less and are less risky. Experience has shown that, in most situations, severing and retrieving structures can be accomplished in one operation using explosives. Uncertainty is increased substantially if nonexplosive techniques prove to be inadequate or are unsuccessful during the removal process. Such failures may require active intervention, such as diver cutting. Diver interaction with a structure that has been damaged to an undetermined extent is inherently dangerous, time consuming, and expensive. The prevailing judgment of platform owners and operators is that explosive cutting is cheaper, safer, more flexible, and more reliable than available or reasonably prospective nonexplosive technologies for most platform removals.

Most of the problems with the explosive method are associated with the environmental impact, especially mortality of marine life in the region affected by the detonation. Although the presence of turtles and marine mammals around platforms is not well documented, the National Marine Fisheries Service of the U.S. Department of Commerce has identified explosive removals of offshore structures as a possible contributor to turtle and marine mammal mortality.

Fish kills associated with explosive removals are also of concern; however, only fragmentary data pertinent to fish kills are available. The range at which fish can be killed by explosives depends on several factors: the intensity of the explosive shock wave as determined by the type, configuration, and amount of explosive used; reflection and refraction of the shock wave, which varies with bottom material and water conditions (temperature, salinity, etc.); and the susceptibility of specific fish species to various shock waves.

The U.S. General Accounting Office (GAO) recently reviewed offshore structure removal operations and concluded that nonexplosive technologies merit further consideration and development because of concerns about the impact of explosive removal techniques on biological communities (GAO, 1994). The agency also concluded that the MMS has not adequately studied the costs and benefits of using nonexplosive technology that would reduce the risk of environmental damage from the removal of offshore structures. Moreover, the GAO concluded that certain actions by MMS may actually discourage the use of nonexplosive platform removal measures (e.g., an MMS proposal to relax limits on the use of explosives).

The MMS requested that the National Research Council (NRC) address the issues raised in the GAO report. A committee was convened to undertake a study of the technical issues and recommend alternatives for future MMS action. Specifically, the committee was asked to:

- review platform removal technology, including the costs of alternative techniques
- examine and appraise innovative technologies and techniques under development

- assess the occupational and environmental hazards of explosive and alternative removal techniques
- identify ways to mitigate the identified hazards

In the course of the study, the committee also learned about the requirements and concerns of other users of the marine environment (including shrimpers, fishers, recreational boaters, and people concerned about environmental damage), which should be taken into account in developing federal procedures for full or partial platform removal and for site clearance. The committee also assessed the adequacy of existing MMS regulations governing the removal of fixed offshore structures.

Based on its work, the committee prepared this report, which provides a comparative assessment of offshore structure removal technologies and existing and potential mitigation strategies for decreasing the damage to living marine resources. This report is intended to provide guidance to the MMS on the technical basis for development of offshore structure removal techniques and for updating pertinent federal rules and procedures. The report identifies alternatives for minimizing damage to the marine ecosystem from offshore structure removals.

COMMITTEE COMPOSITION AND SCOPE OF THE STUDY

A committee of 12 people was convened by the NRC Marine Board. Biographies of committee members appear in appendix A. Members of the committee include experts on offshore civil engineering, geotechnical engineering, marine construction, underwater blast effects and mitigation, technical assessment, biology, ecology, and management of living marine resources. Composition of the committee provided the scientific, technical, economic, policy, and practical expertise to assess current conditions and make recommendations for the future. The points of view of the offshore oil and gas industry and associated service industries were represented on the committee, as were the views of scientists involved in research on the specific living marine resources (sea turtles, marine mammals, and fish) that may be affected by explosives used to remove offshore structures.

The committee was assisted by liaison representatives from the MMS, which sponsored the study, and the National Marine Fisheries Service (NMFS), which is charged with ensuring compliance with regulations protecting living marine resources. The principle guiding the committee, consistent with NRC policy, was not to exclude any information because of possible bias, if the information was vital to the study, but to treat all points of view fairly.

The committee focused on the assessment of offshore structure removal technologies and associated hazards and the development of strategies to mitigate environmental damage. Disposal of platforms after removal, either on site, in deep water, or onshore, was outside the scope of this study. Although issues concerning the requalification of offshore structures for extended service and their reuse through state-sponsored "rigs-to-reefs programs" were originally excluded from the scope of the study, the committee found it necessary, for a full understanding of the complexity of the issues, to include a limited examination of the latter program and to present findings concerning the role of these programs in the Gulf of Mexico ecosystem. Although the assessment may provide valuable insights concerning removal of offshore structures from state as well as federal waters, an assessment of state rules was beyond the scope of the study. This report addresses technical and regulatory issues relating to the safe removal of offshore structures and minimizing harm to living marine resources.

HOW THE STUDY WAS CONDUCTED

The committee initiated the study with briefings from MMS and NMFS representatives involved in overseeing offshore removal activities. Experts from government, industry, and the research and environmental communities were invited to present information and insights on present and alternative methods of removal; the costs, reliability, safety, and measures for mitigating damage to the environment; and on regulatory issues, including possible changes in existing regulations. The committee reviewed available scientific literature on the effects of removals on living marine resources and invited representatives of other users of the marine environment, including the fishing, shrimping, boating, and recreation communities, to present their concerns about the effects of explosive removals on their activities and on the Gulf of Mexico ecosystem. The committee also heard presentations and obtained information from private companies about new technologies for nonexplosive removals and devices to mitigate the damage from explosions to marine animals.

A notice was issued in the *Federal Register* offering interested parties the opportunity to contribute information on all the major issues in the study. A copy of the notice and a list of those who responded can be found in Appendix B. This information was used by the committee in its analysis.

The report is not intended as a sourcebook on removal technology but as an assessment of the current status of explosive, nonexplosive, and mitigation techniques. The objective of this assessment is to formulate a strategy to ensure that as little harm is inflicted on the environment and on living marine resources as is compatible with safe, cost-effective operations.

ORGANIZATION OF THE REPORT

The report represents a synthesis of information gathered by the committee through briefings, review of the literature, technical presentations, analysis, and review of additional information gathered from interviews and articles.

- The Executive Summary is a synopsis of the report.
- Chapter 1 is an overview of the status of platforms at the present time and the regulations governing removals.
- Chapter 2 is an assessment of alternative cutting techniques.
- Chapter 3 is a discussion of technical considerations relevant to the selection of particular removal methods.
- Chapter 4 presents the environmental effects of current removal technologies.
- Chapter 5 is a comparative summary of the costs and benefits of alternative approaches to removals.
- Chapter 6 presents the major conclusions and recommendations that follow from the findings of the investigation.
- Appendices provide the reader with additional background information, a list of individuals who made presentations to the committee, the respondents to the *Federal Register* notice, and biographies of committee members.

This report is intended as a guide to the Minerals Management Service for making decisions about regulations governing the removal of offshore structures and about strategies for encouraging the use of techniques that will decrease damage to the environment and to living marine resources.

ACKNOWLEDGMENTS

The committee wishes to thank the federal liaisons, Charles Smith and Mary Ann Turner of the Minerals Management Service and Gregg Gitschlag of the National Marine Fisheries Service, for invaluable information on agency activities and perspectives on the issues under examination in this study. Other staff members of both agencies also made timely and enthusiastic contributions of time and information to the committee. Special thanks are also extended to individuals who spoke to the committee on behalf of professional and public interest groups (see appendix C). These presentations enabled the committee to grasp the broader context in which the technical issues are embedded.

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Figures and Tables

FIGURES

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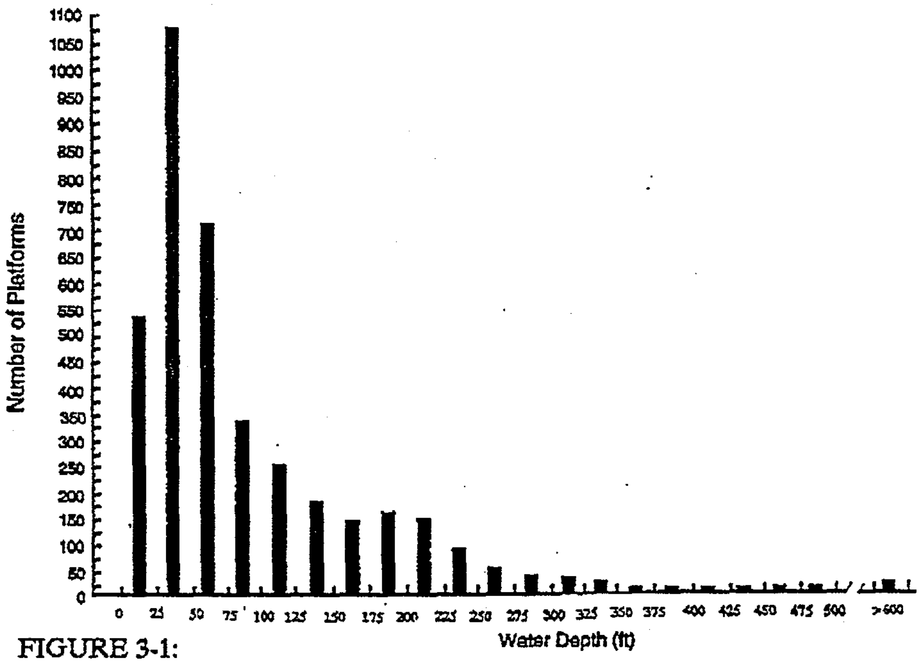
ERRATA: *An Assessment of Techniques for Removing Offshore Structures*. 1996.
Marine Board, National Research Council. Washington, D.C.

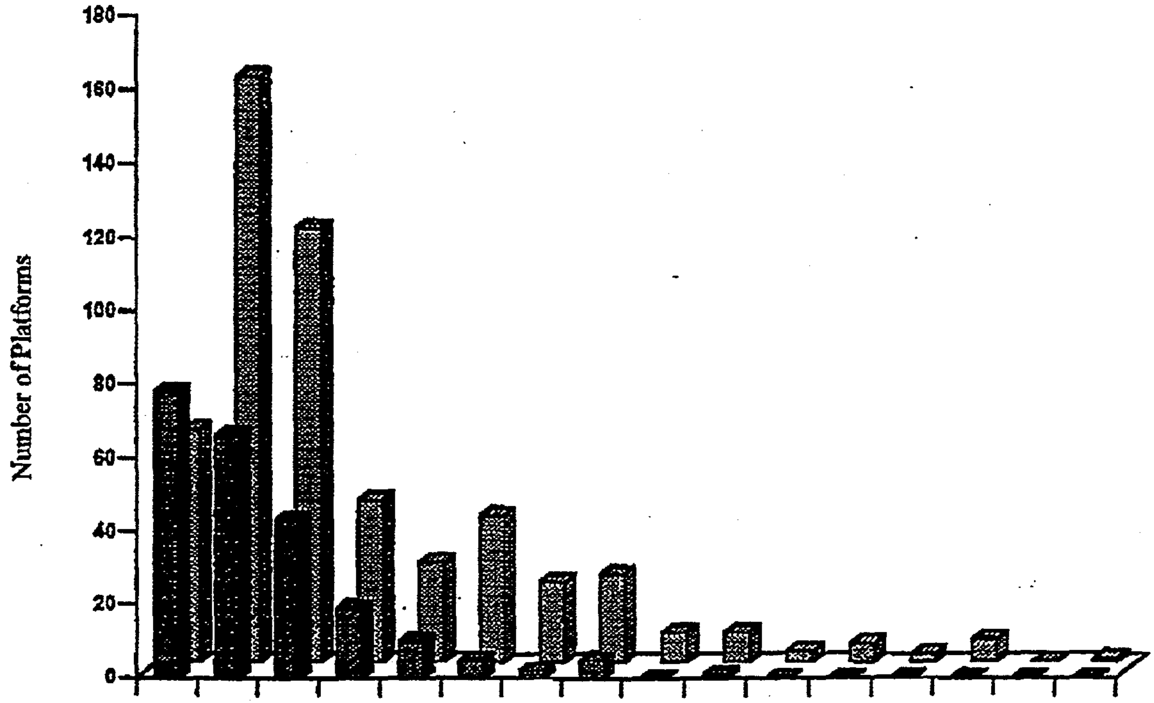
p. 3 and p. 56:

3. Allow partial removal of structures in 300 (or more) feet of water, with a cut at least 85 feet below the water surface when nonexplosive or advanced explosive techniques are used. If the top of the remaining structure is 200 feet or ~~more~~ less below the water, a buoy should be installed and maintained.

p. 6. FIGURE 1-2:



p. 31. FIGURE 3-1:



Water Depth Range (ft)	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400
Nonexplosive	78	66	43	19	10	5	2	5	0	1	0	0	0	0	0	0
Explosive	68	159	118	44	27	40	22	24	8	8	3	5	2	6	0	1

FIGURE 3-1 Number of platform removals, excluding caissons, by method and water depth (1985-1994). Source: Courtesy of Minerals Management Service.

Executive Summary

In the U.S. waters of the Gulf of Mexico today, there are about 3,800 platforms along the outer continental shelf in water depths ranging from less than 10 feet to nearly 3,000 feet. These platforms vary from simple vertical caissons supporting one well in 10 feet of water to a huge structure in 1,350 feet of water supporting some 50 wells and a tension-leg platform in 2,860 feet of water. Approximately one-fourth of these platforms are more than 25 years old and will soon require removal.

Platform abandonment has five steps: (1) obtaining necessary permits and approvals; (2) plugging the well; (3) decommissioning (removing hydrocarbons from equipment); (4) removing the platform (the subject of this report); and (5) clearing the site.

The Minerals Management Service (MMS) requires removal to a depth of 15 feet below mudline of all platforms within one year after production ceases. The industry currently removes about 150 structures per year, and all indications are that this figure will gradually rise as older structures reach their economic limits. Moreover, the ratio of deep-water structures to shallow-water structures that have been removed is small now but will increase as more deep-water platforms reach the end of production. Because deep-water platforms are much more expensive to remove, removal costs will inevitably increase. It is estimated that by the year 2000, the industry will spend more than $300 million per year for platform removals.

Nearly 70 percent of the platforms removed since 1987 have been removed with explosives. Nonexplosive methods used to remove the other 30 percent include mechanical cutting, abrasive cutting, and torch cutting by divers.

In a report by the U.S. General Accounting Office (GAO, 1994), questions were raised about whether current MMS requirements and practices governing removals are adequate to protect living marine resources, particularly with respect to the use of explosives. In response to the GAO report, MMS requested that the National Research Council undertake an assessment of technical issues related to the state of practice of explosive and nonexplosive platform removal technology. A committee was appointed under the auspices of the Marine Board.

The Committee on Techniques for Removing Fixed Offshore Structures reviewed reports and papers on the subject and developed data on the comparative costs and effects of explosive removal techniques on marine life. The committee heard presentations by industry representatives, experts on explosive and nonexplosive removal techniques, representatives of the shrimping and fishing industries, and representatives of state and federal agencies with regulatory responsibilities for removals and for protecting living marine resources. Representatives of environmental organizations and scientists conducting research on the ecology of the Gulf of Mexico also presented their views. The committee assessed the hazards of each removal process and ways they can be mitigated and appraised the adequacy of current regulations governing platform removals. Responses to questions posed by the MMS, which were published in the *Federal Register*, were also reviewed. Although there were different opinions among the parties about what should be done, the committee found sufficient common ground to recommend a framework for improving the program.

CONCLUSIONS

Regulations governing the removal of offshore structures need to be sufficiently flexible to accommodate the complex requirements of a wide variety of structures, a spectrum of marine life, and various users in the Gulf of Mexico.

The many different types and locations of platforms, an array of potential interactions with other users of the ocean, and the complexity and variety of the biological communities associated with platforms indicate that regulations for platform removals must be flexible if they are to be both efficient and fair to all interested parties.

Existing MMS regulations have functioned well for many years. They are prescriptive in some areas (such as establishing the depth to which a platform must be removed). In other areas, the regulations are more flexible and can accommodate unusual cases by approving specific procedures in specific cases. Since the regulations have been in place, the oversight and approval processes have been continuously improved and modified. For example, the National Marine Fisheries Service (NMFS) Observer Program was instituted to minimize the incidental taking of sea turtles and marine mammals. Another improvement made in recent years is the requirement for written reports and verification of site clearance.

There are significant opportunities to satisfy concerns of all interested parties without slighting the concerns of others. To take advantage of these opportunities, regulations must allow for individual circumstances and conditions.

Explosives are an economical and reliable tool for removing most structures, especially structures located in deep water.

At this time there is insufficient information about the mortality of fish from explosive removals to warrant changes in the current regulations and procedures. However, losses may be substantial, and continued efforts should be made to reduce them.

The available evidence on damage to sea turtles and marine mammals does not support prohibiting or further restricting the use of explosives in the platform removal process. However, the effects on fish population dynamics are uncertain. Prohibiting explosive removals would incur risks to divers and other offshore workers and would substantially increase the cost of platform removals. Research and development on techniques to remove platforms without using explosives, and on techniques that use smaller amounts of explosives more effectively, are progressing, as are research and development efforts on methods to mitigate the effects of explosives on marine life. Wider deployment and field testing are needed to evaluate the costs and benefits of these techniques.

The requirement that structures be removed to a depth of at least 15 feet below the mudline is a disincentive to the development and use of nonexplosive techniques and advanced techniques using smaller explosive charges.

The 15-foot depth requirement significantly increases the risks to divers and the costs of nonexplosive cutting or advanced explosive cutting, which requires divers to place explosives. Divers can work much more efficiently and safely near the mudline. Relaxing the 15-foot depth of removal requirement could encourage the use of nonexplosive or advanced explosive techniques using smaller charges.

The NMFS Observer Program has significantly improved understanding of the effects of platform removals on sea turtles and marine mammals. However, the effects of explosive removals on populations of fish that frequently reside near platforms are not well understood.

The NMFS Observer Program is valuable from both a research and an enforcement perspective. Continuing this program can significantly improve understanding of the effects of explosive removals on living marine resources and suggest ways to mitigate them. Available empirical information about the numbers, location, and variation of species of interest is too fragmented to support conclusions at this time about the effects on total fish populations or population dynamics. Further research is needed for a definitive understanding of these effects.

The simplest means of blast mitigation are unlikely to reduce significantly fish killed from explosive removal operations.

Although there is considerable uncertainty about how to mitigate fish kills using existing methods, the evidence seems to indicate that blast effects of multiple detonations are severe enough that reducing the size of the explosive charge (e.g., using 25-pound charges instead of 50-pound charges) or setting deeper detonations (e.g., 32 feet instead of 16 feet) will result in only a modest reduction in the number of fish killed.

Devices to scare fish away from platforms during explosive activity are not currently applicable for use in open ocean water. However, this line of technological development offers promise for the future and should be encouraged.

Fish in shallow water (less than 50 feet deep) are vulnerable to the pressure wave generated by explosions (high compression followed by rapid decompression). There has been some success in frightening fish away using acoustic or "fish scare" devices, for example, near water intakes. If these techniques could be adapted to the fish species, water depths, and distances (e.g., 200 to 300 feet) associated with platform removals in the Gulf of Mexico, the number of fish killed could be significantly reduced. Mitigation techniques, such as reducing the size of explosive charges and increasing the depth of emplacement of explosives, when used in conjunction with other mitigation techniques, would then be more effective in reducing the number of fish killed.

Limiting the number of near-simultaneous explosions to eight and limiting the weight of individual charges to 50 pounds may have undesirable effects.

Although limits on the number of detonations and the weight of individual charges were motivated by concern about the adverse effects of explosions on marine life, these limits may increase rather than decrease change. There are no data comparing the effects of a single explosive charge or near-simultaneous charges with the effects of a series of charges of the same size set off at timed intervals. In the absence of contrary information, estimates—based solely on existing data—of the number of fish killed from the explosive removal of a platform using a single charge must be assumed to be less than the number of fish that would be killed by a series of blasts set off at close intervals. Requiring a delay if more than eight explosions are necessary to remove a structure would expose surviving fish to subsequent explosions.

Because the 50-pound limit for individual charges is approved routinely under a generic permit, this limit may become a de facto industry standard, which would tend to discourage more discriminating analyses of the size of the charge needed to do a particular job. Such a standard could sometimes result in the use of a larger explosive charge than necessary. At other times, too small a charge might be used, which would necessitate using a second charge. In either case, more fish would be killed than if the appropriate-sized charge were used.

Nonlethal effects of explosive removals on living marine resources (e.g., temporary or permanent hearing loss or other physiological or neurological damage) on survival factors like productive performance or predator avoidance are not known. If species found near platforms represent specific year classes or are unique components of the reef ecosystem, the impact could be significant.

Studies are needed to determine the nonlethal morphological and physiological effects of high-level impulse noise on fish and other marine species affected by explosive removals.

Leaving platforms in place, partially removing them, toppling them in place, or using them for artificial reefs are options that are economically and environmentally attractive to many ocean users groups. Transport costs, concerns about liability, and regulatory issues now limit their use.

Commercial and recreational fishermen, environmentalists, and others concerned with maintaining or expanding the habitats provided by platforms (and reducing the damage they perceive when platforms are removed explosively) would, in some cases, prefer to leave platforms in place. Operators would avoid costs of removal. However, the potential liability and the costs of maintenance are perceived as outweighing these savings. Coastal states are hesitant to assume potentially unlimited liability for platforms left in place. Partial removal would solve most of the liability problems but is only feasible in deep water because of the need for navigation clearance. The cost of transporting a platform may limit its use as an artificial reef if a suitable site is far from the original platform site.

RECOMMENDATIONS

The committee recommends that the Minerals Management Service:

1. Change the minimum depth at which structures or well conductors must be severed from the current depth of 15 feet below the mudline to 3 feet below the mudline, provided that platform removal measures are employed that do not increase adverse environmental effects. Such measures include nonexplosive techniques, reduced charges, fish scare devices, or other effective mitigating methods. A 3-foot requirement would be consistent with regulations for the burial of pipelines as well as extensive research indicating that a 3-foot limit would provide ample protection against exposure of the remaining structural elements by erosion or scouring of the seabed.

2. Work with industry representatives, explosives experts, and other interested parties and user groups to develop guidelines for determining the size of explosive charges necessary for cutting a specific structural element.

3. Allow partial removal of structures in 300 (or more) feet of water, with a cut at least 85 feet below the water surface when nonexplosive or advanced explosive techniques are used. If the top of the remaining structure is 200 feet or more below the water, a buoy should be installed and maintained.

4. Remove the limit of a maximum of eight detonations at any one time during the removal process, but retain the requirement of a 0.9-second delay between individual detonations.

5. Incorporate into the permit process the flexibility, including necessary request procedures, to encourage testing of removal techniques that could reduce the risks to living marine resources.

The committee recommends that the National Marine Fisheries Service in cooperation with the Minerals Managment Service and appropriate state agencies:

6. Maintain the procedures of the existing Marine Mammal and Sea Turtle Observer Program, including the ban on night-time detonations, but shorten the required period of observation from 48 to 24 hours prior to detonation. The 48-hour timeframe is costly in terms of human resources and support equipment and does not produce any additional benefits over a 24-hour timeframe.

7. Systematically gather more information to augment available information about the species, numbers, and age distribution of fish killed and fish surviving when platforms are removed by explosives.

The committee recommends that the offshore oil and gas industry, in cooperation with the appropriate federal and state agencies:

8. Develop a guidebook through appropriate industry-supported groups on recommended practices for using explosives in the platform removal process. The guidebook should deal with issues of reliability, environmental effects, and mitigation strategies including

tradeoffs between depth of placement, size of charge, and associated environmental effects.

9. Sponsor and support programs to explore the feasibility and cost effectiveness of acoustic means of keeping fish at a relatively safe distance from removal operations.

10. Investigate means of incorporating safe removal techniques and the reduction of environmental damage techniques into the initial design process for platform removal.

The committee recommends that appropriate state agencies, in cooperation with the appropriate federal agencies and the offshore industry:

11. Evaluate existing state-administered artificial reef programs to enhance their potential for accommodating more platforms as well as their potential for providing commercial, recreational, or environmental benefits to other ocean users.

REFERENCE

GAO (U.S. General Accounting Office). Offshore Oil and Gas Resources: Interior Can Improve Its Management of Lease Abandonment. Washington, D.C.: U.S. Government Printing Office.

1

Overview of Existing Offshore Structures and Removal Regulations

In 1946 the first exploratory well was drilled on the outer continental shelf (OCS) of the Gulf of Mexico, about 30 miles south of Morgan City, Louisiana. In 1947 the first commercially successful well was drilled from a fixed platform in about 16 feet of water, 12 miles south of Terrebonne Parish, Louisiana. The platform was built of timbers and wooden pilings. Today on the U.S. Gulf of Mexico OCS there are about 3,800 platforms in water depths ranging from less than 10 feet to nearly 3,000 feet.[1]

This report concerns the removal of platforms in OCS waters. It does not include the removal of more than 1,000 structures in state waters off the coast of Louisiana and Texas, almost all of which are installed in water depths of less than 35 feet. Most of these are small structures that support one to four wells and are relatively inexpensive to remove.

The platforms in use on the OCS today range from a simple vertical caisson (a single pile with a minimal deck) supporting one well in shallow water to the tension-leg platform Auger, located in 2,860 feet of water in the western Gulf of Mexico. A typical OCS platform supports numerous individual wells drilled directionally from the platform to bottom-hole targets thousands of feet away.

Conventional platforms are secured to the seafloor by steel pipes called piles (or pilings) driven through the legs of tubular frames called jackets. Only the upper portions of the jacket are visible above the water surface. The deck portion of the platform rests on top of the jacket. Most decks are multilevel structures that support drilling rigs, production equipment, crew quarters, and serve various other functions. The deepest conventional fixed platform is Shell's Bullwinkle platform, which is located in 1,350 feet of water in the central Gulf of Mexico.

EXISTING PLATFORMS

The focus of this report is the removal of older platforms in relatively shallow water (less than 300 feet). Figure 1-1 shows the age distribution of existing platforms in the Gulf of Mexico. Approximately one-fourth of the platforms in the OCS region of the Gulf of Mexico are more than 25 years old and have reached or exceeded their design life. These older platforms, and some newer platforms in short-lived fields, will require removal in the near future. Larger platforms in deep water (more than 300 feet) will require highly sophisticated removal methods; but they are few in number, and most of them are not expected to be removed for many years.

To date (through 1995) the only platforms removed from federal waters have been in the Gulf of Mexico. Because there are no existing platforms on the Alaska OCS or the Atlantic OCS, and only 23 on the Pacific OCS, this study is focused on platforms in the Gulf of Mexico. Figure 1-2 charts the distribution of existing platforms, including free-standing caissons, by water depth. Both caisson and other platform removals have been catalogued since 1985. Of the 900 or so platforms removed, approximately 30 percent were caissons (MMS, 1994); more than 95 percent of these caissons were in 100 feet of water or less. About 70 percent of the total were in 100 feet of water or less.

Platform Types and Configurations

The types of platforms and range of configurations vary widely. Platforms are designed to be used under specified environmental conditions and operating loads. In shallow water, the intended use may be simply to provide protection for a single well, as with a single-well caisson or multipile well-protector platform. Oil and gas produced from single caissons and well protectors are transported through in-field flow lines to gathering platforms where they are metered, processed, separated, and sold. In deeper water, a single large platform may be used to support both drilling and production of several wells. Platforms may also be used to house production personnel, gas compressor stations, oil storage tanks, or

[1]Technical note: The U.S. offshore oil and gas industry and associated support industries use the U.S. customary measurement system for water depths (feet) and equipment diameters (inches). In this report, this system (feet and inches) is used in all discussions and data.

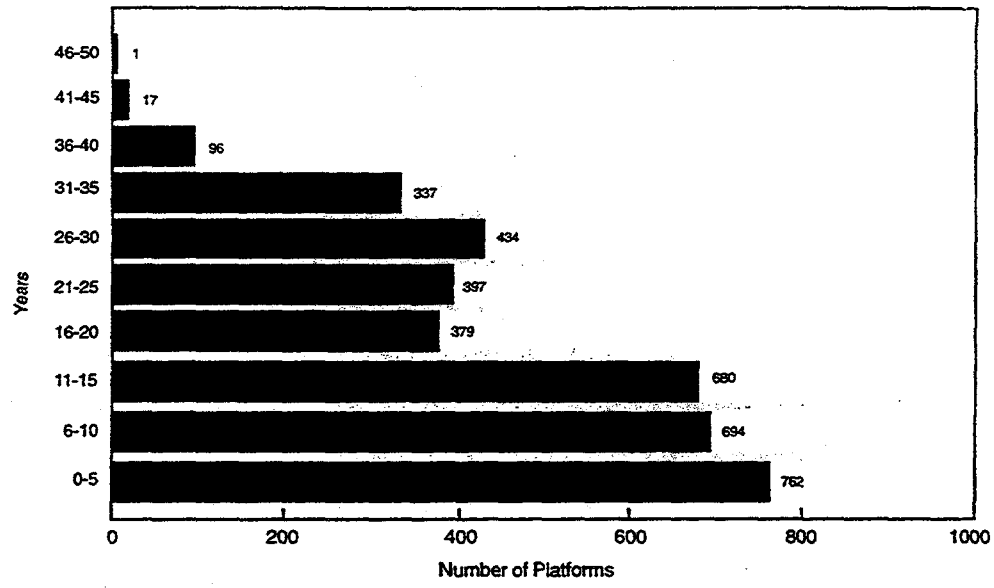


FIGURE 1-1 Number of existing platforms, including caissons, by age. Source: Courtesy of Minerals Management Service.

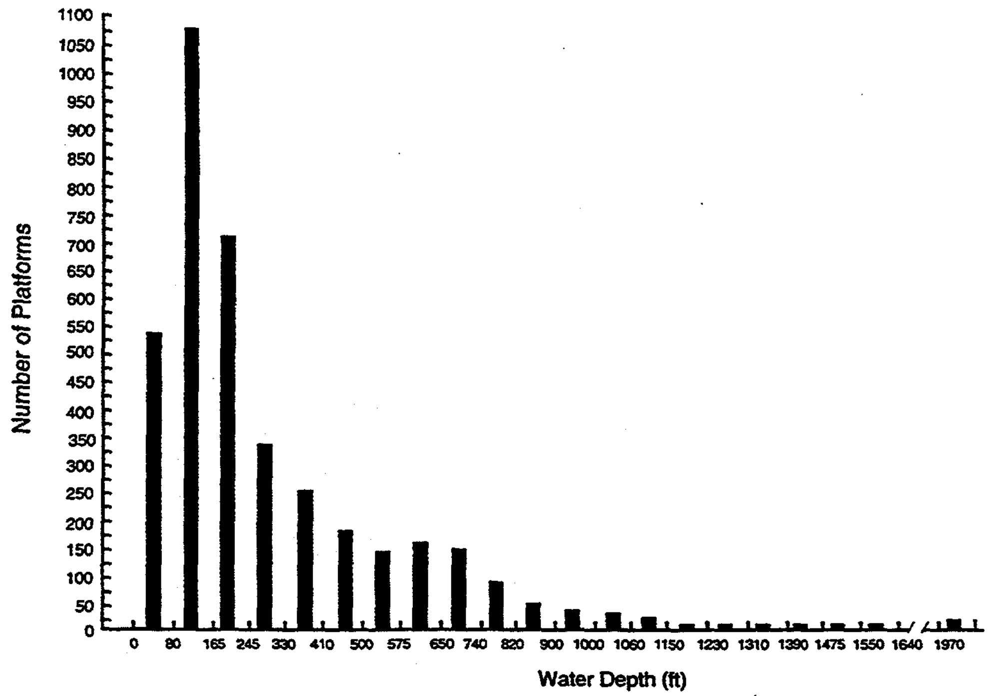


FIGURE 1-2 Number of existing platforms, including caissons, by water depth. Source: Courtesy of Minerals Management Service.

pipeline junction and metering facilities. The overwhelming majority of platforms are intended for drilling and production.

