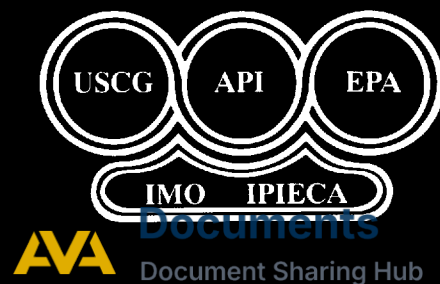


INTERNATIONAL

1995 Oil Spill Conference

*Achieving and
Maintaining
Preparedness*

ABSTRACTS



1995 International Oil Spill Conference

SECTION I—EVOLVING TECHNOLOGIES

SECTION II—MARINE TRANSPORTATION

SECTION III—FATE AND EFFECTS IN AQUATIC ENVIRONMENTS

SECTION IV—SPILL MANAGEMENT/MITIGATION

SECTION V—SUSTAINABLE GLOBAL PREPAREDNESS

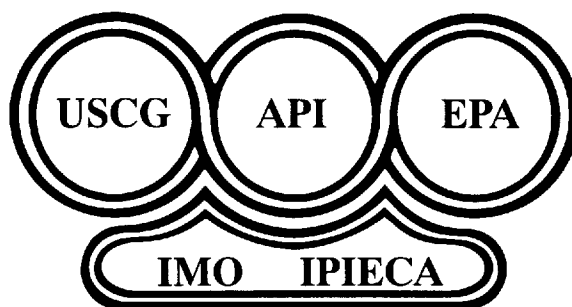
SECTION VI—THE *BRAER* INCIDENT

SECTION VII—POSTER PRESENTATIONS

Abstracts

***1995
International Oil Spill
Conference
(Achieving and Maintaining Preparedness)***

***February 27–March 2, 1995
Long Beach, California***



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In Memoriam

Kenneth E. Biglane 1927–1994

The 1995 International Oil Spill Conference Proceedings volume is dedicated to the memory of Kenneth E. Biglane in recognition of his devoted service with the Environmental Protection Agency and valuable contributions to the Biennial International Oil Spill Conferences.

Mr. Biglane was instrumental in pioneering the development of the National Response System in the United States. Early on, he was appointed to head the Emergency Response Office of the Environmental Protection Agency and served as the first Chairman of the National Response Team. It was Mr. Biglane's foresight in working with his government and industry counterparts that identified the need to establish a routine forum for information exchange on oil spill prevention, preparedness, and response that resulted in the first Oil Spill Conference in 1969. Mr. Biglane continued to provide vital guidance and commitment to the Conference through 1993.

1995 International Oil Spill Conference

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FOREWORD

This proceedings represents the 14th biennial International Oil Spill Conference (IOSC). Since its inception a quarter of a century ago, the Conference has slowly evolved upward as the political winds of oil spill interest have waxed and waned. Today, this Conference stands as the premiere international technical conference and trade exposition for the world's oil spill community. In a maturing and more sophisticated industrialized world, nations of all sizes have recognized the importance of international environmental stewardship. Oil spills, though generally of relatively short term, localized influence, are one more environmental perturbation that can be minimized and mitigated by man's active intervention. The goals of this Conference remain much as they were in 1969: "... to delineate the overall dimensions of the oil spills problem, explore the present state of the art of prevention and control of oil spills, and review the relevant research and development efforts of government and private industry, both here and abroad."

The 1995 Conference takes another step forward to maintain its position as the premiere international conference on oil spill issues. To further develop the international cooperation and flow of information, the long time sponsors—the American Petroleum Institute, U.S. Coast Guard, and Environmental Protection Agency—are joined this year by two international organizations. Representing the international regulatory community is the International Maritime Organization (IMO), and representing the international petroleum industry is the International Petroleum Industry Environmental Conservation Association (IPIECA). With this new partnership, the IOSC will greatly enhance its international balance of technical contributions and trade exhibits. More importantly, it will help to communicate the latest in oil spill information to nations of all sizes throughout the world. The long term benefits should include reduced loss of oil to the seas, quicker cleanup, and less environmental impact due to cleanup practices.

During the past half dozen years, new oil spill management regulations have been implemented in the United States and internationally. Although complex and detailed, one primary facet is better preparation and training of response personnel. Unfortunately, the level of interest and involvement in oil spill activities in the world communities is inversely related to the length of time since the last major, newsworthy oil spill event. For that reason, the theme chosen for the 1995 Conference is "Achieving and Maintaining Preparedness." How do we get and stay prepared? The technical papers to be presented, although covering a broad range of topics, were selected with this theme in mind.

What is new for the 1995 Conference? Many changes have been made to continue the process of improving the Conference and to meet the needs of the attendees. This year, one of our goals was to continue the improvement of the technical quality of the papers accepted. A selected group of 45 international reviewers chose 136 papers for this Proceedings and presentation at the Conference. This was from more than 490 submitted. Additionally, 126 poster presentations will be displayed in seven special sessions over a two day period, and are also included in this Proceedings. A new Abstract Book and a day-at-a-glance chart has been developed to assist attendees in selecting the presentations of their choice. Almost 300 vendors of oil spill related goods and services are participating in the associated trade show. Two major west coast spill cooperatives are conducting an on-water demonstration of spill equipment and techniques.

Many other special events are planned. A theme session, highlighted by a keynote luncheon address by the Rt. Honorable Lord Donaldson of Lymington, will feature the *Braer* oil spill in the Shetland Islands. IMO and IPIECA are hosting a special evening session summarizing a recent world-wide seminar series they have sponsored. There also will be a special evening session dealing with Natural Resource Damage Assessment.

Another new feature is the preparation and distribution of three selected topic "white papers." These reviews will cover major topics of interest and will be formatted to provide detailed discussions and information on relevant issues. Corresponding panels of experts have been invited to discuss and debate the issues raised in these white papers.

A sponsors' scholarship program has been instituted to support students and other interested parties who might contribute to and participate in the Oil Spill Conference. Most importantly, this Conference provides a place where the world's experts can meet, visit, and exchange the latest information.

As can be seen, many changes have been made to ensure that the Conference continues to improve to meet the needs of the oil spill community that supports it. In order to continue fulfilling this role, it is most important that attendees provide feedback on the content and quality of this Conference.

The sponsors of the 1995 IOSC would like to thank all of the contributors, reviewers, and others who have made this Proceedings volume possible. I would also like to acknowledge the considerable contribution of time by the various members of sponsoring organizations who have staffed the Steering and Program Committees. They are the heart and soul of the IOSC. Finally, I would like to recognize the professional contributions of Courtesy Associates, and Trade Associates, who have been responsible for the organization and management of this Conference and the trade show. Their considerable expertise brings order out of chaos on a biennial basis.

James P. Ray

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CONTENTS

I—EVOLVING TECHNOLOGIES

Session M1A: Remote Sensing—Chairman: Royal Nadeau

Tracking Buoys for Oil Spills.....	3
Ron H. Goodman, Debra Simecek-Beatty, Don Hodgins	
Airborne Detection, Imaging and Telemetry of Oil and Other Spectral Features on the Ocean Surface.....	4
Charles P. Giammona, F. Rainer Engelhardt, Kandace S. Binkley	
Oil Thickness Detection Using Wideband Radiometry.....	4
O. B. McMahon, E. R. Brown, G. D. Daniels, T. J. Murphy, G. L. Hover	
Advanced Aerial Surveillance System for Detection of Marine Pollution and International Aerial Surveillance Cooperation in the North and Baltic Seas	5
Capt. Klaus Schroh	

Session T4C: Mechanical Containment and Recovery—Chairman: Ken Keane

Costs Associated with the Cleanup of Marine Oil Spills	5
John Harper, Ann Godon, Alan A. Allen	
Full Scale Oil Containment Boom Testing at Sea	6
Atle Nordvik, Ken Bitting, Paul Hankins, Larry Hannon, Robert Urban	
Texas Marsh Burn: Removing Oil from a Salt Marsh Using In-Situ Burning.....	6
Manuel F. Gonzalez, Gabriel A. Lugo	
Evaluation and Limits of Protective Boom Plans for High Tidal Range and Strong Current Areas	7
Daniel Fauvre	

Session W1C: Spill Simulation—Chairman: Frank Wood

A Multicomponent Oil Spill Model for Dissolved Aromatic Concentrations.....	7
Henrik Rye	
The Use of Knowledge-Based Software to Identify Shoreline Treatment Options	8
Alain Lamarche, Chrystel Black, Anna-Paula Varanda, Edward H. Owens	
A Three-Dimensional Oil and Chemical Spill Model for Environmental Impact Assessment	8
Mark Reed, Deborah French, Henry Rines, Henrik Rye	
State-of-the-Art Techniques in Oil Spill Modeling.....	9
H. M. Cekirge, M. Koch, C. Long, C. P. Giammona, K. Binkley, R. Engelhardt, R. Jamail	

Session W2C: Geographic Information Systems—Chairman: Harry Aston

An Integrated Program for Sensitive Environment Mapping	10
Robert Pavia, Jacqueline Michel, Jill Petersen, Lt. Stacy Birk-Risheim	
Sensitivity Mapping Worldwide: Harmonization and the Needs of Different User Groups.....	11
Jennifer M. Baker, Mark Spalding, Jon Moore	
Geographic Information System (GIS) for Impact Assessment, Ecologically Sound Measures, and Documentation of Oil Spills.....	11
Gustav Törning, Jonas Fejes	

Session W3B: Bioremediation—Chairman: Lisa Parker

Oil Spill Bioremediation Agents—Canadian Efficacy Test Protocols	12
Sandra Blenkinsopp, Gary Sergy, Zhendi Wang, Mervin F. Fingas, Julia Foght, Donald W. S. Westlake	
The Development of Bioremediation for Oil Spill Cleanup in Coastal Wetlands: Product Impacts and Bioremediation Potential	13
Irvin A. Mendelssohn, Qianxin Lin, Karolien Debusschere, Charles B. Henry, Jr., Edward B. Overton, Ralph J. Portier, Maude M. Walsh, S. Penland, Nancy N. Rabalais	
Dispersion and Biodegradation of Oil Spills on Water	14
R. Varadaraj, M. L. Robbins, J. Bock, S. Pace, D. MacDonald	
Bioremediation of Oiled Beach Sediments: Assessment of Inorganic and Organic Fertilizers	14
Kenneth Lee, Gilles H. Tremblay, Susan E. Cobanli	

Session W4C: In-Situ Burning—Chairman: Alan A. Allen

Studies of In-Situ Burning of Emulsions in Norway	15
Chantal C. Guénette, Per Sveum, Cathe M. Bech, Ian A. Buist	
The Newfoundland Offshore Burn Experiment—NOBE	16
Mervin F. Fingas, Greg Halley, Francine Ackerman, Robert Nelson, Martine Bissonnette, Nanci Laroche, Zhendi Wang, Patrick Lambert, Ken Li, Paula Jokuty, Gary Sergy, Edward J. Tennyson, Joe Mullin, Larry Hannon, Rod Turpin, Phil Campagna, Wayne Halley, John Latour, Roy Galarneau, Bill Ryan, Don V. Aurand, Robert R. Hiltabrand	
Environmental Impact and Recovery of a High Marsh Pipeline Oil Spill and Burn Site, Upper Copano Bay, Texas	17
John W. Tunnell, Jr., Beau Hardegree, David W. Hicks	
In-Situ Burning of Alaska North Slope Emulsions	17
Ian A. Buist, Nick Glover, Bruce McKenzie, Richard Ranger	

Session Th1B: Chemical Countermeasures I—Chairman: Dick Lessard

Dispersant Effectiveness at Sea	18
T. Lunel	
Weathering and Chemical Dispersion of Oil at Sea	18
Alun Lewis, Per S. Daling, Tove Strøm-Kristiansen, Atle B. Nordvik, Robert J. Fiocco	
Improved Laboratory Demulsification Tests for Oil Spill Response	19
Robert J. Fiocco, Kenneth W. Becker, Marjorie A. Walsh, Jorunn N. Hokstad, Per S. Daling, Alun Lewis	

Session Th2B: Alternative Response Technology—Chairman: Ann Hayward Walker

A New Cleaning Product for Oiled Birds and an Integrated Automated Process	20
Anne Basseres, Bruno Verschuere, Jean-Pierre Jacques, Gerard Holtzinger, Bernard Tramier	
Biological Effects Monitoring During An Operational Application of COREXIT 9580	21
Gary Shigenaka, Vance P. Vicente, M. Angela McGehee, Charles B. Henry, Jr.	
Fast Source-Fingerprinting Analysis for Oil Spill Response	21
Paulene O. Roberts, Charles B. Henry, Ursula Ehrmann, Edward B. Overton	
Effect of Stokes' Law Settling on Measuring Oil Dispersion Effectiveness	22
M. L. Robbins, R. Varadaraj, J. Bock, S. J. Pace	

Session Th3C: Chemical Countermeasures II—Chairman: John Cunningham

Testing and Use of Shoreline Cleaning Agents During the <i>Morris J. Berman</i> Oil Spill	22
Jacqueline Michel, Bradford L. Benggio	
Removing Oil and Saving Oiled Marsh Grass Using a Shoreline Cleaner	23
S. R. Pezeshki, R. D. DeLaune, J. A. Nyman, R. R. Lessard, G. P. Canevari	
Chemical Treating Agents: Response Niches and Research and Development Needs	23
Ann Hayward Walker, Janet H. Kucklick, Jacqueline Michel, Debra K. Scholz, Timothy Reilly	

Shoreline Cleansing by Interactions Between Oil and Fine Mineral Particles	24
James R. Bragg, Edward H. Owens	

II—MARINE TRANSPORTATION

Session M1B: Salvage—Chairman: Oleg Khalimonov	
Lightering and Salvage of the Tank Barge Ocean 255 in Aftermath of a Collision, Explosion, and Fire in Tampa Bay, Florida, August 1993	27
Cdr. Jerzy J. Kichner	
Responder Immunity and Salvage.....	27
William L. Peck, Cdr. Allan F. Elmore	
Enhancing the Capabilities of Salvage-Based Pollution Defense	28
John Arnold Witte, Sr.	
Session T1A: Financial Liabilities—Chairman: Sidney A. Wallace	
Certificates of Financial Responsibility: Can the Train Wreck be Averted?.....	28
David Bovet	
Liability Incentives for Reducing the Costs of Oil Spills	29
Bobbie Lively-Diebold, Paul Ameer, Gary Yoshioka, Justin Anand	
Vessel Liability and Financial Responsibility in the U.S. Coastal States.....	29
Amy M. Stolls	
OPA 90 and the International Regimes Concerning Oil Pollution Liability and Compensation: Are They So Far Apart, Must They Remain So?	29
Daniel F. Sheehan	
Session W1B: Tanker Routing—Chairman: Steven A. McCall	
Application of Oil Spill Simulations to Tanker Routing Off the U.S. Coast	30
Robert P. LaBelle, Charles M. Marshall	
Tanker Routing, A Private Company's Perspective.....	30
Gary A. Reiter	
Tug Usage for Escort and Rescue Towing in Prince William Sound, Alaska	31
David L. Gray, Johan H. de Jong	
World-Class Oil Spill Prevention and Response for the Alaskan Trans-Alaska Pipeline System Tanker Trade.....	31
Sharon O. Hillman, James E. McHale, Steve D. Hood, Richard C. Long, John C. Klepper, Gary P. Bader	
Session W2B: Inspection and Maintenance—Chairman: Charles Huber	
Using Internal Environmental Auditing Programs to Help Prevent Spill Incidents.....	32
David A. Davidson, Thomas L. Wills	
Evaluation of the U.S. Coast Guard's Tanker Inspection Program: Tanker Inspection Impacts	32
Christine S. Meers, Paul Ameer	
Port State Control in Latin America	33
Cap. Francisco Pizarro	
Safety Management for the Maritime Industry: The International Safety Management Code	33
William H. Moore, Karlene H. Roberts	
Session W4B: Prevention—Chairman: Klaus Schroh	
Operational Pollution Prevention Programs for Loaded Tankers Transiting Coastal Waters.....	34
N. Robin Lee	
Salvage or Preventive Measure? A Practical Perspective	34
John M. Noble	

Protecting the Great Barrier Reef from an Oil Spill	35
Wendy Craik	

III—FATE AND EFFECTS IN AQUATIC ENVIRONMENTS

Session M1C: NRDA Implementation Issues—*Chairman:* Linda Burlington

A Cooperative Approach for Measuring Direct-Use Damages: The 1992 Avila Beach (California) Oil Spill	39
Richard W. Dunford, Kristy E. Mathews, H. Spencer Banzhaf	
Natural Resource Damage Assessment of the <i>Presidente Rivera</i> Oil Spill, Delaware River	39
Douglas Helton, Donna Lawson, Martin McHugh	
Computer Models for Damage Assessment: Estimates of Use and Results	40
James F. Bennett, Bruce E. Peacock, Timothy R. Goodspeed	
Incident Command System and Natural Resource Damage Assessment: Multiple Roles Facing Natural Resource Trustee Agencies	40
Pierre H. duVair	

