

建立海岸油污染適當清理之決策支援程序

Trinh Hoang Long、陳宜清

E-mail: 9805417@mail.dyu.edu.tw

摘要

溢油污染經常造成嚴重及長期的生態、經濟、政治、文化及社會等層面的衝擊。吾等雖不能確定地預測上述之衝擊何時發生?然而吾等卻可以事前先演練及評估當某等程度之油污對脆弱海岸的衝擊情形。其中,可利用環境敏感指標之方法來評價。本研究將建置一套模式,稱為「越南油污管理輔助系統」(VOAM),其主體為結合地理資訊之決策支援系統,並運用Borland Delphi 2005之程式語言撰寫。這套模式可提供非技術官僚之決策者在最短時間內獲得最合適之清理方法的建議,並能有效預防或減低油污對海岸之衝擊。為評價油污對生態之影響,環境敏感指標地圖將被應用及確認已經調查之敏感生態系及人類相關活動情況。環境敏感指標地圖也與VOAM模式相結合。運用VOAM模式,甚至一些非技術性人員也能簡單應對油污對海岸之衝擊。

關鍵詞:溢油污染、決策支援系統、環境敏感指標地圖、Borland Delphi 2005程式語言、油污清理。

目錄

ABSTRACT	iv	中文摘要	
.....	v	ACKNOWLEDGEMENTS	
.....	vi	CONTENTS	vii
LIST OF FIGURES	x	LIST OF TABLES	
.....	xii	ABBREVIATIONS	
xiii Chapter I. INTRODUCTION	1	1.1 Origin of Research	
.....	1	1.2 Research Objectives	2
Scope of Research	4	Chapter II. LITERATURE REVIEWS	
.....	5	2.1 Behaviors of Spilled Oil in Marine Environment	5
2.1.1 Weathering	5	2.1.2 Movement of Oil	
.....	10	2.2 Impacts of Oil on Coastal Environments	
12 1. Aquatic environments	12	2. Fish	
.....	13	4. Benthic invertebrates	
13 5. Epontic organisms	14	6. Marine mammals	
.....	14	7. Intertidal fauna	14
Marine plants	15	9. Special ecosystems	
.....	15	10. Birds	15
Environmental Sensitivity Index (ESI) and Maps	15	2.4 Emergency Responses to Oil Spills	
.....	17	2.4.1 Fate and Behaviors of Spilled Oil	18
Selecting the Appropriate Response	20	2.4.3 Wildlife Rescue and Rehabilitation	
.....	21	2.4.4 Health and Safety	22
Oily Waste	23	2.4.6 Management of Spill Response	
.....	24	2.4.7 Contingency Planning	24
Techniques for Cleanups of Coastal Oil	25	2.5.1 Cleanup Strategies	
.....	26	2.5.2 Cleanup Methods	28
Some Oil-spill Forecasting Models	30	2.6.1 Oil Spill Model and Response System (OILMAP)	
.....	30	2.6.2 The Oil Spill Identification System (OSIS)	31
General NOAA Oil Modeling Environment (GNOME)	32	2.6.3 The	
(ADIOS2)	33	2.6.4 Automated Data Inquiry for Oil Spills	
.....	34	2.7 Oil Spill Response Management in Vietnam and Other Countries	
.....	34	2.7.1 Overview of Oil-spill Events in Vietnam	34
Management in Vietnam	37	2.7.2 Oil Spill	
Countries	40	2.7.3 National Oil Spill Response Management in Some Other	
Chapter III. MODEL DEVELOPMENT	50	3.1.	
Decision Support Systems	50	3.1.1 The Role of ESI Maps in Emergency Response	