Environmental factors that influence platform design include water depth; soil strength; and wind, wave, and current loads. Operating loads include the weight of production equipment for processing oil or gas. If platform rigs are required, drilling loads must also be taken into account.

Although it is difficult to sort all platform configurations into categories, most platform types may be characterized as follows:

- free-standing caissons with well(s)
- well-protector jackets
- braced caissons with wells
- conventionally piled platforms with wells
- conventionally piled platforms without wells
- skirt-piled platforms
- special application platforms (e.g., mud slide resistant, wells in legs, deep-water structures)

The distribution of platform types presently standing in OCS waters is shown in figure 1-3.

Free-Standing Caisson with Well(s)

There are more than 600 free-standing caissons with wells, which comprise 16 percent of the platforms on the Gulf of Mexico OCS. Most are located in 100 feet of water or less. The purpose of most caissons is simply to protect wells from damage. Most free-standing caissons are single-diameter steel pipes that range from 36 inches to 96 inches in diameter. The caisson is driven into the soil to a sufficient depth to support itself and to resist environmental loads under storm conditions. The thickest section of the steel pipe is at or slightly below the sea floor at the point of greatest stress from wave and current loading. Wells are inside the caissons and consist of a variety of casing strings that may or may not be cemented together. Figure 1-4 shows an example of a caisson with a well with three casing strings. In smaller-diameter caissons the annulus between the well and caisson are cemented, but in larger-diameter caissons (60 inches to 96 inches) annuli are not usually cemented.

Another type of free-standing caisson is the tapered caisson (also figure 1-4). In deeper water these caissons may be 14 feet in diameter at the mudline and tapered to 6 feet at the water surface. Tapered caissons may support three wells or more. At these depths, tapered caissons usually have 2-inch to 3.5-inch-thick walls at and below the mudline. The procedures for removing a 36-inch-diameter caisson in 25 feet of water are different from the procedures for removing a 14-foot-diameter caisson with three partially cemented wells in 200 feet of water.

Well-Protector Jackets

Well-protector jackets comprise a second type of platform. These platforms are multipiled jackets, with or without decks, that do not support drilling or production equipment (figure 1-5). The pilings are generally small in diameter (up to 30 inches) and are used in shallow water (up to about 100 feet). Well-protector jackets are used to protect wells (generally no

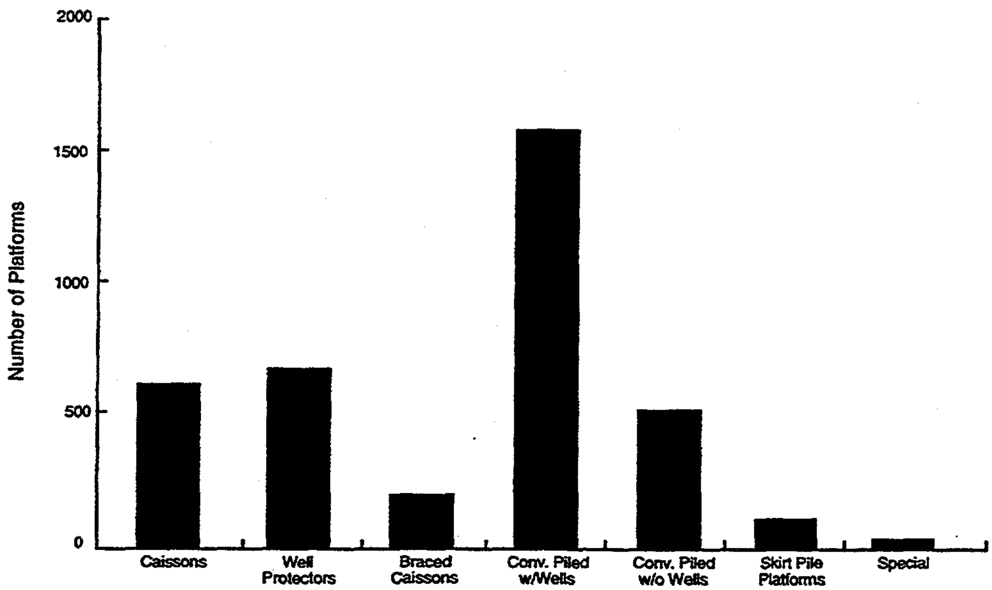


FIGURE 1-3 Distribution of existing platforms in the Gulf of Mexico. Source: MMS (1994, 1995).

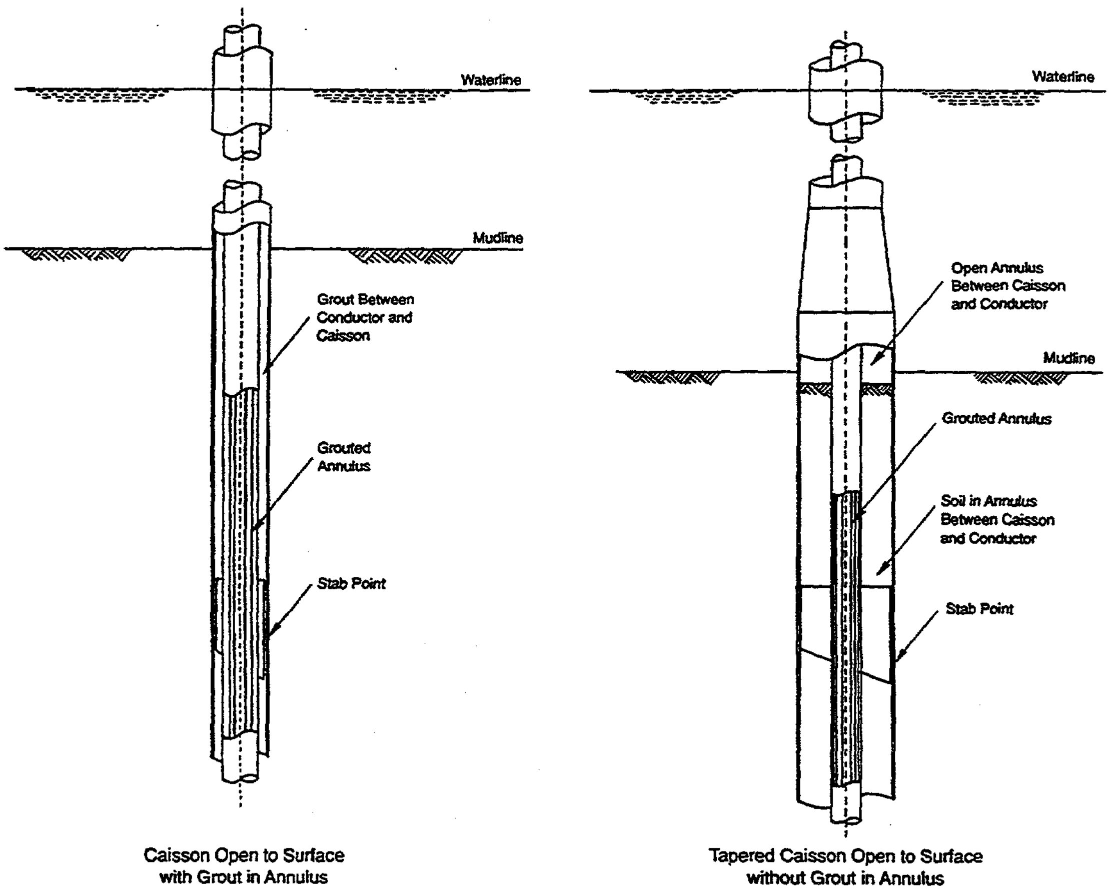


FIGURE 1-4 Examples of caissons with wells. Source: Courtesy of Twachtman Snyder & Thornton, Inc.

more than four or six). The wells are often outside the piling, but they may be drilled through the piling. The oil and gas from well-protector jackets are transported through flow lines connected to a production platform. There are 650 well-protector jackets remaining on the Gulf of Mexico OCS, most of them in 100 feet of water or less (MMS, 1994, 1995). Well-protector jackets comprise 17 percent of the platforms remaining in the Gulf of Mexico.

Braced Caissons with Well(s)

"Braced caissons with well(s)" is a term that describes most minimal platforms. Minimal platforms are useful for developing some economically marginal fields. In some minimal platforms, the well or caisson is used as one leg of a tripod; the other two may be conventionally piled legs (figure 1-6) or skirt piles that terminate below the water surface (figure 1-7). Skirt piles are almost always grouted to the skirt pile sleeve. Braced-caisson platforms can support a few wells, generally no more than three or four, and can be used in water up to 300 feet deep. Most braced-caisson platforms are in 50 to 200 feet of water. More than 200 have been built and installed since 1986; very few have been removed.

Conventionally Piled Platforms with Wells

The most common type of offshore structure in the Gulf of Mexico OCS is the conventionally piled platform with wells. In these structures, the pilings are driven through the legs of the jackets into the seabed. The number of piles can vary from three to eight or more (figure 1-8). The pile diameter can be as small as 24 inches (or smaller) or as large as 96 inches, depending on design requirements. The pile-to-jacket annulus in conventionally piled platforms is sometimes grouted. Mud mats near the bottom of a jacket provide temporary support until the piles are installed. In many cases the jacket is installed over one or more exploratory wells; several more development wells are then drilled through conductor slots in the jacket. There can be as few as one or two wells or as many as sixty. There are approximately 1,600 platforms of this type remaining in the Gulf of Mexico at all water depths. Conventionally piled platforms comprise 42 percent of the total.

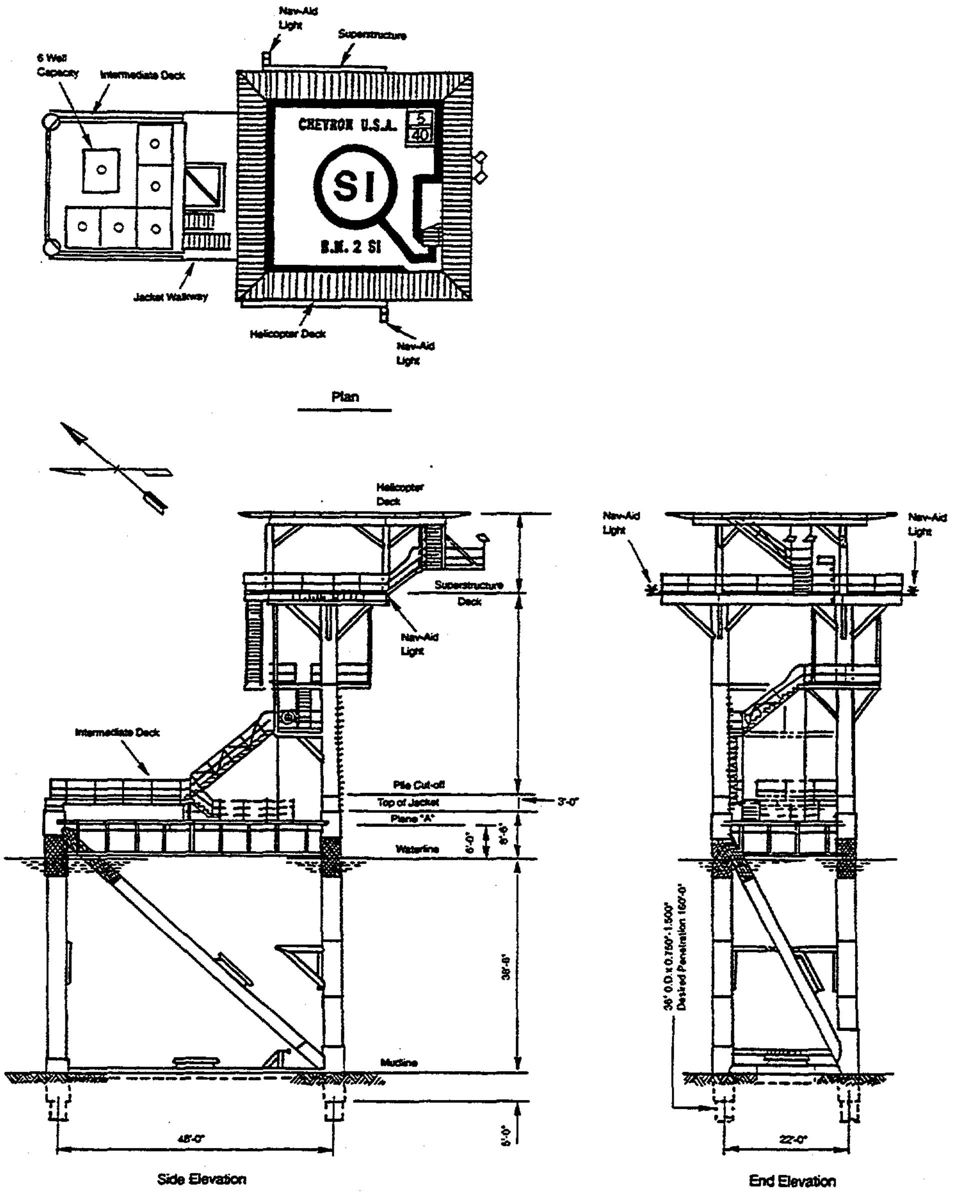


FIGURE 1-5 Well-protector platform. Source: Courtesy of Chevron U.S.A., Inc.

Conventionally Piled Platforms without Wells

Conventionally piled platforms without wells are used to house personnel (figure 1-9) and to support gas compressor stations, production equipment, oil storage tanks, or pipeline junction or metering facilities. Although no wells are located on these platforms, the design considerations are similar to conventionally piled platforms with wells. Platforms without wells are usually located in water less than 300 feet deep. There are about 500 of these platforms, approximately 13 percent of the total.

Skirt-Piled Platforms

Skirt-piled platforms have skirt piles driven through sleeves that terminate under water 50 to 100 feet above the seafloor (figure 1-10). This type of platform may also have conventional piling in the jacket legs in addition to skirt piles. Skirt piles may be from 36 inches to 84 inches in diameter. Like some of the minimal platforms described above, the piles are grouted to the sleeves. Skirt piles provide additional axial and lateral load bearing without adding much surface area, which minimizes wave loading. This type of platform is

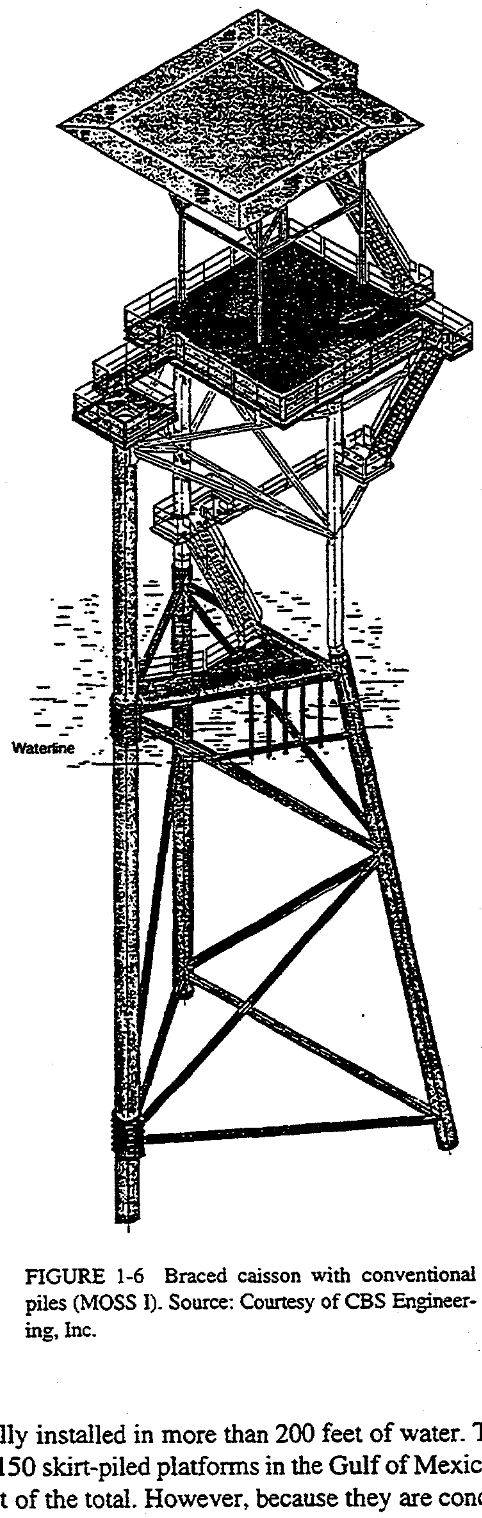


FIGURE 1-6 Braced caisson with conventional piles (MOSS I). Source: Courtesy of CBS Engineering, Inc.

generally installed in more than 200 feet of water. There are about 150 skirt-piled platforms in the Gulf of Mexico, only 4 percent of the total. However, because they are concentrated in deep water, they will be expensive to remove.

Special Application Platforms

There are several types of special application platforms. For example, around the mouth of the Mississippi River, where the upper layer of sediment is very soft and thick, downslope movement of sediment, or mud slides, can be triggered by hurricanes. Mud slides exert tremendous lateral force on platform pilings. Consequently, pilings and jacket legs of platforms installed in areas subject to mud slides are large (12 feet or more in diameter) and thick (4 to 6 inches). Jacket legs in areas prone to mud slides commonly extend 50 to 75 feet below the mudline, and wells are drilled through the vertical legs of the platform (figure 1-11). There are relatively few of these platforms in the Gulf of Mexico, but removal costs will be very high.

CONSTRUCTION EQUIPMENT USED IN PLATFORM REMOVALS

In general, platforms are removed in the reverse order of installation: first the deck is removed, then the conductors, the piling, and the jacket. The components of a platform are often large and heavy. Jackets in 100 feet of water can weigh as much as 600 tons and in 300 feet of water more than 2,000 tons (NRC, 1985). Decks can weigh from 100 to more than 3,000 tons. Conductor weight varies with the number and size of casing strings and water depth; conductors usually weigh from 20 tons to more than 150 tons. Soil shear resistance on the pipe, depending on the depth of the cut, can add several tons to removal forces.

Construction equipment used to decommission platforms, plug and abandon (P&A) wells, and remove platforms varies from small lift-boats to large derrick barges. Lift-boats, which are limited to water 100 feet deep or less, are self-propelled, self-elevating vessels with three or four legs connecting a lower mat to the upper hull. The mat is lowered to the seafloor, where it serves as a shallow foundation supporting the upper hull, which is jacked up above the water surface. The hull dimensions are generally 70 feet by 120 feet or less. Lift-boats can house from 10 to 25 people. When outfitted with cranes, lift-boats have a capacity of 10 to 70 tons. They can be used to P&A wells, set cement plugs, and remove production tubing. Lift-boats are not equipped to remove wells with multiple casing strings and are used only to remove very shallow, lightweight platforms.

Derrick barges are large, floating, ocean-going vessels with either ship-shaped or rectangular hulls. Some are self-propelled, but most are towed by tugboats. Although a few derrick barges are dynamically positioned and hold station by means of thrusters, most are anchored at platform sites, with as many as eight drag-embedment anchors and up to a mile of large (1.5 inches to 2.5 inches in diameter) anchor wire per anchor. Derrick barges are equipped with revolving cranes that are built into the hull of the vessel. Crane capacity on a small derrick barge (240 feet by 70 feet) ranges from 150 to 300 tons. Larger hull vessels (350 feet by 100 feet) have crane lift capacities of 600 to 800 tons. A few large derrick barges

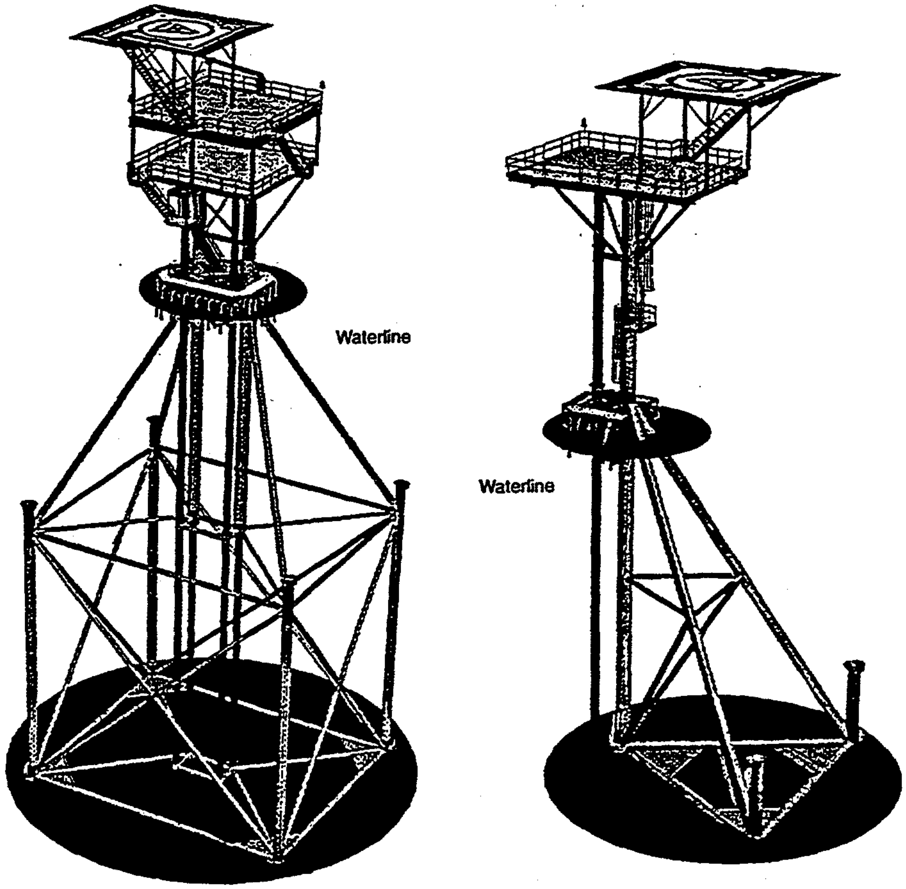


FIGURE 1-7 Braced caisson with skirt piles (Seahorse). Source: Courtesy of Atlantia Corporation.

in the Gulf of Mexico have 1,600- to 4,000-ton lift capabilities. (Some vessels based in the North Sea have more than 10,000-ton lift capacities.)

Derrick barges have quarters and support facilities for 50 to 200 people and carry tugs, cargo barges, crew boats, and helicopters as part of the construction equipment. Personnel includes surveyors, divers, welders, riggers, crane operators, mechanics, cooks, and supervisors. The operational people are supported by engineers, estimators, logistics personnel, and others to plan and perform each job as safely and efficiently as possible in the hostile offshore environment.

REGULATIONS, LAWS, AND PERMITS

Since 1953, the U.S. Department of the Interior has managed the development of OCS oil and gas resources. Within the department, the Minerals Management Service (MMS) issues and manages OCS oil and gas leases. Among other responsibilities, MMS ensures that when production ends, sites are abandoned in a manner that minimizes damage to marine life and the environment. MMS ensures that the responsible party plugs abandoned wells to prevent leaks, removes platforms, and clears the lease site of obstructions that might be hazardous to commercial fishers, shrimpers, and other shipping.

The MMS has a comprehensive program to regulate platform removals. As new issues and concerns arise, the MMS reviews existing regulations and issues revised regulations or notices-to-lessees with additional requirements or procedures. Two examples of this revision process are the U.S. Department of Commerce's National Marine Fisheries Service (NMFS) Observer Program and the Site Clearance Verification Program. The former provides a 48-hour observation period to ensure that there are no sea turtles or marine mammals in the vicinity of a platform before it is removed. The latter program requires that the area be trawled with a special net after a platform is removed to ensure that there is no remaining debris. The MMS has also been active in developing and promoting the Safety and Environmental Management Program concept with operators and contractors to improve the safety and environmental aspects of offshore operations and facilities.

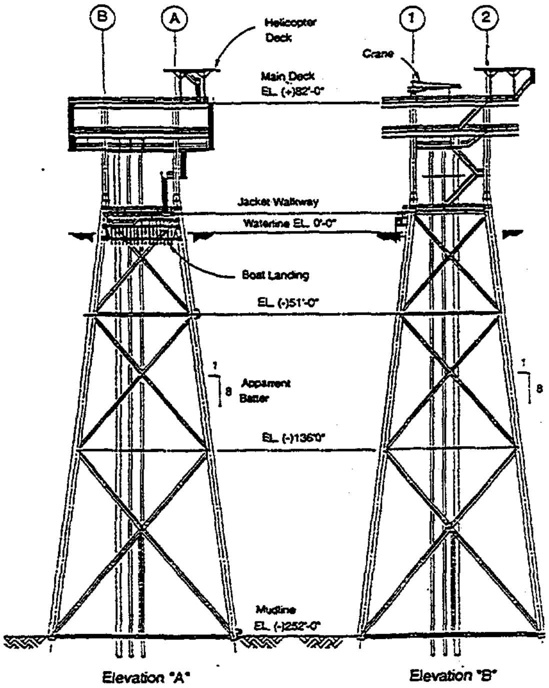


FIGURE 1-8 Conventional 4-pile platform with wells. Source: Courtesy of Pinnacle Engineering.

Federal Laws and Regulations

A number of laws and regulations that apply to the removal of offshore platforms are summarized in this section. A detailed description of applicable laws appears in appendix D.

Outer Continental Shelf Lands Acts

The Outer Continental Shelf Lands Act (OCSLA) requires the secretary of the interior to administer mineral leasing, exploration, and development on the OCS. Objectives of OCSLA include balancing the development of resources with protection of the environment and encouraging the development of new and improved technology that will eliminate or minimize damage to the environment. OCSLA also mandates that the secretary of the interior require the use of the best available and safest technologies.

National Environmental Policy Act of 1969

Under the National Environmental Policy Act of 1969 (NEPA), all federal agencies, including MMS, are mandated to promote efforts to reduce damage to the environment. Under NEPA, agencies must study alternative courses of action when a recommended action might have significant adverse effects on the environment.

Endangered Species Act

The Endangered Species Act requires, among other things, that federal agencies consult with the secretaries of commerce and the interior to ensure that no action taken to remove OCS platforms jeopardizes any endangered or threatened marine species. For example, the NMFS (Commerce) and MMS (Interior) formally agreed on measures for protecting endangered sea turtles in the Gulf of Mexico when oil and gas structures are removed using explosives.

Marine Mammals Protection Act

The Marine Mammal Protection Act prohibits the "taking" of marine mammals except as approved under the act by the secretary of commerce. The term "taking" means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." "Harassment" is defined as "an intentional or negligent act or omission that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns that include, but are not limited to breeding, feeding, or sheltering."

"Harm" is defined as "an act that actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering." MMS also addresses the effects of abandoning OCS leases on marine mammals in environmental impact statements and environmental studies.

Other Laws and Regulations

Other federal laws and regulations that affect platform removal operations include the Magnuson Fisheries Conservation and Management Act, the Clean Water Act, the National Fishing Enhancement Act, U.S. Coast Guard regulations, and National Oceanic and Atmospheric Administration regulations. State laws include the Louisiana Artificial Reef Initiative Act and the Texas Artificial Reef Act.

Platform Removal Permit Process

The permit process for removal of an offshore platform in federal OCS waters requires the following steps:

- The operator submits an application with the appropriate form and information to the MMS (the same form is used for explosive and nonexplosive platform removals). Prior to submitting this form, the operator must

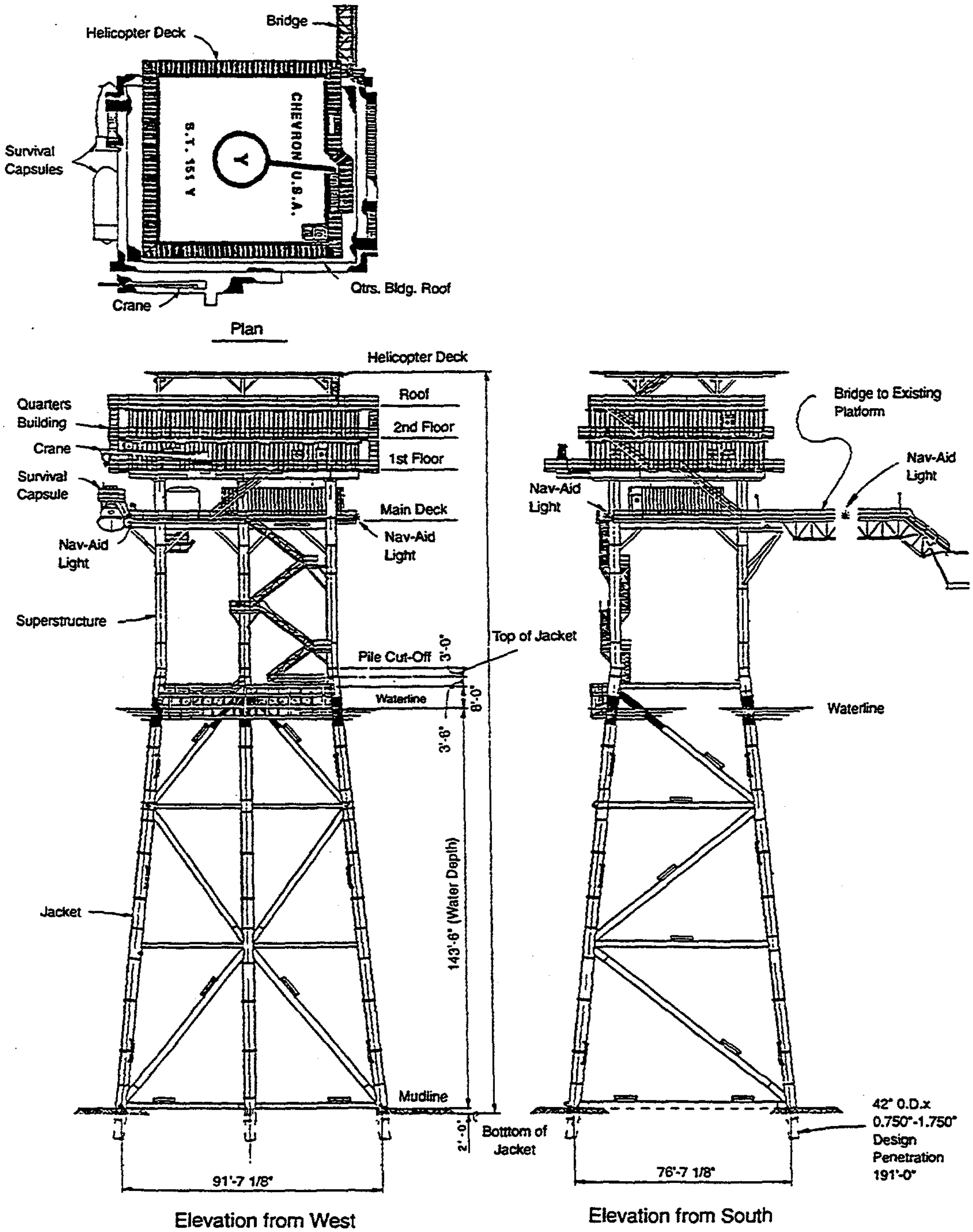


FIGURE 1-9 Conventional 6-pile quarters platform. Source: Courtesy of Chevron U.S.A., Inc.