Session T2A: NRDA State Perspectives, Case Studies—*Chairman:* John Chlada

Innovative Procedures for Natural Resource Damage Assessment.....	41
Ingrid K. Hansen	
A Cooperative Damage Assessment: Lessons from the Greenhill Spill	42
J. Heather Warner Finley, Karolien Debusschere, James G. Hanifen, Maura J. Newell, Brian E. Julius, Pasquale F. Roscigno, Johannes von Beek	
The Great Pom-Pom Caper: Washington's First Compensation Schedule Application	42
Paul Heimowitz	

Session T3C: Fresh Water Concerns, Planning—*Chairman:* David Fritz

Identifying and Mapping Sensitive Resources for Inland Area Planning.....	43
Miles O. Hayes, Jacqueline Michel, Jeffrey A. Dahlin, Lt. Kenneth Barton	
Oil Spill Chemicals in Freshwater Environments: Technical Issues	43
Ann Hayward Walker, Janet H. Kucklick, Alexis E. Steen, David E. Fritz	
Aquatic Resource Characterization of the Upper Ohio River Basin Using a Geographic Information System	44
John Arway, Douglas Nieman, Thomas Proch, Jerry Shulte	
The Great Lakes Spill Protection Initiative: A Public/Private Partnership	44
William J. Trumbull	

Session Th1A: Fresh Water Fate and Effects—*Chairman:* Gary Sergy

A Screening-Level Evaluation of Impacts to a Montana Lotic Macroinvertebrate Community from a Fuel Oil Spill	45
William D. Van Derveer, Royal J. Nadeau, Georgia L. Case	
Fate and Effects of Crude Oil in a Southern California Stream Drainage	46
Eugene R. Mancini, Dilworth W. Chamberlain, Mark A. Lowe, Marion Fischel, Eric J. Greenwood, Susan Rankin	
An Oil Spill in an Illinois Lake: Environmental Exposure Assessment.....	47
Ted Sauer, Jerry Neff, Lawrence Reitsema	
An Oil Spill in an Illinois Lake: Ecological and Human Health Assessment.....	47
Jerry Neff, Ted Sauer, Lewis Osborn, Pamela Tazik, Lawrence Reitsema	

Session Th2A: Fate and Effects in Aquatic Environments—*Chairman:* Gail Thomas

Oiling of Mangrove Keys in the 1993 Tampa Bay Oil Spill	48
Sally C. Levings, Stephen D. Garrity	

Mitigation Strategies at an Estuarine Mangrove Area Affected by an Oil Spill	48
Antonio Quilici, Carmen Infante, Jorge Rodríguez-Grau, José A. LaSchiazza, Henry Briceño, Néstor Pereira	
Weathering Experiment on Spilled Crude Oils Using a Circulating Water Channel.....	49
Tsutomu Tsukihara	
Distribution and Weathering of Oil from the Iraq-Kuwait Conflict Oil Spill Within Intertidal Habitats—Two Years Later	49
Miles O. Hayes, Jacqueline Michel, Todd M. Montello, Don V. Aurand, Theodor C. Sauer, Ahmed Al-Mansi, Abdul Halim Al-Momen	
Session Th3D: Fresh Water Cleanup, Case Studies—Chairman: Don Erickson	
Response to a Major Gasoline Release into the Mississippi River.....	50
Cdr. Jane M. Hartley, Donald F. Hamera	
San Joaquin Valley Crude Oil Spill Into A Freshwater Stream: A Case Study	51
Mark A. Lowe, Eugene R. Mancini, Dilworth W. Chamberlain, Eric Greenwood, Sue Rankin, Marion Fischel	
Follow-Up Study on Oiled Vegetation Cutting Along the Delaware River.....	52
Edwin A. Levine, Jay Pinckney, Todd Montello	
The Colonial Pipeline Spill: A Case Study	53
Kevin Koob, Lt. Roger Lafferiere, Jennie DeVeaux, Greg DeMarco	

IV—SPILL MANAGEMENT/MITIGATION

Session M1D: Command and Control—Chairman: Deborah Dietrich

An Integrated Approach to Corporate Preparedness	57
K. Tim Perkins	
Confirming Response Effectiveness: An Overview and Guide to Operational Monitoring.....	57
Alan J. Mearns	
Northridge Earthquake Pipeline Rupture into the Santa Clara River	58
Cdr. Thomas P. Leveille, Dan Shane, Lt. Cdr. James Morris	

Session T1B: Preparedness Planning I—Chairman: Stacey Gerard

Challenges of Contingency Planning in a Small Island Developing State—Trinidad and Tobago	58
Oswald M. Adams, Kenrick Haynes	
Contingency Planning in Chile.....	59
Capt. Francisco Pizarro	
Industry, Government, and Regional Efforts in Oil Spill Contingency Planning: Malaysia's Perspectives..	59
Hussein Bin Rahmat, Mohd Radzuan Bin Yusof	

Session T3A: Training/Exercises I—Chairman: Brent Pyburn

Exercises as Assessment Opportunities: A Focus on the Fix.....	60
David McLain	
National Drill of the Venezuelan Oil Spill Contingency Plan	60
Carlos Villoria, Elia Gomez, Nelson García Tavel	
Ship Escort Response Vessel System (SERVS) Fishing Vessel Oil Spill Response Training	61
Dennis A. Ulvestad, N. Vincent Kelly	
Canada's Development of a National Exercise Program	61
Paul Alexander Attfield, Dave Takata, Cliff Barber	

Session T4A: Training/Exercises II—Chairman: Therrence Melhuish

Development and Training of a Facility Oil Response Team.....	62
Stephen M. Collins, Phillip A. Lebednik	

Delivering Oil Spill Health and Safety Training for Beach Cleanup: Innovative Environmental Education at Work.	62
Paul Penn	
Lessons Learned from the National Preparedness for Response Exercise Program	63
W. Michael Kurgan, MSTC Karen Laney	
Swedish Coast Guard Response Training Program	63
Cdr. Dan Thorell, Capt. Thomas Fago	
Session W1A: Low API Gravity Oils, Response to Oils that Sink—Chairman: Doug Kodama	
Recovery of Submerged Oil at San Juan, Puerto Rico 1994	64
Lt. George H. Burns III, C. A. Benson, Tom Eason, Jacqueline Michel, Steve Kelly, Lt. Cdr. Bradford Benggio, Mark Ploen	
Group V Fuel Oils: Source, Behavior, and Response Issues.....	65
Jacqueline Michel, Debra Scholz, Charles B. Henry, Bradford L. Benggio	
Heavy Oil Spills: Out of Sight, Out of Mind	65
Robert W. Castle, Fred Wehrenberg, Jeremy Bartlett, Jason Nuckols	
Conditions Under Which Floating Slicks Can Sink in Marine Settings	66
Jacqueline Michel, J. A. Galt	
Session W2A: Preparedness/Response—Chairman: Paul Egner, Jr.	
Burial and Breakdown of Oil in Coastal Dune Systems.....	66
Roger E. Daniels, Anthony F. Harrison, John A. Parkinson, Graham Hall	
Response Operations to the <i>Aegean Sea</i> Accident	67
Fernando Pardo	
Handling and Disposal of Oily Waste from Oil Spills at Sea.....	67
Madeleine McDonagh, John Abbott, Richard Swannell, Erich Gundlach, Atle Nordvik	
Session W3C: Response Considerations I—Chairman: Thomas Fago	
Scientific Criteria to Optimize Oil Spill Cleanup.....	68
David Sell, Lucy Conway, Tracy Clark, Gordon B. Picken, Jenifer M. Baker, George M. Dunnet, Alasdair D. McIntyre, Robert B. Clark	
Net Environmental Benefit Analysis for Oil Spill Response	68
Jenifer M. Baker	
Evaluating Oil Spill Contingency and Prevention Plans Using Measures of Quality, Not Quantity.....	69
Faisal Abordaif, John R. Harrald, Thomas A. Mazzuchi	
Session W3D: The 1993 Tampa Bay Oil Spill—Chairman: Donald Jensen	
Tampa Bay Spill: Command and Control Issues	69
Capt. Richard W. Harbert	
Beach Cleaning and the Role of Technical Support in the 1993 Tampa Bay Spill.....	70
Edward H. Owens, Richard A. Davis, Jr., Jacqueline Michel, Kay Stritzke	
Response to Oiled Wildlife in Tampa Bay	70
Lynne Frink, Glenn Gauvry	
Session W4A: Preparedness Planning II—Chairman: R. C. Oldham	
Oil Spill Capability Assessment Program for Fixed Facilities	71
Jeffrey R. James	
Just Make It Happen: Logistics Concepts, Processes, and Infrastructure in Major Oil Spill Response ...	71
John R. Ives	
Dynamic Contingency Planning Within a Command and Control Framework.....	72
Lt. Jeff Simmerman	

To Improve the Response Time: A Community Decision	72
Marc Patry, Claude Rivet	

Session W4D: Response Considerations II—Chairman: Charles Corbett

Effectively Managing Level of Effort in Oil Spill Cleanup: Resolving the “How Clean Is Clean” Issue ..	73
Peter A. Tebeau	
The Precautionary Approach and the IMO	73
Sally Ann Lentz	
Prevention of Pollution from Ships in Argentina: Government-Industry Cooperation	74
José Manuel Rolón	
The M/C <i>Haven</i> Oil Spill: Environmental Assessment of Exposure Pathways and Resource Injury.....	74
Massimo Martinelli, Anna Luise, Elisabetta Tromellini, Theodor C. Sauer, Jerry M. Neff, Gregory S. Douglas	

Session Th3B: The *Morris J. Berman* Spill—Chairman: Mark Miller

Spill Response Management and the <i>Morris J. Berman</i> Spill: The FOSC’s Perspective	75
Cdr. Robert G. Ross	
Managing Heritage Resource Protection: A Case Study from the <i>Berman</i> Spill Response	75
Lt. Cdr. Audrey A. McKinley, Agamemnon Gus Pantel	
The <i>Morris J. Berman</i> Spill—MSRC’s Offshore Operations.....	76
James L. McDonald	
Operational Considerations—Tank Barge <i>Morris J. Berman</i> Spill.....	76
Lt. Cdr. Edwin M. Stanton	

V—SUSTAINABLE GLOBAL PREPAREDNESS

Session T2B: International Conventions on Funding and Intervention—Chairman: Daniel Sheehan

Oil Pollution Act of 1990: Cure, Catalyst, or Catastrophe	79
Mary G. Holt, Lindy S. Johnson	
France and the Right of Intervention on the High Seas	79
Jean-François Levy	
The <i>Braer</i> : Legal Aspects of a Major Oil Spill	80
Måns Jacobsson	

Session T3D: Industry/Government Cooperation in Planning and Response I—Chairman: Edmond Thompson

Research on Marine Pollution, Prevention, and Response in Shenzhen, China.....	80
Pu Baokang, Zhang Xiuzhi, Qiao Bing	
Norwegian Pollution Control Authority Work on Shipwrecks.....	81
Kathrine Idaas	
Preparedness Plans Versus Actual Response: The Incident Specific Preparedness Review of the T/B <i>Morris J. Berman</i> Major Oil Spill	81
Capt. Richard C. Vlaun, Cdr. Kenneth Bradford, Lt. Cdr. Phillip Biedenbender, Lt. (j.g.) John White	
Partnerships in Spill Response: A Policy Alternative—The Canadian Experience	82
Suzanne Shirreff, Michel Berthiaume	

Session T4D: Industry/Government Cooperation in Planning and Response II—Chairman: Richard Bavister

Major Oil Spill Response Program of the Petroleum Association of Japan	82
Nobutaka Miyazoe, Yoshihiro Hashizume	

Establishing Optimal Response Strategies Using Real-Time Current Observations: A Local, Cooperative Approach	83
Lt. Cdr. John Salvesen, Beatrice A. Stong, David G. Byers, Austin G. Smith, Richard Arnhart, Scott Gaudet, Thomas G. Tomblin, Kelly M. Teichman	
To Boldly Go Where No State has Gone Before.....	83
Capt. William Boland, Pete Bontadelli	
Oil Spill Response Planning in Eastern Europe: A Bulgarian Case Study	84
Hilary Hoagland-Grey, David Archer	
Session W3A: International Legal Framework—Chairman: Mark Weller	
International Convention on Oil Pollution Preparedness, Response and Cooperation—An Overview. . . .	84
Capt. Ashok Mahapatra	
IMO-OPRC Information System.....	85
Kiyoshi Ohne	
Development of Effective National Response Systems.....	85
Capt. Edmond P. Thompson	
IMO's Strategy for the Implementation of the OPRC Convention	86
David T. Edwards	
Session Th3A: Bilateral Regional Agreements—Chairman: David T. Edwards	
Oil Spill Regulatory Systems in Mexico and the United States.....	86
David Lopez, Alicia Watts Hosmer, Timothy Adams, Elisabeth Morgan	
Transboundary Response Operations: A Look to the North.....	87
Laurie L. Crick, R. Adm. Sidney A. Wallace	
Impediments to Cross-Boundary Oil Spill Response Along United States Borders	87
Jonathan K. Waldron	
Modernizing The Copenhagen Agreement	88
Cdr. Dan Thorell	
 VI—THE BRAER INCIDENT	
Session T3B: Part I—Chairman: Joseph A. Nichols	
The <i>Braer</i> Incident: Shetland Islands, January 1993	91
Chris Harris	
Session T4B: Part II—Chairman: Oleg Khalimonov	
The Donaldson Report: Implications for the Shipping Industry	91
Chris Horrocks	
 VII—POSTER PRESENTATIONS	
Session T2—Chairman: Lawrence J. Hannon	
Technical Correction of the Paint Filter Liquids Test	95
Ed Schrader, A. Mulvihill	
Water-in-Oil Emulsions: How They are Formed and Broken	95
Mervin F. Fingas, Ben Fieldhouse, Joe Mullin	
Evaluation of Dispersant Toxicity Using a Standardized Modeled-Exposure Approach	96
Lisa Weetman, Ina Lee, Michael Singer, Saji George, Susan Jacobson, Ronald S. Tjeerdema, Michael L. Sowby	

Environmental Sensitivity and Protection for the Northeast Caspian Sea	96
Bernhard H. Metzger, Edgue Zholdasov, Philip Manella, Gulmira Khobdabergenova, David I. Little, Erich R. Gundlach	
Making Sense of Multiple Response Planning Requirements	97
Bobbie Lively-Diebold, Gregory DeMarco, Elisabeth Morgan, Philip Rizzi	
Trace Metals and Biomarkers in Oil: A Tool for Identification of Spills.	97
Ranu Gadi, S. Kapoor, H. S. Rawat, K. Chandra	
The Effects of In-Situ Burning of Oil on Fire Boom	97
Richard Lazes	
Joint China-NOAA Port Area Contingency Planning Project.	98
Edwin A. Levine, Debra Payton, Robert Pavia, Caryn Houck, Shuying Chen	
Texas General Land Office Oil Spill GIS and Trajectory Modeling.	98
Robert D. Martin, Mehrdad M. Moosavi, Lee A. Smith	
Mechanical Protection Guidelines.	99
Cdr. Frank Whipple, Sharon Christopherson, Jacqueline Michel	
Trends in Oil Spill Rates for Four High-Traffic Areas	99
Gail Thomas, Gary Yoshioka, Brad Kaiman	
MSRC Shuttle Barge System for Shallow-Water Oil Spill Cleanup	100
George W. Dowell, Tom Coudon	
Obtaining the Federal Responder Immunity Standard in the United States.	100
David N. Lakin	
Simulation-Based Oil Spill Response Management Training	101
David C. Barry, John J. Gallagher	
Emergency Response Activities at Cedre	101
Roger Kantin, Michel Albrecht, Joseph Blanc, Claudine Le Mut Tiercelin	
MMS Gulf Region GIS Database for Oil Spill Contingency Planning.	102
Shea Penland, Lynda Wayne, Norm Froomer	
Session T3—Chairman: Joyce M. Perdek	
Protection of Natural Resources Against Oil Spills by Boom Arrangements	102
Kau-Fui Vincent Wong, Diego Guerrero	
Electronic Desktop Mapping: Environmental Sensitivity Atlases of the Great Lakes	103
Philip Baker, Christine Rowe	
A New Tool for Large-Scale Oil Combat	103
M. R. Ouwerkerk, P. R. H. Verbeek, T. Schut	
Experimental Design to Quantify Chemically Dispersed Crude Bioavailability to Phytoplankton.	104
Christopher O. Youngmans-Haug, Martha F. Wolfe, Ronald S. Tjeerdema, Michael L. Sowby	
Seabird Restoration: A Review of Needs and Options.	104
George J. Divoky, Craig Harrison	
Wildlife Response: Colonial Pipeline Spill	104
Lynne Frink, Curtiss J. Clumpner	
Beach Restoration Procedures.	105
Robert W. Castle, Frederick Wehrenberg, Harris W. Martin	
Bioavailability of Sediment Oil Residues Four Years Following the Martinez Spill	105
Paul D. Boehm, Helder J. Costa	
Resolving the Tow Speed that Causes Boom Oil Loss	106
David S. DeVitis, Larry Hannon	