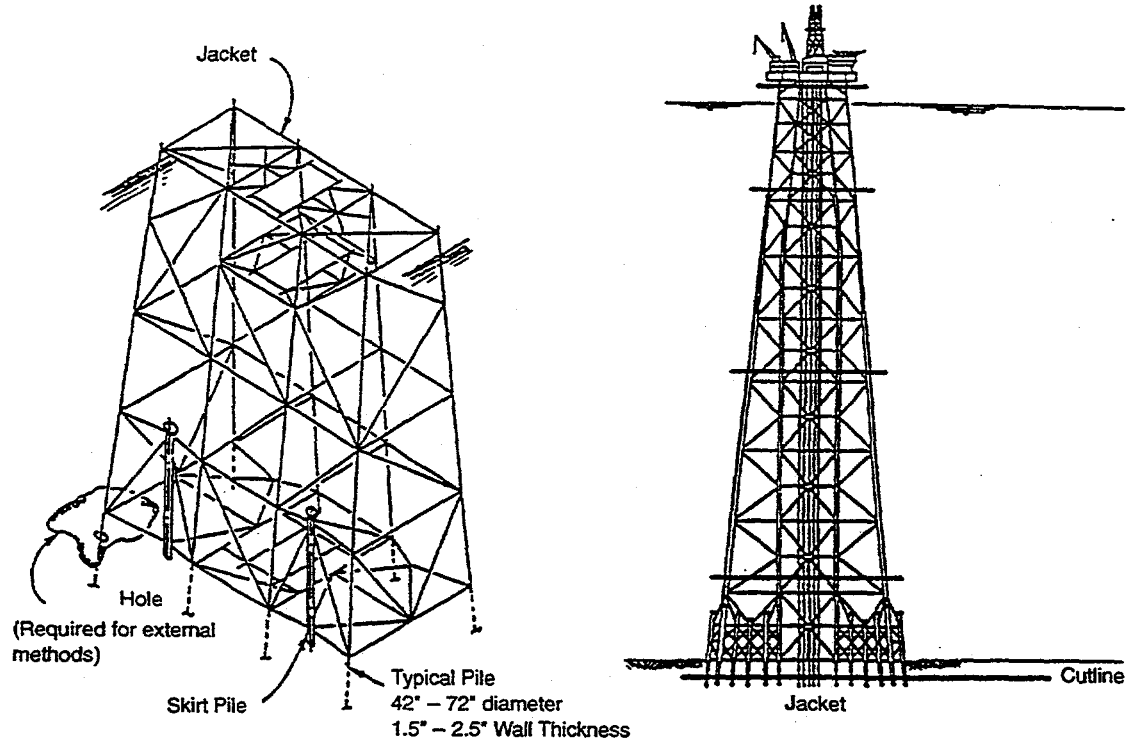


FIGURE 1-10 Examples of skirt-piled platforms. Source: Courtesy of Shell Offshore, Inc.

have already properly abandoned the well(s) per applicable MMS regulations.

- MMS consults with NMFS and the Marine Mammal Commission to ascertain compliance with the Endangered Species Act, Section 7, and the Marine Mammal Protection Act and to identify protective mitigation measures and monitoring requirements for the permit. If the removal plan involves the use of explosives, but less than 50 pounds per charge, a generic Incidental Take Statement is prepared. If explosives involve a single charge of more than 50 pounds, the applicant, in consultation with NMFS, must submit a detailed Incidental Take Statement.
- When the platform removal is scheduled, the operator notifies the MMS district office prior to commencing removal operations. If explosives will be used, NMFS observers are notified to go offshore. NMFS observers must be on site for 48 hours prior to the use of explosives.
- After platform removal, the operator performs the final site clearance operations, which include removal of obstructions on the seafloor and verification by trawling in depths of up to 300 feet. In depths of more than 300 feet, the operator must verify site clearance by a means approved by the MMS.
- The operator submits a completion report to the MMS detailing the removal operation and certifying that the site has been cleared.

Rigs-to-Reef Program

If the operator elects to participate in a state rigs-to-reef program, either by placing the structure at an approved reef site or by leaving it in place (after obtaining MMS approvals to remove the platform), application must be made through the appropriate state agency:

- In Louisiana, the operator submits an application to the U.S. Department of Wildlife and Fisheries; in Texas, to the Texas Department of Parks and Wildlife.
- The appropriate state agency applies for a U.S. Army Corps of Engineers permit. The Corps has jurisdiction over the explosive removal of the structures (they do not have purview over nonexplosive removals). The operator informs the Corps whenever a platform removal is planned, and the Corps then takes the following course of action: (1) if the removal is in inland state waters, the Corps reviews the application and recommends approval for the removal but sends the

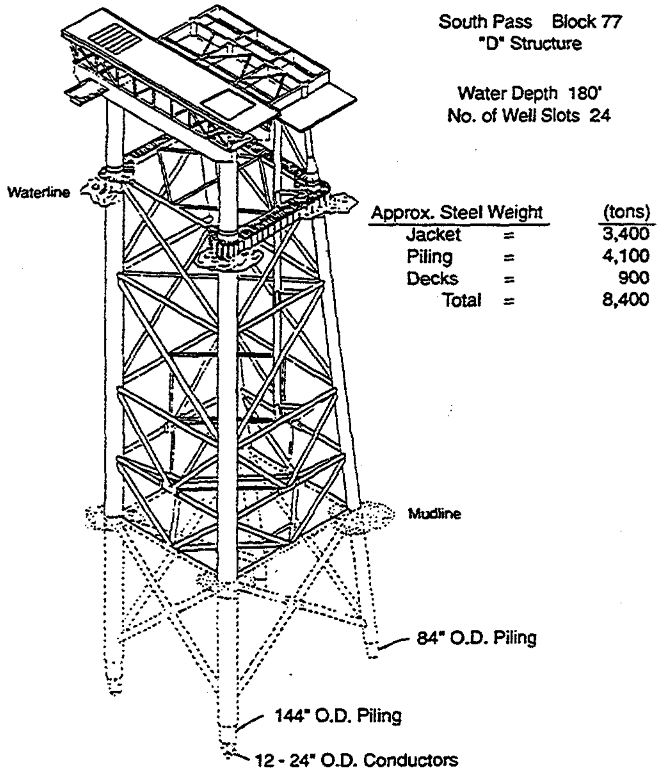


FIGURE 1-11 Mud-slide-type platform. Source: Courtesy of Chevron U.S.A., Inc.

application to the NMFS for final approval; (2) if explosive removal is planned and the structure is in open waters, the Corps informs the NMFS and asks if NMFS observers will witness the platform removal. The NMFS then decides whether to implement the observer program and informs the Corps, which in turn notifies the operator.

- If the platform is to be left on the lease site, the operator must obtain from the MMS a waiver from the lease abandonment regulations, including site clearance requirements.

International Laws

International laws relevant to the removal of offshore structures include the Convention on the Continental Shelf and the U.N. Convention on the Law of the Sea, which require that abandoned or unused installations be removed. International Maritime Organization guidelines also call for the removal of abandoned offshore structures. There is no definition of the depth of removal, except that the structure should be "entirely removed" and not interfere with navigation. Exceptions are granted to coastal nations for reusing structures if they deem it beneficial.

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2

Assessment of Cutting Techniques

For any cutting technique to be effective, it must be safe, reliable, repeatable, flexible and adaptable under field conditions, environmentally sensitive, and economical. The cutting methods described in this chapter are either available to industry or are under development for use in the underwater cutting of piles, conductors, and other platform components.

Cutting techniques can be grouped into two general categories: explosive and nonexplosive. Explosive cutters presently in use are bulk charges, configured bulk charges, and other cutting charges, such as linear-shaped charges. Fracturing charges and cutting tape, such as contact and refraction tape, may have future applications. Available nonexplosive cutting techniques include mechanical cutters using hydraulically driven revolving blades; abrasive cutters using sand or slag with high-volume, low-pressure water pumps; abrasive cutters using low-volume, high-pressure water pumps with garnet injected at the nozzle; and diver cuts using oxy-arc torches. Potential nonexplosive cutting techniques may include hydraulic shears, diamond wire saws, chemical cutters, laser cutters, pyrotechnics (metal powder), chemicals, and cryogenics. None of the nonexplosive cutting techniques has been developed for commercial use, although some have been demonstrated in controlled conditions.

EXPLOSIVE CUTTING TECHNIQUES

Table 2-1 lists the three explosive cutting techniques that are presently available and some that may be available in the future.

TABLE 2-1 Explosive Cutting Techniques

Present	Future
Bulk explosive charges (C-4, Comp B)	Cutting charges (explosive-shaped tape)
Configured bulk charges (ring charges, focusing charges)	Fracturing charges (contact plaster tape; shock refraction tape)
Cutting charges (linear-shaped charges with fabricated containers)	Other explosive charges (shock-wave focused, radial hollow charges)

Present Explosive Cutting Techniques

Bulk Explosive Charges

The most commonly used technique for cutting piles and conductors is with bulk explosives. Castable and moldable explosives, such as C-4 and Comp B, have high velocity on detonation, and shattering power (brisance) that is 15 to 30 percent higher than TNT (Herbst, 1986). Comp B and C-4 are not as dangerous to handle as other high explosives and can be molded in the field to the required size and shape. After more than a quarter of a century of use and hundreds of thousands of worker-hours, no serious injuries have been reported from handling or using bulk explosives in platform removals.

During platform installation, piles are welded together in tubular sections. Cylindrical steel guides (called stabbing guides) are normally welded to the inside of the bottom of each pile section to facilitate mating with the preceding section. The inside diameter at the stabbing guide (above and below the section weld) is therefore smaller than the inside diameter of the pile. This is an important consideration for using most other cutting techniques but is only a minor inconvenience in the placement of bulk charges, which can be sized to sever the pile and do not have to be retrieved. Bulk charges can be shaped to fit pile or well dimensions that differ from the construction drawings. For example, if the smallest casing string in a well is 7 inches in diameter instead of 9.5 inches in diameter, as anticipated, bulk explosives can be reformed into a smaller container with little or no delay. Bulk explosives can also be deployed in conventional piles and wells without the use of divers.

Bulk charges are lowered into the prepared piles and wells and detonated nearly simultaneously (with a 0.9-second delay) in groups of eight or less. All of the piles and wells can be severed within an hour or two; this includes the time required to load the explosives into the structure and conduct an aerial search for turtles and marine mammals (observers for the National Marine Fisheries Service [NMFS] conduct visual searches for at least 48 hours prior to detonation). When bulk explosives are used, wells and pilings generally drop a few inches, a clear indication that they have been completely severed. High-shear-strength soils sometimes keep the piles or wells from dropping, however, which may result in the need to lift the pile with a derrick barge to verify full cuts. Bulk explosives require minimal engineering, planning, and scheduling and (according to an explosives contractor who presented a report to the committee [Kenny, 1995]) result in a 95 percent success rate when sized properly. Increased water depth has no adverse impact on the success rate of bulk explosive cuts. If a bulk charge does not completely sever the piles or conductor, a back-up charge can be deployed quickly. The cost of bulk explosive cutting services is the lowest of all available alternatives (see tables 2-2 and 2-3). In addition to the environmental impact, the explosive force sometimes "bells" out piles and wells so piles cannot be pulled out through jacket legs. In these cases, the jacket must be lifted with the piles and the "belled" portion cut off.

Configured Bulk Charges

Improvements in the configuration of explosives such as ring charges built to collide or "focus" the explosive detonation front have been effective in localizing pile belling and reducing the weight of charges. Ungrouted piling, which may need to be removed separately from the jacket to reduce lift weight, can be removed by collision charges.

Ring Charges. Made from the same explosive material as bulk charges (Comp B or C-4), ring charges are formed into doughnut-shaped rings, which concentrates the explosive closer to the inside of the pile wall, thus making it more effective. Using this technique, the total weight of explosive charges can be reduced by approximately 10 to 15 percent.

"Focusing" Charges. These explosives are configured with steel tamping plates above and below the charge. The tamping plates have the effect of delivering more of the force horizontally, which allows reductions in explosive weight comparable to ring charges, with the added benefit of reducing or eliminating "belling." The concept is proprietary and patented by one explosives contractor.

Both of the configured charges must be prefabricated and are sized to fit each application. There is enough size variation allowance built into each configuration to allow for small miscalculations of inside pile diameters or the dimensions of obstructions. Both types can be lowered into the pile from above, thus eliminating the need for placement by divers. Configured charges, however, cannot be used to severe wells because the diameter of the inner casing is too small to accommodate the charge.

Cutting Charges

Cutting charges include linear-shaped charges, which have been available for several years, and the more recently introduced cutting tape.

Linear-Shaped Charges. These charges use high-velocity explosive energy to accelerate a v-shaped liner material (usually copper) into a high-velocity jet (Welch, 1995) that can penetrate and cut the steel. A linear-shaped charge can be housed in a specially manufactured ring-shaped container made to fit around the outside of a pile, or it can be used with a running tool and an articulated device for making an inside cut. When accurately positioned to a precisely calculated stand-off distance between the charge and the target, smooth cuts can be obtained. The stand-off distance is a function of the thickness of the steel.

There are several limitations to using linear-shaped charges:

- If an external charge is used to cut a pile, there is no attenuation of the explosive energy afforded by the soil.
- To pass by stabbing guides in the pile, an internal-shaped charge must be the articulated type.
- If the thickness of the pile section is unknown (possible in older structures), if the pile is out of round, if the charge is not placed directly against the target, or if a stabbing guide is at the proposed cut elevation, a successful cut may not be obtained.
- Shaped charges require long lead times (several weeks) to fabricate the containers and articulated devices and cost about four or five times more than bulk charges.
- Divers can place the shaped charges, but safety and cost considerations must be taken in consideration.
- Performance of a shaped charge depends on the presence of an air gap between the liner of the charge and the target (pile or caisson). Water infiltration between the charge and the pile greatly diminishes performance (Welch, 1995).

Future Explosive Cutting Techniques

Cutting Charges

A refinement of rigid, linear-shaped charges that may be useful in the future is explosive cutting tape. Explosive cutting tape is a flexible version of a linear-shaped charge. The explosive and the liner are extruded into a shaped charge housed in a flexible jacket that allows the tape to contact the pile and maintain a proper stand-off distance. Although the new type charge is flexible, variations in the shape and dimensions of the liner may cause problems, and the jacket may compress in the high ambient pressures of deeper water (more than 300 feet). Divers would be required to place the charges. According to the manufacturer, who prepared a committee presentation, explosive tape is not as efficient as linear-shaped charges and may not perform well in deep water.

Fracturing Charges

Another class of explosive charges in the development stage that may have future applications is fracturing charges. Two types of fracturing charges are contact "plaster" charges and shock refraction charges. The plaster charge is placed in direct contact with the steel pile, so the explosion causes a pressure wave to propagate through the pile thickness and spalls some of the steel on the opposite side of the pile when it is reflected as a tensile wave. Pressure from expanding gas completes the cut. The charge, which is in tape form, must be deployed by a diver. This type of explosive may reduce charge weight compared with bulk explosives, but has not yet been used to remove a standing structure.

Another type of fracturing charge being developed is called a shock refraction charge, which is the size of a plaster charge and is shaped to resemble shaped charges and cutting tape. Shock refraction charges reportedly have better underwater characteristics than shaped charges and cutting tape (because compressibility is not a factor and precise stand-off distances are not required), but they still require that divers secure the adhesive charge to the pile.

Other Explosive Charges

Shock-Wave Focusing. Advances have been made in the development of shock-wave focusing charges, which are hollow charges flexible enough to be wrapped around tubular structures internally or externally. This method focuses the shock-wave energy through the target thickness and, after exerting very high compressive stress on the material elements, rapidly converts them into tensile stresses that initiate controlled brittle fractures (figure 2-1). Demonstrations in air indicate that the efficiency of this technique could result in a reduction of up to 90 percent of explosive weight compared with the charge weight required for shaped charges. Shock-wave focusing methods are particularly efficient for thicker wall targets but require that the distal surface be backed by either air or water. The shock-wave focusing tool presently used is not adequate for grout-backed targets. In the longer term, it may be possible to combine both focused and shaped charges into an integrated tool for cutting conductors.

Radial Hollow Charge. This is a short, linear-shaped charge bent into an arc with the explosives initiated simultaneously at the central axis. The charge looks like a wedge of pie. The detonation front runs radially outward, detonating the explosives simultaneously at the side of the liner and causing the liner to collapse instantaneously. This produces a flowing radial cutting jet. Because of the diverging flow, a relatively long cut can be produced on a flat or a curved target. By joining a number of these charges, it may be possible to cut along plates and around pipes using relatively less explosive weight (figure 2-2). The advantage of this charge is that the larger stand-off distance produces longer cuts. Radial hollow charges may also overcome some of the disadvantages of commercial-shaped charges, which require robust containers that can withstand the hydrostatic head. The stand-off (radial) distance from the surface could be adjusted to match any rounded, but irregular, surface.

None of the explosive cutting techniques, except bulk charges, can be used to sever wells with multiple casing strings except by repeated explosion done from the outside, one layer at a time. Charges that require precise stand-off distances (shaped charges, cutting tape) or adhesion to the inside of the pile (cutting fracturing tape) require clean surfaces, which means more jetting or brushing of soil from the pile than is required for bulk or configured bulk charges. All of the explosive charges, regardless of weight, would require special regulations and their use is currently restricted.

The positive and negative features of present and future explosive cutting techniques are summarized in table 2-2.

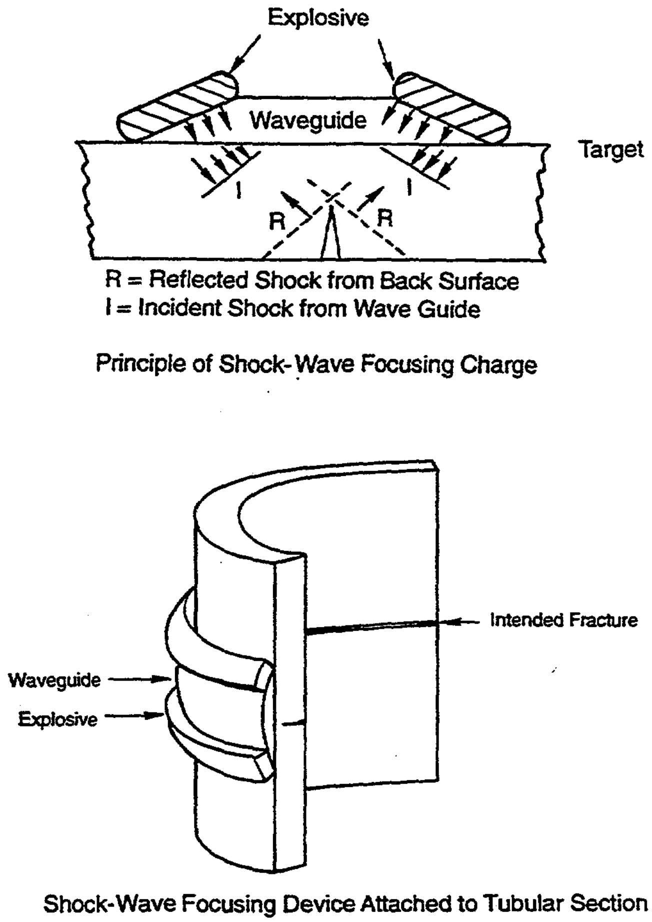
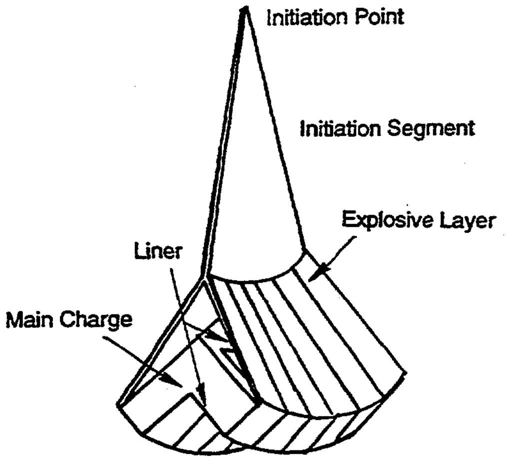
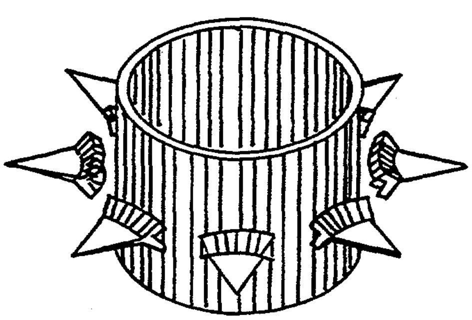


FIGURE 2-1 Shock-wave focusing. Source: Courtesy of UMIST.



Schematic of a Radial Hollow Charge



Schematic of a Radial Hollow Charge Arranged for Cutting a Leg from Outside

FIGURE 2-2 Radial hollow charge. Source: Courtesy of Hydrodynamic Cutting Services.

NONEXPLOSIVE CUTTING TECHNIQUES

For some applications, platform removal using nonexplosive means is the most desirable option. Thirty percent of platforms removed since 1987 have been removed with nonexplosive methods. Large-diameter caissons can be cut by divers. Shallow-water well-protector platforms allow experimental development of abrasive and mechanical cutters in the field at lower cost and less risk than in deep water.

Regulations intended to protect sea turtles and marine mammals already provide built-in incentives for using nonexplosive techniques. The time, scheduling, and expense of coordinating the Minerals Management Service and NMFS observers during explosive removals, and the restrictions on using explosives encourages operators to consider alternative methods when factors such as water depth, platform age, type, and configuration make alternative methods feasible.

Nonexplosive methods presently used include mechanical cutters, abrasive slurry cutters that use high volumes of sand or slag at relatively low pressure, and abrasive slurry cutters that use low volumes of garnet or other materials at high pressure. Another method is diver cutting using a hollow steel rod or several small exothermic rods connected to a DC power source and fed with oxygen from the surface.

Development and testing of two nonexplosive techniques—hydraulic shears for cutting braces externally and diamond wire saws—are under way. These techniques may be applicable in the future for certain types of cutting. Other ideas include laser devices, pyrotechnic metal powder cutters, chemicals, and cryogenics. Another possibility is using remotely operated vehicles instead of divers. In the following sections nonexplosive techniques that have some present applications are described, as well as techniques that may have potential for use in the future.

Present Nonexplosive Cutting Techniques

Mechanical Cutters

Cutting mechanisms that use hydraulically actuated, carbide-tipped tungsten blades to mill through tubular structures are called mechanical cutters. Mechanical cutters have been used with increasing frequency since 1987. Figure 2-3 shows a sketch of a mechanical cutter in position on a battered pile. The tool is lowered into an open pile (or well), and the power swivel is supported and connected to the top of the pile or well. The power swivel turns the drill string so that the milling blades are forced outward hydraulically to cut the pile or well. Centralizers on the tool keep it concentric inside of the pile or well. Mechanical cutters have been used most successfully for cutting shallow-water, small-diameter caissons with individual wells and shallow-water well-protector platforms with vertical piles.

On wells where the casing strings are not cemented, lateral movement after the inner string is cut causes uneven cutting of the next casing. Uncemented strings can be pulled after each successive cut, but this requires lifting equipment and time to remove and reinstall the tool each time. Concentric casing strings that are cemented together may also require trips in and out of the well to replace worn blades. Once all cemented strings are completely cut, larger lifting equipment is required for removal. Variations in casing strings may result in incomplete cuts at the outer string.

Another limitation of mechanical cutters is that pilings must be open at the surface to accommodate the power swivel. Therefore, the deck of a conventional platform must be removed using a derrick barge. Remobilizing a derrick barge with its attendant cargo barges and other support services and personnel can take several days and cost hundreds of thousands of dollars, depending on the location and size of the derrick barge. The time the derrick barge spends on location while sequential piling cuts are made is also expensive

TABLE 2-2 Assessment of Present and Future Explosive Cutting Techniques

PRESENT TECHNIQUES

Positive Impacts	Negative Impacts
Environment • shaped charges allow reduced weight of explosive charges	*Environment* • kills fish • requires protection of turtles and marine mammals
Safety • no serious injuries recorded	
Reliability • accepted by field operators and contractors • no moving parts • predictable results	
Flexibility • can be used for all platform types • bulk explosives can be molded to fit field conditions • easily deployed • can be used on all piles and conductors	*Flexibility* • shaped charges applicable only to piles, difficult to prepare, deploy, place • performance depends on air gap, stand-off distance • requires long lead time
Cost • instantaneous severing • requires minimal engineering, planning, and scheduling • not affected by weather • not affected by water depth • lowest initial and overall cost	*Cost* • costs 4 to 5 times as much as bulk explosives
	Regulation • requires special regulation • Minerals Management Service and NMFS observers required • no night shots allowed • aerial surveys and/or diver searches required • requires U.S. Coast Guard permits for loading and transport

FUTURE TECHNIQUES

Positive Impacts	Negative Impacts
Environment • allows reduced weight, causing less harm to living marine resources	*Environment* • may kill fish • may require protection of turtles and marine mammals
	Safety • requires diver deployment
Reliability • successful cuts do not bell pile	*Reliability* • must be designed for specific thickness
	Flexibility • requires clean surface for stand-off distance and adhesion • requires custom fit for each application • tape is affected by water depth
	Cost • materials deployment and preparation costs are higher
	Regulation • requires same special regulation as bulk explosives

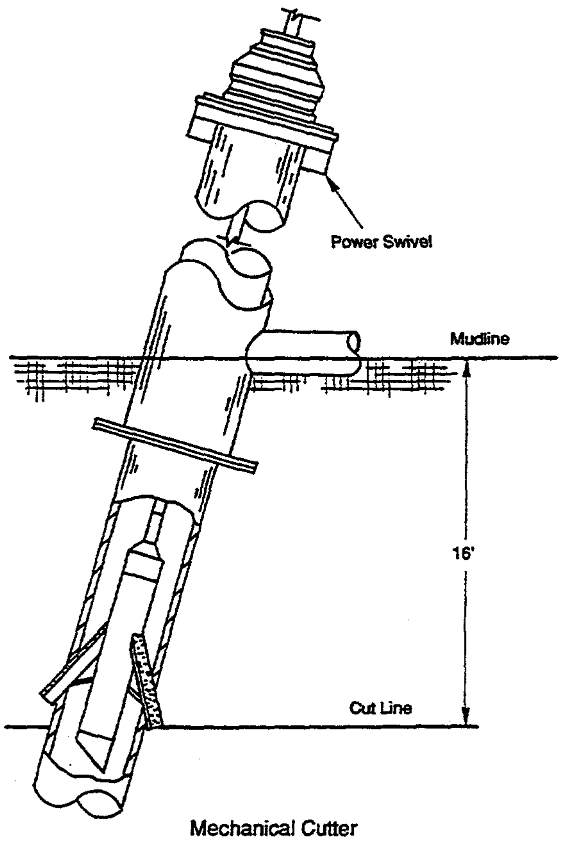


FIGURE 2-3 Sketch of a mechanical cutter on a pile. Source: Courtesy of Hydrodynamic Cutting Services.

because mechanical cuts can take several hours each and the rig-up and rig-down times may also be considerable (Herbst, 1986).

Abrasive Cutters

Mechanisms that inject cutting materials into a water jet and abrasively wear away steel are called abrasive cutters (also called sand cutters, abrasive jet cutters, or abrasive slurry cutters). There are two types presently in use: (1) cutters that use sand or slag mixed with water at relatively low pressure (4,000 to 10,000 psi) and high volume (80 to 100 gallons/minute); and (2) those that use garnet or other abrasive materials injected at the nozzle at relatively high water pressure (50,000 to 70,000 psi) with lower water volume.

The first type (commonly called a sand cutter) uses a turning mechanism, or power swivel, as a mechanical cutter. The power swivel rests on and is connected to the top of an open pile or conductor (figure 2-4). The entire drill string, or "work string," turns the cutting head at about one revolution per minute, and the centralizing ring centers the cutting head. The cutting nozzle requires a stand-off distance of about 0.5 to 1.5 inches and delivers about 80 to 100 gallons of water per minute and sand from a 4,000-psi to 10,000-psi pump.

This type of cutter is used mostly for cutting shallow-water, open-pile, well-protector jackets; single-thickness, small vertical caissons; and wells with uncemented casing strings. Single strings of casing can be cut quickly (20 minutes cutting time each) and removed separately, but, like mechanical cutters, sand cutters require frequent trips in and out of the well. Cemented casing strings require longer cutting times, and reliability decreases with distance from the nozzle. Sand cutters have seldom been successful in cutting more than two cemented casing strings at a time. Casing string variations cause similar problems.

Sand cutters can be used on open piles after soil plugs or other obstructions have been removed. Rollers are required to move the cutter head past pile stabbing points when it is lowered and retrieved. If a mechanical failure occurs, such as a stabilizer failure or nozzle cut-out, and the tool must be

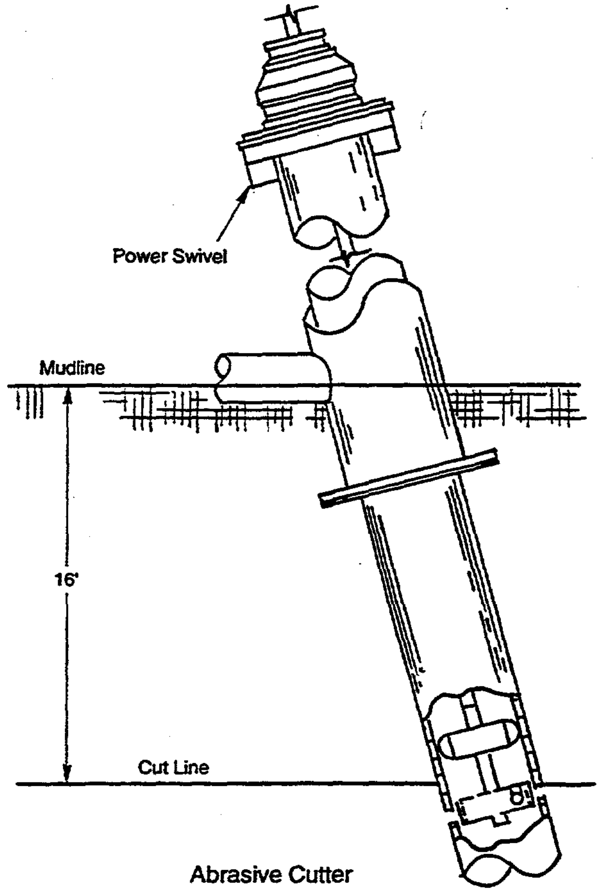


FIGURE 2-4 Sketch of a sand cutter on a pile. Source: Courtesy of Hydrodynamic

removed, a new cut may be required because returning to the same partial cut cannot be assured. The only visual evidence of a successful cut is fluid return, which is not always a clear indication of a complete cut. Determining when a cut is complete requires judgment and skill by the operator. Sand cutters require open pilings, and decks must be removed prior to deployment. The time required to cut piles varies with water depth, pile thickness, and mechanical problems.