Regional Response Team Preapproval of In-Situ Burning for Operational Use	106
Gus Stacy, III	
Information Technology: Key to Achieving and Maintaining Oil Spill Preparedness	106
Andrew Tyler, Mike Walker	
Development of an Optimal Oil Boom in Waves.....	107
Il-Hyoung Cho, Byung-W. Cho	
Emergency Weather Station System Support to Oil Spill Response.....	107
Evelyn E. Wilson	
Integrated Oil Containment and Recovery System	108
Jan Allers, Stu Penny	
The <i>Braer</i> Oil Spill.....	108
Robin Perry	
Protocol Development for Sorbent Containment Booms	109
David Cooper, Atle Nordvik	
New Technique for Oil Recovery Along Shores (Floating and Grounded).....	109
Jean Bronnec	
Effect of Waves on Containment Boom Response	110
Robert L. Van Dyck, Michael S. Bruno	
Teflon Nets: A Novel Approach to Thin Film Oil Sampling	110
MST2 Dean Greimann, Ens. April Zohn, Lt. Cdr. Kristy Plourde, Cdr. Thomas Reilly	
Coast Guard VOSS/NOFI/FIOCS/SEA SLUG At-Sea Evaluation	111
D. A. Furey, K. C. Eisenberg, J. F. Etxegoien	
Session T4—Chairman: Joyce M. Perdek	
The National Contingency Plan Product Schedule Database.....	111
Gail F. Thomas, Gary N. Moore, Linda Tyrance-Strickland	
Bioremediation Study of Spilled Crude Oil on Fowler Beach, Delaware	112
Albert D. Venosa, John R. Haines, Brian A. Wrenn, Kevin L. Strohmeier, B. Loye Eberhart, Miryam Kadkhodayan, Edith Holder, Makram T. Suidan, Dennis King, Benjamin Anderson	
Biotreatment of Petroleum Contamination in Open Systems	112
Eugene Rosenberg, Rachel Legmann, Elinora Z. Ron, W. Michael Griffin, A. Thomas Merski	
Unified Command: The Mechanism for Ensuring a Comprehensive, Coordinated Response	113
Thomas G. McCloskey	
Numerical Simulation of the <i>Aegean Sea</i> Oil Spill.....	113
Pierre Daniel	
Nutrient Retention in the Bioremediation Zone of a Sandy Beach	114
Brian A. Wrenn, Makram T. Suidan, Kevin L. Strohmeier, B. Loye Eberhardt, Gregory J. Wilson, Albert D. Venosa	
Sensitivity Analysis in Oil Spill Models: Case Study Using ADIOS	114
Roy Overstreet, Andrzej Lewandowski, William Lehr, Robert Jones, Debra Simecek-Beatty, Donna Calhoun	
A Protocol for Experimental Assessments of Bioremediation Strategies on Shorelines.....	115
Kenneth Lee, François-Xavier Merlin, Richard P. J. Swannell, Tim Reilly, Per Sveum, Jean Oudot, Michel Guillerme, Jean Ducreux, Christian Chaumery	
USCG Response Equipment Integrated Logistics System	116
Christine Burk, Joseph Stahovec, David Vaught	
Case Studies of Standardized Techniques to Document Shoreline Oiling Conditions.....	116
Edward H. Owens, Gary A. Sergy, Jacqueline Michel	

Oil Spill Decision Support System for the Venezuelan Oil Industry	117
Carlos Villoria, Rosa Pérez	
A General Migration Model for Biological Impact Assessment	117
Keith Downing	
Role of Environment Canada Emergency Officers in Oil Spill Response Management.....	118
Caroline Ladanowski	
In Situ Bioremediation of Petroleum Hydrocarbon Contaminated Soil and Ground Water	118
Douglas E. Jerger, Patrick M. Woodhull	
Immobilization Technique for In Situ Biodegradation of Crude Oil	119
Asha Juwarkar, Aradhana Amin, Bharati Oke, P. Khanna	
Integrated Hydrodynamic-Oil Spill Modeling in Coastal Waterways Using SPILLSIM	119
Donald O. Hodgins, Ruben Solis, Robert Martin	
Bioremediation: Results of the Field Trials of Landevennec (France).....	120
François-Xavier Merlin, Philippe Pinvidic, Christian Chaumery, Jean Oudot, Richard P. J. Swannell, Anne Basseres, Christine Dalmazzone, Jean Ducreux, Kenneth Lee, Tim Reilly	
Decontamination for the T/B <i>Morris J. Berman</i> Incident	120
Joseph B. H. Smith, Barry McFarland	
A Cooperative Approach to Oil Spill Planning	121
William Gorham, Martin Cramer	
Session W1—Chairman: John S. Farlow	
The U.S. EPA 1994 National Survey of Oil Storage Facilities	121
Janet LaFiandra Weiner, Jennie DeVeaux, Paul Brown	
California's Area Contingency Plans: A Successful State/Federal Partnership.....	121
Adam Sutkus	
Vessel Response Plans: A Tile in the Mosaic of the National Response System.....	122
Lt. Cdr. Duane Michael Smith	
Consensus-Based, Consolidated Contingency Plan	122
Capt. Roger D. Mowery, Lt. Cdr. Bill Edgar	
Principles of War Applied to Oil Spill Incident Management	123
John Giesen	
CISPRI Technical Manual—A Different Approach	123
Victoria Askin	
Clean Coastal Waters Cost Participation Formula	123
J. Michael Sartor, Christopher L. Gregory	
Getting a “GRP:” The Geographic Response Planning Effort in Washington State	124
Paul Heimowitz	
Major Oil Spill Incidents: Lessons for Response Planning.....	124
Dana Stalcup, Gary Yoshioka, Brad Kaiman, Lora Siegmann, Kate Masters	
Decision Support for Oil Spill Response Configuration Planning.....	125
Roberto Desimone, John Mark Agosta	
Spill Response Planning for Seasonal Variability of River Currents.....	125
Paul Slyman, Eric Heinitz	
Estimating the Volume of Oil Leaking from Aboveground Storage Tanks.....	126
Kevin Mould, Steve Watson, Mike Renga, Lora Siegmann	
Development of Cultural Resources Protection Guidelines for Alaska's On-Scene Coordinators	126
Pamela Bergmann	

COSS: A Mesoscale Test Bed for Nearshore Spill Research.....	127
Timothy J. Reilly, William R. Wise, Nicholas C. Kraus, Robin Jamail	
Area Contingency Plans: The Good, the Bad, and the Ever-Evolving	127
Carolyn M. White, Patricia Donahue	
Worker Safety and Training Requirements in the Marine Environment	128
Jonathan K. Waldron	
On-Scene Coordinator Area Response System	128
Donald P. Smith	
California Office of Oil Spill Prevention and Response	129
Mark B. Garcia	
Session W2—Chairman: John S. Farlow	
Safety Systems Integration in a Large Oil Spill Response Organization	129
Steven Magasis, John Redden, Dan LeBlanc	
Fishing Industry and Community Support.....	130
Richard C. Long	
Oil Spill Contingency Planning Criteria for International River Basins.....	130
Elia Gómez Figueroa	
The <i>Braer</i> Spill: Oil Fate Governed by Dispersion	130
T. Lunel	
New Oil Spill Environment Protection and Contingency Plan Requirements—Argentina	131
Erich R. Gundlach, Hugo A. Rizzato, Enrique Natri, Aldo Murut	
Remediation of Oil-Contaminated Debris Using a Rotary Kiln Combustor.....	131
Laura Ouellette, Vladimir Razbin	
MEXUSPAC: Mexico/U.S. Pacific Regional Response Coordination Team	132
Lt. Cdr. Daniel Whiting	
Frequency of Oil Spills Compared to Everyday Hazards	132
George Lowden, Gary Yoshioka	
Oil Spill Contingency Planning in the Latin American Petroleum Industry	133
Juan Miguel Moyano, Aldo Héctor Brussoni	
Private Sector/Government Cooperation During a Bahrain Spill Response Operation	133
Derek J. S. Brown	
Information to Minimize Impacts from Freshwater Oil Spills	134
David E. Fritz, Alexis E. Steen	
Risk Management in Oil Pipelines and Gas Pipelines.....	134
Luiz de Lima Buzelin, Anibal José Constantino Alves	
Advanced Chemical Fingerprinting for Oil Spill Identification and Natural Resource Damage Assessments.....	135
Paul D. Boehm, Gregory S. Douglas, John S. Brown	
Session W3—Chairman: Daniel A. Sullivan	
The Vulnerability Analysis: Evaluating Effects of Oil Discharges on the Environment.....	135
Bobbie Lively-Diebold, Susan M. Davis	
Shoreline Oil from <i>Exxon Valdez</i> : Change from 1991 to 1993	136
James C. Gibeaut, Ernest Piper	
Evaluation of Historic Spill Sites for Long-Term Recovery Studies	136
Erich R. Gundlach, Jerry M. Neff, David I. Little, Don V. Aurand	
Oil Boom Linear Hauler Launch and Recovery System.....	137
Steve Koepenick, LeRoy Maples, David Molsberry	

NOAA's <i>Exxon Valdez</i> Long-Term Shoreline Ecosystem Monitoring Program—1990–1994 Trends	137
Alan J. Mearns	
Recovery of Saudi Arabian Shore Biota Following the Gulf War	138
David A. Jones, Jaime Plaza, Iain Watt, Mahmoud al Sanei	
A Comprehensive Approach to Oil Spill and Hurricane Impacts	138
Karolien Debusschere, Dianne Lindstedt, Qiang Tao, Irving A. Mendelssohn, Qianxin Lin	
Visual Information Systems and GIS in Crisis Management	138
Stephen R. J. Sheppard, David R. Blatchford	
Effectiveness of Oil Spill Recovery Systems	139
Robert L. Watkins	
Hardshelled Clam Recovery from <i>Exxon Valdez</i> Oiling and Shoreline Treatment	139
J. P. Houghton, R. Gilmour, D. C. Lees, W. B. Driskell	
Options for Minimizing Environmental Impacts of Freshwater Spill Response	140
Kenneth Barton, Jacqueline Michel, David E. Fritz, Edward H. Owens, Alexis E. Steen	
Mangrove Restoration: Cartagena, Colombia, Coastal Oil Spill Case Study	140
Mauricio Ibáñez	
Is Ground Water Protected Against Releases from Aboveground Storage Facilities?	141
Kevin Mould, Gregory DeMarco, Robert Frederick	
Identifying and Incorporating Sensitive Environment Considerations for Inland Response/Contingency Planning	141
Jeffrey L. Underwood, Robert Pavia	
Protection of Coastal Shorelines from Oil Spills Using Natural Agents	141
Anne Basseres, Bernard Tramier	
Venezuelan Oil Spill National Contingency Plan: Dispersant Laboratory Program	142
Jorge Rodríguez-Grau, José A. La Schiazza, Carlos Villoria, Gustavo Belisario, Iván Galindo, Rosa Pérez, Luis Torres	
Cost Effective Oil Seep Remediation: Sorbent Waste Minimization Pilot Project	142
John J. Andreasik, John P. Scambos	
Texsonde '94—Radar Measurement of Surface Currents for Oil Spill Modeling	143
Donald O. Hodgins, Charles Giammona, Ronald Goodman, Robert Martin, Robert LaBelle	
Comparing Crude Oil Toxicity Under Standard and Environmentally Realistic Exposures	143
Charles B. Pace, James R. Clark, Gail E. Bragin	
Chemical Analysis Methods for Crude Oil	144
Zhendi Wang, Mervin F. Fingas	
Oil Spill Intelligence Report International Oil Spill Database: Recent Trends	144
Jeff Welch	
Session W4—Chairman: Daniel A. Sullivan	
Training and Documentation	144
Michael D. Cain, Linda C. George	
The Development of Potential Protection Strategies for Tidal Inlets	145
Miles O. Hayes, Todd M. Montello	
Review of U.K. Policy on Response to Oil at Sea	145
T. Lunel, D. Albone, M. McDonagh, J. Abbott, D. Tookey	
Lessons Learned: The Methodology of Conducting Oil Spill Response Training	146
Bernard Bennett	
<i>Jin Shiang Fa</i> Case Study: What Could Have Been Done?	146
Lt.(j.g.) William K. Capune	

Developing the State On-Scene Coordinators' Course for Alaska	147
Harry Young, Larry Dietrick, Arthur Pilot, Geoff Harben, Mark Burger	
Evaluation of Various Surface Oil Detectors Applied to Hazardous Zones	147
François Cabioc'h, Jean-Pierre P. Olard, Catherine Stéphan	
Deployment Test for Alyeska, GPS-Positioned Drifter Buoy	148
Michael Hefer, Brian Burda, Sharon Hillman, Kevin Eldridge	
The Performance of Booms in an Offshore Environment	148
James H. Nash, David D. Molsberry	
Training for Success: A Functional Management Training System for Response Organizations.....	149
Lt. David C. Stalfort, Gary L. Ott	
Quality and the Unified Command: The Reinvention of Spill Response	149
Capt. Gary J. E. Thornton	
Evaluation and Correction: Keys to Response Preparedness.....	150
Roger W. Mickelson	
Environmental Training for Oil Spill Response	150
Maureen Moffatt	
Santa Monica Bay Prep 94: Major Spill Exercise Planning/Execution.....	150
Lt.(j.g.) Kara M. Satra	
Air Curtain Incineration for Emergency Disposal of Oil Spill Debris	151
Alan J. Kennedy, Robert J. Dallas, Paul Wotherspoon	
On-Scene Coordinator Training: The Challenge and the Solution	151
Gordon Goff, Michael Norman, Mary Jo Bragan, Arthur Smith	
Alaska Nearshore Demonstration Projects	152
Larry Dietrick, Geoff Harben, Mark Burger	
Drilling for Reality.....	152
Robert A. Levine	
On Scene Coordinator/COTP Employment of an Infrared Sensor.....	153
Capt. Thomas E. Thompson, Lt. Cdr. William R. Marhoffer, CW04 Robert F. Melia	
Late Poster, Session W1	
U.S. Coast Guard Spill Planning, Exercise, and Response System (SPEARS)	153
Lt. Cdr. Shane Ishiki, Dexter Chan	

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Program Sessions

Th3D: Fresh Water Cleanup, Case Studies

IV—SPILL MANAGEMENT/MITIGATION

M1D: Command and Control

T1B: Preparedness Planning I

T3A: Training/Exercises I

T4A: Training/Exercises II

W1A: Low API Gravity Oils,
Response to Oils that Sink

W2A: Preparedness/Response

W3C: Response Considerations I

W3D: The 1993 Tampa Bay Oil Spill

W4A: Preparedness Planning II

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Program Sessions

W4D: Response Considerations II

Th3B: The *Morris J. Berman* Spill

V—SUSTAINABLE GLOBAL PREPAREDNESS

T2B: International Conventions on Funding
and Intervention

T3D: Industry/Government Cooperation in
Planning and Response I

T4D: Industry/Government Cooperation in
Planning and Response II

W3A: International Legal Framework

Th3A: Bilateral Regional Agreements

VI—THE *BRAER* INCIDENT

T3B: Part I

T4B: Part II

VII—POSTER PRESENTATIONS

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Program Sessions

Poster Session T3

Poster Session T4

Poster Session W1

Poster Session W2

Poster Session W3

Poster Session W4

OPENING PLENARY SESSION

CLOSING PLENARY SESSION

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Establishing and Maintaining Response Capabilities