The second type of abrasive cutter is commonly called an abrasive jet cutter. This cutter (figure 2-5) produces a cutting jet of water mixed with garnet under very high pressure (50,000 to 70,000 psi) directed through a diamond orifice. Abrasive jet cutters are relatively new and have been used for cutting wells and some pilings. There are two versions of abrasive jet cutters, external and internal. External cutters must be deployed and retrieved by divers. Internal cutters do not rely on top-drive power swivels. Instead a downhole motor turns the cutting head one revolution per cut at a speed dependent on the thickness of the cut. This allows the operator to monitor acoustically the sound level in the water outside the cut. Changes in the sound level indicate penetration of the cutting jet.

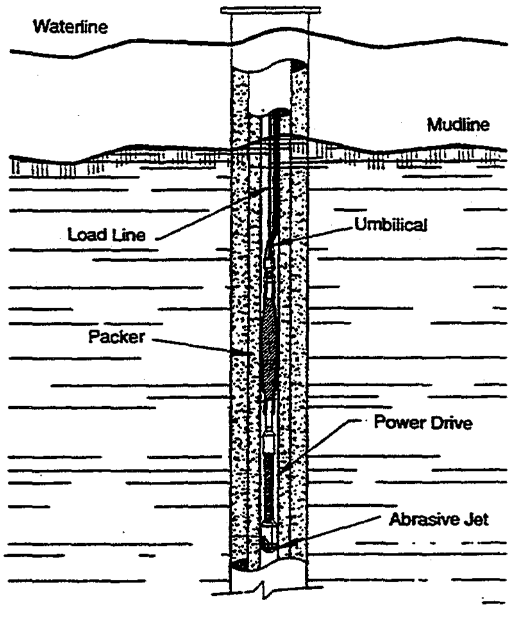
Wells with fully cemented casing strings are easier to cut with an abrasive jet cutter than wells without a cemented annulus. Fully cemented wells maintain the jet stream focus; but partially cemented wells may cause the cutting jet stream to be diffused, which slows or stops the cut. Multistring, fully cemented wells may take 1.5 to 2.5 hours of cutting time per well plus rig-up and rig-down time (Allen, 1995). Small-diameter piles (up to 42 inches) can be cut in approximately half the time it takes to cut wells.

The cost of abrasive jet cutting services is two to five times the cost of explosives; there may also be costs for additional derrick barge time if one is on location during the cuts. Additional limitations include the difficulty of returning to a cut after mechanical problems or nozzle replacement, the difficulty of maintaining a clean surface to ensure stand-off distance, and the noise level of the supersonic cutting jet.

Diver Cuts

Divers can use oxygen-fed hollow rods connected to a DC welding machine to burn through steel under water. They can also use exothermic rods, which are fed with oxygen and remain "lit" after the initial arc, to make underwater cuts. Underwater burning is generally limited to caissons, pilings, bracing, or other structural components, but not wells.

For underwater burning a general rule of thumb is that a diver can burn 1 linear inch of steel per inch of thickness per minute (Brown, 1995; Hall, 1995). A piling 1.5 inches thick would be cut at the rate of two-thirds of an inch per minute. Theoretically, a pile 48 inches in diameter with a 1.5-inch-thick wall should be cut in less than four hours. Table 2-3 compares the cost of such a cut in three different water depths. The figures are calculated for divers using surface air and



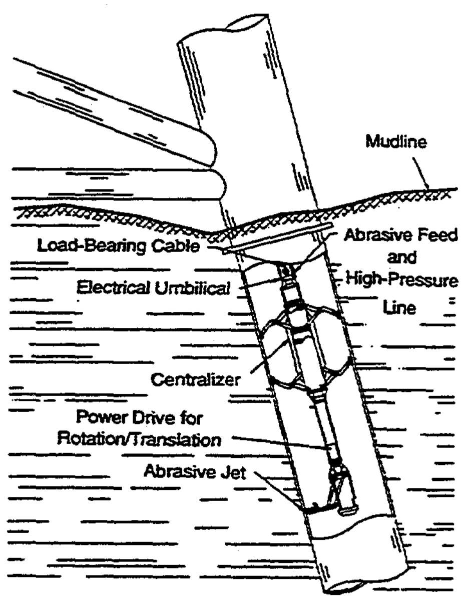


FIGURE 2-5 Sketches of an abrasive jet cutter on a well and pile. Source: Courtesy of Hydrodynamic Cutting Services.

TABLE 2-3 Cost of Diver Cuts in Increasing Water Depth

Depth (feet)	Maximum Bottom Time per Dive (minutes)	Maximum Diver Decompression Time per Dive (minutes)	Number of Dives Required	Total Time Required to Cut Pile (minutes)	Total Cost of Cutting One Pile*
50	200	45	2	271	$13,174
100	80	65	3	411	$19,979
150	50	90	5	652	$31,694

*Does not include the cost of excavating soil or maintaining the excavation.
NOTE: Cost estimates provided by the Association of Diving Contractors.

modified U.S. Navy dive tables, cutting from a derrick barge with a spread rate of $70,000 per day, including diver costs. An 8-pile jacket in 150 feet of water would thus cost approximately $250,000 using divers to cut the piling. The costs do not include the considerable expense of excavating soil outside the pile or maintaining the excavation. The same cut in 50 feet of water would cost approximately $105,000. Using explosives, the same cut would cost approximately $30,000 in any water depth.

Another consideration when using diver cuts is ability and skills vary considerably among divers, and time can be lost retracing partially cut pilings. A 2-inch-long uncut section (or hanger) of a 1.5-inch-thick pile takes 54 tons of force to yield. Under present regulations, cuts are required to be 15 feet below the mudline, so cuts made from the outside of a piling require excavation, which adds to the cost (figure 2-6). Safety is another consideration: it is dangerous to cut from the inside because of "blowback," the explosion of oxygen and hydrogen that can build up around the periphery of the pile unless the area around the piling is adequately vented by jetting the soil away (figure 2-7). And it is always dangerous to put a diver in a pilewhere he may be suspended. It should be noted, however, that this is probably less dangerous for a diver than if he must work at the base of a deep excavation around a pile. Because of the risks, underwater diver cuts 15 feet below the mudline are controversial in the diving community. It is considered less dangerous for divers to cut from inside pilings in caissons that are 48 inches in diameter or larger where the diver is less constricted. However, excavation still poses cost and safety problems.

Future Nonexplosive Cutting Techniques

The successful field application of future nonexplosive techniques and the improvement of existing techniques will depend on the results of testing and development under way in the United States and Europe. Alternative cutting techniques have been developed in the field on actual contracts, sometimes at significant cost to the contractor or the operator. Based on the committee's investigations, most of the research in this area is being done in Europe, often funded by government and industry consortia. Research in the United States has been limited to a few studies. Techniques in the early stages of research and development are described below.

Hydraulic Shears

Hydraulic shears have jaws that close around a tubular element, like scissors. The upper jaw is driven by a hydraulic jack mounted on the lower jaw (figure 2-8). Thus the shears do not require a fixed position to operate but can be suspended from a crane with the proper rigging; the attitude is controlled by a counterweight. The position can be fixed with a hydraulic gripper. The goal of developers is to produce shears that can cut tubular elements up to 42 inches in diameter and 1.5 inches thick.

Diamond Wire Cutter

Diamond wire cutters use a steel wire with small beads embedded with diamond particles mounted on the wire at regular intervals. The wire can be made any length by joining the ends. Like the cutting mechanism of a chain saw, the wire runs over pulleys mounted on a frame. One of the pulleys is driven by an electro-hydraulic motor; another acts as a tensioner (figure 2-9).

Sometimes confirming cuts by diamond wire cutters is difficult. When the reliability of these cutters improves, confidence, and acceptance of the technique will increase. At present, diamond wire cutters are limited to cutting medium- to small-size tubular structures and standard steel shapes. The size of the equipment will probably limit the development and potential use of this technique. The prototype proved capable of cutting various shapes in test conditions simulating an offshore platform (the deck of a large semisubmersible derrick barge), although cutting structures under compression caused the mechanism to jam if the cutting was interrupted.

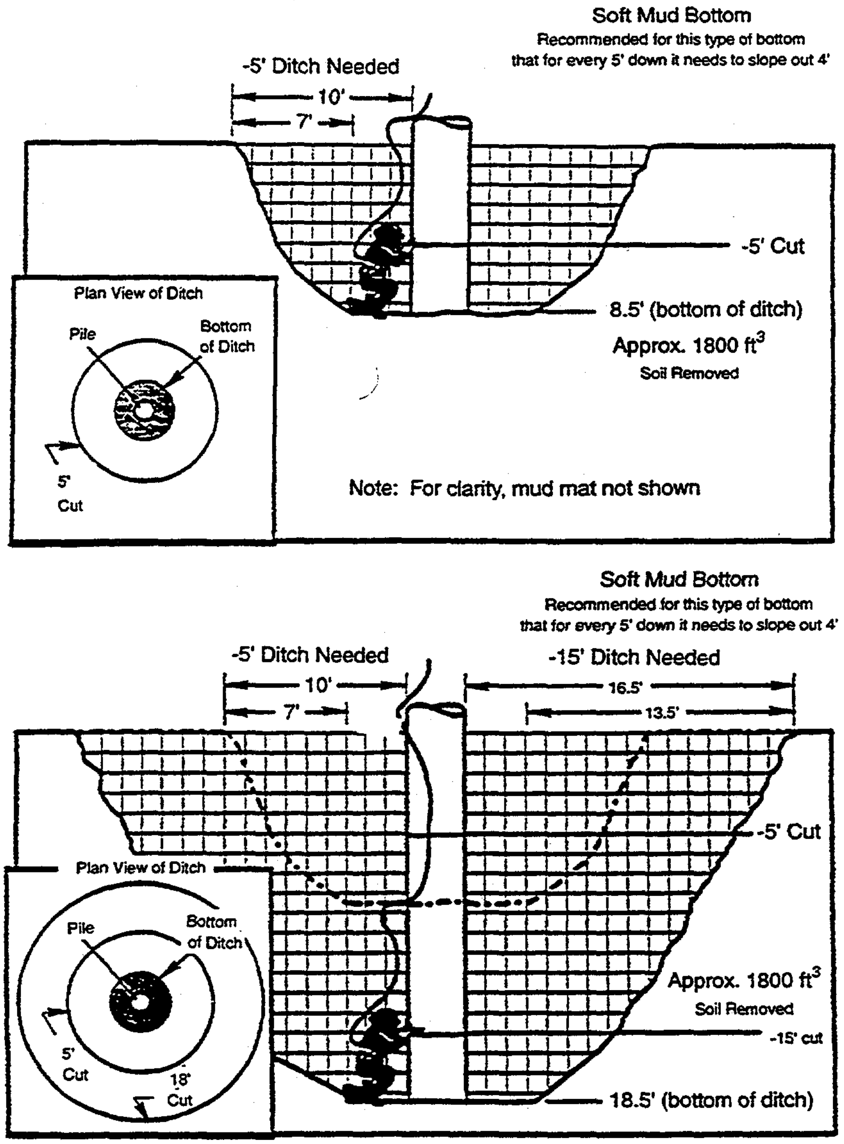


FIGURE 2-6 Excavation required for external diver cuts. Source: Courtesy of Association of Diving Contractors.

The cost, reliability, safety, and routine application of diamond wire cutters for removals in the Gulf of Mexico cannot yet be determined because, given the risks and high cost of failure, companies have been unwilling to test them in actual field operations.

TECHNIQUES BEING DEVELOPED

Laser Cutting

The laser cutting technique uses beams of coherent light focused onto the material to be cut, which creates high enough temperatures in a concentrated area to vaporize the material. Laser cutting requires considerable further development of both process and equipment to determine the feasibility and cost effectiveness of offshore use.

Pyrotechnic Cutting

Pyrotechnic cutting relies on an exothermic reaction that produces a high-velocity jet of molten iron that penetrates the target material. The equipment consists of a reusable torch and iron oxide reactants; an excess of aluminum that reacts with nickel to raise temperatures; and polytetrafluoroethylene, which helps expel the jet through the graphite focusing nozzle at high speed. The cutting action results from

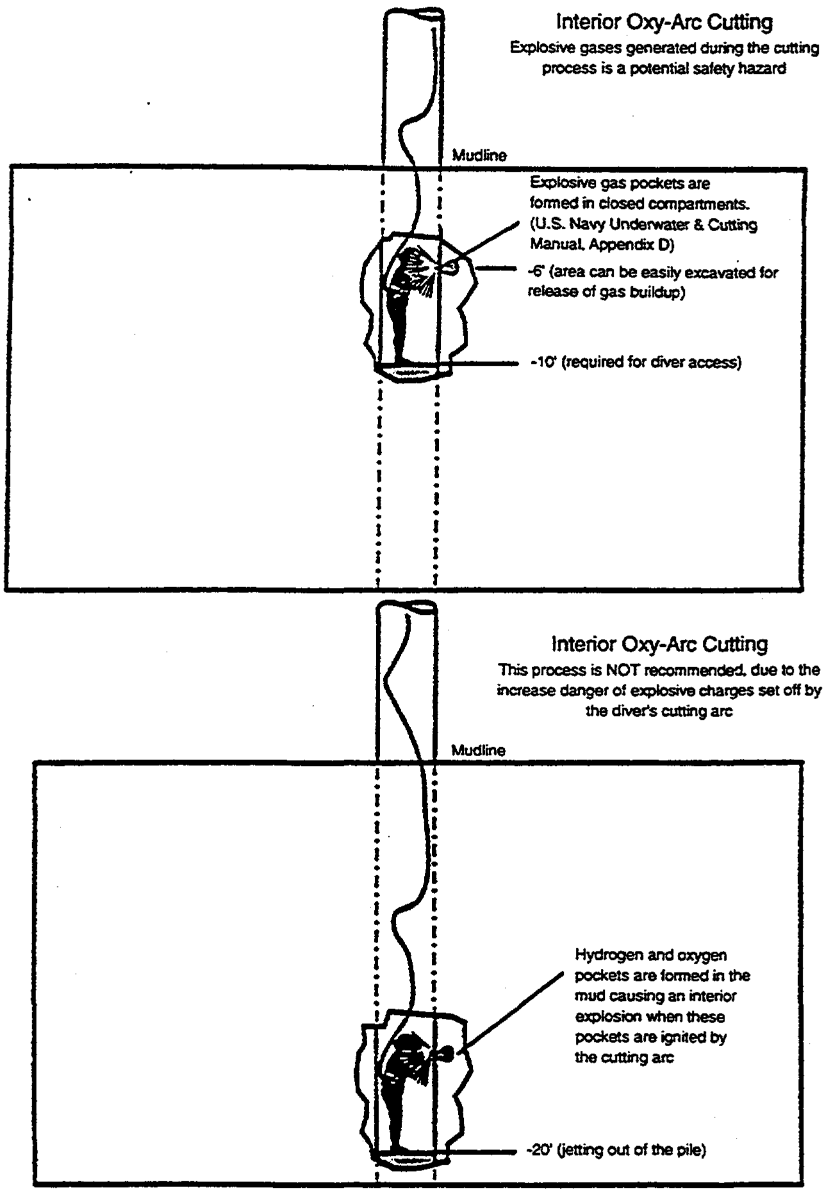


FIGURE 2-7 Sketches showing internal diver cut. Source: Courtesy of Association of Diving Contractors.

melting the target material, which produces a crater or hole. The charge is placed and detonated in the same way as an explosive charge and is self-sustaining once it is initiated (figure 2-10). This technique requires highly efficient thermite mixtures and automated systems to produce linear cuts.

Cryogenics

For the cryogenics technique the steel is cooled to a brittle stage with liquid nitrogen and then cut with a small charge or mechanical hammer. The amount of nitrogen necessary for reflective cooling has not been determined with any degree of certainty. There is also still some uncertainty about how long it takes to cool the steel and about the size of the ice plug. All of these appear to be issues that can be resolved. Further work is required on the practical aspects of applying the nitrogen and understanding how it affects the surrounding soil.

Chemical Cutters

The chemical cutter technique uses highly corrosive liquids such as hydrofluoric compounds that are squirted from chemical flasks pressurized by a pyrotechnic mixture. Multiple jets are used to produce a series of closely packed perforations inside the casing. This technique is rarely used because of the hazardous nature of the compounds. New

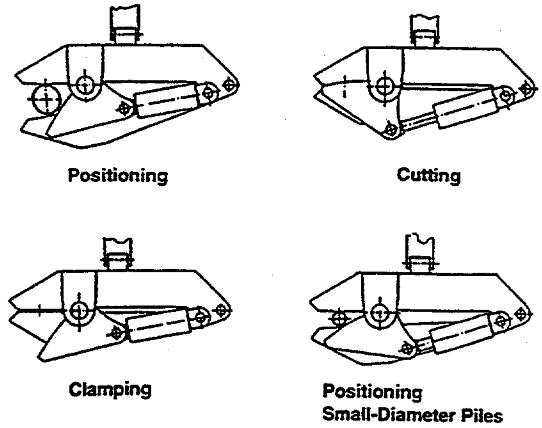


FIGURE 2-8 Hydraulic shears. Source: Courtesy of THC Handling Systems.

techniques have been developed using inert chemicals in separate containers, which are punctured *in situ* to allow the chemicals to combine. The reaction produces a corrosive liquid for perforating the structure.

Other projects are underway to adapt the electro-chemical machining process, which has been used successfully in the manufacturing industry, for subsea applications. This method requires an electrical current to be passed through the cutting jet to accelerate the erosion process. The pressure of salt water improves the efficiency of cutting.

Deployment of Remotely Operated Vehicles

Remotely operated vehicles (ROVs) are commonly used in underwater operations such as photography, visual observation, the manipulation of valves, and the delivery or recovery of lightweight materials in deeper water. ROVs are also used in deep-water dredging operations and for cutting steel beams (up to 2 inches by 12 inches). ROVs have been considered for use in platform removal for both economic and safety reasons. Tools mounted on ROVs can be configured to handle and deploy both explosives and some types of mechanical cutters. Although the technology to do this exists, the procedure is complicated and expensive, albeit less costly than using divers at depths requiring mixed gas and decompression. ROV tools must be configured for each application. For platform removals, many different ROV configurations would be required to carry out a variety of tasks and to accommodate various platform shapes and sizes. Because of their size, outside power source, tether requirements, and maneuverability, ROVs may be too unwieldy to work in confined spaces—for example under mud mats or inside conductor arrays. A great deal of planning and preliminary work would be required to use ROVs in removal operations. But there is little doubt that when ROVs can be configured to perform tasks that divers are unable to do because of water depth they will be widely used in platform removals.

Bubble Curtains

Bubble curtains have been used with some success in shallow, protected waters to attenuate the blast pressure of detonations (Regalbuto et al., 1977). Bubble curtains are created by pumping compressed air through perforated piles installed on the seafloor around the detonation site. The rising air expands to the water surface creating a "curtain" of water under low pressure. It is not known if a bubble curtain would work offshore to reduce fish kill around a platform. Certainly there are significant problems with using bubble curtains:

- A substantial pipe network would be required.
- A large surface vessel, probably a derrick barge, would be necessary to support the operation (to house compressors, for example).
- The effectiveness of the curtain in open water more than 100 feet deep in the presence of currents is not known.
- Fish inside the curtain would have to be removed somehow (or they will be killed).

Acoustic Devices

Acoustic devices have been successful in keeping fish 100 feet or more away from platforms in very shallow water; for example, acoustic devices have been used effectively to keep

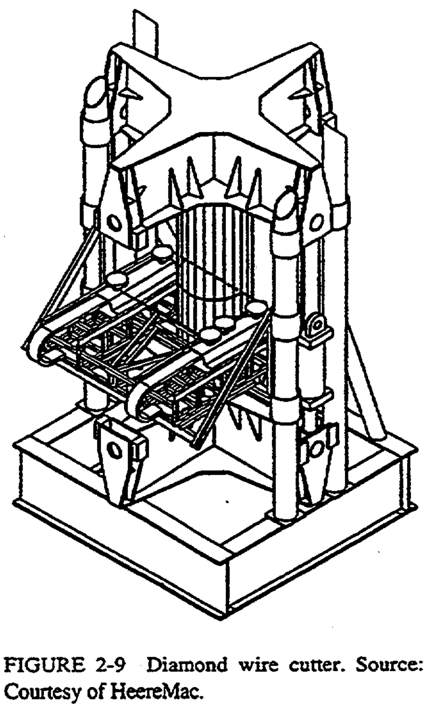


FIGURE 2-9 Diamond wire cutter. Source: Courtesy of HeereMac.

fish away from water intakes for power plants. Their effectiveness offshore has not been demonstrated, although it appears to be promising from the limited data available. Much more work needs to be done on acoustic devices, such as establishing power requirements, determining frequencies for different species of fish, and so on.

Platform Design Considerations

Over the past few years, suggestions have been made for incorporating into the original platform design ways of making platform removal easier and possibly less damaging to marine life. This topic was considered by the committee but was not a focus of recommendations for the following reasons:

- There is no way of knowing what types of marine removal equipment will be available in the future. It is likely that in the long interval between the time a platform is designed and when it is removed (20 to 30 years) new, efficient tools will be developed—tools the original designer did not foresee and which make current removal methods obsolete.
- Even if a removal strategy is designed into an installation (using assumed criteria), there is no way of knowing what the condition of the structure will be 25 to 30 years later, given the rigors of the marine environment.
- Legal considerations and regulations are constantly changing. A designer must necessarily base the design on current regulations and cannot predict which regulations are likely to be in effect in 20 to 30 years, when the structure is removed.
- Incorporating removal techniques into the original design could have an adverse effect on the long-term integrity of the platform (i.e., the ability to withstand the rigors of weather and ocean conditions over the lifetime of the structure). Considerable engineering and technical research are needed to incorporate safe removal into the original design. This is the first step in designing platforms for more efficient and less environmentally damaging removal in the future.

The advantages and disadvantages of various nonexplosive cutting techniques are summarized in table 2-4.

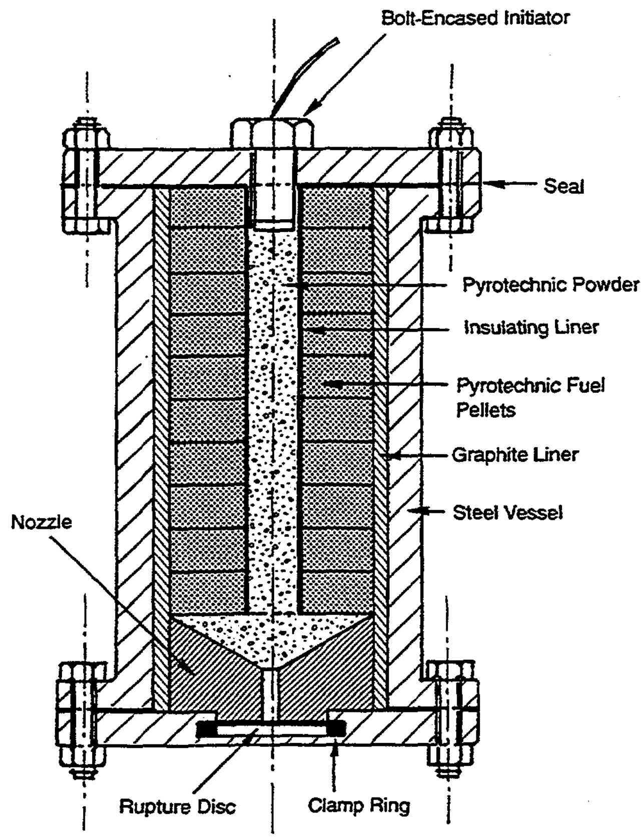


FIGURE 2-10 Pyrotechnic torch. Source: Courtesy of HeereMac.

TABLE 2-4 Assessment of Nonexplosive Cutting Techniques (present applications)

Positive Impacts	Negative Impacts
Environment • does not kill fish or harm other marine life • acceptable to other users of water resources	
	Safety • risks to divers when cutting below mudline • risks to divers when cutting under mud mats • risks to divers when deploying external cutter • risks to divers if retrieval of cutter is required • risks to divers when hand jetting • risks to divers in poor visibility in shallow water or turbid conditions
	Reliability • depends on operator/diver skills • difficult to redeploy cutters to same cut • abrasive cutters require cleaner surface • complicated machinery • no clear indication of successful cut • explosives must be used in case of failure
	Flexibility • requires custom fit for each application • sensitive to platform type • sensitive to water depth • requires extensive planning and scheduling
	Cost • service costs more • time-consuming deployment and cutting operation • weather sensitive because of length of operation • multiple cuts must be done in sequence rather then simultaneously • requires more personnel and increases risk of personal injury
Regulation • no NMFS observers required • no night restrictions • no aerial or diver surveys required • no U.S. Coast Guard permit required • platform recertification less stringent	

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3

Technical Considerations

RECENT REMOVAL PATTERNS

The Minerals Management Service (MMS) requires that platforms be removed within one year after termination of a lease. Lease operators may also elect to remove a platform if the cost of upgrading or maintaining a structure to meet current design or safety standards exceeds reserve revenues or if the structure is obsolete or damaged.

Platform Removals by Water Depth

Figure 3-1 tracks all platform removals since 1985 by water depth. The majority of removals have been in less than 100 feet of water. The percentage of nonexplosive removals is highest in less than 25 feet of water (55 percent) and decreases with increasing water depth. It is easy to understand why nonexplosive technology is most efficient in shallow water. Divers can work more easily and safely in shallow water, and smaller, less expensive construction equipment is needed to lift platforms. Nonexplosive methods in shallow-water removals pose fewer financial and safety risks than they do in deep water.

Platform Removals by Year

Approximately 70 percent of platform removals since 1987 have involved the use of explosives (figure 3-2). Prior to 1987, no record of removal methods is available. Nonexplosive methods used for the remaining 30 percent include mechanical cutters, abrasive cutters, and cuts made by divers with cutting torches.

Platform Removal Trend

The number of platform removals is growing (figure 3-3). In 1992, for the first time, the number of removals exceeded the number of installations. A 1985 National Research Council report on the disposition of offshore platforms projected the increase in platform removals to continue almost unabated for 25 years. The ratio of deep-water to shallow-water structures will also increase as more platforms in deeper water reach the end of production. Because removal costs in deeper water are higher, the total cost of removals of platforms in the Gulf of Mexico will increase rapidly (NRC, 1985).

TYPICAL ABANDONMENT PROCESS

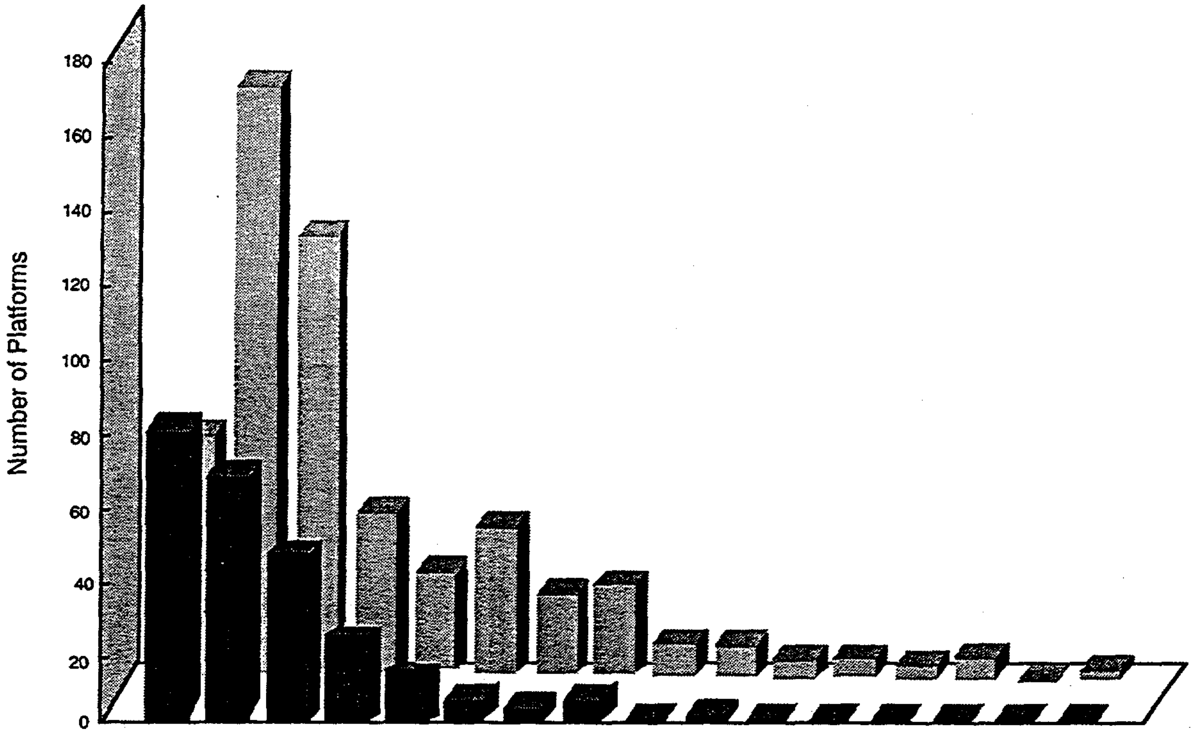
The complete abandonment of a platform well involves five steps: (1) securing permits—securing necessary approvals for plugging and abandoning wells and pipelines, structure removal, and site clearance procedures; (2) plug and abandon wells—setting various cement plugs in the wells; (3) decommission platform—cleaning and purging hydrocarbons from production equipment and abandoning the pipeline(s); (4) remove the platform—the focus of this study; and (5) clear the site—removing any remaining debris and verifying a clean site by trawling.

Removal Options

For a more complete assessment of present platform removal methods, the disposition options and various factors and requirements for selecting removal methods are described in the next two sections. Disposition options include leaving-in-place, partial removal (including toppling in place), and complete removal.

Leave-in-Place Option

Commercial and recreational fishermen, environmentalists, and others concerned with maintaining or expanding the habitat that platforms provide (and avoiding the damage they perceive from explosive platform removals) would prefer that platforms be left in place as artificial reefs, thus expanding the marine ecosystem by adding hard-bottom habitat. This scenario, however, raises significant problems. Federal law requires that non-operating platforms be removed. But even if the law were changed, problems would still exist. Who would maintain the structures? Who would be liable for accidents, collisions, and other potential hazards? How would navigational problems be resolved? How would conflicts with other users of the ocean—such as shrimpers and commercial fishermen—be resolved?



Water Depth Range (ft)	80	165	245	330	410	500	575	650	740	820	900	1000	1060	1150	1230	1310
■ Nonexplosive	78	66	43	19	10	5	2	5	0	1	0	0	0	0	0	0
□ Explosive	63	159	118	44	27	40	22	24	8	8	3	5	2	6	0	1

FIGURE 3-1 Number of platform removals, excluding caissons, by method and water depth (1985–1994). Source: Courtesy of Minerals Management Service.

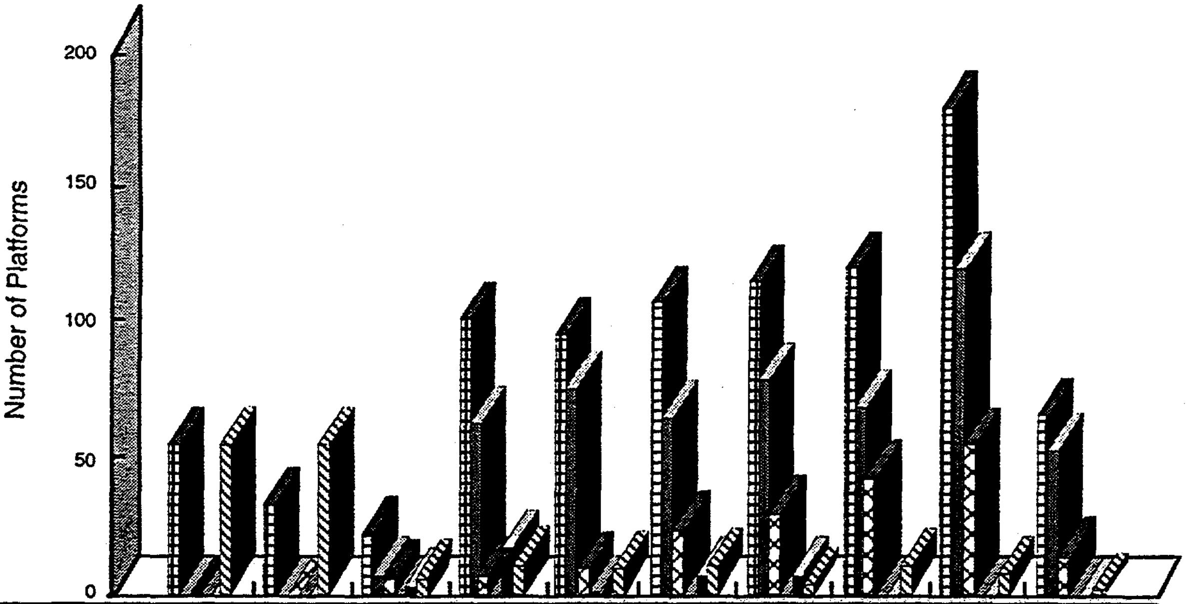
Given all of these problems, the leave-in-place option is probably not feasible now, except in a very few cases, such as when a structure has become a popular spot for recreational fishermen. Some way of handling the liability problem, such as an industry-financed fund, would have to be established to make leaving-in-place a viable option. Table 3-1 summarizes the positive and negative aspects of the leave-in-place option.

Partial Removal Option

The partial removal of platforms (in a manner that does not create hazards to navigation) provides less extensive habitat but reduces residual liability and maintenance costs for operators. Substantial savings, compared with complete removal, could be realized if this option were permitted, particularly for larger platforms located in deeper water. Shrimpers are the primary opponents of partial removals in waters shallower than 300 feet, because partially removed platforms could create obstructions that decrease trawlable waters.

Partial removal involves removing the top sections of a platform to between 50 and 150 feet below the water surface. The exact depth depends on state and federal requirements. The U.S. Navy and Coast Guard were contacted by the committee and asked to comment on issues relevant to the navigation of commercial and navy ships and federal responsibilities under international agreements. Any modification of current regulations requiring removal to 15 feet below the seafloor must take into account the safety of navigation and the operational needs of the U.S. armed forces, particularly submarine passage. Any change in U.S. practice should minimize interference with the navigational rights and freedom of other states in U.S. territorial waters and the exclusive economic zone.

Partial removals can be done by nonexplosive methods (or using smaller explosive charges) more easily than total removals. For example, divers can work fairly efficiently in water depths of less than 150 feet. Problems with partial removals remain, however. The wells still have to be severed and removed, and there are no efficient means of severing them other than with bulk charges. Also, structural members in addition to the legs and piles must be cut, and the risks increase if divers are used, especially for the last few cuts. Another problem is that on many platforms the annular space between the jacket leg and pile is filled with grout, and severing grouted annulars presents the same problems as severing wells.



Year of Removal	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Total	55	33	22	102	96	108	116	120	181	66
Explosives	0	1	7	63	76	65	78	69	119	52
Mechanical	0	0	6	9	10	24	29	43	55	13
Torch Cut	0	0	0	1	1	0	0	0	0	0
Sand Cut	0	0	3	17	1	8	6	0	0	0
Other	55	32	6	12	8	11	3	8	7	1

FIGURE 3-2 Number of platform removals, including caissons, by method of removal by year (1/1/85–11/21/94). Source: Minerals Management Service.

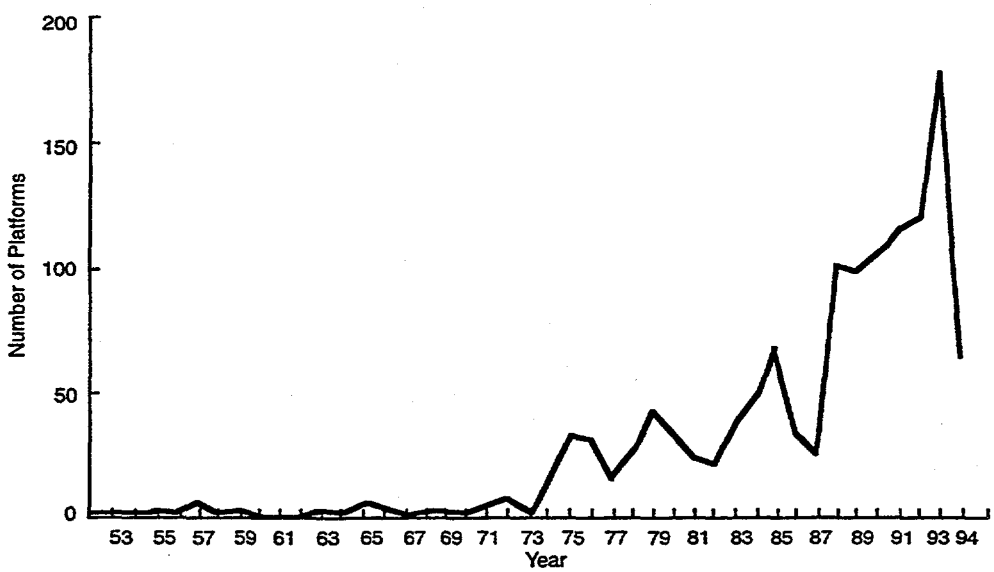


FIGURE 3-3 Number of platform removals, including caissons, Gulf of Mexico (1/1/53–11/21/94). Source: MMS (1994).

TABLE 3-1 Assessment of the Leave-in-Place Option

Advantages	Disadvantages
No harm to marine life	Maintains unnatural habitat
Immediate cost savings	Maintenance costs escalate with age • requires protective coating above water • requires cathodic protection under water • requires navigation-aid lights and horns • remains susceptible to storm damage
Provides recreational fishing, diving habitat	Continues conflicts with other users
Provides emergency safe havens	Potential liabilities • unauthorized boarding • collisions • surface and subsurface navigation hazards
Maintains status quo • structure remains visible • requires no research and development • requires no site clearance • provides migratory animal habitat (surface) • provides reef habitat (subsurface)	May require eventual removal with • reduced structural integrity • increased safety risk • increased cost
	Negatively affects construction/removal industry • no recycling of steel
	Requires changes in regulations and laws

Partial removals would be less expensive for operators, especially in deeper waters. There would be some benefit to the marine environment because the portion of the structure left would continue to provide habitat for marine life. There would be some benefit to commercial fishermen, but not to shrimpers, because of the possibility of trawl nets catching on the remaining structures. The structures to which such an option would logically apply are located in deeper waters relatively far from shore, so sport fishermen would reap little or no direct benefit. They would, however, benefit overall from the existence of more fish habitats.

This option is likely to be exercised in only a limited number of casesmostly in areas designated for the rigs-to-reef program or in deeper water, where the economic and safety benefits to an operator may be significant and there is some benefit to the marine environment. In rigs-to-reef areas, there is little or no problem for shrimpers because of the water depth. Some nonexplosive methods probably can be used more efficiently for partial removals than for total removals because they would be in much shallower water. Adequate clearance for navigation would have to be maintained. Table 3-2 summarizes the positive and negative aspects of partial removal.

Topple-in-Place Option

An option similar to a partial removal is to topple a structure in place. The deck portion could be removed for reuse, scrapped, lowered to the sea bottom, or toppled with the jacket. The topple-in-place option involves severing the structure near the sea bottom and pulling it over on its side until it rests on the seafloor where it would become a habitat for marine life. This option would be less expensive for owners than total removal (no transportation charges) and would be of some benefit to the marine environment. But it would be of no benefit to shrimpers. Toppling-in-place would, however, benefit commercial and, particularly, sport fishermen if the structure is relatively close to shore (e.g., in a rigs-to-reef area) where the 85-foot clearance requirement allows for toppling shallow-water structures. If the wells are not severed but simply bent as the structure is toppled (assuming this is structurally feasible), the use of explosives could be minimized.

Complete Removal Option

This option requires removal to a sufficient depth below the mudline to eliminate any interference with other users of the site, including fishermen, shrimpers, ships, and naval operations. The area around the platform must be cleared of debris and verified clean by trawling. The obvious advantages of complete removal are that the site is returned to a natural condition, there is no interference with shrimping or navigation, and there is no maintenance or liability problem. The disadvantages include cost, possible harm to marine

TABLE 3-2 Assessment of the Partial Removal Option

Advantages	Disadvantages
Potentially reduces harm to marine life during removal and maintains some reef habitat	Does not return habitat to natural state Eliminates habitat structure in upper range of water column
Potentially cost effective • requires no maintenance • requires no site clearance	Must maintain buoys Useful only in water depths allowing sufficient clearance Potentially increases diver risk during removal
May provide recreational fishing and diving habitat	Decreases shrimping access
Operators released from liability	Liability attaches to regulatory agency • court test inevitable • creates navigational hazards (surface and subsurface)
Encourages innovative removal methods	Loss of resources • eliminates surface habitat • no recycling of steel

life during removal, and the elimination of reef habitat if the platform is scrapped onshore. Towing all or part of a platform to a designated disposal site under the rigs-to-reef program lowers the cost of disposal for operators but requires either permission from the state managing the designated rigs-to-reef site or permission from the state to establish and maintain such a site.

Current regulations require that structures be removed to 15 feet below the mudline. The committee was unable to determine the basis or origin of this requirement or its technical rationale. Changing the depth of removal to a depth that still meets shrimpers needs (i.e., preventing damage to trawlers) would be advantageous in several ways: using nonexplosive or less damaging explosive methods would be easier; the need for jetting the soil inside the pile, which is required for abrasive, mechanical, or diver internal cuts, would be lessened; jetting would be required outside the pile to vent oxygen build-up in cases where an internal diver cut is made, which would immediately reduce costs and safety risks. In cases using an external diver cut or diver placement of abrasive cutters, a considerably smaller excavation of the soil would be required, which is less expensive and safer because the danger of cave-ins would be reduced. Table 3-3 presents the positive and negative aspects of complete removal at both the present requirement of removal to 15 feet below the mudline and for a substantially shallower depth of less than 5 feet.

An investigation of the displacement of sediment on the ocean floor by natural forces, called scour, shows that scouring to depths of more than 3 or 4 feet is extremely rare (see the discussion of soil strengths in the next section, "Factors in Selecting Removal Methods"). Moreover, regulations require that pipelines be buried to a depth of 3 feet in waters less than 200 feet deep. (There are no requirements for pipeline burial in water depths of more than 200 feet.) Thus there is a strong case to be made in favor of changing the 15-foot requirement to a 3-foot requirement and little or no discernible reason to maintain the existing regulation, which incurs extra costs and risks and encourages the use of bulk explosives.

Factors in Selecting Removal Methods

Factors to consider in selecting a method for each platform removal include the age of the platform, the water depth, the configuration and type of platform, the weight of the lifts, soil strength, weather conditions, and scour.

The age of the platform is an obvious factor in selecting a removal method. The older the platform, the less likely it is that accurate records and drawings are available. If drawings and records are not accurate, the chosen removal method may prove to be inadequate. Another related factor is the condition of the platform. A badly corroded platform may not maintain its integrity during removal, which could create a dangerous situation. In the early days of platform installation, operators made field changes, such as increasing or decreasing the length or thickness of pile sections but made no record of these changes. Platform owners, therefore, tend to select removal methods that can be adapted to various conditions.

Water depth is an important factor in the selection of a removal method. Nonexplosive methods were used 55 percent of the time in water depths of less than 25 feet. This may be because shallow-water construction equipment and activities cost much less than deep-water equipment. Consequently, nonexplosive methods carry much less financial and operational risk in shallow water than in deep water. Abrasive

TABLE 3-3 Assessment of the Complete Removal Option

Advantages	Disadvantages
AT 15 FEET BELOW MUDLINE	
Meets shrimper requirements • maintains clearance for trawlers	Environmental impacts • relocates or eliminates reef habitat • fish kill from explosives
Requires no changes in regulations or laws	Expensive to operators • explosives require NMFS observer program • restricts use of explosives • discourages development of nonexplosive techniques • requires transportation to shore or reef site
Poses no navigational hazards	Requires site clearance • may require backfill
Eliminates liability and site maintenance	Hazardous to divers
Allows reuse and recycling	Potential removal problems from soil skin friction at 15 feet below mudline
AT SHALLOWER DEPTH BELOW MUDLINE (less than 5 feet)	
Immediate cost savings • requires less jetting • minimizes problems from soil skin friction	Requires changes in regulations and laws
Encourages use of nonexplosive methods • less hazardous to divers • easier to clean for access by mechanical or abrasive tools	Explosives may still be necessary in some cases although advanced techniques using smaller charges could be used
Meets shrimpers requirements • nothing remains above mudline	Site clearance required
Poses no navigational hazards	
Requires no backfill	
Eliminates liability and site maintenance	
Reuse or recycling possible	Environmental impact • relocates or eliminates reef habitat • requires disposal

or mechanical cutters can be used to remove shallow-water caissons or small platforms using a lift-boat or a barge with a small crane. Cutting the wells and pilings of a small platform can sometimes be accomplished at the same time the wells are plugged and abandoned using the same equipment. Derrick barge costs increase as the water depth increases, as do diving costs; at the same time, the length of dives decreases. While divers are in the water, descending, working, ascending, or decompressing, no construction work can be safely undertaken topside. Increases in platform size and weight are also strongly correlated with water depth, adding to costs.

The reliability of mechanical or abrasive cutters decreases as water depth increases. Problems can arise with the delivery of abrasives to the cutting nozzles of cutters driven by downhole motors. Both mechanical and abrasive cutters require cranes to position cutting equipment.

The type and configuration of a given platform are important considerations in selecting a removal method. Abrasive and mechanical cutters have been used effectively on shallow-water platforms, such as caissons and small well-protector jackets. Larger caissons have been most effectively cut by divers. On larger platforms, however, especially platforms with wells, the preferred method has been explosives. When severing wells, bulk explosives can be sized for unexpected field changes (such as unanticipated member sizes), give a clear indication the wells are cut, and are cost effective when compared with other methods.

If the wells are not severed prior to the arrival of derrick barges, the cost increases tremendously because of the added time (while the barge is waiting) of severing the wells by nonexplosive means. According to a presentation to the committee by a supplier of abrasive cutting services, the time required to cut one 30-inch-diameter multistring well with an abrasive cutter is two hours, plus rig-up and rig-down time. Cutting six wells sequentially (with no problems) would take at least 12 to 18 hours, plus several hours rig-up and rig-down time. This would result in an increase of $50,000 to $70,000 for an 800-ton derrick barge. In comparison, it would take about two hours to load and sever all six wells using explosives.

If casing strings are cemented together, mechanical cutters can not always cut more than two casing strings at a time. Casing strings that are not concentric, a common occurrence, also cause problems for mechanical cutters.

Configured explosive charges, shaped charges, explosive cutting tape, and fracturing tape have not been used to sever conductors because inside access is limited by the smallest casing string (usually 7 inches in diameter). Divers cannot cut wells efficiently from the outside because of problems caused by the cement between casing strings and the huge crater in the soil required to reach 15 feet below the mudline (the side slopes of an excavation in weak soil must be gradual to ensure stability). To reach an inner casing string, the cement in the annulus must be chipped away by hand.

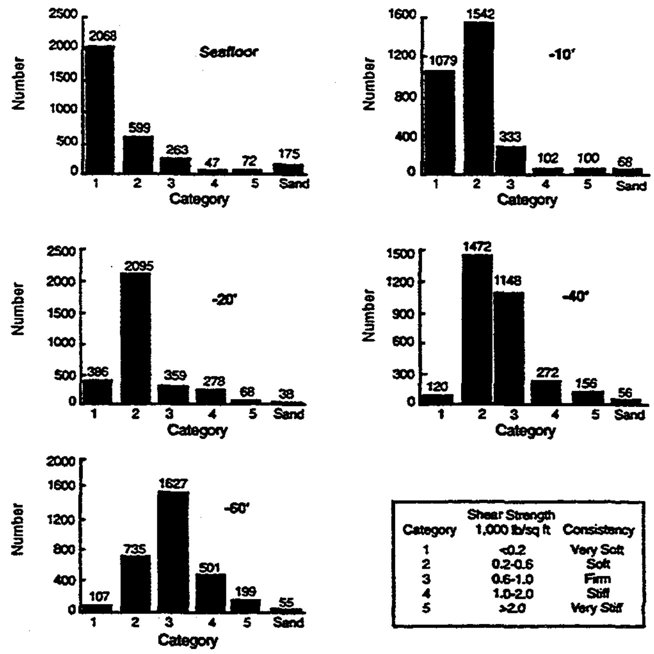
If the operator chooses the more costly option of using a nonexplosive method to sever wells, the severing operation should be done in the decommissioning process in order to minimize construction costs. In many cases, the well and the wellhead are supported by the lower casing strings cemented to the foundation. So if the casing is severed, this support is lost and the weight above the cut must be transferred to the deck. This may require strengthening to reinforce the deck. A serious disadvantage of nonexplosive methods is that determining if wells have been completely severed often requires using a large crane to test the result. It is also possible that a severed deck may have to support a portion of the well load.

Pilings in conventional platforms have been cut with explosives, mechanical cutters, and abrasive cutters, as well as divers, with varying degrees of success and at various costs. Mechanically or abrasively cutting piling through access windows cut in the deck legs or jacket legs could be done without a derrick barge on site, leaving the deck in place. If successful, questions of safety and liability arise because the platform may not be stable and could be overturned in a storm. In some cases, cutting a single pile could lead to a sudden displacement that could endanger a diver. If enough of the right piles are cut, the platform could fail under its own dead weight. Skirt-piled platforms are generally constructed in deep water (more than 200 feet) and are not good candidates for mechanical, abrasive, or diver cuts.

Weight of the lifts and strength of soil are also factors to consider in selecting a removal method. Clay soils are prevalent in the Gulf of Mexico. The skin friction that soil exerts on pilings and wells near the mudline may vary from less than 100 pounds per square foot at the mouth of the Mississippi River to 2,000 pounds per square foot offshore western Louisiana and eastern Texas. In the high-shear-strength areas, stiff to very stiff clay can add considerably to the force required to pull pilings, caissons, conductors, or jackets out of the mud. For example, for each foot of soil penetration of a 48-inch-diameter pile or caisson, about 12 tons of added force are required to remove it from the soil.

Removing a 48-inch-diameter pile or caisson cut 15 feet below the mudline in stiff clay can take 200 tons of force plus the weight of the pile or caisson. If the explosion from bulk explosives deforms the pile or well at the cut into a bell shape, the distortion can add to the soil removal forces. A platform that has four 48-inch-diameter piles grouted to the jacket legs with a combined buoyant weight of 400 tons may require as much as 800 tons of force to remove using bulk charges. Eight-hundred tons is the maximum capacity of several derrick barges in the Gulf of Mexico. One option is to use mechanical or abrasive cutters to avoid belling the piles. Another option has also been using "focusing" charges that shatter the piles rather than bell them.

Figures 3-4 and 3-5 show the number of existing platforms by soil type, shear strength, depth below the seafloor, and



Category	Shear Strength 1,000 lb/sq ft	Consistency
1	<0.2	Very Soft
2	0.2-0.6	Soft
3	0.6-1.0	Firm
4	1.0-2.0	Stiff
5	>2.0	Very Stiff

FIGURE 3-4 Number of platforms by soil type. Source: Courtesy of Fugro-McClelland.

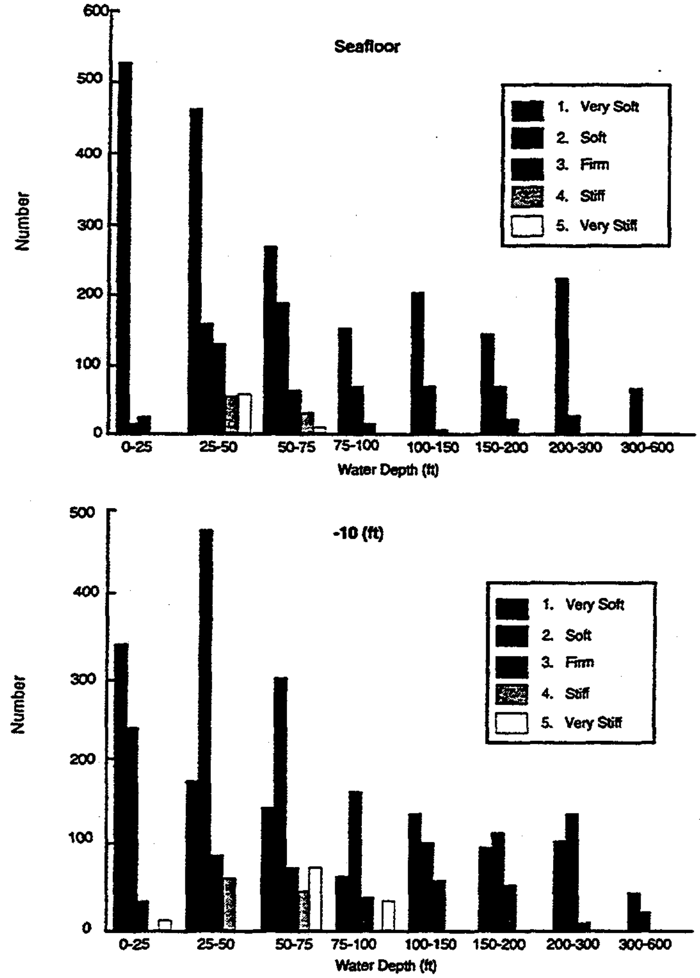


FIGURE 3-5 Number of platforms by soil type and water depth. Source: Courtesy of Fugro–McClelland.

water depth. Soil strength and varying water depth are considerations that clearly affect removal loads.

The weather in the Gulf of Mexico can change quickly. A placid day with 2- to 4-foot seas can quickly deteriorate to 10- to 15-foot seas with 40-knot winds. Even under ideal conditions, it takes several days to remove a deck, cut a well and pile, lift the jacket off the seafloor, set it on a floating cargo barge, and secure it for safe transit. Minimizing vulnerability to adverse weather conditions is essential for protecting the safety of operating personnel, equipment, and the environment. Operating floating construction equipment in a hostile environment requires realistic and adequate planning, flexibility, and a reliable back-up plan.

Scour and deposition rates are also factors that must be taken into account. MMS regulations for removing offshore structures require that "all casing, wellhead equipment, and piling shall be removed to a depth of a least 15 feet below the ocean floor, or to a depth approved by the district supervisor after a review of data on the ocean bottom conditions." This requirement is intended to ensure that obstructions do not protrude above the seafloor and that subsequent erosion at the site will not result in a seafloor obstruction.

A knowledge of deposition and erosion is necessary for recommending a reasonable depth of removal of all structural components that penetrate the seafloor. The geology of the continental shelf in the northern Gulf of Mexico has been studied extensively; several hundred thousand miles of high-resolution seismic profiles and more than 2,000 foundation bores on the outer continental shelf (OCS) have been collected and studied. Methods of assessing erosion and deposition processes on the OCS include: radiocarbon and other tests on cored material; examination of repeated bathymetric surveys; operator experience regarding exposure or burial of existing objects on the seafloor (such as pipelines and platform legs); and site-specific studies of deposition and erosion after storms or other high-energy events, such as hurricanes and earthquakes.

Geologic and geotechnical studies conducted on the Gulf of Mexico continental shelf (Coleman and Roberts, 1988) have shown that Holocene deposits (sediments generally less than 12,500 years old) vary in thickness across and along the shelf. During the Holocene epoch and during the last rise in sea level, the shelf was a net receiver of sediments. Generally, the largest deposits (6 inches per year) on the continental shelf occurred near the mouth of the Mississippi River (excluding mudslide areas); the smallest deposits (less than a fraction of an inch per decade) occurred off the coast of Texas and in deeper water near the shelf-edge break. Regional studies have shown that there has not been much erosion; however, these are long-term averages and do not account for short-term changes or localized effects. Nevertheless, one can conclude from these studies that most of the continental shelf does receive sediment and is not subject to long-term erosion.

Detailed bathymetric surveys have been conducted within virtually every offshore block that has been leased, and in many instances repeated surveys of a block have been made. Geotechnical reports and examination of these surveys indicate that over a relatively short period of time (one to five years), there is no significant erosion except locally around structures. Erosion varies greatly and rarely exceeds 3 to 5 feet at any one site. Erosion usually occurs in water depths of less than 30 feet. No scouring of more than 2 feet in water depths of more than 30 feet has been observed. Thus, in a period of a few years, erosion appears to be confined to relatively shallow water (less than 30 feet) with magnitudes of less than a few feet (Tubman and Suhayda, 1976; McClelland Engineers, 1979).

Scour around existing structures has been monitored by various operators, and to the committee's knowledge, localized scour of more than 3 feet has not been observed. In deeper water (more than 100 feet), no scour has been observed, even after major storms. One operator (Shell Offshore, Inc., 1995) indicates that no scour of more than 3 feet has been observed around any of the company's hundreds of platforms. Moreover, once a platform is removed, the major cause of scour is removed.

In addition to existing platforms, there are nearly 17,000 miles of marine pipeline in OCS waters and another 5,000 miles in state waters. Regulations require that these pipelines be buried at least 3 feet under the seabed out to water depths of 200 feet. In 1991, the U.S. Department of Transportation Office of Pipeline Safety began requiring that operators resurvey pipelines in water depths of less than 15 feet and rebury pipelines with a foot or less of sediment cover to a depth of 3 feet. With more than 95 percent of the survey completed, only 24.4 miles of the 1,456 miles surveyed were found to have a foot or less of sediment cover. This survey was conducted in water depths where the greatest scour from storms occurs, but only 1.7 percent of the pipelines were exposed or scoured to a depth of 2 feet. Thus, scour around obstacles on the seafloor tends to be minimal (generally less than 3 feet). Even in extremely shallow water (less than 15 feet), repeated pipeline surveys show that scour is minimal (NRC, 1994).

Studies of scour have rarely been conducted on the continental shelf, but analysis of data associated with meter moorings does provide some information on bottom current speeds and localized scour associated with major storms and hurricanes. A number of studies (Partheniades, 1971; Tubman and Suhayda, 1976; Young and Southard, 1978; Wells et al., 1979) document the effect of bottom currents on fine-grained sediment, which comprises the vast majority of the bottom soil on the continental shelf. All of these studies indicate that the fine-grained sediments are extremely resistant to scour by bottom currents generated by storms. Along the Florida coast, bottom currents during Hurricane Camille were as high as 5 feet/sec (Murray, 1970); off Texas, Hurricane Anita generated currents, some two to three times the normal speed (Wells et al., 1981). Even these abnormally swift currents did not cause significant scour of muddy sediments. Current meters placed during these measurement periods remain in place but have not caused significant scouring.

Thus, although the number of studies is limited, all scientific data tend to indicate that scouring to depths of more than 3 or 4 feet is extremely rare on the Gulf of Mexico continental

TABLE 3-4 Comparative Costs of Platform Removals Using Explosives (in dollars)

Water Depth (ft)	Caisson	Well Protector	4-Pile Production Platform	8-Pile Drilling and Production
50	100,000	180,000	470,000	760,000
150	—	—	780,000	1,030,000
250	—	—	1,275,000	1,945,000

Source: Courtesy of Offshore Operators' Committee.

TABLE 3-5 Cost Comparison for Alternative Removal Methods (in dollars)

Alternative	Bulk Explosives	Mechanical Cutting	Abrasive Cutting	Diver Cutting	Rigs to Reef
COST					
4-Pile Production Platform					
• 50′ water depth	470,000	662,000	605,000	785,000	n/a
• 100′ water depth	620,000	871,000	780,000	1,070,000	n/a
• 150′ water depth	780,000	1,079,000	950,000	1,415,000	535,000
• 200′ water depth	960,000	1,295,000	1,185,000	n/a	610,000
• 250′ water depth	1,275,000	1,660,000	1,520,000	n/a	875,000
8-Pile Drill/Production					
• 50′ water depth	760,000	1,125,000	965,000	1,105,000	n/a
• 100′ water depth	810,000	1,211,000	1,025,000	1,320,000	n/a
• 150′ water depth	1,030,000	1,497,000	1,270,000	1,690,000	7 20,000
• 200′ water depth	1,350,000	1,910,000	1,625,000	n/a	950,000
• 250′ water depth	1,945,000	2,575,000	2,255,000	n/a	1,335,000
Remarks/Reliability The abandonment costs include severing piles and conductors with the method listed at the top of each column. Assumed each structure had six (6) conductors (30"/10.75"/7"). Site clearance costs are included.	Very reliable High experience level Excellent safety record Lowest exposure time of all severing methods	Prone to having problems Very labor intensive Safety concerns	Not very reliable to date This assumes using very high pressure with low volume abrasive cutters Still in testing phase	Guaranteed cut if can be done safely Diver safety concerns Very high risk of blowback due to grout and/or mud Very labor intensive	Jacket and deck are toppled in place Piles and conductors cut by explosives
COST					
Six 30" diameter conductors in 83′ of water	18,900	104,500	55,300	300,000	n/a
Remarks/Reliability Conductor makeup = 30"/10.75"/7" All strings grouted. Conductor removal costs are already included in each of the above estimates of total abandoment costs.	Very reliable Excellent safety record Lowest exposure time of all severing methods	Prone to having problems Very labor intensive	Not very reliable Safety concerns about high pressure hoses or piping	Reliable Safety is a major concern Very high risk of blowback due to grout and/or mud	

shelf, and no scour has been observed in water more than 30 feet deep. In some areas of the Gulf of Mexico, immediately off the Mississippi River delta, active mudslides cause localized removal of material to subbottom depths of more than 20 feet. These areas have been mapped (Coleman and Prior, 1988) and are readily identifiable, and offshore structures in these areas are designed to withstand such forces. None of these platforms is scheduled to be removed in the near term, but requirements for removing them should be given special consideration.