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Program Sessions

**The Use and Misuse of Science in
Natural Resource Damage Assessment (NRDA)**

Implementing an Effective Response Management System

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AUTHOR INDEX

- Abbott, John, 67, 145
 Abordaif, Faisal, 69
 Ackerman, Francine, 16
 Adams, Oswald M., 58
 Adams, Timothy, 86
 Agosta, John Mark, 125
 Albone, D., 145
 Albrecht, Michel, 101
 Allen, Alan A., 5
 Allers, Jan, 108
 Al-Mansi, Ahmed, 49
 Al-Momen, Abdul Halim, 49
 al Sanei, Mahmoud, 138
 Ameer, Paul, 29, 32
 Amin, Aradhana, 119
 Anand, Justin, 29
 Anderson, Benjamin, 112
 Andreasik, John H., 142
 Archer, David, 84
 Arnhart, Richard, 83
 Arway, John, 44
 Askin, Victoria, 123
 Attfield, Paul Alexander (Alec), 61
 Aurand, Don V., 16, 49, 136
- Bader, Gary P., 31
 Baker, Jenifer M., 11, 68
 Baker, Philip, 103
 Banzhaf, H. Spencer, 39
 Barber, Cliff, 61
 Barry, David C., 101
 Bartlett, Jeremy, 65
 Barton, Kenneth, 43, 140
 Basseres, Anne, 20, 120, 141
 Bech, Cathe M., 15
 Becker, Kenneth W., 19
 Belisario, Gustavo, 142
 Benggio, Bradford L., 22, 64, 65
 Bennett, Bernard, 146
 Bennett, James F., 40
 Benson, C. A. "Ben," 64
 Bergmann, Pamela, 126
 Berthiaume, Michel, 82
 Biedenbender, Phillip, 81
 Binkley, Kandace S., 4, 9
 Bin Rahmat, Hussein, 59
 Bin Yusof, Mohd Radzuan, 59
 Birk-Risheim, Stacy, 10
 Bissonnette, Martine, 16
 Bitting, Ken, 6
 Black, Chrystel, 100
 Blanc, Joseph, 101
 Blatchford, David R., 138
 Blenkinsopp, Sandra, 12
 Bock, J., 14, 22
 Boehm, Paul D., 105, 135
 Boland, William, 83
 Bontadelli, Pete, 83
 Bovet, David, 28
 Bradford, Kenneth, 81
 Bragan, Mary Jo, 151
 Bragg, James R., 24
- Bragin, Gail E., 123
 Briceño, Henry, 48
 Bronnec, Jean, 109
 Brown, Derek J. S., 133
 Brown, E. R., 4
 Brown, John S., 135
 Brown, Paul, 121
 Bruno, Michael S., 110
 Brussoni, Aldo Héctor, 133
 Buist, Ian A., 17, 15
 Burda, Brian, 148
 Burger, Mark, 147, 152
 Burk, Christine, 116
 Burns, George H. III, 64
 Byers, David G., 83
- Cabioc'h, François, 147
 Cain, Michael D., 144
 Calhoun, Donna, 114
 Campagna, Phil, 16
 Canevari, G.P., 23
 Capune, William K., 135
 Case, Georgia L., 45
 Castle, Robert W., 65, 105
 Cekirge, H. M., 9
 Chamberlain, Dilworth W., 46, 51
 Chan, Dexter, 153
 Chandra, K., 97
 Chaumery, Christian, 115, 120
 Chen, Shuying, 98
 Cho, Byung-W., 107
 Cho, Il-Hyoung, 107
 Christopherson, Sharon, 99
 Clark, James R., 123
 Clark, Robert B., 68
 Clark, Tracy, 68
 Clumpner, Curtiss J., 104
 Cobanli, Susan E., 14
 Collins, Stephen M., 62
 Constantino Alves, Anibal José, 134
 Conway, Lucy, 68
 Cooper, David, 109
 Costa, Helder J., 105
 Coudon, Tom, 100
 Craik, Wendy, 35
 Cramer, Martin, 121
 Crick, Laurie L., 87
- Dahlin, Jeffrey A., 43
 Daling, Per S., 18, 19
 Dallas, Robert J., 151
 Dalmazzone, Christine, 120
 Daniel, Pierre, 113
 Daniels, G. D., 4
 Daniels, Roger E., 66
 Davidson, David A., 32
 Davis, Richard A. Jr., 70
 Davis, Susan M., 135
 de Lima Buzelin, Luiz, 134
 Debusschere, Karolien, 13, 42, 138
 de Jong, Johan H., 31
 DeLaune, R. D., 23
- DeMarco, Gregory, 53, 97, 141
 Desimone, Roberto, 125
 DeVeaux, Jennie, 53, 121
 DeVitis, David S., 106
 Dietrick, Larry, 147, 152
 Divoky, George J., 104
 Donahue, Patricia, 127
 Douglas, Gregory S., 74, 135
 Dowell, George W., 100
 Downing, Keith, 117
 Driskell, W. B., 139
 Ducreux, Jean, 115, 120
 Dunford, Richard W., 39
 Dunnet, George M., 68
 duVair, Pierre H., 40
- Eason, Tom, 64
 Eberhart, B. Loye, 72, 112
 Edgar, Bill, 122
 Edwards, David T., 86
 Ehrmann, Ursula, 21
 Eisenberg, K. C., 111
 Eldridge, Kevin, 148
 Elmore Allan F., 27
 Engelhardt, F. Rainer, 4, 9
 Etxegoien, J. F., 111
- Fagoe, Thomas, 63
 Fauvre, Daniel, 7
 Fejes, Jonas, 11
 Fieldhouse, Ben, 95
 Fingas, Mervin F., 12, 16, 95, 144
 Finley, J. Heather Warner, 42
 Fiocco, Robert J., 18, 19
 Fischel, Marion, 46, 51
 Foght, Julia, 12
 Frederick, Robert, 141
 French, Deborah, 8
 Frink, Lynne, 70, 104
 Fritz, David E., 43, 134, 140
 Froomer, Norm, 102
 Furey, D. A., 111
- Gadi, Ranu, 97
 Galarneau, Roy, 16
 Galindo, Iván, 142
 Gallagher, John J., 101
 Galt, J. A., 66
 García Tavel, Nelson, 60
 Garcia, Mark B., 129
 Garrity, Stephen D., 141
 Gaudet, Scott, 83
 Gauvry, Glenn, 70
 George, Linda C., 144
 George, Sagi, 96
 Giammona, Charles P., 4, 9, 143
 Gibeaut, James C., 136
 Giesen, John, 123
 Gilmour, R., 139
 Glover, Nick, 17
 Godon, Ann, 5

Goff, Gordon, 151
 Gómez Figueroa, Elia, 60, 130
 Gonzalez, Manuel F., 6
 Goodman, Ronald, 3, 143
 Goodspeed, Timothy R., 40
 Gorham, William, 121
 Gray, David L., 31
 Greenwood, Eric J., 46, 51
 Gregory, Christopher L., 123
 Greimann, Dean, 110
 Griffin, W. Michael, 112
 Guénette, Chantal C., 15
 Guerrero, Diego, 102
 Guillerme, Michel, 115
 Gundlach, Erich R., 67, 96, 131, 136

Haines, John R., 112
 Hall, Graham, 66
 Halley, Greg, 16
 Halley, Wayne, 16
 Hamera, Donald F., 50
 Hanifen, James G., 42
 Hankins, Paul, 6
 Hannon, Larry, 6, 16, 106
 Hansen, Ingrid K., 41
 Harben, Geoff, 147, 152
 Harbert, Richard W., 69
 Hardegree, Beau, 17
 Harper, John, 5
 Harrald, John R., 69
 Harris, Chris, 91
 Harrison, Anthony F., 66
 Harrison, Craig, 104
 Hartley, Jane M., 50
 Hayes, Miles O., 43, 145
 Haynes, Kenrick, 58
 Hefer, Michael, 148
 Heimowitz, Paul, 42, 124
 Heintz, Eric, 125
 Helton, Douglas, 39
 Henry, Charles B. Jr., 13, 21, 65
 Henry, Charles B. Jr., 21
 Hicks, David W., 17
 Hillman, Sharon O., 31, 148
 Hiltabrand, Robert R., 16
 Hoagland-Grey, Hilary, 84
 Hodgins, Donald O., 3, 119, 143
 Hokstad, Jorunn N., 19
 Holder, Edith, 112
 Holt, Mary G., 79
 Holtzinger, Gerard, 20
 Hood, Steve D., 31
 Horrocks, Chris, 91
 Hosmer, Alicia Watts, 86
 Houck, Caryn, 98
 Houghton, J. P., 139
 Hover, G. L., 4

Ibáñez, Mauricio, 140
 Idaas, Kathrine, 81
 Infante, Carmen, 48
 Ishiki, Shane, 153
 Ives, John R., 71

Jacobson, Susan, 6
 Jacobsson, Måns, 80
 Jacques, Jean-Pierre, 20
 Jamail, Robin, 9, 127
 James, Jeffrey R., 71
 Jerger, Douglas E., 118
 Johnson, Lindy S., 79

Jokuty, Paula, 16
 Jones, David A., 138
 Jones, Robert, 114
 Julius, Brian E., 42
 Juwarkar, Asha, 119
 Kadkhodayan, Miryam, 112
 Kaiman, Brad, 99, 124
 Kantin, Roger, 101
 Kapoor, S., 97
 Kelly, N. Vincent, 61
 Kelly, Steve, 64
 Kennedy, Alan J., 151
 Khanna, P., 119
 Khobdabergenova, Gulmira, 96
 Kichner, Jerzy J., 27
 King, Dennis, 112
 Klepper, John C., 31
 Koch, M., 9
 Koepenick, Steve, 137
 Koob, Kevin, 53
 Kraus, Nicholas C., 127
 Kucklick, Janet H., 23, 43
 Kurgan, W. Michael, 63

LaBelle, Robert P., 30, 143
 Ladanowski, Caroline, 118
 Lafferiére, Roger, 53
 LaFiandra Weiner, Janet, 121
 Lakin, David N., 100
 Lamarche, Alain, 100
 Lambert, Patrick, 16
 Laney, Karen, 63
 Laroche, Nanci, 16
 LaSchiazza, José A., 48, 142
 Latour, John, 16
 Lawson, Donna, 39
 Lazes, Richard, 97
 Lebednik, Phillip A., 62
 LeBlanc, Dan, 129
 Lee, Ina, 96
 Lee, Kenneth, 14, 115, 120
 Lee, N. Robin, 34
 Lees, D. C., 139
 Legmann, Rachel, 112
 Lehr, William, 114
 Le Mut-Tiercelin, Claudine, 101
 Lentz, Sally Ann, 73
 Lessard, R. R., 23
 Leveille, Thomas P., 110
 Levine, Edwin A., 52, 98
 Levine, Robert A., 152
 Levings, Sally C., 141
 Levy, Jean-François, 79
 Lewandowski, Andrzej, 114
 Lewis, Alun, 18, 19
 Li, Ken, 16
 Lin, Qianxin, 138
 Lindstedt, Dianne, 138
 Little, David I., 96, 136
 Lively-Diebold, Bobbie, 29, 97, 135
 Long, C., 9
 Long, Richard C., 31, 130
 Lopez, Daid, 86
 Lowden, George, 132
 Lowe, Mark A., 46, 51
 Lugo, Gabriel A., 6
 Luise, Anna, 74
 Lunel, T., 18, 130, 145

MacDonald, D., 14
 Magasis, Steven, 129

Mahapatra, Ashok, 84
 Mancini, Eugene R., 46, 51
 Manella, Philip, 96
 Maples, LeRoy, 137
 Marhoffer, William R., 153
 Marshall, Charles M., 30
 Martin, Harris W., 105
 Martin, Robert D., 98, 119, 143
 Martinelli, Massimo, 74
 Masters, Kate, 124
 Mathews, Kristy E., 39
 Mazzuchi, Thomas A., 69
 McCloskey, Thomas G., 113
 McDonagh, Madeleine, 67, 145
 McDonald, James L., 76
 McFarland, Barry, 120
 McGehee, M. Angela, 21
 McHale, James E., 31
 McHugh, Martin, 39
 McIntyre, Alasdair D., 68
 McKenzie, Bruce, 17
 McKinley, Audrey A., 75
 McLain, David, 60
 McMahon, O.B., 4
 Mearns, Alan J., 57, 137
 Meers, Christine S., 32
 Melia, Robert F., 153
 Mendelssohn, Irving A., 13, 138
 Merlin, François-Xavier, 115, 120
 Merski, A. Thomas, 112
 Metzger, Bernhard H., 96
 Michel, Jacqueline, 10, 22, 23, 43, 64, 65, 66, 70, 99, 116, 140
 Mickelson, Roger W., 150
 Moffatt, Maureen, 150
 Molsberry, David D., 137, 148
 Montello, Todd M., 52, 145
 Moore, Gary N., 111
 Moore, Jon, 11
 Moore, William H., 33
 Moosavi, Mehrdad M., 98
 Morgan, Elisabeth, 86, 97
 Morris, James, 58
 Mould, Kevin, 126, 141
 Mowery, Roger D., 122
 Moyano, Juan Miguel, 133
 Mullin, Joe, 16, 95
 Mulvihill, A., 95
 Murphy, T. J., 4
 Murut, Aldo, 131

Nadeau, Royal J., 45
 Nash, James H., 148
 Nastri, Enrique, 131
 Neff, Jerry M., 47, 74, 136
 Nelson, Robert, 16
 Newell, Maura J., 42
 Nieman, Douglas, 44
 Noble, John M., 34
 Nobutaka Miyazoe, 82
 Nordvik, Atle B., 6, 18, 67, 109
 Norman, Michael, 151
 Nuckols, Jason, 65
 Nyman, J. A., 23

Ohne, Kiyoshi, 85
 Oke, Bharati, 119
 Osborn, Lewis, 47
 Ott, Gary L., 149
 Oudot, Jean, 115, 120
 Ouelette, Laura, 131

Ouwerkerk, M. R., 103
Overstreet, Roy, 114
Overton, Edward B., 13, 21
Owens, Edward H., 8, 24, 70, 116, 140

Pace, Charles B., 123
Pace, S. J., 14, 22
Pantel, Agamemnon Gus, 75
Pardo, Fernando, 67
Parkinson, John A., 66
Patry, Marc, 72
Pavia, Robert, 10, 98, 141
Payton, Debra, 98
Peacock, Bruce E., 40
Peck, William L., 27
Penland, Shea, 13, 102
Penn, Paul, 62
Penny, Stu, 108
Pereira, Néstor, 48
Pérez, Rosa, 117, 142
Perkins, K. Tim, 57
Perry, Robin, 108
Petersen, Jill, 10
Pezeshki, S.R., 23
Picken, Gordon B., 68
Pilot, Arthur, 147
Pinckney, Jay, 52
Pinvidic, Philippe, 120
Piper, Ernest, 136
Pizarro, Francisco, 33, 59
Plaza, Jaime, 138
Ploen, Mark, 64
Plourde, Kristy, 110
Polard, Jean-Pierre, 147
Portier, Ralph J., 13
Proch, Thomas, 44
Pu Baokang, 80

Qianxin Lin, 13
Qiao Bing, 80
Quilici, Antonio, 48

Rabalais, Nancy N., 13
Ranger, Richard, 17
Rankin, Susan, 46, 51
Rawat, H. S., 97
Razbin, Vladimir, 131
Redden, John, 129
Reed, Mark, 8
Reilly, Thomas, 110
Reilly, Timothy J., 23, 115, 120, 127
Reiter, Gary A., 30
Reitsema, Lawrence, 47
Renga, Mike, 126
Rines, Henry, 8
Rivet, Claude, 72
Rizzato, Hugo A., 131
Rizzi, Philip, 97
Robbins, M. L., 14, 22
Roberts, Karlene H., 33
Roberts, Paulene O., 21
Rodríguez-Grau, Jorge, 48, 142
Rólon, José Manuel, 74
Ron, Eliora Z., 112
Roscigno, Pasquale F., 42
Rosenberg, Eugene, 112
Ross, Robert G., 75

Rowe, Christine, 103
Ryan, Bill, 16
Rye, Henrik, 7, 8

Salvesen, John, 83
Sartor, J. Michael, 123
Satra, Kara M., 150
Sauer, Ted, 47
Sauer, Theodor C. (Ted), 47, 49, 74
Scambos, John P., 142
Scholtz, Debra K., 23, 65
Schrader, Ed, 95
Schroh, Klaus, 5
Schut, T., 103
Sell, David, 68
Sergy, Gary A., 12, 16, 116
Shane, Dan, 58
Sheehan, Daniel F., 29
Sheppard, Stephen R. J., 138
Shigenaka, Gary, 21
Shirreff, Suzanne, 82
Shulte, Jerry, 44
Siegmann, Lora, 124, 126
Simecek-Beatty, Debra, 3, 114
Simmerman, Jeff, 72
Singer, Michael, 96
Slyman, Paul, 125
Smith, Arthur, 151
Smith, Austin G., 83
Smith, Donald P., 128
Smith, Duane Michael, 122
Smith, Joseph B. H., 120
Smith, Lee A., 98
Solis, Ruben, 119
Sowby, Michael L., 96, 104
Spalding, Mark, 11
Stacy, Gus III, 106
Stahovec, Joseph, 116
Stalcup, Dana, 124
Stalford, David C., 149
Stanton, Edwin M., 76
Steen, Alexis E., 43, 134, 140
Stéphan, Catherine, 147
Stolls, Amy M., 29
Stong, Beatrice A., 83
Stritzke, Kay, 70
Strohmeier, Kevin L., 72, 112
Strm-Kristiansen, 18
Suidan, Makram T., 72, 112
Sutkus, Adam, 121
Sveum, Per, 15, 115
Swannell, Richard P. J., 67, 115, 119