TYPICAL PLATFORM REMOVAL COSTS

It is impossible to provide a complete table of the costs for all removal methods for all types and sizes of platforms in all water depths and soil conditions. But tables 3-4, 3-5, and 3-6, which were submitted to the committee by an offshore operator, provide a general idea of the order of magnitude of the costs. It is important to recognize that these figures do not represent the costs of abandonment or removal costs. Well-plugging and transportation costs are not included. Costs for

TABLE 3-6 Detailed Cost Comparison of Alternative Removal Methods (in dollars)

Alternative/Criteria	Bulk Explosives	Mechanical Cutting	Abrasive Cutting	Rigs to Reef
Cost—Operator/Consumer				
8-Pile production/drill platform (150′ Water Depth, 6 Wells)				
Decommissioning cost	100,000	150,000	140,000	100,000
Derrick barge removal cost	616,000	859,000	714,000	497,000
NMFS cost	13,000	n/a	n/a	13,000
Direct severing cost	12,000	180,000	110,000	12,000
Pipeline abandonment cost	43,000	43,000	43,000	43,000
Site clearance cost	180,000	180,000	180,000	0
Positioning cost	16,000	20,000	18,000	10,000
Miscellaneous support cost (engineer, supervisor, etc.)	50,000	65,000	65,000	45,000
TOTAL COST	1,030,000	1,497,000	1,270,000	720,000

NOTES:

1. Severing cost includes only the direct cost from the severing method. Additional support costs such as additional decommissioning and derrick barge costs are included in their respective categories.
2. The above costs assume no major problems are encountered during the severing operations.
3. Rigs-to-reef alternative does not include payment (lump sum donation) to state agency for site/buoy maintenance. This payment is usually 50 percent of the difference of disposal onshore versus disposal at a reef site.
4. Cost estimates provided by Chevron U.S.A., Inc.

removing larger, complex platforms in the same water depths may be twice as high as the costs indicated.

Table 3-4 is a comparison of cost estimates for removing four types of platforms in 50, 150, and 250 feet of water using bulk explosives to sever piles and conductors. Removals of caisson and well-protector platforms in deep water were not included because they are relatively in small number and the removal costs vary widely.

Table 3-5 compares cost estimates of removing a 4-pile production platform and an 8-pile drilling and production platform (with 6 wells) in 50 to 250 feet of water using present explosive and nonexplosive cutting techniques. The costs in each estimate assume a "trouble-free" severing operation with successful cuts on the first try. Allowances for the actual costs of unanticipated field problems and safety risks must also be considered in cost projections.

A further breakdown of the costs of removing an 8-pile drilling and production platform with 6 wells in 150 feet of water is shown in table 3-6. This table details the estimated cost of each phase of the typical abandonment process for a representative platform using various cutting techniques. The cost estimates are based on a trouble-free operation and successful first cuts. The data indicate that, at this time, explosive cutting is the most economical and safest (to personnel) removal method.

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4

Environmental Assessment of Present Removal Techniques

Explosive detonations during offshore removals may have serious adverse effects on sea turtles, marine mammals, and finfish in the vicinity of the platforms. Both marine mammals and sea turtles are protected under the Endangered Species Act, which prohibits all "take" or potential take of plants and animals designated as endangered (see Chapter 1, "Regulations, Laws, and Permits" for a definition of take). Sea turtles and several species of marine mammals are covered by this Act; all marine mammals are also protected under the Marine Mammal Protection Act.

Because of the potential damage from underwater explosions to both sea turtles and marine mammals, Section 7 of the Endangered Species Act requires that the Minerals Management Service (MMS) and the National Marine Fisheries Service (NMFS) be consulted about every explosive removal. To expedite this process, and because many removals are similar, a generic consultation was established on July 25, 1988 (Richardson, 1989).

In 1994 the Marine Mammal Protection Act (MMPA) was reauthorized. Section 101(a)(5) of the MMPA allows the secretaries of the U.S. Departments of Commerce and the Interior to authorize, in certain instances, the unintentional taking of small numbers of marine mammals by U.S. citizens incidental to activities other than commercial fishing. A new provision, Section 101(a)–(5)(D), was added in 1994 as an amendment to MMPA to streamline the authorization of incidental take of small numbers of marine mammals by "harassment."

The harvest of fish in federal waters of the Gulf of Mexico is managed by the Gulf of Mexico Fisheries Management Council (GMFMC) under the authority of the Magnuson Fisheries Conservation and Management Act. The GMFMC implemented a Reef Fish Management Plan in November 1984, which introduced regulations designed to rebuild reef fish stocks declining because of overfishing.

HABITAT AND ECOSYSTEMS

Offshore structures provide hard-bottom habitat for a variety of marine organisms, including reef fish, sea turtles, and marine mammals. The GMFMC (1989) estimated the total natural reef habitat in the Gulf of Mexico to be approximately 15,000 square miles. One-third of this habitat lies off the coast of Louisiana and Texas, which is also where approximately 99 percent of the platforms are located. Gallaway (1981) estimated that offshore petroleum platforms provide an additional 2,000 square miles, increasing the reef fish habitat by an estimated 27 percent.

The habitat provided by offshore platforms is particularly important in the northern Gulf of Mexico, where most of the substrate is clay, silt, and sand, with little or no relief. The added habitat provided by platforms and other oil and gas-related facilities has undoubtedly affected fish populations, although these effects are not well understood (Stanley, 1994). It has been estimated that 5 to 100 times more fish occupy the area around oil and gas platforms than the neighboring areas over soft mud substrate of the Gulf of Mexico (Gerlotto et al., 1989; Stanley, 1994). Since platforms were installed, they have become important to both the recreational fishermen and the commercial fishing industry and have long been recognized as *de facto* artificial reefs. Artificial reef habitats have attracted an increasing number of recreational fishermen to the coastal waters of Louisiana and Texas.

From 1973 to 1993, more than 1,150 structures have been removed from the Gulf of Mexico. The loss of habitat provided by these structures may have long-term negative impacts on reef fish populations or, at a minimum, may result in the dispersal of these populations away from established fishing areas.

Many coastal states recognize the vital fish habitat of offshore platforms and have decided to try to keep these platforms in their coastal waters. In 1986, Louisiana passed legislation creating the Louisiana Artificial Reef Program which is designed to transfer ownership from participating oil and gas companies to the state through the U.S. Department of Wildlife and Fisheries. This program permits the state to share the savings from decreasing the cost of removal. The Texas legislature followed suit in 1989 with the Texas Artificial Reef Act, which directs the Texas Department of Parks and Wildlife "to actively pursue acquiring offshore platforms for use as artificial reefs in the Gulf of Mexico in deference to other structures" (Stephan et al., 1990). To date 101 platforms have been deployed as artificial reefs in the Gulf of Mexico and off the east coast of Florida, approximately 10 percent of the platforms removed from 1978 to the present.

Sea Turtles

Sea turtles have been observed in the vicinity of offshore platforms. The loggerhead turtle is the most common species sighted around oil platforms (Hastings et al., 1976; Rosman et al., 1987), but leatherback, green turtles, Kemp's ridley and hawksbill have also been observed (Fuller and Tappan, 1986; Gitschlag and Renaud, 1989; Gitschlag and Herczeg, 1994). Loggerheads may reside at specific offshore structures for long periods of time (Rosman et al., 1987; Gitschlag and Renaud, 1989). The probability of occupation by sea turtles increases with the age of the structure (Rosman et al., 1987).

Sea turtles probably use oil platforms as places to feed and rest. They habitually sleep next to or under hard structures—usually rock outcroppings or reefs (Ogden et al., 1983; Wershoven and Wershoven, 1989). Offshore structures afford refuge from predators and stability in water currents, and loggerheads have been seen sleeping under platforms or next to support structures (Hastings et al., 1976; Rosman et al., 1987; Gitschlag and Renaud, 1989; Gitschlag, 1990; Renaud and Carpenter, 1994).

The potential for damage to sea turtles from the explosive removal of offshore structures first became apparent in March and April of 1986 when 51 dead sea turtles, primarily Kemp's ridleys, washed ashore on Texas beaches after the removal of platforms in state waters that involved 22 underwater explosions. Because shrimp fishing (another cause of sea turtle mortality) was at a very low level in the area, the explosions were identified as the probable cause (Klima et al., 1988), although this was never verified. A short time later, 11 sightings of sea turtles were reported at a platform prior to an explosive removal.

Two programs to evaluate the association of sea turtles with platforms were planned by NMFS: aerial surveys in the north-central Gulf of Mexico and an observer program during explosive removals. Aerial surveys were conducted in seven survey areas off the coast of Louisiana from June 1988 to June 1990 (Lohoefener et al., 1989, 1990). Two of the survey areas were near the Chandeleur and Breton islands; the other five were west of the Mississippi River. The number of platforms in each area varied from 40 to 155. In the study areas near the Chandeleur and Breton islands, sea turtles were positively associated with platforms. That is, there were significantly more turtles near platforms than there would be by random distribution.

In 1987 the NMFS initiated a sea turtle observer program at all explosive removal sites of oil and gas structures in state and federal waters of the Gulf of Mexico (Gitschlag, 1990). For at least 48 hours prior to detonation, NMFS observers watch for sea turtles from the surface. Helicopter aerial surveys within a mile radius of the removal site are conducted 30 minutes prior to and after detonation (Gitschlag and Herczeg, 1994). If sea turtles are observed, detonations are delayed until the sea turtles have been safely removed or have left the area.

From March 1987 through the end of 1988, 108 structures were removed; there were 36 sea turtles sighted at 13 percent of the structures (Gitschlag and Renaud, 1989). In 1992 NMFS observers conducted 6,500 hours of monitoring at 106 structure removals; turtles were observed at 20 percent of the removal sites (Gitschlag and Herczeg, 1994). Official NMFS observers recorded 45 sightings of 18 individual sea turtles. Twenty-seven turtles were observed (some by individuals who were not NMFS employees) in 61 sightings. The observation rate for aerial surveys was nearly 30 times greater than surface surveys.

The concentration of sea turtles around offshore platforms can be quite high. During 30 hours of surface observations at a platform approximately 30 miles off the coast of Galveston, Texas, there were 170 sightings of sea turtles. Over a period of 10 days, at least 11 individual loggerheads were identified (Gitschlag, 1990). There are only a few estimates of turtle abundance and turtle mortality because turtles can be difficult to observe, and turtles killed by explosions may not float to the surface until sufficient bacterial activity has occurred, which takes several days (NRC, 1990). In addition, nonlethal damage from the explosions or delayed lethal effects—both of which may have a greater impact on sea turtle populations than immediate death from explosions—are not apparent to observers.

Plans for long-term management have been developed to ensure the recovery of sea turtle populations in U.S. waters (e.g., NMFS and USFWS, 1991; USFWS and NMFS, 1992). If these efforts are successful and turtle populations increase, the numbers of sea turtles near platforms—and thus the risk from explosive removals—will also increase.

To document the effects of underwater explosions on sea turtles, the NMF undertook an experiment to determine the extent of injuries to sea turtles placed at 750 feet, 1,200 feet, 1,800 feet, and 3,000 feet from an explosive removal of an oil platform (Klima et al., 1988). On June 21, 1986, a platform in 30 feet of water was removed by detonating 50 pounds of nitro-methane inside each of four jacket legs 15 feet below mudline. A pressure of 1 by 10^6 psi was produced at the point of detonation (Duronslet et al., 1986). One Kemp's ridley and one loggerhead were placed in a cage at each of the four distances. Just before the detonation, the cages were lowered to a mid-water depth of 15 feet. The cages were retrieved shortly after detonation. The four turtles within 1,200 feet of the explosion were unconscious, as was the loggerhead in the cage at 3,000 feet. If they had been left in the water these turtles may have drowned. Turtles in all of the cages were affected. Some suffered everted cloaca and vasodilation, which lasted for two to three weeks.

Two observations of sea turtles severely wounded by explosive removals of platforms have been made. A dead or injured turtle drifting about 10 feet below the surface was sighted 1.5 hours after the explosive removal of a structure in 1986 (Gitschlag and Renaud, 1989). At the removal site of a caisson in 1991, within one minute of detonation, a loggerhead with a fracture down the length of its carapace surfaced (Gitschlag, 1995). The turtle was 15 to 100 feet from the detonation site.

Two immature green turtles (100 to 150 feet away) were killed when 20 pounds of plastic explosives (C-4) were detonated in open water by a U.S. Navy Ordnance Disposal Team. Necropsies revealed extensive internal damage, particularly to the lungs (Schroeder, 1995). Three sea turtles were unintentionally exposed to underwater shock tests by the Naval Coastal Systems Center in 1981 off the coast of Panama City, Florida. Three detonations of 1,200 pounds of TNT at mid-depth (in about 120 feet of water) injured one turtle at a distance of 500 to 700 feet and another at 1,200 feet. A third turtle at 2,000 feet was apparently not injured (O'Keeffe and Young, 1984; Klima et al., 1988).

The Committee on Sea Turtle Conservation of the National Research Council (NRC, 1990) estimated that between 8 and 50 turtles have been killed each year from the explosive removal of oil platforms. The committee report cautioned that this estimate may not be accurate. On the one hand, the estimate may be low because it is based on data from aerial surveys; on the other hand, it may be high because it does not include the effect of mitigation measures now required by NMFS. The 1990 report concluded that the data on the association of sea turtles with platforms and the effects of explosive removals on sea turtles are inadequate and that further research is needed.

Marine Mammals

Dolphins have been observed around platforms, especially in water deeper than 450 feet; and 28 species of cetaceans have been documented in the Gulf of Mexico, most of which are deep-water species (Mullin et al., 1990; Davis et al., 1995). This includes endangered sperm whales, which have been observed within sight of deep-water platforms off the coast of Louisiana.

An extensive survey of the distribution and abundance of cetaceans in the north-central and western Gulf of Mexico was conducted in 1992 and 1993. In the survey, conducted quarterly by Texas A&M University and NMFS and sponsored by the MMS, 21 species of cetaceans were identified in the area mentioned above (Davis et al., 1995). The most common species, except for bottlenose dolphins, sighted during these quarterly surveys were sperm whales and pantropical spotted dolphins. At least 25 species of cetaceans are permanent or transient residents in the entire Gulf of Mexico. Bottlenose dolphins are found throughout the area from the bays and estuaries to waters more than 1,640 deep. Atlantic spotted dolphins are also present in shelf waters 260 to 650 feet deep. Sperm whales have been observed in the Gulf of Mexico from water depths of 340 feet to more than 6,500 feet (Collum and Fritts, 1985). Pantropical dolphins are found along the continental slope in the north-central and western Gulf of Mexico and have been spotted in and around some deeper water production platforms (650 feet or more). It is possible that animals of any or all of these species could be found near deeper offshore oil and gas platforms at one time or another. In the future, as platforms are located in deeper water, the risks to these species could increase.

The species most likely to be near shallow-water platforms, which are usually older and, therefore, candidates for explosive removal, are bottlenose dolphins and Atlantic spotted dolphins. Bottlenose dolphins have been found around platforms in as little as a few feet of water. Atlantic spotted dolphins are found over the slope in depths of 600 feet and deeper, and sperm whales, although observed at depths of 340 feet and more, prefer depths more than 3,000 feet (Davis et al., 1995). Forty-one dead dolphins (40 bottlenose dolphins and 1 Atlantic spotted dolphin) found on Texas beaches in March and April 1986 may have been associated with the removal of platforms in state waters that involved 22 underwater explosions (Klima et al., 1988).

There are also many reports of stranded cetaceans in the gulf after hurricanes or other large oceanic storms. But evidence from the necropsies has not revealed explosive-impact-type injuries. In 1987 and 1988, 740 bottlenose dolphins were stranded along the Atlantic coast from New Jersey to Florida and in the Gulf of Mexico from Alabama to Texas. Unfortunately, most of the stranded mammals were in an advanced state of decomposition that the cause of death was difficult if not impossible to ascertain. Biotoxins were implicated as the cause of death in the animals that could be examined (Geraci, 1989). There was speculation that some animals had been injured by explosive impact from seismic or other outer continental shelf activities, but no evidence was reported from necropsies.

No direct scientific evidence of physical damage from exposure to high noise levels exists, but baleen whales, sperm whales, and several species of dolphins have exhibited disturbance reactions, such as cessation of feeding, changes in respiration and diving patterns, and avoidance behavior (ARPA, 1995). The sound reception and production capabilities of many suborders and families of marine mammals are well known. And every group of cetaceans studied has been found to be affected by high-level noise, including every species thought to be present in the Gulf of Mexico.

Although the current procedures in place to protect endangered sea turtles from high noise levels provide some protection, peak levels of exposure calculated during tests on sea turtles in 1986 (213 decibels (dB) reference (re:)

1 micropascal (μPa)* at 1,200 to 1,800 feet), which many scientists feel are potentially damaging to the hearing mechanism of marine mammals (Malme et al., 1983; Richardson et al., 1986; NRC, 1994). However, there is no scientific evidence that the minor and short-term behavioral reactions observed indicate any significant or long-term effects. For example, bottlenose dolphins observed 1,950 feet from the platform to be removed by explosives during the 1986 sea turtle exposure test mentioned above, swam rapidly away at detonation. They were reportedly exposed to a calculated peak of 213 dB re: 1 μPa at 1,200 to 1,800 feet. Unfortunately, measured levels and data on the acoustic spectra of the explosion are not available.

In response to a request by the American Petroleum Institute for a small-take authorization, NMFS proposed a new rule, which is currently under consideration. The rule authorizes the incidental take of bottlenose dolphins and Atlantic spotted dolphins. The rule specifies that explosives can be used only during daylight hours, unless authorized by the on-site representative of NMFS or MMS, and only after it has been determined that there are no dolphins within 3,000 feet of the structure. This distance was selected on the basis of a computer model that predicted that a dolphin calf would be only slightly injured from a 1,200 pound charge detonated in open water at 4,000 feet. In most instances under current practice, charges are limited to 50 pounds and are placed at least 15 feet below the mudline. NMFS assumed, based on the effects of a 1,200-pound charge at 4,000 feet, that a 3,000-foot safety zone would ensure that dolphins would not be injured. It is not clear what assumptions were made about environmental or oceanographic conditions, water depth, or bottom type.

The Marine Mammal Commission, in a 1994 report to Congress (MMC, 1994), voiced the same concerns about potential harm to marine mammals from explosive removal operations and recommended that acoustic monitoring around platforms scheduled for removal by explosive means would be useful for assessing the presence or absence of dolphins and whales and potential exposure to high-level noise. The commission also recommended that permit requests include all species of marine mammals that could be affected. Based on recent surveys, these would include bottlenose dolphins, Atlantic spotted dolphins, pantropical spotted dolphins, and sperm whales (Collum and Fritts, 1985). Existing data indicate that the current NMFS Observer Program has been successful in preventing injuries and deaths of turtles and marine mammals from explosive removals.

*Seismic exploration devices produce peak levels of 212 to 230 dB re: 1 μPa at one meter (Johnston and Cain, 1981; Holiday et al., 1984).

Fish

Oil and gas platforms provide significant habitat for Gulf of Mexico reef fishes and have become the preferred destination for many fishermen. Witzig (1986) estimated that 70 percent of all saltwater fishing trips in the exclusive economic zone (more than 3 miles from shore) off Louisiana were destined for one or more of the offshore oil and gas structures. Furthermore, it was determined that anglers who fish around platforms catch bigger, more desirable fish than those who fish in other areas (Reggio, 1987). In fact, they had the highest catch rates of all recreational fishers in the United States (Stanley and Wilson, 1990). Avanti, Inc. (1991), using data from the Marine Recreational Fisheries Statistical Survey, estimated that 30 percent of the 15 million fish caught off the coast of Louisiana and Texas by recreational fishers were caught near platforms. Dimitroff (1982) conservatively estimated that a group of 112 commercial snapper and grouper fishers from the Florida panhandle who regularly fish at petroleum platforms off the coast of Louisiana and Texas catch approximately 450,000 pounds of reef fish annually valued at approximately $2 million.

Although these figures are impressive, there is little documentation as to whether oil and gas platforms increase fish populations or just redistribute them. There are many reasons for the lack of information: the difficulty of sampling with traditional sampling gear; limited visibility; the tendency of fish to avoid divers; and the lack of standard survey techniques.

Despite these difficulties, however, investigators have found that the number of fish around platforms ranges from a few hundred to thousands, depending on platform size, location, and the time of the survey (Continental Shelf Associates, 1982; Putt, 1982; Stanley and Wilson, 1991). One study (Gerlotto et al., 1989) found that fish densities were 5 to 50 times higher immediately adjacent to platforms than they were 500 feet away. Stanley (1994) estimated the region of influence around a platform to be about 50 feet. Fish densities were 10 to 100 times higher within this area than on adjacent soft substrate. In a study conducted between September 1990 and June 1992, the fish population at a platform in 72 feet of water ranged from 1,990 to 28,100 fish, with an average of 12,600 fish; 2,644 (±689) red snappers per month were found at the site (Stanley, 1994).

The GMFMC (Gulf of Mexico Fisheries Management Council) became concerned about the effect of platform removals on reef fish populations of commercial and recreational value, particularly the number of fish killed by explosives. NMFS began evaluating the impact of explosive removals on fish in conjunction with the sea turtle observer program by collecting and counting dead fish floating on the surface. From 1986 through 1994, they monitored 751 removals involving explosives—513 platforms, 185 caissons, 47 submerged wells, and 6 flare piles. To enhance our understanding of the long-term effects of removals on fish population dynamics, this information needs to be supplemented with statistically valid data of the number of fishboth sinkers and floaterskilled during removal operations (Gitschlag, 1995).

A study assessing the fish kill at explosive platform removals is currently being conducted by NMFS with funding from MMS. As of April 1995, three platforms had been studied at water depths of 45, 55, and 82 feet. Results from this small sample may not be representative, and use of the preliminary data is inappropriate at this time. Nevertheless, some general conclusions may be drawn. The vast majority of the estimated fish kill within a radius of 330 feet of a platform occurs within 80 to 100 feet of the structure (Gitschlag, 1995). Most fish at a platform in 72 feet of water were within approximately 50 feet of the platform. Based on preliminary data, the species most affected by the explosive removals monitored by NMFS were Atlantic spadefish, sheepshead, red snapper, and blue runner. These are the same species found around platforms at similar depths described by Gallaway and Lewbel (1982) and Stanley (1994). Standard explosive removal procedures would kill most of the fish near a platform at the time of detonation.

Stanley (1994) estimated the number of fish around an 8-pile platform in 72 feet of water ranged from 1,990 to 28,100 fish over a period of 18 months (figure 4-1). The mean, or maximum, density (plus or minus one standard deviation or standard error), of red snapper around the platform was 2,644 (±699) per month. Higher densities of red snapper could be expected in deeper water (Gitschlag, 1995).

Although the number of certain fish of overexploited species (e.g., red snapper) impacted by explosive structure removals is economically insignificant compared with the take by commercial fisheries, the by-catch of shrimp fisheries and recreational fisheries, the long-term biological effects could be significant. Fish killed during explosive removals

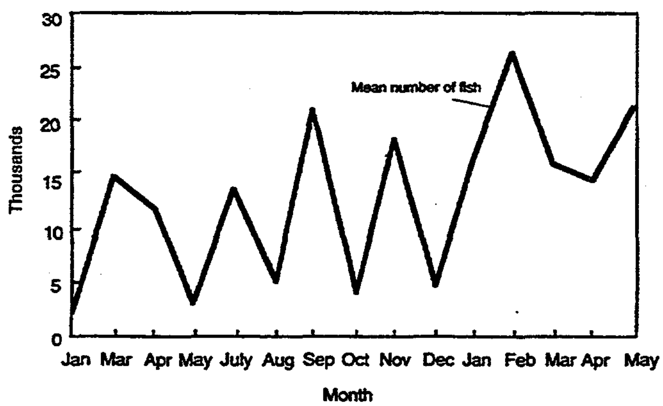

FIGURE 4-1 Number of fish at Platform WC 352. Source: Stanley (1994).

can be counted and therefore accounted for when estimating population levels. Fish that die later from the effects of an explosion are not counted, although this additional loss, depending on the numbers and the age of the fish killed, could have a significant impact on population dynamics as well as unfortunate ecological and economic implications. Reef fish are managed as a multispecies complex. The combined snapper and grouper complex accounted for $38.7 million of the total value of fish for Gulf of Mexico commercial fishing. Some 3.3 million recreational fisherman fishing the Gulf of Mexico in 1993 caught about 5 million red snapper (Newlin, 1993). Snappers, which constitute a large percentage of the fish around offshore platforms, are obviously a major commercial and recreational resource in the Gulf of Mexico. The long-term effects of destroying a component of the reef fish complex are being studied but are still not well understood.

Just as the number of fish at a single platform may vary dramatically from month to month (see figure 4-1), the species composition may also vary from platform to platform. Factors affecting these variations may include the water depth, age, size, geographic location, seasonal variations, how accessible a platform is to recreational and commercial fishermen, and water quality (Gallaway, 1981; Gallaway and Lewbel, 1982; Stanley, 1994). Although reef species around platforms were once thought to be relatively stable (Gallaway, 1981), movement to and from platforms is now more apparent (Stanley, 1994). Therefore, it is difficult to develop estimates of the potential impact of explosive removals on fish considering the wide range of structures in the Gulf of Mexico, although some estimates of species composition and abundance can be made.

To facilitate research on the effects of explosive removals on fish populations, a useful experiment would be to measure the blast wave characteristics (pressures, frequencies, and attenuation) at varying distances from the platform to create a database. The platform should be in relatively deep water with a typical soft bottom. Special attention should be given to the mitigation of explosive effects by reducing the charge weight (including shaped and specially configured charges) and the effect of burial depth. In concert with the blast wave measurements, probability of kill data should be obtained for the fish species of prime interest in cages judiciously placed at varying distances from the blast.

Appropriately deployed bubble curtains can attenuate and refract the blast pressure of detonations; obviously, they require that the fish be expelled from inside the curtain surrounding the platform (e.g., by the acoustic means discussed earlier). Data on the effectiveness of bubble curtains are sketchy so far and limited to shallow water. The distance from the platform for a bubble curtain to reduce blast pressure to acceptable levels has not been determined; nor has the path of the blast wave through the sea bottom under the curtain. Using bubble curtains would also pose significant deploymentproblemsandmaynotbeverybeneficial. Bubble curtains and other mitigating techniques are discussed in detail in chapter 2.

NONLETHAL EFFECTS OF EXPLOSIVE REMOVALS

According to Fish and Mobray (1970), a significant number of finfish species and several crustaceans can produce sound. Some of these species, including the snapper and grouper group, are found near platforms. Many also have reasonable hearing sensitivity, especially at low frequencies. In some species only males are soniferous, and then only seasonally. In others, both sexes produce sound. Also, many of these species have specialized hearing organs and special sound-producing muscles associated with an air bladder.

Although it is assumed that sound is behaviorally significant to this group of fishes, little or no field work has been done on the potential damage from high-level noise from shipping, explosive removals, acoustic tomographic studies, and seismic and other industrial activities. Sound pressure levels comparable to the levels from explosives have lethal effects on fish near the platform.

Based on preliminary data, the dominant species impacted by explosive removals are Atlantic spadefish, red snapper, sheepshead, and blue runner. Long-term, sublethal effects (e.g., temporary or permanent hearing loss and other physiological and neurological damage) on future reproductive performance and predator avoidance are not known. If fish found around platforms represent specific year classes, or are important components of the reef ecosystem as predators or competitors, the damage could be significant. The effects of high levels of sound incidental to industrial development on finfishes in the Gulf of Mexico are not known, although reactions of fish to infrasound have been studied (Enger et al., 1993). Unfortunately, neurophysiological pathology studies in fishes exposed to explosive removals have not been conducted.

SUMMARY

Current data on the deaths of or injuries to sea turtles and marine mammals from explosive removals indicate that the existing NMFS Observer Program has been successful in limiting mitigating damage to these species from explosive removals. According to NMFS observers, the currently required 48-hour observation period could be shortened to 24 hours without decreasing the benefits and with some savings in cost.

The effects of explosive removals on fish are substantial. But more systematic research is needed to determine if the number of fish killed will have long-term effects on population dynamics for certain fish species. Concerns about the potential effects of the loss of habitat once platforms are removed must also be addressed.

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5

Summary Assessment of Explosive and Nonexplosive Technologies

Previous chapters have described practices and policies governing offshore platform removals and dispositions, the prospective and current availability of explosive and nonexplosive techniques for cutting well conductors and platform components, the effects of both explosive and nonexplosive cutting techniques on living marine resources and the marine environment, and the potential interactions between platform removal and disposition policies with the interests of other ocean users. For each chapter, the committee relied on experts with experience to sort and evaluate the facts, probabilities, and uncertainties. It is impossible to reduce the key considerations and conclusions of each chapter to a common denominator that directly addresses the central policy consideration at issue. Thus, in this chapter, the committee tries to capture and summarize the collective wisdom that evolved during the deliberations.

This chapter has two objectives. The first is to present a broad comparative summary of the principal options for platform disposal (complete removal, partial removal, and toppling in place) and the cutting techniques (explosive, mechanical, abrasive, and diver cutting) considered by the committee. The second is to identify and discuss more fully the findings on which the committee based the conclusions and recommendations, which are outlined in chapter 6. The broad summary is given in table 5-1, and the findings that are especially relevant to the committee's charge are enumerated.

The criteria used to compare options for platform disposal and cutting techniques fall into three broad categories: (1) economic and operational, including considerations of relative costs, reliability, and risks to human health and safety; (2) environmental, encompassing effects on sea turtles, marine mammals, and fish; and (3) effects on other ocean users, recreational and commercial fishing, shipping and defense.

Cutting options are compared for the complete removal of platforms, the most common disposal method, although exceptions are noted for the two other disposal options. Cost comparisons are given as ratios showing differences among cutting options relative to the cost of explosive removals (more detailed cost estimates from previous chapters averaged for different water depths). For a shorthand comparison of environmental effects, it was assumed that the option under consideration would be subject to relevant federal or state statutes.

FINDINGS

1. There are many different types of platforms in the Gulf of Mexico. The platforms are owned by both major and independent operators who use them for a variety of functions; they were installed at different times in the past 50 years; and they are located at varying depths and on sea bottom of various soil types and compositions.

2. Current regulations require that platforms be removed within one year of the abandonment of a lease. All structural elements of the platform and all well conductors must be removed to a depth of at least 15 feet below the mudline and disposed of onshore unless a special exception is granted. The principal basis for an exception is using the platform in a rigs-to-reefs program administered by the state of Louisiana or Texas. Under these programs, some platforms are deposited at designated sites where they provide habitat for reef fish that are valued by recreational and commercial fishermen.

3. Simple platforms in shallow water can be removed relatively routinely. As the platform size, complexity, and water depth increase, the removal process becomes more complex and costly, creating greater risks to the lives and safety of workers and incurring additional costs to the operators. Procedures for removing large platforms in deep water inherently involve elements of uncertainty that can increase health and safety risks if they are not properly planned for and analyzed prior to and during the removal process. Financial risks to operators are created primarily by the high costs of using specialized equipment, such as large derrick barges. These costs range from $50,000 to $100,000 per day, so interruptions of or delays in schedules can mean a rapid escalation of removal costs.

4. Current estimates are that between 100 and 150 platforms (including caissons) will be removed annually for at least the next 5 to 10 years; a slightly lower number of new

platforms will be installed each year over the same period. More of the removals are expected to be from shallower to more accessible waters (i.e., less than 200 feet deep), and more of the installations are likely to be in deeper and less accessible waters. Estimates of both installations and removals could change as technology, the price of oil and gas, economic conditions, legislation, and regulations evolve during the next decade.

5. Deciding when to abandon or remove a platform is a business decision based on many factors. The most important factors include the operator's perception of the potential productivity of the geologic structure from which the oil or gas is extracted; the condition of the platform; whether or not the platform can be used elsewhere; the cost of maintaining the platform; concerns about liability; whether the platform is being used for other purposes, such as an intermediate point on a pipeline; and the operator's financial constraints, business strategies, and objectives. The range of factors leads to considerable variation in the age at which platforms are removed.

6. Explosives were used to remove about 70 percent of the platforms that were taken out of the Gulf of Mexico during the past decade. Almost all of the remaining 30 percent, which were removed by nonexplosive means, were either located in very shallow water or were caissons. A small number of platforms located in deep water were also removed by nonexplosive means because doing so facilitated their reuse.

7. The installation of platforms in the Gulf of Mexico has significantly increased the amount of hard-bottom habitat available for reef fish and other marine lifesometimes in areas accessible to recreational and commercial fishermen. Some platforms have been important destinations for fishermen for decades, and a high percentage of the annual take of some highly valued species of fish, notably red snapper, is near platforms.

8. Fish that reside near platforms are subject to a very high probability of being killed when structural members of the platform or well conductors are cut with explosiveseven when the use of explosives conforms to current, best engineering practices and MMS and NMFS regulations and procedures.

9. Estimates of fish kill by the best methods currently available is uncertain at best, and some fundamental causal questions remain unanswered. The blast waves from buried detonations differ significantly from the blast waves of traditional in-water detonations used in fish kill experiments in the following ways:

- The blast impulse lasts significantly longer because of velocity differences. This raises questions about the validity of existing kill criteria which are all based on observations from controlled, in-water detonation experiments. (Current kill criteria also apply predominantly to detonations and fish in relatively shallow water.)
- The blast strength alternates with distance at about half the rate of in-water detonations. The attenuation rate is strongly affected by attenuation in the soil which varies significantly with location of the platform site.
- There are no data on the lethal effects of a series of detonations as compared to a single detonation equal to the cumulative charge in the series, even for in-water detonations. In the absence of evidence to the contrary, it seems prudent to assume that multiple buried detonations are significantly more lethal than a single one.

10. Acoustic devices have been successful in keeping fish of 100 feet or more away from structures in very shallow water. Their effectiveness appears to be species-dependent, however, and has not been demonstrated for the resident species near offshore platforms in the Gulf of Mexico. Moreover, there are no experimental fish kill data relating fish kill to distance from a platform; nor can this distance be computed with reasonable confidence from available information.

11. Reducing the size of explosive charges by using shaped or specially configured charges, to half or a quarter of the currently used 50 pounds, would reduce the intensity of the blast but apparently not enough to significantly reduce fish kill. However, if the fish could be kept far enough from the platform (say by the acoustical technique) so that there would be an appreciable percentage of survivors, the foregoing strategies might become more effective. For example, reducing the size of the charge may then reduce the kill by, perhaps, another 10 to 20 percent, and increasing the depth of the charge may reduce the kill by another 10 percent. Using smaller charges may reduce the distance fish must be kept away from platforms.

12. Studies are scarce and specialized, but according to the available evidence the expert judgment is that:

- The populations of highly valued and overfished species vary greatly around individual platforms throughout the year and are subject to migratory changes.
- Under current law, the effects on fish populations from events outside the purview of existing regulations, such as fish killed as a consequence of platform removals, could be incorporated into fish management plans by adjusting the parameters that are under regulatory control (e.g., catch limits, fishing seasons, or allowable harvests). Adjusting regulatory parameters appears to be cost effective because these changes cost much less than prohibiting the use of explosives to remove

TABLE 5-1 Comparison of the Effects of Disposal Options and Cutting Techniques

Alternative/ Consideration	Complete Removal				Partial Removal	Topple in Place
	Explosives	Mechanical Cutting	Abrasive Cutting	Diver Cutting		
ECONOMICS AND OPERATIONS*						
Cost						
Ratio: Explosives = 1 (based on unweighted costs for different water depths)	1.0	1.5	1.3	1.7	Likely 25 to 50 percent of complete removal Dependent on type and depth Feasible only in deep water	0.7 For rigs-to-reefs, add transportation to site Assumes piles and conductors cut explosively
Reliability	Current industry practice for platforms in water deeper than 50 feet Regarded as most predictable and flexible Lowest probability of delaying removal	Used in shallow water where large lifting equipment is not required More likely to cause delays than explosives Ability to cut well conductors efficiently is questionable 15-foot depth requirement complicates use	Same as mechanical cutting but less experience Improving technology and shows promise in limited applications	Dependent on skill of diver Used for shallow-water pile cutting and large caissons	Potential costs and reliability benefits increase with depth and size of platform	Same as partial removal, but fewer benefits for larger platforms in deeper water
Human Health and Safety	Least health and safety risk	Lack of deployment and experience More use of divers	Same as mechanical Additional risks created by high-pressure hoses and piping	Considerable risks inherent in diving Risks increase with depth	Reduces risk by simplifying operation	Same as partial removal

*All cost estimates assume a trouble-free operation. This assumption may result in an underestimate of the cost advantage of explosive techniques in light of the reliability problems of nonexplosive techniques.

Alternative/ Consideration	Complete Removal				Partial Removal	Topple in Place
	Explosives	Mechanical Cutting	Abrasive Cutting	Diver Cutting		
ENVIRONMENT						
Effects on Fish and Marine Life	Kills fish, including highly valued and overfished species	No significant fish kill	No significant fish kill	No significant fish kill	Preserves habitat Fish killed if explosives are used	Same as partial removal
Applicability of Endangered Species Act	Sea turtles, some marine mammals such as sperm whales	Not likely No effects demonstrated	Not likely No effects demonstrated	Not likely No effects demonstrated	If explosives are used Maintains habitat	If explosives are used Provides habitat
Applicability of Magnuson Act	Possible effects on highly valued and overfished species	Not likely No effects demonstrated	Not likely No effects demonstrated	Not likely No effects demonstrated	Effects of explosives would be weighed against maintenance of habitat	Effects of explosives would be weighed against provision of habitat
Applicability of Marine Mammal Protection Act	If "take" via harassment demonstrated	If noise level affects behavior	If high noise level affects behavior	Not likely	Same as explosives	Same as explosives
Possibilities for Mitigation of Damage to Marine Life	NMFS observer program helps both intervention and enforcement Acoustic "scare" devices might prove effective	May require observer program if effects on marine mammals are significant	May require observer program if effects on marine mammals are significant	None needed	Remaining structure mitigates habitat loss	Remaining structure mitigates habitat loss
EFFECTS ON OTHER OCEAN USERS						
Commercial Fishing	Loss of habitat Possible impact on fish population	Loss of habitat	Loss of habitat	Loss of habitat	Maintains habitat Negative impact if explosives are used	Preserves habitat Negative impact if explosives are used
Recreational Fishing	Removal of accessible habitat Impact on catchable fish	Loss of accessible habitat	Loss of accessible habitat	Loss of accessible habitat	Maintains habitat, but accessibility limited by depth requirement	Preserves habitat Creates destinations if accessible sites are used
Shrimping	No effect on shrimp Increases trawlable waters if completely removed	Same as explosives	Same as explosives	Same as explosives	Decreases trawlable waters No effect in water deeper than 300 feet	Same as partial removal
Commercial Shipping/ Navy/Defense	No effect if completely removed or minimum clearance is maintained	Same as explosives	Same as explosives	Same as explosives	Need to maintain safety of navigation	Need to maintain safety of navigation

platforms. However, regulatory adjustments may cause economic losses and hardships for commercial shrimpers or fishermen, thus raising questions about equity or fairness. These equity issues are essentially political rather than technical in nature and fall outside the professional expertise and purview of the committee.

13. The NMFS Observer Program helps to ensure that the efficient use of explosives as constrained by current NMFS, MMS, and Marine Mammal Protection Act regulations is not likely to harm either sea turtle or marine mammal populations or to violate any of the provisions of the Endangered Species Act. The observer program promotes strict adherence to NMFS and MMS regulations and facilitates intervention in scheduled operations if sea turtles or marine mammals are threatened.

14. Nonexplosive techniques involving mechanical or abrasive cutting, either by machines or divers, and torch cutting by divers are viable techniques that have been used in the Gulf of Mexico—particularly on simple structures or components located in shallow water. But grouted well conductors or grouted piles, either independent of or within the structural elements of a platform, may be difficult to cut using existing nonexplosive techniques. Limiting the use of explosives to well conductors and grouted piles and requiring the use of nonexplosive techniques for other elements of the structure would not appreciably reduce the damage to fish or other marine life because every explosion poses a risk to nearby marine life.

15. Research and development on a wide variety of nonexplosive techniques and advanced explosive techniques using smaller charges are currently supported by potential vendors, users, and governments. Motivation for this research and development is economic (especially when nonexplosive cutting techniques may make reuse of a platform more feasible) but has also been undertaken in anticipation of regulatory restrictions on the use of explosives for ecological reasons.

16. The prevailing judgment of platform owners and operators, as well as the engineering community, is that using either existing or reasonably prospective technologies, explosive cutting is more economical, safer, more flexible, and more reliable than nonexplosive removal techniques for most platform removals in the Gulf of Mexico. The premises on which this judgment rests include:

- scheduling and cost uncertainty of nonexplosive cutting based on lack of field experience.
- failure of nonexplosive techniques may necessitate the use of divers, who would be subject to additional risk
- nonexplosive techniques require sophisticated and delicate operations (therefore expensive) that can potentially complicate the removal procedure when compared to explosive techniques

17. Leaving platforms in place, partially removing them, toppling them in place, using them to make artificial reef habitat, or disposing of them in designated disposal areas are options that some ocean-user groups believe are advantageous. Other groups, however, object to these alternatives and recommend complete removal and onshore disposal of all platforms.

6

Conclusions and Recommendations

CONCLUSIONS

Regulations governing the removal of offshore structures need to be sufficiently flexible to accommodate the complex requirements of a wide variety of structures, a spectrum of marine life, and various users in the Gulf of Mexico.

The many different types and locations of platforms, an array of potential interactions with other users of the ocean, and the complexity and variety of the biological communities associated with platforms indicate that regulations for platform removals must be flexible if they are to be both efficient and fair to all interested parties.

Existing Minerals Management Service (MMS) regulations have functioned well for many years. They are prescriptive in some areas (such as establishing the depth to which a platform must be removed). In other areas, the regulations are more flexible and can accommodate unusual cases by approving specific procedures in specific cases. Since the regulations have been in place, the oversight and approval processes have been continuously improved and modified. For example, the National Marine Fisheries Service (NMFS) Observer Program was instituted to minimize the incidental taking of sea turtles and marine mammals. Another improvement made in recent years is the requirement for verification of site clearance and written reports.

There are significant opportunities to satisfy some of the concerns of the interested parties without slighting the concerns of others. To take advantage of these opportunities, regulations must allow for individual circumstances and conditions.

Explosives are an economical and reliable tool for removing most structures, especially structures located in deep water.

At this time there is insufficient information about the mortality of fish from explosive removals to warrant changes in the current regulations and procedures. However, losses may be substantial, and continued efforts should be made to reduce them.

The available evidence on the effects of explosive removals on sea turtles and marine mammals does not support prohibiting or further restricting the use of explosives in the platform removal process. However, the effects on fish population dynamics are uncertain. Prohibiting explosive removals would incur risks to divers and other offshore workers and would substantially increase the cost of platform removals. Research and development on techniques to remove platforms without using explosives, and techniques that use smaller amounts of explosives more effectively, are progressing, as are research and development efforts on methods to mitigate the effects of explosives on marine life. Wider deployment and field testing are needed to evaluate the costs and benefits of these techniques. Suggested adjustments in MMS regulations and procedures that would encourage the development of nonexplosive techniques, as well as recommendations regarding research and testing that demonstrate the value of techniques for mitigating the damage from explosions, are discussed below.

The requirement that structures be removed to a depth of least 15 feet below the mudline is a disincentive to the development and use of nonexplosive techniques and advanced techniques using smaller explosive charges.

The 15-foot depth requirement significantly increases the risks to divers and the costs of nonexplosive cutting or advanced explosive cutting, which requires divers to place explosives. Divers can work much more efficiently and safely near the mudline. Relaxing the 15-foot depth of removal requirement could encourage the use of nonexplosive or advanced explosive techniques using smaller charges.

The NMFS Observer Program has significantly improved understanding of the effects of platform removals on sea turtles and marine mammals. However, the effects of explosive removals on populations of fish that frequently reside near platforms are not well understood.

The NMFS Observer Program is valuable from both a research and an enforcement perspective. Continuing this program can significantly improve understanding of the effects of explosive removals on living marine resources and suggest ways to mitigate them. Available empirical information about the numbers, location, and variation of species of interest is too fragmented to support conclusions at this time about the effects on total fish populations or population dynamics. Further research is needed for a definitive understanding of these effects.

The simplest means of blast mitigation are unlikely to reduce significantly fish killed from explosive removal operations.

Although there is considerable uncertainty about how to mitigate fish kills using existing methods, the evidence seems to indicate that blast effects of multiple detonations are severe enough that reducing the size of the explosive charge (e.g., using 25-pound charges instead of 50-pound charges) or setting deeper detonations (e.g., 32 feet instead of 16 feet) will result in only a modest reduction in the number of fish killed.

Devices to scare fish away from platforms during explosive activity are not currently applicable for use in open ocean water. However, this line of technological development offers promise for the future and should be encouraged.

Fish in shallow water (less than 50 feet deep) are vulnerable to the pressure wave generated by explosions (high compression followed by rapid decompression). There has been some success in frightening fish away using acoustic or "fish scare" devices, for example, near water intakes. If these techniques could be adapted to the fish species, water depths, and distances (e.g., 200 to 300 feet) associated with platform removals in the Gulf of Mexico, the number of fish killed could be significantly reduced. Mitigation techniques, such as reducing the size of explosive charges and increasing the depth of emplacement of explosives, when used in conjunction with other mitigation techniques, would then be more effective in reducing the number of fish killed.

Limiting the number of near-simultaneous explosions to eight and limiting the weight of individual charges to 50 pounds may have undesirable effects.

Although limits on the number of detonations and the weight of individual charges were motivated by concern about the adverse effects of explosions on marine life, these limits may increase rather than decrease damage. There are no data comparing the effects of a single explosive charge or near-simultaneous charges with the effects of a series of charges of the same size set off at timed intervals. In the absence of contrary information, estimates—based solely on existing data—of the number of fish killed from the explosive removal of a platform using a single charge must be assumed to be less than the number of fish that would be killed by a series of blasts set off at close intervals. Requiring a delay if more than eight explosions are necessary to remove a structure would expose surviving fish to subsequent explosions.

Because the 50-pound limit for individual charges is approved routinely under a generic permit, this limit may become a *de facto* industry standard, which would tend to discourage more discriminating analyses of the size of the charge needed to do a particular job. Such a standard could, in some cases, result in the use of a larger explosive charge than necessary. At other times, too small a charge might be used, which would necessitate using a second charge. In either case, more fish would be killed than if the appropriate-sized charge were used.

Nonlethal effects of explosive removals on living marine resources (e.g., temporary or permanent hearing loss or other physiological or neurological damage) on survival factors like reproductive performance or predator avoidance are not known. If species found near platforms represent specific year classes or are unique components of the reef ecosystem, the impact could be significant.

Studies are needed to determine the nonlethal morphological and physiological effects of high-level impulse noise on fish and other marine species affected by explosive removals.

Leaving platforms in place, partially removing them, toppling them in place, or using them for artificial reefs are options that are economically and environmentally attractive to many ocean users groups. Transport costs, concerns about liability, and regulatory issues now limit their use.

Commercial and recreational fishermen, environmentalists, and others concerned with maintaining or expanding the habitats provided by platforms (and reducing the damage they perceive when platforms are removed explosively) would, in some cases, prefer to leave platforms in place. Operators would avoid costs of removal. However, the potential liability and the costs of maintenance are perceived as outweighing these savings. Coastal states are hesitant to assume potentially unlimited liability for platforms left in place. Partial removal would solve most of the liability problems but is only feasible in deep water because of the need for navigation clearance. The cost of transporting a platform may limit its use as an artificial reef if a suitable site is far from the original platform site.

RECOMMENDATIONS

The committee recommends that the Minerals Management Service:

1. Change the minimum depth at which structures or well conductors must be severed from the current depth of 15 feet below the mudline to 3 feet below the mudline, provided that platform removal measures are employed that do not increase adverse environmental effects. Such measures include nonexplosive techniques, reduced charges, fish scare devices, or other effective mitigating methods. A 3-foot requirement would be consistent

with regulations for the burial of pipelines as well as extensive research indicating that a 3-foot limit would provide ample protection against exposure of the remaining structural elements by erosion or scouring of the seabed.

2. Work with industry representatives, explosives experts, and other interested parties and user groups to develop guidelines for determining the size of explosive charges necessary for cutting a specific structural element.

3. Allow partial removal of structures in 300 (or more) feet of water, with a cut at least 85 feet below the water surface when nonexplosive or advanced explosive techniques are used. If the top of the remaining structure is 200 feet or more below the water, a buoy should be installed and maintained.

4. Remove the limit of a maximum of eight detonations at any one time during the removal process, but retain the requirement of a 0.9-second delay between individual detonations.

5. Incorporate into the permit process the flexibility, including necessary request procedures, to encourage testing of removal techniques that could reduce the risks to living marine resources.

The committee recommends that the National Marine Fisheries Service in cooperation with the Minerals Managment Service and appropriate state agencies:

6. Maintain the procedures of the existing Marine Mammal and Sea Turtle Observer Program, including the ban on night-time detonations, but shorten the required period of observation from 48 to 24 hours prior to detonation. The 48-hour timeframe is costly in terms of human resources and support equipment and does not produce any additional benefits over a a 24-hour timeframe.

7. Systematically gather more information to augment available information about the species, numbers, and age distribution of fish killed and fish surviving when platforms are removed by explosives. Topics of particular importance include the following:

   - experimentally compare the fish kill for species of interest resulting from a series of equally buried detonations separated by the required 0.9 seconds, to the number of fish killed by a single detonation of the same size
   - experimentally determine the fish kill for species of interest at various depths and horizontal ranges for typical single explosion removal detonations
   - experimentally determine the effectiveness of acoustic systems, tailored for the species of interest, in scaring fish away from the sound source to a safe distance

The committee recommends that the offshore oil and gas industry, in cooperation with the appropriate federal and state agencies:

8. Develop a guidebook through appropriate industry-supported groups on recommended practices for using explosives in the platform removal process. The guidebook should deal with issues of reliability, environmental effects, and mitigation strategiesincluding tradeoffs between depth of placement, size of charge, and associated environmental effects.

9. Sponsor and support programs to explore the feasibility and cost effectiveness of acoustic means of keeping fish, including the grouper/snapper complex, at a relatively safe distance from removal operations.

10. Investigate means of incorporating safe removal techniques and the reduction of environmental damage into the initial design.

The committee recommends that appropriate state agencies, in cooperation with the appropriate federal agencies and the offshore industry:

11. Evaluate existing state-administered, artificial reef programs to enhance their potential for accommodating more platforms (by increasing the number of sites, for example) as well as their potential for providing commercial, recreational, or environmental benefits to other ocean users. The evaluation should include considerations of potential liability as well as the longer-term issues raised by the eventual loss of marine habitat.

APPENDICES

Appendix A

Biographical Sketches of Committee Members

F. Pat Dunn, Chair, retired from Shell Oil Company, served as a member of the Marine Board Committee on Disposition of Offshore Platforms (1985) and as a Marine Board member from 1986–1989. At Shell, Mr. Dunn was manager of civil engineering in the Offshore Production Division, where his group designed and supervised construction of more than 100 major platforms and numerous minor structures. He also was involved in an industry group that played a major role in setting industry practices and guidelines for offshore platform design. Mr. Dunn has bachelor's and master's degrees in civil engineering from Ohio State University.

Karen A. Bjorndal is an associate professor of zoology and director of the Archie Carr Center for Sea Turtle Research at the University of Florida in Gainesville. She received a B.A. in biology at Occidental College and a Ph.D. in zoology from the University of Florida. Dr. Bjorndal serves as the chair of the Marine Turtle Specialist Group of the International Union for the Conservation of Nature. She was a member of the National Research Council Committee on Sea Turtle Conservation, which issued a report entitled *Decline of the Sea Turtles: Causes and Prevention* in 1990. Dr. Bjorndal is a member of the Scientific Advisory Council of the Bahamas National Trust and the Board of Directors of the Annual Sea Turtle Symposium. Her research includes sea turtle demographics, feeding ecology, growth rates, and nutrition.

James M. Coleman (NAE) is the executive vice chancellor of Louisiana State University, and a professor in the Department of Oceanography and Coastal Sciences. Dr. Coleman's research focuses on continental shelf, slope, and deltaic sedimentation, and he has authored or co-authored more than 180 papers in the field of geomorphology. He has served as a principal investigator on a number of projects for oil and gas companies on the geological characteristics of continental shelf sediments in the Gulf of Mexico. Dr. Coleman has received several honors for contributions to the field, including election as a member of the National Academy of Engineering and a fellow to the Geological Society of America. He was appointed a member of the Marine Board in 1993. Dr. Coleman received his B.S., M.S., and Ph.D. degrees in geology from Louisiana State University.

William E. Evans is president of the Texas Institute of Oceanography of Texas A&M University, where he previously served as dean and then superintendent of the Texas State Maritime Program. Dr. Evans served as the Under Secretary of Commerce for Oceans and Atmosphere (Administrator of NOAA) from 1988–1989, assistant administrator of NOAA for Fisheries from 1986–1988, and as chairman of the Marine Mammal Commission from 1983–1986. He was responsible for directing the conservation, management, and development of living marine resources for commercial and recreational use and developing and implementing national policy for the nation's marine waters and resources. Dr. Evans is currently a principal investigator in a research project for the Minerals Management Service to examine the effects of various human activities on marine mammal populations in the Gulf of Mexico. His special area of research is the effects of noise on marine mammals. Dr. Evans has a B.S. in science education, an M.A. in audiology, and a Ph.D. in biology and biophysics.

Richard A. Kasprzak is the coordinator of the Artificial Reef Program for the State of Louisiana Department of Wildlife and Fisheries. The focus of this program is to coordinate the conversion of decommissioned oil platforms into fish habitats. Mr. Kasprzak previously was a biologist with the Department of Wildlife and Fisheries, focusing on population dynamics of finfish and shrimp, and has previously worked for the National Marine Fisheries Service. He has a B.S. in biology from Loyola College and pursued graduate studies at the University of Alabama and Louisiana State University.

James E. Kiesler is general manager of Global Movible Offshore, an offshore construction company that installs and removes offshore structures in the Gulf of Mexico. Prior to that, Mr. Kiesler worked for 17 years as a manager of offshore construction and in positions concerned with marine construction. Mr. Kiesler has experience in offshore platform fabrication and installation and has been involved in the installation of more than 500 platforms and the removal of more than 200 platforms in the Gulf of Mexico. He holds a B.S. in civil engineering from Purdue University.

Patrick E.G. O'Connor is team leader of the offshore and civil engineering team for the Amoco Corporation World-wide Engineering and Construction group in Houston. He has 28 years of experience in civil engineering, 20 of them related to offshore activities. Mr. O'Connor has engineering and construction experience in the North Sea, the Gulf of Suez, West Africa, the Far East, Trinidad, the Arctic, and the Gulf of Mexico, and is currently involved in the evaluation and development of explosive and platform-toppling technologies for abandoning platforms in the North Sea. He has a B.S. degree in civil engineering and is a chartered engineer in the United Kingdom.

Alan Powell is a professor in the Mechanical Engineering Department at the University of Houston. He previously served as technical director of the David W. Taylor Naval Ship Research and Development Center, where he was responsible for research on all aspects of ships (except nuclear vessels), including underwater acoustics and the effects of explosions on ships. Dr. Powell is currently teaching and doing research in acoustics and gas dynamics. He is a member of the Acoustical Society of America (fellow, Biennial Award, Silver Medal, past president), Royal Aeronautical Society (fellow, Orville Wright Prize, Baden-Powell Prize), and the American Society of Mechanical Engineers (Per Brüel Gold Medal). Declared a meritorious executive by President Reagan, he also received the Captain Robert Dexter Conrad Gold Medal for Scientific Achievement from the Secretary of the Navy. Dr. Powell is a member of the National Research Council Naval Studies Board, has served on several of its committees, and was chair of the National Research Council standing Committee on Hearing, Bioacoustics, and Biomechanics. He is a chartered engineer in the United Kingdom and has B.Sc. and Ph.D. degrees in engineering.

Allan G. Pulsipher is the director of the Policy Analysis Program of the Center for Energy Studies at Louisiana State University. The center conducts research and policy analyses on topics of concern to Louisiana's economy, environment, and government. He has directed studies of both the economic and environmental implications increasing the role of smaller, independent oil and gas companies on the outer continental shelf. He has served as chief economist at the Monitored Retrievable Storage Review Commission and the Tennessee Valley Authority. Dr. Pulsipher was also a program officer at the Ford Foundation and a senior staff economist at the President's Council of Economic Advisers. He has B.A. and Ph.D. degrees in economics.

Daniel J. Sullivan is manager of marine operations of J. Ray McDermott, Inc., a major offshore construction company operating in the Gulf of Mexico. He has 22 years of field experience in all aspects of offshore construction, including the removal of platforms. In his present position, Mr. Sullivan is responsible for all offshore operations in the Gulf of Mexico. He has a B.S. in civil engineering from Tulane University.

J. Pace VanDevender is director of the National Industrial Alliances Center at Sandia National Laboratories in Albuquerque, New Mexico. The goals of the center are to create large-scale, long-term work to improve the global competitiveness of U.S. industry by determining the key issues and opportunities for synthesis of organizations and technology for new applications. Dr. VanDevender previously held positions at Sandia as a research scientist, a manager for fusion research, and director of pulsed power sciences. Dr. VanDevender is a member of the National Research Council Naval Studies Board and has served on numerous committees under this board. He has B.A., M.A., and Ph.D. degrees in physics.

Peter K. Vélez is manager of regulatory affairs for Shell Offshore, Inc. He joined Shell in 1975 and has had assignments in designing, constructing, installing, and removing offshore structures and as manager of health, safety, and the environment. He is active in trade association groups, including the American Petroleum Institute, the Offshore Operators Committee, the National Ocean Industries Association, and the Louisiana Mid-Continent Oil and Gas Association and is a member of the U.S. Coast Guard National Offshore Safety Advisory Committee, which provides advice on offshore mineral and energy safety issues. He also serves on the governor of Louisiana's Energy Task Force, which is charged with advising the governor on oil and gas issues that affect the state. Mr. Vélez received B.S. and M.S. degrees in civil engineering from Rensselaer Polytechnic Institute.

Appendix B

Federal Register Notice and List of Respondents

6282 Federal Register / Vol. 60, No. 21 / Wednesday, February 1, 1995 / Notices

Minerals Management Service

Request for Comments Concerning the Effect of Removing Oil and Gas Platforms and Structures in the Outer Continental Shelf

AGENCY: Minerals Management Service (MMS), Interior.

ACTION: Notice.

SUMMARY: The MMS is assessing oil and gas platform and structure removal techniques. The assessment will focus on safety and environmental issues. This document requests comment regarding the effects of using various removal techniques.

DATES: The MMS must receive comments to this notice on or before March 3, 1995.

ADDRESSES: Mail or hand-carry comments to the Department of the Interior: Minerals Management Service; MS—4700; 381 Elden Street; Herndon, Virginia 22070-4817: Attention: Acting Chief, Technology Assessment and Research Branch.

FOR FURTHER INFORMATION CONTACT: Charles E. Smith, Acting Chief, Technology Assessment and Research Branch, telephone (703) 787-1559.

SUPPLEMENTARY INFORMATION: At the request of MMS, the Marine Board of the National Research Council (NRC) is assessing techniques for removing fixed offshore structures. The assessment will determine the occupational hazards and environmental effects of removal processes, determine techniques to mitigate undesirable effects, and appraise current regulations government the removal of platforms and structures located in the OCS. The study will evaluate both explosive and nonexplosive removal offshore structures, their hazards and effects, and mitigating strategies. The MMS offers the following information and questions to assist you in your response to this notice.

Requirements for Removal

1. Current regulations require that lessees remove all structures to a depth of 15 feet below the mud line. The MMS is inviting the public, including other users of ocean space (boaters, fishers, conservationists, etc.) to comment on the need for this requirement and to bring to the attention of the NRC committee any information that MMS should consider in assessing and updating this requirement.

Status of Technology

2. What are the alternatives to the removal of offshore structures?
3. What new approaches or improvements to existing techniques for removing offshore structures are in development?
4. What are the requirements and/or limitations of the existing or new techniques relative to different water depths or soil types?

Economic Costs

5. What are the comparative costs of explosive versus nonexplosive techniques for removing offshore structures.
6. Are new technologies in development likely to alter the comparative economics of alternative approaches?