Takata, Dave, 61
Tao, Qiang, 138
Tazik, Pamela, 47
Tebeau, Peter A., 73
Teichman, Kelly M., 83
Tennyson, Edward J., 16
Thomas, Gail F., 111, 99
Thompson, Edmond P., 85
Thompson, Thomas E., 153
Thorell, Dan, 63, 88
Thornton, Gary J. E., 149
Tjeerdema, Ronald S., 96, 104
Tomblin, Thomas G., 83
Tookey, D., 145
Törling, Gustav, 11

Torres, Luis, 142
Tramier, Bernard, 20
Tramier, Bernard, 141
Tremblay, Gilles H., 14
Tromellini, Elisabetta, 74
Trumbull, William J., 44
Tsukihara, Tsutomu, 49
Tunnell, John W. Jr., 17
Turpin, Rod, 16
Tyler, Andrew, 106
Tyrance-Strickland, Linda, 111

Ulvestad, Dennis A., 61
Underwood, Jeffrey L., 141
Urban, Robert, 6

Van Derveer, William, 45
Van Dyck, Robert L., 110
Varadaraj, R., 14, 22
Varanda, Anna-Paula, 100
Vaught, David, 116
Venosa, Albert D., 112, 114
Verbeek, P. R. H., 103
Verschuere, Bruno, 20
Vicente, Vance P., 21
Villoria, Carlos, 60, 117, 142
Vlaun, Richard C., 81
von Beek, Johannes, 42

Waldron, Jonathan K., 87, 128
Walker, Ann Hayward, 43, 23
Walker, Mike, 106
Wallace, Sidney A., 87
Walsh, Marjorie A., 19
Walsh, Maude M., 13
Wang, Zhendi, 12, 16, 164
Warner Finley, J. Heather, 42
Watkins, Robert L., 139
Watson, Steve, 126
Watt, Iain, 138
Wayne, Lynda, 102
Weetman, Lisa, 96
Wehrenberg, Frederick, 65, 105
Welch, Jeff, 144
Westlake, Donald W. S., 12
Whipple, Frank, 99
White, Carolyn M., 127
White, John, 81
Whiting, Daniel, 132
Wills, Thomas L., 32
Wilson, Evelyn E., 107
Wilson, Gregory J., 114
Wise, William R., 127
Witte, John Arnold Sr., 28
Wolfe, Martha F., 104
Wong, Kau-Fui Vincent, 102
Woodhull, Patrick M., 118
Wotherspoon, Paul, 151
Wrenn, Brian A., 72, 112

Yoshihoro Hashizume, 82
Yoshioka, Gary, 29, 99, 124, 132
Young, Harry, 147
Younghans-Haug, Christopher O., 104

Zhang Xiuzhi, 80
Zholdasov, Edgue, 96
Zohn, April, 110

SUBJECT INDEX

This index is limited to the material presented in this Abstracts volume. A more detailed index is in the Conference Proceedings volume.

- activity reports, GIS, 11
- Aegean Sea*
 - response, 67
 - simulation, 113
- Alaska
 - cultural resources protection guidelines, 126
 - nearshore demonstration projects, 152
 - on-scene coordinator's course, development, 147
 - pipeline system tanker trade, prevention and response, 31
 - sensitive environment mapping, 10
 - see also* Prince William Sound; Trans-Alaska Pipeline System
- Alberta Sweet Mixed Blend (ASMB), chemical analysis, 144
- Alyeska Pipeline Service Company
 - buoy deployment, 148
 - community and fishing industry support, 130
 - prevention and response, 31
 - see also* Trans-Alaska Pipeline Service
- American Petroleum Institute (API)
 - freshwater response guidelines, 140
 - freshwater spill research, 134
- American Trader*
 - cleanup, 73
 - natural resource damage assessment, 40
- AMI *see* ARCO Marine, Inc.
- API *see* American Petroleum Institute
- archeological sites protection, *Morris J. Berman*, 75
- ARCO Marine, Inc. (AMI), training, 152
- Argentina
 - contingency planning requirements, 131
 - environmental protection requirements, 131
 - prevention of pollution from ships, 74
- Asistencia Reciproca Petrolera Empresarial Latinoamericana (ARPEL), contingency planning, 133
- ASMB *see* Alberta Sweet Mixed Blend
- assessment, exercises and, 60
- AST *see* storage tanks, aboveground
- ASTM standards, recovery systems, 139
- Australia, Great Barrier Reef protection, 35
- Automated Data Inquiry for Oil Spills (ADIOS), sensitivity analysis, 114
- Avila Beach, California, pipeline rupture, damage assessment, cooperative, 39
- Bahrain spill, private sector/government response, 133
- Balsa* 37, 27
- Baltic Sea, international aerial surveillance, 5
- beach cleaning, Tampa Bay spill, 70
- beach restoration, procedures, 105
- beach sediments, bioremediation assessment, 14
- bioavailability, petroleum to phytoplankton, 104
- biodegradable shoreline protection, 141
- biodegradation
 - immobilization of crude oil, 119
 - oil spills on water, 14
- biological impact assessment, general migration model, 117
- biomarkers, in oil, 97
- bioremediation
 - agents, efficacy test protocols, 12
 - agents, evaluation, 23
 - assessment, beach sediments, 14
 - coastal wetlands, 13
 - experimental spill, Fowler Beach, Delaware, 112
 - nutrient retention of a sandy beach, 114
 - open systems, 112
 - shoreline strategy assessments, 115
 - soil and ground water, 118
 - trials, France, 120
 - see also* Corexit
- birds
 - Braer* spill, 108
 - cleaning product and process to remove oil, 20
 - recovery, pipeline rupture, 46
 - restoration needs and options, 104
 - secondary oiling, prevention, 52
 - see also* wildlife
- bivalves
 - recovery from oiling and shoreline treatment, Alaska, 139
 - sediment oil residues, bioavailability post-spill, 105
- blowout (gas), Greenhill damage assessment, 42
- Bonn Agreement, 5
- booms
 - air-inflated, 107
 - collection strategies, GRP, Washington, 124
 - fireproof, 97
 - launch and recovery system, 137
 - natural resource protection, 102
 - performance offshore, 148
 - protective, CEDRE feasibility study, 7
 - sorbent containment, testing protocol, 109
 - testing at sea, 6
 - tow speed and oil loss, 106
 - waves and, 107, 110
- Braer*, 108
 - Donaldson Inquiry report, 91
 - legal aspects, 80
 - oil fate and dispersion, 130
 - response and cleanup, 91
- Brazil, pipeline risk management, 134
- Bulgaria, response planning, 84
- buoys
 - experimental, 3
 - oil tracker, deployment, Alyeska Pipeline Service Co., 148
 - response strategies, optimal, 83
- burning
 - agents, evaluation, 23
 - cleanup for marsh, Texas, 6, 17
 - cost, 5
 - effects, 97
 - emulsions in Norway, 15
 - emulsions, Alaska North Slope, 17
 - experiment, Newfoundland, 16
 - regional response team preapproval, 106
 - see also* fire
- Cabo Pilar*, 59
- Cabo Tamar*, 59
- California
 - Conservation Corps, training, beach cleanup, 62
 - contingency planning, 83
 - cooperative planning, 121
 - incident command system, 40
 - natural resource damage assessment, 40
 - OSPR, 129
 - pipeline rupture, oil fate and effect, 46
 - protection strategies, tidal inlets, 145
 - response, 83
 - sensitive environment mapping, 10
 - see also* Avila Beach; Grapevine Creek; Santa Clara River; Santa Monica Bay
- Canada
 - air curtain incineration, 151
 - bioremediation agents, 12
 - environmental sensitivity mapping, Great Lakes, 103
 - national exercise program, 61
 - NOBE, 16
 - pollution prevention programs, tankers, 34
 - response partnerships and policy, 82
 - Shipping Act, community involvement, 72
 - transboundary response, 87
 - treatment options software, 6
 - United States, cross-boundary response, 87
 - see also* Environment Canada; Industry Canada
- Canadian Liberty*, vegetation cutting and recovery, 52
- Canflex Sea Slug storage device, evaluation, 111
- Caribbean, Trinidad and Tobago, contingency planning, 58
- Caspian Sea, environmental sensitivity and protection, 96
- Center for Marine Environmental Protection and Safety, NorControl Oil Spill Management Simulator, 101
- Centre de Documentation de Recherche et d'Expérimentations (CEDRE)
 - emergency response activities, 101
 - protective booms, 7
 - terminal spills detection, 147
- Certificates of Financial Responsibility (COFRs), 28
- CGVOSS *see* U. S. Coast Guard Vessel of Opportunity Skimming System

- chemical analysis methods, crude oil, 144
- chemical fingerprinting, spill identification and natural resource damage assessments, 135
- chemical treating agents
 - evaluation, 23
 - freshwater environment, 43
- Chile, contingency planning, 59
- Chilean Maritime Authority, Latin America, 33
- Chilipin Creek *see* Copano Bay
- China
 - NOAA port area contingency planning project, 98
 - pollution prevention and response research, 80
- circulating water channel, weathering experiment on crude oil, 49
- CISPRI *see* Cook Inlet Spill Prevention & Response, Inc.
- claims
 - Aegean Sea* response, 67
 - recovery from *Exxon Valdez* oiling and shoreline treatment, 139
 - see also* liability
- Clean Coastal Waters, Inc. (CCW), cost allocation computation, 123
- cleanup
 - beach, training for health and safety, 62
 - biological effects of Corexit 9520, 21
 - burning, Texas marsh, 96
 - costs, offshore, 5
 - dredges, 103
 - equipment evaluation, 111
 - managing level of effort, 73
 - method, GIS, 11
 - Morris J. Berman*, 76
 - MSRC shuttle barge system for shallow water, 100
 - oil thickness distribution, radiometric detection, 4
 - optimization, scientific literature, 68
 - pipeline rupture (crude oil), Grapevine Valley, California, 51
 - pipeline rupture, Copano Bay, Texas, 17
 - see also* shoreline cleanup
- Coastal Oil-spill Simulation System (COSS), 127
- coasts
 - dune systems, burial and breakdown of oil, long-term, 66
 - environmental protection, 145
 - pollution prevention programs, tankers, 34
 - hydrodynamic oil spill modeling with SPILLSIM, 119
- collision *see* Tampa Bay
- Colombia
 - contingency planning for river basins, 130
 - mangrove restoration, 140
- Colonial Pipeline spill, Fairfax County, Virginia, 53
- wildlife response, 104
- Columbia River, response planning, 125
- command and control, response logistics, 71
- command system, unified, 113
 - training, 149
 - quality and, 149
- commanders' report, GIS, 11
- community, response time, 72
- compensation
 - OPA 90 and international regimes, 457
 - Washington, *Nosac Forest* spill, 42
- computers
 - ADIOS, 114
- COSTPART, 123
- crisis management and, 138
- damage assessment, 40
- National Contingency Plan Product Schedule Database, 111
- operating system, safety, 129
- see also* databases; experimentation; models; simulations
- consensus, cleanup operations, Tampa Bay spill, 70
- contingency planning
 - California, 83, 121
 - CATSNOAA, 98
 - CEDRE, 101
 - Chile, 59
 - CISPRI technical manual, 123
 - command and control framework, 72
 - consensus-based, Northwest Area, 122
 - GIS, Louisiana, 102
 - Great Barrier Reef, 35
 - Latin America, 133
 - Malaysia, 59
 - national, product schedule database, 111
 - quality vs quantity, 69
 - response logistics, 71
 - river basins, Colombia and Venezuela, 130
 - sensitive environment and, 141
 - Trinidad and Tobago, 58
 - various areas, 127
 - Venezuela, 60, 142
- Cook Inlet Spill Prevention & Response, Inc. (CISPRI), technical manual, 123
- cooperation
 - federal state industry, 83
 - planning, California, 97
 - statefederal, California's contingency plans, 121
- coordinator's course, Alaska, 147
- Copano Bay, Texas
 - burning to clean up marsh, 6
 - underground pipeline rupture, 17
- Copenhagen agreement, modernizing, 88
- Corexit 7664, *Morris J. Berman* spill, 22
- Corexit 9500, biodegradation of oil on water, 14
- Corexit 9580
 - biological effects, 21
 - Morris J. Berman* spill, 22
- COSS *see* Coastal Oil-spill Simulation System
- cost
 - cleanup, 5
 - COFRs, 28
 - financial responsibility, U.S. coastal states, 29
 - liability and, 29
 - COSTPART, 123
- crude oil, chemical analysis methods, 144
- toxicity, 143
- Cultural Resources Protection Guidelines for Alaska, 126
- damage assessment, 42
- chemical fingerprinting, 135
- cooperative, 42
- cooperative, Avila Beach pipeline rupture, 39
- lake, pipeline rupture, 47
- natural resources, computer models, 40
- natural resources, Texas, 41
- Presidente Rivera* spill, Delaware River, 39
- see also* claims; compensation; cost; insurance
- Dames & Moore, response plan, Bulgaria, 84
- database
 - international trends, 144
 - see also* computers
- debris
 - air curtain incinerator for emergency disposal, 151
 - oil-contaminated, rotary kiln combustor, 131
- decision support
 - response configuration planning, 125
 - Venezuela, 117
- decontamination
 - Morris J. Berman*, 120
 - see also* cleanup
- degradation *see* biodegradation
- Delaware River
 - Presidente Rivera*, natural resource damage assessment, 39
 - vegetation cutting follow-up study, 52
- demonstration projects, nearshore, Alaska, 152
- demulsifiers, evaluation for oil spill response, improved, 19
- Department of Fish and Game, California, 129
- developing countries, response systems, 85
- dispersants
 - Braer*, 108, 91
 - effectiveness at sea, U.K., 18
 - evaluation, 23
 - oil at sea, 18
 - petroleum bioavailability to phytoplankton, 104
 - shoreline cleanup, 68
 - toxicity, modeled-exposure test, 96
 - Venezuela contingency planning, 142
- dispersion, 14
 - effectiveness, settling and Stokes' law, 22
 - natural, *Braer*, 130
- documentation, 144
- Donaldson Inquiry, 28
 - report, 91
- dredges, cleanup, 103
- drills, training, ARCO Marine, Inc., 152
- Dutos e Terminais do Centro-Oeste e So Paulo, pipeline risk management, 134
- earthquake, pipeline rupture (oil) into the Santa Clara River, California, 58
- Eastern Europe, response planning, 84
- ecological recovery *see* recovery, ecological
- Economic Commission for Latin America and the Caribbean (ECLAC), 33
- emergency plans, 84
- emergency response
 - CEDRE, 101
 - Notification System, rate trends, 99
- emulsification, weathering and dispersants, oil at sea, 18
- emulsions
 - burning, Alaska North Slope, 17
 - burning, Norway, 15
 - formation and breakage, 5
 - tests, 5
- environmental assessment, long-term, fingerprinting pipeline rupture (oil), Newton Lake, Illinois, 47
- environmental auditing (internal), spill prevention and, 32
- environmental damage, factors influencing, 124