Hazards

7. What are the environmental hazards of explosive and nonexplosive removal techniques?
8. What are the occupational hazards of explosive and nonexplosive removal techniques?

Impacts

9. What are the direct and indirect impacts on living marine resources (fish, marine mammals, sea turtles, etc.) from explosive removal of offshore structures (for example: direct=mortality, injury. indirect=damage to habitats, damage to overall health and survivability, etc.)?
10. What are the direct and indirect impacts of living marine resources form nonexplosive removal of offshore structures?
11. How do alternative removal techniques affect other users of the marine environment (fishers, recreational boaters, ship operators, others)?

Regulations

12. Do other users of the marine environment have needs that MMS should take into account in regulations for full or partial platform removal and for site clearance?
13. Are existing MMS regulations and operating rules governing the removal of offshore structures adequate?

Dated: January 25, 1995.

Thomas M. Gernhofer.
Associate Director for Offshore Minerals Management.

(FR Doc. 95-2376 Filed 1-31-95: 8:45 a.m.)

BILLING CODE 4310-MR-M

LIST OF RESPONDENTS

1. National Ocean Industries Association
2. Samedan Oil Corporation
3. Amoco Corporation
4. Mobil Exploration and Producing U.S., Inc.
5. Chevron, U.S.A., Inc.
6. Phillips Petroleum Company
7. Shell Offshore, Inc.
8. State of Louisiana
   (U.S. Department of Wildlife and Fisheries)
9. DALEN Resources Oil and Gas Company
10. Explosive Service International, Ltd.
11. Kenny Enterprises, Inc.
12. CNG Producing Company
13. Unocal
14. California Coastal Commission
15. Offshore Operators Committee

Appendix C

Participants in Committee Meetings

Houston, Texas
January 9–11, 1995

Jim Allen, HydroDynamic Cutting Services

Henry Bartholomew, Operations and Safety Management, Minerals Management Service

Jerry Cottrell, American Oilfield Divers

Jack Couch, Oceaneering International, Inc.

Jan Culbertson, Texas Parks and Wildlife Department

Gary DeMarsh, Senior Engineering Company (Demex Operations)

Charles F. Fahrmeier, Marine Contracting Services, Hunting MCS Company

Terry Henwood, National Marine Fisheries Service, Pascagoula Laboratory

John Kenny, Kenny Enterprises, Inc.

Vance Mackey, III, Engineering Services, Chevron U.S.A., Inc.

Jim Mullen, McDermott Underwater Services

Jim Murmis, Sub Sea International

William T. Poe, Explosives Service International

Tom Reynolds, Global Divers and Contractors

Ross Saxon, Association of Diving Contractors

Greg G. Schulte, Chevron, Inc.

Larry Simpson, Gulf States Marine Fisheries Commission

Paul Versowsky, Chevron Petroleum Technology Company

Brendan Welch, The Ensign-Bickford Company

New Orleans (Metairie), Louisiana
March 8–10, 1995

Ron Anderson, commercial fisherman, Golden Meadow, Louisiana

Ann Bull, Minerals Management Service

John G. Cole, Texas Shrimp Association

Onno de Waard, HeereMac v.o.f.

Felix Dyhrkopp, Minerals Management Service

Darcy Kiffe, Louisiana Shrimp Association

Randy Lanctot, Louisiana Wildlife Federation

Griff Lee, Griff C. Lee, Inc.

Jimmy Martin, B & J Martin, Inc.

Larry R. Martin, LGL Ecological Research Associates

Villeré Reggio, Minerals Management Service

Larry Simpson, Gulf States Marine Fisheries Consortium

David Stanley, Coastal Fisheries Institute, Louisiana State University

John Williams, Texas Charter Boats

Kay Williams, Save American Seafood

Charles Wilson, Coastal Fisheries Institute, Louisiana State University

Washington, D.C.
April 26–28, 1995

Roger Bacon, Sonalysts, Inc.

Neal Brown, Atlantic Research Corporation

Stephen W. Dolat, Sonalysts, Inc.

Charles McKinney, Minerals Management Service

Edward (Ned) Taft, Alden Research Lab

Appendix D

Regulations Governing Removal of Offshore Structures

FEDERAL STATUTES

Marine Mammal Protection Act of 1972, 16 U.S.C. § 1361

Overview of the Act

Section 1371 places a moratorium on the "taking" of marine mammals, including a complete cessation of harassing, hunting, capturing, or killing, except as approved under the Act.[1]

Exceptions are granted through permits "issued for the taking and importation [of marine mammals] for purposes of scientific research and for public display if . . . the taking proposed in the application for any such permit, or the importation proposed to be made, is first reviewed by the Marine Mammal Commission and the Committee of Scientific Advisors on Marine Mammals." 16 U.S.C. § 1371(1).

Section 1371(5)(A) allows U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region, the "incidental, but not intentional, taking by citizens while engaging in that activity within that region of small numbers of marine mammals of a species or population stock that is not depleted. . . ." 16 U.S.C. § 1371(5)(A).

Activity and site-specific regulations can only be issued on request, and following notice and comment rulemaking under the Administrative Procedure Act.

Although specific, regulations neither address nor permit individual operations. A Letter of Authorization (LOA) is required for individual operations.

At present, no approved state Coastal Management Program includes LOAs among the activities requiring consistency review. Although the issue has been raised (but not resolved) in Alaska, there are at least three reasons why LOA applications should not require consistency certifications:

- An LOA is not a permit to conduct an activity, it merely authorizes certain impacts on marine mammals in the event they occur as a result of activities already permitted by other federal agencies.
- Given the rigorous standards which must be met before the LOA can issue, any effect authorized by an LOA could not "affect a land or water use or natural resource of the coastal zone."
- Most activities for which LOAs are requested will have been subject to consistency review during review of the applicable plan of exploration or development and production plan.

[1]The "harassment" portion of the definition is troublesome and has been broadly construed (at least by those opposed to offshore operations) to include almost any activity that would, or could, elicit a behavioral response.

Endangered Species Act (1973), 16 U.S.C. § 1531 et seq.

Overview of the Act

The Act requires that federal agencies consult with the secretary of commerce in order to ensure that any action will not likely jeopardize the continued existence of any endangered or threatened marine species.

Prohibition Against "Taking" Members of Endangered or Threatened Species

It is unlawful for any person subject to U.S. jurisdiction to "take" any "endangered species of fish or wildlife" within the United States, in its territorial sea, and on the high seas. 16 U.S.C. §1538(a)(1)(B) and (C).

The term "take" is defined to mean "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." 16 U.S.C. § 1532(19).

- Harass means "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to breading, feeding or sheltering." 50 C.F.R. § 17.3.
- Harm means "an act which actually kills or injures wildlife. Such act may include significant habitat

modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering." 50 C.F.R. § 17.3.

Exceptions and Exemptions:

- **Permit**: granted for "any taking otherwise prohibited . . . if such taking is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity." 16 U.S.C. § 1539(a)(1)(B).
- **Exemption on Taking of Endangered Species:** exemption granted by vote of not less than five members of the Endangered Species Committee if it determines on the record that the benefits of such action clearly outweigh the benefits of alternative courses of action. 16 U.S.C. § 1536(h)(1)(A)(ii).
- Any taking in compliance with the terms and conditions specified in an "incidental take" statement in a biological opinion issued under Section 7 of the ESA. 16 U.S.C. § 1536(0)(2).

ESA § 7: Interagency Cooperation and Consultation

Federal agencies should not perform "actions" that "jeopardize the continued existence of any endangered species or threatened species" and are likely to "result in the destruction of adverse modification of habitat" of endangered or threatened species. 16 U.S.C. § 1536(a)(2).

- "Actions" affecting fish and animals should be reported to the Fish and Wildlife Service (FWS).
- "Actions" affecting plant-life should be reported to the National Oceanic and Atmospheric Administration (NOAA).

Following consultation with the affected agency, FWS or NOAA will issue a "biological opinion" detailing how the agency action affects the species or its critical habitat. 16 U.S.C. § 1536(b)(3)(A).

FWS and/or NOAA will issue an Incidental Take Statement with the biological statement under the following circumstances:

- FWS and/or NOAA decide the action will not jeopardize a species
- reasonable and prudent alternatives to the action will avoid jeopardy
- incidental taking of the species will not result in jeopardy
- if the species is a marine mammal whose taking is authorized under the Marine Mammal Protection Act

Incidental Take Statements shall detail the "terms and conditions" the agency must follow.

Incidental Take Statement. Section 7(b)(4) of the Endangered Species Act requires that when a proposed agency action is found to be consistent with Section 7(a)(2) of the Act and the proposed actions may incidentally take individuals of listed species, National Marine Fisheries Service (NMFS) will issue a statement that specifies the impact (amount or extent) of such incidental taking. Incidental taking by the federal agency or applicant that complies with the specified terms and conditions of this statement is authorized and exempt from the taking prohibitions of the Act.

Based on stranding records, incidental captures aboard commercial shrimp vessels, and historical data, five species of sea turtles are known to occur in northern Gulf of Mexico waters. Current available information on the relationship between sea turtle mortality and the use of high-velocity explosives to remove oil platforms indicates that injury or death of sea turtles may result from the proposed actions. Therefore, pursuant to Section 7(b)(4) of the Endangered Species Act, an incidental take (by injury or mortality) level of one documented Kemp's ridley, green, hawksbill, or leatherback turtle or ten loggerhead turtles is set for all removal operations conducted under the terms and conditions of this Incidental Take Statement. The level of taking specified here is cumulative for all removals covered by this consultation. If the incidental take meets or exceeds this specified level, Minerals Management Service (MMS) must reinitiate consultation. The Southeast Region NMFS will cooperate with MMS in the review of the incident take to determine the need for developing further mitigation measures.

The reasonable and prudent measures that NMFS believes are necessary to minimize the impact of incidental takings have been discussed with MMS and will be incorporated in the removal design for "standard" structure removals. The following terms and conditions are established for these removals to implement the identified mitigation measures and to document the incidental take should such take occur:

- Qualified observer(s), as approved by NMFS, must be used to monitor the area around the site prior to, during, and after detonation of charges. Observer coverage will begin 48 hours prior to detonation of charges. If sea turtles are observed in the vicinity of the platform and thought to be resident at the site, pre- and post-detonation diver surveys must be conducted.
- On days that blasting operations occur, a 30-minute aerial survey must be conducted within 1 hour before and 1 hour after each blasting episode. The NMFS-approved observer or NMFS on-site personnel (NMFS employee only) must be used to check for the presence of turtles and, if possible, to identify species. If weather conditions (fog, excessive winds, etc.)

make it impossible to conduct aerial surveys, blasting activities may be allowed to proceed if approved by the NMFS or MMS personnel on site.

- If sea turtles are observed in the vicinity of the platform (within 1,000 yards of the site) prior to detonating charges, blasting will be delayed until attempts are successful in removing them at least 1,000 yards from the blast site. The aerial survey must be repeated prior to resuming detonation of charges.
- Detonation of explosives will occur no sooner than 1 hour following sunrise and no later than one hour prior to sunset. However, if it is determined by NMFS or MMS on-site personnel that special circumstances justify a modification of these time restrictions and that such modification is not likely to adversely impact listed species, blasting may be allowed to proceed outside of this time frame.
- During all diving operations (working dives as required in the course of the removals), divers will be instructed to scan the subsurface areas surrounding the platform (blasting) sites for turtles and marine mammals. Any sightings must be reported to the NMFS or MMS on-site personnel. Upon completion of blasting, divers must report and attempt to recover any injured or dead sea turtles or marine mammals that are sighted.
- Charges must be staggered (0.9 second or 900 milliseconds apart) for each group of structures to minimize the cumulative effects of the blasts. If a removal operation involves multiple groupings of structures, the interval between detonation of charges for each group should be minimized to avoid the "chumming" effect. Whenever such intervals exceed 90 minutes, the aerial survey must be repeated.
- The use of scare charges should be avoided to minimize the "chumming effect." Use of scare charges may be allowed only if approved by the NMFS or MMS on-site personnel.
- A report summarizing the results of the removal and mitigation measures must be submitted to the MMS Gulf of Mexico Region within 15 working days of the removal. A copy of the report must be forwarded to NMFS, Southeast Region.

This Incidental Take Statement applies only to endangered and threatened sea turtles. In order to allow an incidental take of a marine mammal species, the taking must be authorized under Section 101(a)(5) of the Marine Mammal Protection Act of 1972. Although interest has been expressed in obtaining an exception authorizing a limited take of dolphins incidental to abandonment activities, no marine mammal take is authorized until appropriate small take regulations are in place and related "letters of authorization" are issued.

Outer Continental Shelf Lands Act, 43 U.S.C. § 1331 et seq.

Overview of the Act

The Outer Continental Shelf Lands Act (OCSLA) mandates that the subsoil and seabed of the outer continental shelf are subject to the jurisdiction, control, and power of the United States (43 U.S.C. § 1332(1)).

- The OCSLA assists states and their affected local governments in protecting their coastal zones from the temporary or permanent adverse affects of exploration, development, and production of the minerals of the outer continental shelf (43 U.S.C. § 1332(4)(A)).

The OCSLA requires that all "operations in the Outer Continental Shelf should be conducted in a safe manner by well-trained personnel using technology, precautions, and techniques sufficient to prevent or minimize the likelihood of blowouts, loss of well control, fires, spillages, physical obstruction to other users of the waters or subsoil and seabed . . . ." (43 U.S.C. § 1332(6)).

Laws and Regulations

The OCSLA states that all artificial islands and fixed structures erected on the outer continental shelf shall be subject to the laws of the state which it would be within if its boundaries were extended seaward to the outer margin of the outer continental shelf (43 U.S.C. § 1333(a)(2)(A)).

- The civil and criminal laws of each state governing portions of the outer continental shelf must be consistent with other federal laws and regulations of the secretary of the interior that are in effect.

The OCSLA grants authority to the secretary of transportation to promulgate and enforce Coast Guard regulations with respect to lights and other warning devices, safety equipment, and other matters relating to the promotion of safety of life and property on artificial islands and installations (43 U.S.C. § 1333(d)(1)).

Administration of Leasing

The secretary of the interior must cooperate with the relevant departments and agencies of the federal government and of the affected states in the enforcement of safety, environmental, and conservation laws and regulations (43 U.S.C. § 1334(a)).

Suspension or temporary prohibition of any operation or activity pursuant to any lease or permit may ensue if "there is a threat of serious, irreparable, or immediate harm or damage to life (including fish and other aquatic life), to property, . . . or mineral deposits" in the outer continental shelf (43 U.S.C. § 1334(a)(1)).

Permit cancellation may result if, after a hearing, the secretary of the interior determines that there is:

- serious harm or damage to life, property, mineral, national security or defense, or to the marine, coastal, or human environment
- threat of harm or damage that will not disappear or decrease to an acceptable extent within a reasonable period of time
- any advantages to cancellation that outweigh the advantages of continuing such lease or permit force (43 U.S.C. § 1334(a)(2)(A)(i-iii))

Minerals Management Service Regulations

Removal of Platforms: 30 C.F.R. Part 250.143

"The lessee shall remove all structures in a manner approved by the Regional Supervisor to assure that the locations have been cleared of all obstructions to other activities in the area."

"All platforms (including casing, wellhead equipment, templates, and pilings) shall be removed by the lessee to a depth of at least 15 feet below the ocean floor or to a depth approved by the Regional Supervisor based upon the type or structure or ocean-bottom conditions."

"The lessee shall verify by appropriate means that the location has been cleared of all obstructions. The results of the location clearance survey shall be submitted to the Regional Supervisor by means of a letter from the company performing the work certifying that the area was cleared of all obstructions, the date the work was performed, the extent of the area surveyed, and the survey method used."

Abandonment of Wells and Site Clearance: 30 C.F.R. §§ 250.110-.114

The goal of this section is to abandon wells in a manner assuring "downhole isolation of hydrocarbon zones, protection of freshwater aquifers, clearance of sites so as to avoid conflict with other uses of the [OCS], and prevention of migration of formation fluids within the wellbore or to the seafloor" (§ 250.110).

Lessee must have MMS district supervisor's prior approval to begin abandonment; must file Form MMS-124 in advance and a report on the same form within 30 days after abandonment work has been completed (§ 250.111).

Lessee shall verify site clearance after abandonment by one or more of the following methods as approved by the district supervisor:

- drag a trawl in two directions across the location
- perform a diver search around the well bore
- scan across the location with a side-scan or bottom-scan sonar

Form MMS-124 must include certification that the area was cleared of all obstructions, the date the work was performed, and the extent of the area searched around the location (30 C.F.R. § 250.114(b)).

Notice To Lessees (NTL) No. 92-02[2]

Notice to Lessees and Operators of Federal Oil and Gas Leases in the Outer Continental Shelf, Gulf of Mexico OCS Region.

Minimum Interim Requirements for Site Clearance (and Verification) of Abandoned Oil and Gas Structures in the Gulf of Mexico.[3] All abandoned wells and platforms must be cleared of all obstructions relating to oil and gas activities in the following locations:

- exploratory or delineation walls drilled with a mobile offshore drilling unit, the area covered by a 300-foot radius circle centered on the well
- platforms, the area covered by a 1,320-foot radius circle centered on the platform geometric center
- single-well caissons and well protectors, the area covered by a 600-foot radius circle centered on the well

Lessees must develop procedural plans for site clearance verification[4] of platform or structure abandonment, to be submitted with permit applications for platform or structure removal to MMS regional supervisor (field operations).

- High-frequency sonar searches shall be conducted over all exploratory or delineation wells, platforms, and

[2]NTL No. 92-02 is provided pursuant to the authority prescribed in 30 C.F.R. § 250.4(b).

[3]These interim procedures will remain in effect from the date of issue until revoked, modified, or superseded by revised regulations.

[4]Vessels used for site clearance verification operations shall be equipped with a navigational positioning system capable of providing position accuracy of ±30 feet.

single-well caissons and well protectors. This procedure may be waived by the regional supervisor.

- Platforms and single-well caissons and well protectors located in water depths of less than 300 feet shall have their locations trawled over 100 percent of their limits in two directions. The trawling contractor may not be associated with the company performing the salvage work.

  - Trawling contractors performing site clearance verification must possess valid commercial trawling licenses from either Louisiana, Texas, Mississippi, Alabama, or Florida, and must have at least two consecutive years of experience.
  - Trawling vessels must be equipped with a navigational system and plotter that will produce a real-time track plot of the vessel.
  - Trawling nets must have a maximum stretched mesh size of 6 inches and may not be equipped with turtle excluder devices. Maximum drag time is 30 minutes.
  - Lessees should contact former pipeline owners to determine whether or not the line will cause an obstruction to unrestricted trawling operations.
  - Trawling should not be conducted closer than 300 feet to any existing shipwreck.
  - Active pipelines, which are buried and for which no above-grade obstructions (such as valves) exist, are to be trawled without any restrictions placed on the trawling procedure or pattern.
  - Trawling shall be carried out no closer than 100 feet to unburied active pipelines greater than 8 inches in diameter.
  - Trawling in the direction of the line shall be carried out for unburied active pipelines smaller than 8 inches in diameter.

- Modifications to trawling requirements must be approved by the regional supervisor, field operations.
- District supervisors must receive at least 48 hours notice prior to conducting the clearance survey.
- Site clearance verification must be completed within 60 days of completion of platform or structure removal or abandonment operations. Verification letters from the company performing the salvage work and the trawling contractor shall be submitted with the subsequent sundry notices and reports on well, platform, or structure removal, and must include sufficient detail.
- Approximately six abandoned structure sites will be selected by the regional supervisor, field operations, for expanded clearance and verification coverage to confirm that extent of debris is limited to platforms and well caissons.

Magnuson Fishery Conservation and Management Act of 1976 (FWCA), 16 U.S.C. § 1802 et seq.

Overview of the Act

The FWCA, 16 U.S.C. § 1801, et seq., promotes domestic commercial and recreational fishing under sound conservation and management principles. The Act strives to "consider the effects of fishing on immature fish and [to] encourage [the] development of practical measures to avoid unnecessary waste of fish . . . ."

The term "fishing" is defined as the "catching, taking, or harvesting of fish; the attempted catching, taking, or harvesting of fish; any other activity which can reasonably be excepted to result in the catching, taking, or harvesting of fish; . . . ." 16 U.S.C. § 1802(10)(A),(B), and (C) [emphasis added].

Section 1811 establishes a fishery conservation zone that runs contiguous to the territorial sea of the United States. Section 1812(a)(1) grants the United States exclusive fishery management authority over all fish within the fishery conservation zone.

Section 1851(a)(1) sets national standards for fishery conservation and management whose measures "shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry."

Eight regional fishery management councils (FMCs) were created by the Act. FMCs have the discretion to prescribe "measures, requirements, or conditions and restrictions as are determined to be necessary and appropriate for the conservation and management of the fishery." 16 U.S.C. § 1853(b)(8).

Clean Water Act (CWA), 33 U.S.C. § 1251 et seq.

Overview of the Act

The CWA, 33 U.S.C. § 1251 et seq., states that the objective of this Act is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." Furthermore, "it is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife" be established.

Section 102(a) of the act authorizes the administrator the Environmental Protection Agency to prepare and develop comprehensive programs for preventing, reducing, or eliminating the pollution of navigable waters and ground waters. In addition, these comprehensive programs shall consider necessary improvements to "conserve such waters for the protection and propagation of fish and aquatic life and wildlife."

National Fishing Enhancement Act of 1984, 33 U.S.C. § 2101 et seq.

Overview of the Act

The purpose of the Act is to promote and facilitate the development of artificial reefs that will enhance fishery resources and commercial and recreational fishing (33 U.S.C. § 2101(b)).

Section 2102 establishes broad artificial-reef development standards, including those which will:

- enhance fishery resources to the maximum extent practicable
- minimize environmental risks and risks to personal health and property
- be consistent with generally accepted principles of international law and shall not create any unreasonable obstruction to navigation (33 U.S.C. § 2102(1),(4), and (5))

National Artificial Reef Plan

The secretary of commerce will provide leadership in developing and publishing a long-term plan that identifies criteria for siting artificial reefs, design and construction criteria, methodologies for monitoring compliance and managing the use of artificial reefs, and provide a synopsis of existing information and future research needs (33 U.S.C. § 2103 (1-6)).

Permits for Construction and Management of Artificial Reefs

The secretary of the army will issue permits for reef development projects in compliance with the National Artificial Reef Plan, and regional, state, and local criteria (33 U.S.C. § 2104(b)).

- Permits subject to this section shall specify the design, location for reef construction, and construction materials.
- Permits shall specify terms and conditions for the construction and maintenance of the artificial reef as are necessary for compliance with all applicable provisions of law.

Persons holding permits shall not be liable for damages caused by activities required to be undertaken by the terms and conditions of the permit. (33 U.S.C. § 2104(c)(1)).

Persons holding permits shall be liable if damages arise from operations outside the terms and conditions of the permit. (33 U.S.C. § 2104(c)(2)).

- Persons violating any provision of a permit shall be liable to the United States for a civil penalty not to exceed $10,000 for each violation. (33 U.S.C. § 2104(e)).

Coast Guard Regulations

Aids to Navigation on Artificial Islands and Fixed Structures

Artificial islands and structures that are erected on or over the seabed and subsoil of the outer continental shelf must be equipped with obstruction lights and fog signals meeting the requirements of (33 C.F.R. Part 67).

Marking of Structures, Sunken Vessels, and Other Obstructions

"Structures" mean any fixed or floating obstruction, intentionally placed in the water, which may interfere with or restrict marine navigation. (33 C.F.R. § 64.06).

Upon abandonment of a lease, if a platform is only partly removed or is converted to an artificial reef, 33 C.F.R. Part 64 may require that the submerged "structure" be marked with lights or signals.

- Section 64.11 mandates that the owner of a vessel, raft, or other craft wrecked and sunk in a navigable channel shall mark it immediately with a buoy or daymark during the day and with a light at night.

Prior to establishing a structure, the owner/operator must apply to the Coast Guard for authorization to mark it. (33 C.F.R. § 64.21).

U.S. Department of Commerce—National Oceanic and Atmospheric Administration Regulations (Marine Protection, Research, and Sanctuaries Act of 1972, as amended, 16 U.S.C. § 1431 et seq.)

NOAA has certain restrictions with regard to the use of explosives at marine sanctuaries that are found in 15 C.F.R. Part 943. The rule was finalized on February 24, 1995 (60 F.R. 10312), and adopted the rule that was proposed on December 5, 1991 (57 F.R. 63634).

The final rule states in 15 C.F.R. Part 943.5(a)(14), "Prohibited Activities," that the following activity is prohibited and thus unlawful for any person to conduct or cause to be conducted: "Possessing, except for valid enforcement purposes, or using explosives or releasing electrical charges within the sanctuary."

There are two marine sanctuaries in the Gulf of Mexico at this time: East Flower Garden Bank and West Flower Garden Bank. These are located in a small area of the southern portion of the High Island planning area. The provision would only affect a small number of platforms (2 to 3), which are adjacent to the marine sanctuary.

INTERNATIONAL LAW

Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention or LC), *done* December 29, 1972, 26 U.S.T. 2403, T.I.A.S. No. 8165.

Article III defines dumping to include "any deliberate disposal at sea of . . . platforms or other man-made structures" but to exclude "matter incidental to . . . the normal operations of . . . platforms" and matter placed in the sea "for a purpose other than the mere disposal thereof . . . ."

As a general matter, the parties to the LC agree to prohibit the dumping of wastes and other matter, except as allowed under the LC. (LC Art. IV).

The United States has advised the secretariat of the International Maritime Organization of its view that constructive abandonment, toppling, or other sea disposal of platforms, for no purpose other than disposal, is "dumping" governed by the LC. The United States views the conversion of platforms to other uses, such artificial reefs, and the toppling of structures by natural causes not to be "dumping."

Convention on the Continental Shelf, *in force* June 10, 1964, 15 U.S.T. 471, T.I.A.S. No. 5578, 499 U.N.T.S. 311 (the 1958 Convention on the Continental Shelf)

Article 5, Part One: "The exploration of the continental shelf and the exploitation of its natural resources must not result in any unjustifiable interference with navigation, fishing or the conservation of the resources of the sea . . . ."

Article 5, Part Two: "[T]he coastal State [i.e., nation] is entitled to construct and maintain or operate on the continental shelf installations and other devices necessary for its exploration and the exploitation of its natural resources . . . ."

Article 5, Part Five: "Any installations which are abandoned or disused must be entirely removed."

"Thus, the Convention requires the complete removal of oil and gas structures which have been abandoned or are no longer being used. It is our view that oil and gas structures purposely left in place for use as artificial fishing reefs do not fall within the requirement of the Convention."

Customary International Law

The U.N. Convention on the Law of the Sea (1982 UNCLOS), 21 *International Legal Materials* 1261 (1982), has not been ratified by the United States. 18 *Weekly Comp. Pres.* Doc. 887 (1982). Nevertheless, the United States accepts many of its provisions as reflective of customary international law.

Article 60 of the 1982 UNCLOS prescribes that any installations or structures that are abandoned or disused shall be removed to ensure safety of navigation, taking into account any generally accepted international standards established in this regard by the competent international organization, and that such removal shall also have due regard to fishing, protection of the marine environment, and the rights and duties of other States.

Citing the principle of law in Article 60 as its authority, the Maritime Safety Committee of the International Maritime Organization (IMO) issued Guidelines and Standards for the Removal of Offshore Installations and Structures on the Continental Shelf and in the Exclusive Economic Zone (IMO Removal Guidelines) on May 4, 1988 (M.S.C. Circ. 490). With minor changes, the Assembly of the IMO adopted them in 1989.

IMO Removal Guidelines, Part 1.1: "Abandoned or disused offshore installations or structures on any continental shelf or in any exclusive economic zone are required to be removed, except where non-removal or partial removal is consistent with the following guidelines and standards."

IMO Removal Guidelines basically call for a case-by-case review of the effects of nonremoval on navigation and the environment, the feasibility of removal, and the desirability of allowing a new use.

- For example, IMO Removal Guidelines, Part 3.1, calls for the complete removal of an abandoned platform "standing in less than 75 meters of water and weighing less than 4,000 tons in air, excluding the deck and superstructure . . . ."
- But Part 3.4 allows such a platform to remain "wholly or partially in place" if it will serve a new use.

STATE LAW

Louisiana Artificial Reef Initiative Act

The emplacement of oil and gas platforms off the Louisiana coast has resulted in an extensive artificial reef system providing prime recreational fishing areas. Removal of oil and gas platforms could result in major losses of revenue for Louisiana fishermen. The Louisiana Artificial Reef Initiative was created to compensate for this potential loss of habitat and involves representatives from the university, state, federal, and industry levels. The Louisiana Artificial Reef Plan contains guidelines for implementation of a state artificial reef program, which will be periodically updated through the Louisiana Artificial Reef Council. Phase 1 of the Reef Program is composed of nine areas. The state must obtain permits from the U.S. Army Corps of Engineers, which operates in conjunction with other federal and state agencies. Permits authorizing the use of aids to navigation must be obtained from the U.S. Coast Guard. Permit for coastal zone activities must be obtained from the Louisiana Department of Natural Resources. Artificial reef plans approved by the Louisiana Senate and House Natural Resources Committees are implemented by the Louisiana Department of Wildlife and Fisheries after general implementation requirements are fulfilled. Artificial reef complexes are supervised by the Louisiana Department of Wildlife and Fisheries, the Louisiana Geological Survey, and the Center for Wetland Resources at Louisiana State University.

The Special Artificial Reef Site (SARS) program was designed to provide the Artificial Reef Planning Councils of Louisiana's Artificial Reef Program the flexibility to include in the reef program selected artificial reefs that have arisen outside of designated planning areas. SARS must meet general criteria, including the following:

- The SARS site must have historical or biological significance; for example, the site provides good fishery habitat.
- The site is a cooperative effort between the Louisiana Artificial Reef Program and other state, federal, or private groups.
- The site contains unremovable shipwrecks or derelicts that are environmentally beneficial.
- The site is part of an experimental project undertaken by the Louisiana Artificial Reef Program.

Establishing a SARS requires drafting a SARS proposal depicting relevant site information for submission to the Louisiana Artificial Reef Council. Necessary permits for accepted proposals are obtained by Artificial Reef Coordinators, and are signed with Deeds of Donations by the secretary of wildlife and fisheries.

Texas Artificial Reef Fishery Management Plan

The Texas Artificial Reef Act of 1989 promoted the enhancement of artificial reef potential in state and federal waters adjacent to Texas. The Texas Artificial Reef Plan was developed in accordance with the Texas Parks and Wildlife Department code and is a product of a process designed to maximize input of various interest groups who comprise the Texas Artificial Reef Advisory Committee. The state's Artificial Reef Act of 1989 provided guidance for planning and developing cost-effective and environmentally sound artificial reefs. All Texas artificial reefs are sited, constructed, maintained, monitored, and managed according to specified criteria listed in the plan. Several recommendations developed in the Artificial Reef Plan have been made to guide the department's artificial reef program.