- environmental education, beach cleanup, training health and safety, 62
- environmental impact
 - assessment, *Haven*, 74
 - assessment, three-dimensional model, 96
 - freshwater response guidelines, 140
 - pipeline rupture (fuel oil), Flathead, Indian Reservation, Montana, 45
 - pipeline rupture and burn as cleanup method, Copano Bay, Texas, 17
- Environmental Protection Agency (EPA)
 - oil storage facility survey, 121
 - OSCARS, 128
 - PET, 95
 - vulnerability analysis, 135
- environmental risk analysis, 135
- Environment Canada
 - environmental training for response, 150
- EWS, 107
- response management role of emergency officers, 118
- rotary kiln combustor, 131
- treatment options software, 8
- environment, offshore, MSRC's operations for the *Morris J. Berman* spill, 76
- environment, sensitive
 - Great Barrier Reef, 35
 - mapping worldwide, 11
 - mapping, NOAA's integrated program, 10
 - response and contingency planning, 141
 - analysis, ADIOS, 114
 - protection, Caspian Sea, 96
 - mapping, electronic, 103
 - Mechanical Protection Guidelines, 99
- Ephemeroptera : Plecoptera : Tricoptera,
 - pipeline rupture (fuel oil) impact, Flathead Indian Reservation, Montana, 45
- equipment
 - inventory management, 116
 - response planning, 125
- escort, tug usage, Prince William Sound, 31
- evaluation, response preparedness and, 150
- evaporation, weathering and dispersants, oil at sea, 18
- EWS *see* weather station, emergency
- exercises
 - assessment opportunities, 60
 - PREP, 63
 - program, Canada, 61
 - USCG SPEARS, 153
 - see also* response
- experimentation
 - design to quantify chemically dispersed crude bioavailability to phytoplankton, 104
 - burning emulsions, Alaska North Slope, 17
 - burning emulsions, Norway, 15
 - burning, Newfoundland, 16
 - radiometry to detect oil thickness, 4
 - spill model for dissolved PAHs, 7
 - weathering and dispersants, oil at sea, 18
 - see also* models; simulation
- Exxon Pipeline Company *see* Copano Bay
- Exxon Valdez
 - clam recovery, 139
 - cleanup, 73
 - natural resource damage assessment, 40
 - response, evaluation, 69
 - SERVS and fishing vessels, 61
 - shoreline cleaner, 23
 - shoreline ecosystem (1990 to 1994) trends, 137
 - shoreline oil, 1991 to 1995, 136
- fertilizers, inorganic and organic,
 - bioremediation of beach sediments, 14
- financial responsibility, vessel, U.S. coastal states, 29
- fingerprinting
 - source identification, new method, 21
 - spill identification, India, 97
- FIOCS *see* Fully Integrated Oil Collection System
- fire
 - air curtain incineration of debris, 151
 - Haven*, damage assessment, 74
 - Ocean 255*, lightering and salvage, 27
 - sunken oil and, 66
 - see also* burning
- fishing vessels
 - SERVS, 61
 - TAPS, 130
- Flathead Indian Reservation, Montana,
 - pipeline rupture (fuel oil), environmental impact, 45
- FLIR *see* infrared, forward looking
- floculation, oil at shoreline, 24
- Florida
 - protection strategies, tidal inlets, 145
 - see Ocean 255*; Tampa Bay
- FOSC *see* on-scene coordinator, federal
- France
 - bioremediation trials, 120
 - CEDRE emergency response activities, 101
 - intervention on the high seas, pollution threat, 79
 - protective boom plans, 7
- freshwater
 - pipeline rupture (crude oil), Grapevine Creek, California, 51
 - pipeline rupture, recovery, 47
 - response, environmental impact, 140
 - spill research, API, 134
 - technical issues, 43
 - see also* rivers
- fuel oils, Group V, source, behavior, and response issues, 65
- Fully Integrated Oil Collection System (FIOCS), evaluation, 111
- gas (natural) well, blowout, 42
- gases, combustion, burn experiment, 16
- gasoline discharge, Mississippi River, 50
- geographic information systems (GIS)
 - advantages, 11
 - contingency planning, MMS, 102
 - crisis management and, 138
 - impact assessment, 11
 - Ohio River Valley resource characterization, 44
 - resource assessment, 43
 - Texas decision support system, 98
- geographic response plans (GRPs),
 - Washington, 124
- Grapevine Creek, pipeline rupture into freshwater stream, 51
- Great Barrier Reef Marine Park Authority,
 - prevention, 35
- Great Lakes
 - environmental sensitivity mapping, electronic, 103
 - sensitive environment mapping, 10
- Spill Protection Initiative (GLSPI), 44
- Greenhill spill, 42
- ground water, storage leaks and, 141
- bioremediation, 118
- GRP *see* geographic response plans
- Gulf of Mexico, buoys, tracking for oil spills, 3
- Haven*, environmental damage assessment, 74
- hazards, frequency, 132
- Helsinki Convention, 5
- Heritage Resources Management Team, *Morris J. Berman*, 75
- hurricanes, salt marsh recovery, Louisiana, 138
- IAT *see* international assistance team
- Illinois *see* Newton Lake
- imaging technology, airborne surveillance and reconnaissance, 4
- immobilization, biodegradation of crude oil, 119
- immunity, responder, 27
- impact assessment, GIS, 11
- Incident Specific Preparedness Review (ISPR), *Morris J. Berman* oil spill, 81
- incident command system (ICS)
 - Morris J. Berman*, 75
 - natural resource damage assessment and, 40
- incident management
 - OSCARS, 128
 - principles of war applied, 123
- India, spill identification, 97
- Industry
 - Canada, treatment options software, 96
 - contingency planning, Malaysia, 59
 - damage assessment, cooperative, pipeline rupture, 39
 - Donaldson Report, 91
 - Latin America, contingency planning, 133
 - preparedness, 57
 - tanker routing, 30
- information system, IMO-OPRC, 85
- information technology, preparedness and, 106
- infrared, forward looking (FLIR), OSC and, 153
- International Convention on Oil Pollution Preparedness, Response and Cooperation (OPRC), IMO's strategy, 86
- International Convention on Prevention of Pollution from Ships (MARPOL), Chile, 59
- International Management Code for the Safe Operation of Ships and for Pollution Prevention (ISM Code), 33
- International Maritime Organization (IMO)
 - information system, 85
 - Latin America, 33
 - OPRC convention implementation, 86
 - precautionary approach, 73
 - safety code, 33
- International Salvage Union, 28
- international assistance team (IAT), 85
- international convention, preparedness, 84
- international cooperation
 - contingency planning for river basins, 130
 - MEXUSPAC, 132
- international issues
 - cross-boundary response, U.S., 87
 - OPA 90 and, 457
- invertebrates, recovery, pipeline rupture, 46
- IraqKuwait conflict spill, distribution and weathering of oil two years later, 49

- island states, Trinidad and Tobago, contingency planning, 58
- islands, Louisiana, salt marsh recovery, 138
- ISM Code *see* International Management Code for the Safe Operation of Ships and for Pollution Prevention
- Italy, *Haven*, damage assessment, 74

- Japan, response program, PAJ, 82
- Jin Shiang Fa* spill, 146

- LAPIO spills, 65
- Latin America
 - contingency planning, 133
 - port state control, 33
- law
 - Braer* spill, 80
 - Canada, response partnerships and policy, 82
 - France and the right to intervene on the high seas, 79
 - responder immunity and salvage, 27
 - Texas statute for natural resources damage assessment, 41
 - U.S. coastal states, vessel liability and financial responsibility, 29
- leakage, volume estimation, ASTs, 126
- liability
 - cost-reduction incentives, 29
 - OPA 90 and international regimes, 457
 - response in a foreign jurisdiction, 87
 - vessel, U.S. coastal states, 29
 - see also* responder immunity
- lightering
 - Ocean 255*, 27
 - spill simulations and tanker routing, 30
- Lloyd's Standard Form of Salvage Agreement (1990) (LOF 90), 34
- Louisiana
 - contingency planning, GIS, 102
 - Greenhill spill, 42
 - Gulf Coast, marsh grass, oil removal, 23
 - in-situ burning preapproval, 106

- macroinvertebrate, pipeline rupture (fuel oil), Flathead Indian Reservation, Montana, 45
- Malaysia, contingency planning, 59
- mangrove
 - mitigation strategies, 48
 - recovery, Tampa Bay spill, 48
 - restoration, Colombia, 140
 - Rhizophora mangle*, simulated oil spill, 48
- mapping
 - sensitive environments, 10, 11, 103, 141
 - shoreline habitat, 43
- Marine Environment Protection Committee (MEPC), precautionary approach, 73
- Marine Pollution Control Unit, *Braer*, 91
- Marine Spill Response Corp. (MSRC)
 - booms, performance offshore, 148
 - Morris J. Berman*, offshore operations, 76
 - responder immunity, 100
- MARPOL *see* International Convention for Prevention of Pollution of the Sea from Ships
- marsh
 - bioremediation and, 13
 - burning as cleanup, 6
 - recovery, Louisiana, 138
 - removing oil, 23
 - shoreline cleaner, 23

- Mechanical Protection Guidelines, 99
- metals, trace, in oil, 97
- Menula*, 59
- Mexico
 - spill regulatory systems, 86
 - United States, cross-boundary response, 87
 - U. S. Pacific cooperation, 132
- MEXUSPAC, 132
- MIDMOD, 82
- migration model, biological impact assessment, 117
- mineral particles, oil interactions, 24
- Minerals Management Service (MMS), GIS for contingency planning, 102
- Mississippi River, gasoline discharge, 50
- mitigation strategies, mangrove, 48
- MMS *see* Minerals Management Service
- Mobil Oil, preparedness assessment program, 71
- modeling
 - dissolved PAH, 7
 - environmental impact assessment, three-dimensional, 8
 - radar measurement of surface currents, 143
 - Stokes' law and settling vs. dispersion, 22
 - techniques, 97
 - weathering on crude oil, circulating water channel, 49
- monitoring, response effectiveness, guide, 57
- Montana, pipeline rupture (fuel oil), environmental impact, 45
- Morris J. Berman*
 - cleanup, 73, 76
 - Corexit 9580 biological effects, 21
 - decontamination, 120
 - heritage resources protection, 75
 - MSRC's offshore operations, 76
 - oil recovery, 64
 - operational considerations, 76
 - preparedness plan, 81
 - response, 76
 - response logistics, 71
 - response management, FOSC perspective, 75
 - shoreline cleaning agents, 22
- MSRC *see* Marine Spill Response Corp.

- National Contingency Plan
 - area committee responsibilities, 127
 - Product Schedule Database, 111
- National Environmental Technology Centre, U. K. response policy at-sea, 145
- National Oceanic and Atmospheric Administration (NOAA) China, port area contingency planning project, 98
- freshwater response guidelines, 140
- sensitive environmental mapping program, 10
- National Oil Spill Contingency Plan (NOSCP), Malaysia, 59
- National Preparedness for Response Exercise Program (PREP), 63
- National Response System
 - vessel response plans, 122
 - war principles applied to incident management, 123
- Natural Resource Damage Assessment Model
 - Coastal and Marine Environments (NRDAM/CME), 40
 - Great Lakes Environments (NRDAM/GLE), 40

- natural resources *see* resources, natural
- NEBA *see* Net Environmental Benefit Analysis
- Nestucca*, cleanup cost, 5
- Net Environmental Benefit Analysis, oil spill response, 68
- NETCEN *see* National Environmental Technology Centre
- nets, Teflon, thin film oil sampling, 110
- New Jersey *see* *Canadian Liberty*; Delaware River
- Newfoundland Offshore Burn Experiment (NOBE), 16
- Newton Lake, Illinois *see* pipeline rupture
- NOBE *see* Newfoundland Offshore Burn Experiment
- NOFI VEE Sweep, evaluation, 111
- NorControl Oil Spill Management Simulator, 101
- North Sea, international aerial surveillance, 5
- Northwest Area Contingency Plan, 122
- Norway
 - burning of emulsions, 15
 - NOFI VEE Sweep, evaluation, 111
 - Pollution Control Authority (NPCA), shipwrecks, 81
 - shipwrecks, 81
- Nosac Forest*, compensation schedule, 42
- NOSCP *see* National Oil Spill Contingency Plan
- NRDAM *see* Natural Resource Damage Assessment Model
- nutrient washout, tides, 114

- Ocean 255*, lightering and salvage, 27
- ocean currents, airborne surveillance, 4
- Office of Pipeline Safety, sensitive environment mapping, 10
- Ohio River Valley, GIS resource characterization, 44
- Oil Pollution Act of 1990 (OPA 90)
 - California compliance, 83
 - international community and, 79
 - international regimes and, 29
 - liability and cost, 29
 - tanker inspection program, 32
- Oil Pollution Co-ordination Centre (OPCC), information system, 85
- Oil Pollution Preparedness Response and Co-operation Convention, 1990 (OPRC), 84
- Oil Spill Intelligence Report, rate trends, 99
- Oil Spill Prevention and Response Act, California, 97, 129
- oil boom linear hauler launch and recovery system, 137
- oil burial and breakdown, coastal dune systems, long-term, United Kingdom, 66
- oil containment and recovery system, 108
- oil fate
 - dispersion, natural, 130
 - Shell Martinez Refinery spill, 105
 - shoreline, Alaska (1991 to 1992), 136
 - oil seeps, remediation, cost effectiveness, 142
- oil spill response organizations (OSROs) *see* response organization
- oil thickness, radiometric detection, 4
- oil tracking, buoy deployment, Alyeska Pipeline Service Co., 148
- oil, sunken *see* LAPIO
 - conditions that favor, 66
 - see also* recovery, oil
- on-scene coordinator
 - federal (FOSC), 75, 72

- PREP, 63
Morris J. Berman, 75
infrared sensors, 153
see also training
- OPA 90 *see* Oil Pollution Act of 1990
- OPRC *see* International Convention on Oil Pollution Preparedness, Response and Cooperation, 1990
- organic compounds, volatile (VOCs), burn experiment, 16
- OSC *see* on-scene coordinator
- OSCARS *see* response, EPA
- OSPR *see* response organization, oil spill
- Pacific, U. S. Mexico cooperation, 132
- Paint Filter Liquids Test (PET), correction, 95
- particulates in air, burn experiment, 16
- Pennsylvania
Ohio River Valley resource
characterization by GIS, 44
see also Delaware River
- personnel, response planning, 125
see also safety; training
- PES-51, *Morris J. Berman* spill, 22
- PET *see* Paint Filter Liquids Test
- Petroleum Association of Japan (PAJ),
response program, 82
- Petroleum Industry of Malaysia Mutual Aid Group (PIMMAG), 59
- Petrolite EXO 0894, 17
- PIMMAG *see* Petroleum Industry of Malaysia Mutual Aid Group
- pipeline rupture (oil)
Avila Beach, California, damage
assessment, 39
burning as cleanup, 6
Copano Bay, Texas, 17
Fairfax County, Virginia, 53
Grapevine Creek, California, 51
Newton Lake, Illinois, environmental
assessment, 47
Newton Lake, Illinois, recovery, 47
oil fate and effects, California, 46
Santa Clara River, California, Northridge
earthquake, 58
underground, Copano Bay, Texas, 17
- pipelines, oil and gas, risk management, 134
- Planning & Evaluation Guide, Canada's
national exercise program, 61
- planning, cooperative, 121
- Planning, Exercise, and Response System,
Spill, USCG (SPEARS), 153
- pollution
Copenhagen agreement, 88
prevention and response research, China,
80
prevention, tankers in coastal waters, 34
prevention, Argentina, 74
salvage, 28
threat, France, intervention on the high
seas, 79
- Polmar plans, 7
- polyaromatic hydrocarbons (PAHs)
burn experiment, 16
fingerprinted 6 years post-spill, Newton
Lake, Illinois, 47
spill model, 7
- port state control, Latin America, 33
- ports, contingency planning, CATSNOAA,
98
- Prairie Oil Spill Containment and Recovery
Advisory Committee (PROSCARAC),
air curtain incineration, 151
- precautionary approach, framework, IMO,
73
- Préfet Maritime, 79
- PREP *see* National Preparedness for
Response Exercise Program
- preparedness
assessment program, 71
corporate, 57
evaluation and, 150
information technology and, 106
international convention, 84
methods, 146
Morris J. Berman, 81
PREP, 63
- Presidente Rivera*, natural resource damage
assessment, Delaware River, 39
- prevention
environmental auditing (internal) and, 32
intervention on the high seas, France, 79
pollution from ships, Argentina, 74
quality vs quantity, 69
salvage vs., 34
TAPS tanker trade, 31
- Prince William Sound
response plan, 61
tug escort and rescue towing, 31
- private sector government response, Bahrain,
133
- Program Guide*, Canada's national exercise
program, 61
- PROSCARAC *see* Prairie Oil Spill
Containment and Recovery Advisory
Committee
- protection strategies
Mechanical Protection Guidelines, 99
tidal inlets, 145
- public, the, prevention and response, TAPS
tanker trade, 31
- Puerto Rico *see* *Morris J. Berman*
- radar
FLIP, 153
surface currents for oil spill modeling, 143
- radiometry, oil thickness detection, 4
- reconnaissance, airborne, imaging
technology, 4
- recovery, ecological
Alaska shoreline, ecosystem monitoring
(1990 to 1994) trends, 137
burn as cleanup method, Copano Bay,
Texas, 17
intertidal, Saudi Arabia, 49
long-term follow-up, value of, 136
shoreline cleaner, 23
timescales, scientific literature, 68
- recovery, oil
containment system, 108
Morris J. Berman, Puerto Rico, 64
Ocean 255, 27
sorbents, cost effectiveness, 142
systems, effectiveness, 139
technique along shores, 109
waste disposal at sea and, 67
- Regional Operative Network for Cooperation
among Latin American Maritime
Authorities (ROCRAM), port state
control, 33
- Regional Response Team, in-situ burning
preapproval, 106
- regulations
Chile, 59
GLSPI, 44
- requirements, multiple response planning,
97
see also legislation
- regulatory systems, spill, Mexico United
States, 86
- remediation
rotary kiln combustor, 131
sorbents, cost effectiveness, 142
see also bioremediation
- remoteness, response, *Jin Shiang Fa*, 146
- reporting procedures, 84
- rescue, tanker towing and escort, Prince
William Sound, 31
- resources, cultural
Alaska guidelines, 126
protection, *Morris J. Berman*, 75
- resources, natural
Braer, 91
GIS assessment, 43
GIS characterization, Ohio River Valley,
44
incident command system and, 40
protection by booms, 102
recovery, mangroves, 48
trustee agencies, 40
see also damage assessment
- responder immunity
salvage and, 27
U. S., 100
- response
Aegean Sea, 67
California, 83
Colonial Pipeline spill, Virginia, 53
cross-boundary, 87
demulsification tests, 19
effectiveness, monitoring, guide, 57
emergency weather station system support,
107
environmental training, 150
EPA, OSCARS, 128
equipment, 82
gasoline discharge, Mississippi River, 50
logistics, 71
management, Environment Canada
emergency officers' role, 118
management, *Morris J. Berman*, 75
management training, 149
Morris J. Berman, 76
national, development, 85
natural resource damage assessment and,
40
oiled wildlife, Tampa Bay, 70
operations, pipeline rupture, oil,
California, 46
options, software, 8
PAJ program, 82
partnerships and policy, Canada, 82
preparedness, evaluation and correction,
150
remote, *Jin Shiang Fa*, 146
ship escort (SERVS), fishing vessel
response training, 61
strategies, tide and current data, 83
time, community and, 72
training, Sweden, 63
Trans-Alaska Pipeline System tanker
trade, 31
U. K. policy at-sea, 145
unified command, 113, 149
SPEARS, 153
volunteer team, development and training,
62
see also exercises; training

- response organization, oil spill (OSRO)
 - logistics, 71
 - transboundary response, 87
- response planning
 - Bulgaria, 84
 - Eastern Europe, 84
 - equipment and personnel, 125
 - geographic, Washington, 124
 - lessons from major incidents, 124
 - Mechanical Protection Guidelines, 99
 - multiple, regulatory requirements, 97
 - seasonal river currents, 125
 - sensitive environment and, 141
 - vessel, 122
- Response Vessel System, Ship Escort, (SERVS), 31
- Rhizophora mangle*, simulated oil spill, 48
 - see also mangroves
- river currents, response planning, 125
- ROGRAM see Regional Operative Network for Cooperation among Latin American Maritime Authorities
- rotating flask emulsion test (ROFLET), 19
- safety
 - international management code, 33
 - marine environment, 128
 - response planning, 129
 - see also personnel; training
- salvage
 - Convention, 34
 - Ocean 255*, 27
 - pollution defense, 28
 - prevention vs., 34
 - responder immunity, 27
- San Joaquin Valley see Grapevine Creek
- San Patricio County, Texas see Copano Bay
- sand mixing, and sunken oil, 66
- Santa Clara River, pipeline rupture (oil), 58
- Santa Monica Bay, spill exercise planning and execution, 120
- Saudi Arabia
 - oil weathering two years later, 49
 - shore biota recovery, 138
- seaport construction, environmental concern, 80
- SeaSonde, currents measurement, 143
- sediment
 - damage assessment, *Haven*, 74
 - mixing, and sunken oil, 66
 - oil residues, bioavailability post-spill, 105
 - removal, beach cleanup, Tampa Bay spill, 70
- sensitive environment see environment.
- settling, dispersion effectiveness, and Stokes' law, 22
- shallow water, MSRC shuttle barge system for cleanup, 100
- Shell Martinez Refinery, sediment oil residues, bioavailability post-spill, 105
- ships
 - Escort Response Vessel System (SERVS), pipeline system tanker trade, 31
 - response plans, 122
 - site assessment system, safety, 129
- ship-source spill see *Aegean Sea*; *Arco Anchorage*; *Arrow*; *Avicennia*; *Bouchard*; *Braer*; *Cabo Pilar*; *Cabo Tamar*; *Canadian Liberty*; *Esso Bernicia*; *Exxon Valdez*; *Florida*; *Haven*; *Irini*; *Jin Shiang Fa*; *Metula*; *Metula*; *Mobiloil*; *Morris J. Berman*; *Nosac Forest*; *Presidente Rivera*; *Torrey Canyon*; *World Prodigy*
- shipwrecks, Norwegian Pollution Control Authority registration, inspection, planning, 81
- shoreline
 - Alaska, ecosystem monitoring (1990 to 1994) trends, 137
 - Exxon Valdez*, 1991 to 1993, 136
 - mapping, 43
 - oil distribution and weathering after 2 years, 49
 - oil recovery technique, 109
 - oiling, standardized assessment, 116
 - protection using natural agents, 141
 - Saudi Arabia, recovery, 138
- shoreline cleaning agents
 - Morris J. Berman* spill, 22
 - marsh grass, 23
- shoreline cleanup, 24
 - bioremediation strategy assessments, 115
 - costs, 5
 - MSRC shuttle barge system for shallow-water cleanup, 100
 - NEBA, 68
 - treatment and clam recovery, Alaska, 139
 - treatment options, software, 8
 - treatment, software, 8
- simulations
 - Aegean Sea* spill, 113
 - exercise planning and execution, Santa Monica Bay, 150
 - mitigation strategies, mangrove and, 48
 - nearshore spill research, 127
 - response management training, 101
 - tanker routing off U.S. coasts, 30
- slicks
 - burning Alaska North Slope emulsions, 17
 - conditions that favor sinking, 66
- slop oil spill, Colombia, mangrove restoration and, 140
- socioeconomics, cleanup and ecological recovery, 68
- software, treatment, shoreline, 8
 - see also computers; name of particular program
- soil, bioremediation, 118
- sorbents
 - cost effectiveness, 142
 - rotary kiln combustor, 131
 - testing protocol, 109
- Spain, *Aegean Sea* response, 67
- Spartina alterniflora*, bioremediation and, 13
- Spill Planning, Exercise, and Response System (SPEARS), 153
- spills
 - detection, 147
 - experimental, Delaware, bioremediation, 112
 - frequency, 132
 - modeling, SPILLSIM, 119
 - source identification, 21, 135
 - trends, international database, 144
- SPILLSIM, hydrodynamic oil spill modeling, 119
- St. Lawrence, ecosystem protection, 72
- Stokes' law, settling effect on dispersion, 22
- storage
 - facilities, EPA survey, 121
 - leaks, ground water and, 141
- storage tanks, aboveground (ASTs)
 - estimating volume of oil leaking, 126
 - see also pipeline rupture
- streams, mapping, 43
- surveillance, aerial
 - imaging technology, 4
- North and Baltic Seas, 5
 - radiometry to detect oil thickness, 4
- Sweden, response training, 63
- System ET 20, 67
- Tampa Bay spill, 48
 - beach cleaning, 70
 - command and control issues, 69
 - wildlife response, 70
- tankers
 - inspection program, U.S. Coast Guard, 32
 - routing, industry's concerns, 30
 - routing, U.S. coasts, 30
 - pollution prevention programs, coastal waters, 34
 - TAPS, prevention and response, 31
 - tug usage for escort and rescue towing, 31
- TAPS see Trans-Alaska Pipeline System
- technical support, beach cleanup, Tampa Bay spill, 70
- terminal spills, detection, CEDRE, 147
- testing
 - dispersant toxicity, modeled-exposure, 96
 - oil containment boom, at sea, 6
- Texaco Offshore Bulgaria, response plan, 84
- Texaco, Inc., environmental auditing (internal) to prevent spills, 32
- Texas
 - General Land Office, GIS and trajectory modeling, 98
 - in-situ burning preapproval, 106
 - natural resources damage assessment, 41
 - response system, 128
 - sensitive environment mapping, 10
 - see also Copano Bay
- TexSonde '94, 143
- thin film oil sampling, Teflon nets, 110
- tidal inlets, protection strategies, 145
- tide, nutrient retention in a sandy beach, 114
- Tosco Refining Company, response team training, 62
- tourism, Bulgaria, response planning, 84
- tow speed, booms and oil loss, 106
- towing, escort and rescue, Prince William Sound, Alaska, 31
- toxicity
 - crude oil, 143
 - modeled-exposure test, 96
- tracking buoys, 3, 83
- training, 144
 - ARCO Marine, Inc., 152
 - beach cleanup, health and safety, 62
 - cost, 62
 - environmental, 150
 - fishing vessels, 61
 - in-house, 62
 - marine environment, 128
 - methods, 146
 - on-scene coordinator, 147, 151
 - on-scene coordinator, course development, 147
 - performance standards, 62
 - response management, 101, 149
 - Swedish Coast Guard, 63
- trajectory analysis
 - Aegean Sea* spill, 113
 - Texas decision support system, 98
- Trans-Alaska Pipeline System (TAPS)
 - community and fishing industry support, 130
 - tanker route, prevention and response, 31
 - see also Alyeska Pipeline Service Co.
- trends, international database, 144

- Tri-State Bird Rescue & Research, Tampa Bay, 70
- Trinidad and Tobago, contingency planning, 58
- tugs, tanker escort and rescue towing, 31
- U. S. Coast Guard
 - contingency planning, 83
 - equipment integrated logistics system, 116
 - infrared sensors and OSC, 153
 - response, 83
 - SPEARS, 153
 - tanker inspection program, 32
 - training for response management, 149
 - Vessel of Opportunity Skimming System (CGVOSS), evaluation, 111
- U. S. Fish and Wildlife Service, sensitive environment mapping, 10
- UCS *see* command system, unified
- United Kingdom
 - dispersant effectiveness at sea, 18
 - oil burial and breakdown, coastal dune systems, long-term, 66
 - response policy at-sea, 145
- United Nations Conference on Environment and Development (UNCED), precautionary approach, 73
- United States
 - cross-boundary response, 87
- NOBE, 16
- Pacific and Mexican cooperation, 132
- PREP, 63
- regulatory systems, 86
- responder immunity, 100
- simulations and coastal tanker routing, 30
- vessel liability and financial responsibility, 29
- Unocal
 - damage assessment, Avila Beach pipeline rupture, 39
 - preparedness, 57
- vegetation cutting, recovery and, 52
- Venezuela
 - contingency planning, 142
 - contingency planning for river basins, 130
 - decision support system, 117
 - national drill of contingency plan, evaluation, 60
- vessels *see* ships
- Virginia *see* Colonial Pipeline spill
- vulnerability analysis, 135
- war, principles applied to incident management, 123
- Washington
 - geographic response planning, 124
- Nosac Forest* spill compensation schedule, 42
- prevention plan, evaluation, 69
- waste disposal at sea, 67
- water *see* freshwater; ground water
- water quality
 - burn experiment, 16
 - pipeline rupture, oil fate and effect, CA, 46
- watersheds, mapping, 43
- waves, booms and, 107, 110
- weather, *Braer* spill and, 108
- weather station, emergency (EWS) system, response support, 107
- weathering
 - at sea, 18
 - experimental, 49
 - follow-up (2-year), IraqKuwait conflict spill, 49
- wetlands, coastal, bioremediation and, 13
- wildlife
 - recovery, Saudi Arabia shore, 138
 - response, 104
 - response, Tampa Bay, 70
 - see also* birds
- workers *see* personnel; safety; training
- World Bank, Ship Waste Disposal Project, CATSNOAA contingency planning, 98
- wrist-action shaker emulsion test (WRASET), 19

Section I

EVOLVING TECHNOLOGIES

Session M1A: Remote Sensing

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U.S. Environmental Protection Agency

Session T4C: Mechanical Containment and Recovery

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TRACKING BUOYS FOR OIL SPILLS

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The use of tracking buoys in oil spill response, planning, and training and criteria for the selection of these buoys were studied in conjunction with an experiment conducted in the Gulf of Mexico during March 1994 on the relative motions of several oil spill drifter buoys. For the test, wood chips and cottonseed hulls were used to simulate the motion of the oil. Six different types of buoys and three different positioning and tracking systems, in various combinations, were tested. The first day of the program was conducted in Galveston Bay, the second in the Gulf of Mexico off Galveston. Significant differences were noted in the movements of the various buoys. Analysis of the data from these experiments suggests that tracking of the buoys should occur for a

longer time period than in the experiments in order to reduce the influence of positioning errors.

AUTHOR: Ron H. Goodman attended the University of Saskatchewan and was graduated with a Bachelor of Arts in Science with specialization in physics. He undertook graduate studies at McMaster University in Hamilton and obtained a PhD. in nuclear physics in 1964. He served as the manager of surveillance and tracking for the *Exxon Valdez* response during 1989. He has been in the oil spill technology business for twenty years, specializing in remote sensing and oil spill models.

AIRBORNE DETECTION, IMAGING AND TELEMETRY OF OIL AND OTHER SPECTRAL FEATURES ON THE OCEAN SURFACE

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A transition is underway in imaging technology for airborne surveillance and reconnaissance operations. Large independent sensor systems carried in dedicated airframes, are being replaced by more economical, compact, and integrated multisensor arrays with a common processor that are portable enough to fit into a variety of small aircraft. Development of such a system was stimulated by a perceived need to enhance marine oil spill response and cleanup, and to better mitigate the environmental and economic impact of such incidents.

The newest of these systems incorporates an aerial platform, a suite of advanced commercial sensors, a six degrees of freedom global positioning system (GPS), advanced database technology to manage spatial data, and image analysis capabilities.

The operational goal of this development is to furnish valuable reconnaissance information in real time to ground users. Such a capability could advance oil spill response and other applications where rapid acquisition, integration, and communication of complex data is essential to decision-making. The ability to conduct day, night, and adverse weather surveillance operations is restricted in current systems and is another benefit this system is designed to provide.

The innovation in the system especially lies in the development of a common processor and image fusion system which integrates, geo-references, and geocorrects multisensor data and transmits it in real

time. A graphic interface was designed to provide maps or other projections as a spatial reference system on which to plot data from a surveillance mission. New imaging numerical methods allow processing of composite images, multi-image mosaics, change detection, and other data manipulation, and were tested in field trials of the system.

AUTHORS: Charles P. Giammona has recently become a private consultant, following positions as Director of Physical and Engineering Science for the Marine Spill Response Corporation, and as Associate Dean for Faculty and Research at the City University of New York. His professional experience has included teaching, administration, and research in geoscience, engineering, marine resource assessment, and impact mitigation. His current research emphasis is in remote sensing, dispersant countermeasures, and oil fate and behavior studies.

F. Rainer Engelhardt is Vice President for Research and Development of MSRC. He formerly held executive positions in the Canadian government, responsible for national science and technology programs and petroleum industry regulation, and was a professor in physiology and toxicology in U.S. and Canadian universities. He received his doctorate in environmental physiology in 1973 from the University of Guelph.

OIL THICKNESS DETECTION USING WIDEBAND RADIOMETRY

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A major problem in the cleanup of oil spills on large bodies of water is determining the oil thickness distribution since much of the oil can be contained in a small fraction of the spill area. Knowledge of the location of the thick patches allows one to use cleanup resources more efficiently. To address this problem, we have designed, built and tested a millimeter-wave, frequency-scanning radiometer for remotely determining the thickness of oil films. The work is based on the theory of the frequency-scanning radiometer. Experimental results, obtained in an outdoor laboratory setting, show agreement between our theory and

measured data for oil thicknesses ranging from 0 to 10 mm in 1 mm steps. A visible change was obtained for 0.1 mm steps from 0.0 to 1.0 mm of oil. The study also demonstrated that thin oil/water emulsions are detectable.

AUTHOR: Oliver McMahon received his BEE from Manhattan College in 1988 and has been with MIT Lincoln Laboratory ever since. He is a member of IEEE, Eta Kappa Nu, and Tau Beta Pi.

ADVANCED AERIAL SURVEILLANCE SYSTEM FOR DETECTION OF MARINE POLLUTION AND INTERNATIONAL AERIAL SURVEILLANCE COOPERATION IN THE NORTH AND BALTIC SEAS

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Marine pollution of the North and the Baltic Seas caused by accidental and illegal operational discharges has sharpened the awareness of states adjoining these waters. Consequently, the member states of the Bonn Agreement, for the North Sea and the Helsinki Convention, for the Baltic Sea have agreed to cooperate closely to develop remote-sensing techniques to improve the detection of oil pollution and the identification of polluters, and to develop reliable methods to estimate the total level of oil pollution at sea. In the ministerial declaration of the Third International Conference on the Protection of the North Sea (1990) and according to a recommendation of the Helsinki Commission, the member states are invited to develop and improve the existing remote-sensing techniques for effective evaluation of spills, even at night and under bad weather conditions. With the integration of a laser fluorosensor (LFS) and a microwave radiometer (MWR) in its existing

sensor system (SLAR, IR/UV scanner, single frequency MWR), Germany has widened the detection and identification by enabling classification of discharged oil and the detection of released chemicals with fluorescent properties.

Apart from this technical progress, the international cooperation between the North Sea and Baltic Sea states is a further step to deter potential polluters and to improve the prosecution of suspected offenders and to assist oil recovery operations at sea through permanent aerial guidance.

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COSTS ASSOCIATED WITH THE CLEANUP OF MARINE OIL SPILLS

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The cost of offshore and coastal cleanup of spilled oil varies greatly from spill to spill but is of high interest in risk assessments, because cost is often used as the basis of comparison. We present data on the costs associated with mechanical offshore cleanup, shoreline cleanup, and offshore burning. A review of eight offshore recovery operations in North America indicates a mean offshore, on-water cleanup cost of approximately \$2,500/bbl, with a range of \$10 to \$6,000/bbl. Smaller spills (1,000 to 2,000 bbl) have a higher per-unit recovery cost than large spills ($\geq 10,000$ bbl)—at about two to three times the cost. Review of ten shoreline cleanup operations indicates a mean cleanup cost of approximately \$8,000 to \$9,000/bbl, an average of 2.5 to 4 times higher than the cost of offshore recovery. Variability in shoreline cleanup costs is high, and costs are highly dependent on both the size of the spill and the remoteness of the spill location; small, widely dispersed spills,

such as the *Nestucca* (British Columbia and Washington coasts), involve cleanup costs of more than \$20,000/bbl. Although there are few spills where offshore *in situ* burning has been used as a response option, preliminary estimates indicate comparable unit "elimination" costs of about \$500/bbl, five times less expensive than offshore on-water recovery and more than an order of magnitude less than mean shoreline cleanup costs.

AUTHOR: John Harper is the President of Coastal & Ocean Resources, Inc., and specializes in coastal studies, especially regarding oil spill impacts, coastal mapping, scientific monitoring, and experimental research. He has been involved with scientific monitoring studies of the *Exxon Valdez* spill from 1989 to 1994.

FULL SCALE OIL CONTAINMENT BOOM TESTING AT SEA

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In May 1994 the Marine Spill Response Corporation, U.S. Coast Guard, U.S. Navy, and Minerals Management Service conducted a joint test of oil containment booms in Lower New York Bay and in the Atlantic Ocean east of Sandy Hook New Jersey. These tests allowed the collection of quantitative data on boom performance, including tow forces, skirt draft, and boom freeboard, as a function of tow speed and environmental forces due to currents, wind, and waves. Four booms were chosen for testing based on their different physical characteristics: The 3M Fire Boom, the Barrier Boom, the USCG/Oil Stop inflatable boom, and the U.S. Navy USS-42 boom. Use of these booms

allowed data acquisition over a range of buoyancy to weight ratios from 5:1 up to 52:1, nominal skirt drafts from 61 cm up to 150 cm, and freeboards from 37 cm up to 119 cm.

The data collected allows a comparison between methods for calculating boom loads and measured loads. Existing calculation methods predict towing loads below the mean loads experienced by a boom when used at sea. Further research will be required to develop an encompassing dimensionless empirical formula, based on hydrodynamic theory and the dynamics of vessel motions, to more closely predict oil containment boom tow loads.

TEXAS MARSH BURN: REMOVING OIL FROM A SALT MARSH USING IN-SITU BURNING

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Frequently coastal marsh is burned to enhance regrowth; but rarely is it burned to remove spilled oil. On January 7, 1992, a 40.64 cm crude oil pipeline ruptured causing a spill in a salt marsh. Four days later, in an unprecedented cleanup coordinated by Exxon Pipeline Company and the Texas General Land Office, 1,150 barrels of South Texas crude was ignited and removed, minimizing environmental damage to Copano Bay, Chiltipin Creek, and the surrounding wetlands.

This cleanup had been made difficult by inclement weather and heavy rainfall that saturated the marsh. Ingress and egress had damaged the marsh and was discontinued. Conventional mechanical cleanup techniques had been used with minimal success. Alternative methods like bioremediation, low pressure flooding, and peat moss applications were considered, but proved unfeasible. The unified com-

mand system then made an application for a permit to burn and gained approval. Seventy-six hours into the event, a successful test burn was conducted; one day later, the majority of the oil was ignited. It maintained a full burn for 21 hours, self-extinguished, and later was re-ignited for further removal.

Emerging technologies such as in-situ burning are additional implementations in the oil spill responder's toolbox. In Texas, burning helped save a marsh.

AUTHOR: Manuel F. Gonzalez is the Director of Field Operations of the Oil Spill Prevention and Response Division of the Texas General Land Office. He is a member of the governor's Environmental Task Force and is on the F-20 committee of ASTM. He is a geologist, and graduated from Texas A & I University, Kingsville.

EVALUATION AND LIMITS OF PROTECTIVE BOOM PLANS FOR HIGH TIDAL RANGE AND STRONG CURRENT AREAS

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The French organization of onshore oil spill response is defined by specific intervention plans (Polmar plans), established for every coastal department. One of the main elements of these plans consists of detailed plans for deploying booms to protect sensitive areas.

The Ministry of the Sea, with assistance from CEDRE, carries out exercises every year in different coastal locations to test the feasibility and efficiency of the boom deployment plans and also to train local personnel in handling antipollution equipment. Lessons learned from these exercises enable the improvement of deployment plans and help define new research areas. Within this framework, CEDRE has undertaken a feasibility study for the installation of booms in high tidal range and strong current areas.

This experimental study involved a 15-day period, during the autumn of 1993, of on-site observations on the behavior of booms installed in one of the most difficult sites on the Atlantic shoreline. The main parameters observed were resistance, containment efficiency,

and mechanical behavior of booms during the tide cycle, particularly when booms are stranded at low tide. In spite of successful boom installation, the experiment encountered difficulties due to meteorological and instrumentation problems.

Nevertheless, important lessons have been learned.

- Static boom protection seems to be difficult for such sites, which leads us to question the validity of numerous Polmar plans. We should test alternative response techniques such as dynamic recovery systems set up at the openings to sensitive areas, which will necessitate good coordination between at-sea and on-shore response authorities.
- Mooring systems design and installation are jobs for specialists and should be prepared in advance.
- Various local means, such as fishing vessels or oyster farm barges, can be used for deploying protective booms.

A MULTICOMPONENT OIL SPILL MODEL FOR DISSOLVED AROMATIC CONCENTRATIONS

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When considering the consequences of an oil spill accident, not all oil components are equally harmful to marine life. Some components are more harmful than others, especially the aromatic components. The polyaromatic hydrocarbons (the PAHs) may be accumulated in food chains, while the monoaromatics dissolve much faster into the water than other components.

A model was therefore developed that separates the behaviors of different components of hydrocarbon release. The oil is divided into 20 different classes with increasing carbon number within the range C_4 to C_{55} . Within each class, the hydrocarbons are divided further into 5 subsets (*n*-alkanes, cycloalkanes, aromatics, naphthenes, and resins). The model then keeps track of the fate of each of the components (loss by evaporation, dissolution, or as droplets; or remaining in the slick) during an actual spill event.

After calculating the amount of aromatics dissolved into the water,

the actual concentrations are then computed by numerically solving a diffusion-advection equation. Vertical and horizontal turbulence in the water mass are included, as well as effects from variations in the vertical velocity profile.

The paper outlines the approach chosen, and provides examples of some results.

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THE USE OF KNOWLEDGE-BASED SOFTWARE TO IDENTIFY SHORELINE TREATMENT OPTIONS

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A PC-based software package has recently been completed that provides decision makers with support for developing shoreline cleanup strategies. Using data obtained from systematic surveys of shore-zone conditions, or from training or drill scenarios, an artificial intelligence approach builds on existing published manuals and on field experience to develop response options and recommendations for planners and managers.

The system has four basic output components that include:

- the synthesis of the physical shore-zone character and oiling conditions,
- an evaluation of stranded oil persistence,
- a ranking of response priorities, and
- recommended shoreline treatment and/or cleanup methods in a four-layer mode that includes surface or subsurface and heavy/moderate or light/very light oiling conditions. The assessment of shoreline oiling conditions includes evaluation of oil volume, oil

type (including weathered oils), and surface and subsurface conditions. The primary functions of the software include storing and sorting data on shoreline character and oiling conditions, simulating spill conditions for training and drills, and providing real-time recommendations in a spill event.

The paper describes the general design as well as the format, input parameters, output data formats, and applications of the software. The project has been a joint government-industry effort supported by Environment Canada and Industry Canada.

AUTHOR: Alain Lamarche is a researcher at CITI, one of Industry Canada's research centers. His main research interests include performance support in general, and environmental decision support in particular. He has practical experience in the design of environmental management systems, including geographical information systems.

A THREE-DIMENSIONAL OIL AND CHEMICAL SPILL MODEL FOR ENVIRONMENTAL IMPACT ASSESSMENT

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A comprehensive model of the dynamic, three-dimensional physical fates of contaminants in the marine environment has been developed. For oil spills, dissolution of aromatics from surface slicks and entrained oil droplets are the source of potential effects for biota in the water column. Oil on the surface and along shorelines provides the basis for

evaluation of impacts on birds, marine mammals, and recreational activities. A graphical user interface couples the model to a variety of environmental databases and tools to facilitate specific applications and viewing of simulation results.

STATE-OF-THE-ART TECHNIQUES IN OIL SPILL MODELING

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The status and possible research directions of oil spill modeling are presented here. The physical and chemical processes that take place in oil spills are explained as is their role in the design of an ideal oil spill model. An ideal oil spill model for forecasting must support rapid response, contingency planning, and training. Accurate, full-dimension, real-time prediction of hydrodynamic calculations and oil movements require intensive computations and computing power. Presently the most promising computational platform appears to be a vector supercomputer that has been given essential geographical, bathymetric, and tidal data before the spill. Parallel processing machines could be used in the same way; but present codes, written for sequential machines, must be changed substantially to take advantage of the parallel architecture. Super minicomputer technology is advancing rapidly and should soon be able to run the numerically intensive hydrodynamic codes, bringing the advantages of portability and low cost. Since the present personal computer oil spill models are not able to make accurate hydrodynamic current predictions, they cannot match the accuracy of more computationally intensive models.

AUTHOR: H. M. Cekirge received an M.S. degree in civil engineering from the Technical University of Istanbul in 1968 and a Ph.D. degree in applied mechanics from Lehigh University in 1972. He has worked in Turkey, Canada, and Saudi Arabia as a faculty member and research engineer. He has published a number of papers in applied mechanics and environmental modeling and has done intensive work on modeling and monitoring oil spills.

AN INTEGRATED PROGRAM FOR SENSITIVE ENVIRONMENT MAPPING

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The objective of the National Oceanic and Atmospheric Administration's (NOAA) national sensitive environment mapping program is to publish a comprehensive series of standard maps and databases for coastal areas that provide the basis for sensitive environment plans.

Sensitive environment maps have been an integral component of oil spill contingency planning and response since 1979, when the first maps were prepared in advance of oil arriving from the Ixtoc I well blowout. Since then, NOAA has undertaken a nationwide sensitive environment mapping effort that covers most U.S. coastlines, including Alaska, Hawaii, and the Great Lakes.

As part of cooperative efforts with federal agencies, states, and industry, NOAA is now undertaking a program to achieve three goals: map new areas and update existing maps, provide means for broadly distributing sensitive environment data in paper and electronic forms, and extend sensitivity mapping methods to new environments.

In 1994, sensitive environment maps were jointly produced with the states of Texas, California, and Alaska. The Great Lakes materials

were completed as part of a cooperative project between the U.S. Coast Guard and Environment Canada. With cooperation from the Marine Spill Response Corporation, NOAA is embarking on a program to format sensitive environment maps for computer-based information systems that help implement requirements of the 1990 Oil Pollution Act (OPA 90). NOAA, the U.S. Fish and Wildlife Service, and the Office of Pipeline Safety are cooperating to extend sensitive environment mapping approaches to inland waters and terrestrial habitats.

AUTHOR: Robert Pavia is Chief of the Scientific Support Coordination Branch of the Hazardous Materials Response and Assessment Division of NOAA in Seattle, Washington. He has worked for NOAA since 1978 and currently directs NOAA's program for providing oil and hazardous chemical scientific support, for planning and response in coastal waters.



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SENSITIVITY MAPPING WORLDWIDE: HARMONIZATION AND THE NEEDS OF DIFFERENT USER GROUPS

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Prospective user groups of sensitivity maps for oil spill response have a variety of needs related to different categories of oil spill, ranging from localized tier 1 spills at fixed installations (such as oil terminals) to catastrophic tier 3 spills. The latter may affect large areas and possibly more than one country. Uses of maps range from planning practical site-specific shore cleanup to strategic planning on a regional scale for "passing ship" scenarios in remote areas. The paper discusses different map types, map scales, categories of information to be included, and symbology, bearing in mind the requirements of different users. Reference is made to international examples. A considerable degree of

harmonization of approach for sensitivity maps worldwide can be achieved. However, given that resources can vary tremendously from one region to another, it seems better to promote a broad consistency with respect to symbology rather than an exhaustively detailed scheme to cover every possible resource worldwide.

AUTHOR: Jenifer Baker is a consultant specializing in coastal ecology. She has 25 years experience with oil pollution problems and has worked in many parts of the world.

GEOGRAPHIC INFORMATION SYSTEM (GIS) FOR IMPACT ASSESSMENT, ECOLOGICALLY SOUND MEASURES, AND DOCUMENTATION OF OIL SPILLS

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The geographic information system (GIS) is an objective and standardized oil spill impact assessment tool. In addition to the impact assessment, the GIS provides a helpful tool for judging the size of the impact, choosing environmentally sound cleanup techniques, and planning resources utilization. All information put into a GIS, including daily activity reports, will constitute the essential base for claims from the International Oil Pollution Compensation Fund (IOPC Fund).

Impact assessment. Before cleanup activities start, an impact assessment is made. The impacted area is geographically defined in the field with the detailed geographic position system (dGPS) and maps. Type of coastline, spill volume, and type of oil are documented for each impacted area. If necessary, photos and other information concerning the impacted area are included in the GIS.

Determination of cleanup method. Documented information from the impact assessment is analyzed together with databases containing ecological sensitivity maps, cleanup methods, and experience. The analysis made using the GIS will suggest what cleanup method/s should

be used and how best to use resources. The cleanup method(s) chosen by use of the GIS is presented in digital maps and tables of resources needed.

Daily activity reports. All daily activities are documented in the GIS. These include time spent, costs, site, amount of oil cleaned up and method used for cleanup, transfer of oil, and waste disposal. Total and specific cost for each impacted area is calculated daily.

Commanders report. The GIS provides the commander with a total report of all actions taken during the cleanup operation. The report contains total costs, claims, experience, geographical location, date and time, and an impact assessment.

Advantages of the GIS. The GIS provides a standardized and objective impact assessment for each contaminated area and at the same time suggests what cleanup method to use. The system can present daily reports of information and activities undertaken, and easily specify the cost for each activity. The GIS also can present a final report immediately upon completion of the work.



**OIL SPILL BIOREMEDIATION AGENTS—
CANADIAN EFFICACY TEST PROTOCOLS**

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Thirteen commercial oil spill bioremediation agents (OSBAs) were tested over a two-year period during the development of a screening protocol designed to evaluate the hydrocarbon degradation efficacy of OSBAs under warm freshwater or cold marine water conditions. The OSBAs were added at the rate specified, to shaker flasks containing a standard test oil, nutrients if requested, and a defined medium. Standardized freshwater or marine microbial inocula were developed to act as internal controls for the screening protocol, that is, to ensure that conditions were suitable for oil biodegradation to occur in each test performed. After the incubation period, the oil was extracted and analyzed using gas chromatography/mass spectrometry (GC/MS) and gas chromatography with a flame ionization detector (GC/FID).

The warm freshwater efficacy method exhibited good reproducibility but the cold marine test requires further refinement. The minimum acceptance standard for products tested under standard warm freshwater conditions is currently based on the product achieving GC-detectable total petroleum hydrocarbon (GCD-TPH), aliphatic, and aromatic reductions of 35, 30, and 10 percent, respectively, when compared with the weathered Alberta Sweet Mixed Blend (ASMB) source oil. These values may be adjusted with further experimental testing. Products with acceptable efficacy and toxicity results will be assumed to have good potential application in spill cleanup and will be identified as such to the spill response community.