..... 50	3.1.2 Applications of ES and EIS	51	3.1.3 Frameworks of DSS	52
..... 52	3.2 Emergency Response Expert System	54	3.2.1 Introduction	54 - v i i i - 3.2.2
..... 57	3.2.3 An Emergency Response with Expert System	58	3.3 Designing Decision Support Systems for Proper Cleanups	59
..... 59	3.3.1 Principles	59	3.3.2 Designing Coastal Sensitivity Map	61
..... 61	3.3.3 Integrating DSS for Coastal Sensitivity Map	62	3.4 The Feature of the GIS-based Application (VOAM).....	73
..... 73	3.4.1 The Update Module	74	3.4.2 The Decision Making Module	75
..... 77	3.5 Model Completion	77	3.5.1 Setup the Oil Spill Information	79
..... 79	3.5.2 Update/modify the Data in the Database	81	3.5.3 Run the Simulation of Spillage Oil	83
..... 83	Chapter IV. CASE STUDY	90	4.1. Sample Case	90
..... 90	4.2. Input Parameters	90	4.2.1 Oil Category	90
..... 90	4.2.2 Weather Condition and Sea State.....	91	4.3 Model Simulation	93
..... 91	4.3.1 Setup the Oil Spill Information	93	4.3.2 Run the Simulation of Spillage Oil	94
..... 94	4.3.4. Select Response Method	97	4.4 Discussion the Results	99
..... 99	Chapter V. CONCLUSIONS AND SUGGESTIONS	101	5.1 Conclusions	101
..... 101	5.2 Suggestions	101	REFERENCES	103
..... 103	- i x - LIST OF FIGURES Figure 1.1. Flow chart of the research procedures	3	Figure 1.2. Map and coastal provinces of Vietnam (MHC, 1996)	4
..... 4	Figure 2.1. Weathering processes (ITOPF, 2008)	6	Figure 2.2. Effect of wind and current directions on the movement of an oil slick (Fingas, 2001) ...	11
..... 11	Figure 2.3. Example of ESI map prepared by NOAA (NOAA, 2002)	16	Figure 2.4. Schematic flowchart of oil spill response	18
..... 18	Figure 2.5. The proportion of oil spill causes in Vietnam (Huynh et al., 2007)	35	Figure 2.6. Summary of oil spills in 2007 along the coastline of Vietnam	36
..... 35	Figure 2.7. The three regional centers for oil spill response for Tier 2	38	Figure 3.1. Proposed DSS in oil spill management (Pourvakhshouri and Shattri, 2003)	53
..... 53	Figure 3.2. Shoreline treatment decision process (Exxon Production Research Company, 1999)	60	Figure 3.3. The schematic flowchart of the VOAM application	73
..... 60	Figure 3.4. The rule chart of decision making	76	Figure 3.5. The splash screen of VOAM	77
..... 76	Figure 3.6. A diagram of VOAM	77	Figure 3.7. Oil spill information dialog	80
..... 77	Figure 3.8. The weather and sea conditions	80	Figure 3.9. Change the ranking matrix of response alternatives	81
..... 80	Figure 3.10. The value of dispersion capability by time	82	Figure 3.11. The response capability value.....	82
..... 82	Figure 3.12. The information of ESI table	83	Figure 3.13. Oil spill trajectory and hit location on shore	85
..... 83	Figure 3.14. The response consideration data	85	Figure 3.15. List of available methods of affected area	86
..... 85	Figure 3.16. List of the methods selected	87	Figure 3.17. Authority information	88
..... 87	Figure 3.18. The report of VOAM	89	Figure 4.1. Oil spill information dialog	93
..... 89	Figure 4.2. The weather and sea conditions	94	Figure 4.3. The oil spill movement and affected location	95
..... 94	Figure 4.4. List of available methods of affected area	98	Figure 4.5. List of the methods selected	98
..... 98	Figure 4.6. The report of VOAM	100	- x i - LIST OF TABLES Table 2.1. Shoreline treatment objectives and strategies (Fingas, 2001)	27
..... 100	Table 2.2. Shoreline treatment strategies and response methods (Fingas, 2001)	27	Table 2.3. Summary of the relative potentially adverse effects of shoreline treatment (Fingas, 2001)	29
..... 27	Table 3.1. Basic steps in making DSS engine (Pourvakhshouri, et al., 2006).....	54	Table 3.2. Sensitivity index of shores	61
..... 54	Table 3.3. Considerations for oil spill response by characteristic coastal habitats (NOAA, 2000) ...	63	Table 3.4. Response considerations for exposed, solid man-made structures (NOAA, 2000)	65
..... 63	Table 3.5. Response considerations for exposed wave-cut platforms (NOAA, 2000)	66	Table 3.6. Response considerations for sand beaches (NOAA, 2000)	67
..... 66	Table 3.7. Response considerations for mixed sand and gravel beaches (NOAA, 2000)	68	Table 3.8. Response considerations for gravel beaches (NOAA, 2000).....	69
..... 68	Table 3.9. Response considerations for exposed tidal flats (NOAA, 2000)	69		

..... 70 Table 3.10. Response considerations for marshes (NOAA, 2000)	71 Table 3.11. Response considerations for mangroves (NOAA, 2000)
..... 72 Table 3.12. List of tables in the relation database of VOAM	74 Table 3.13. Sample input parameters
..... 79 Table 4.1. Parameters of the model.....	91 Table 4.1. List of weather conditions in the VOAM
..... 92 Table 4.2. List of sea state ' s scale in the VOAM	92 Table 4.3. Method selected for affected area
..... 99	

參考文獻

- 1.American Petroleum Institute (API), National Oceanic and Atmospheric Administration (NOAA), U.S. Coast Guard (USCG) and U.S. Environmental Protection Agency (USEPA) (2001). Characteristics of Response Strategies: A Guide for Spill Response Planning in Marine Environments. Seattle, WA: NOAA National Ocean Service.
- 2.Jensen C. (2004). Borland Delphi 2005 Reviewer ' s Guide. Produced for Borland by Jensen Data Systems, Inc., Scotts Valley, CA: Borland Software Corporation.
- 3.Chen, Y. C. (2007). Application of DSS and ESI maps for Cleanups in Coastal Oil-spills. The 4th International Conference on Environmental Disaster and Emergency Response Conference, 2007, National Yunlin University of Science and Technology (NYUST), Touliou, Yunlin, Taiwan.
- 4.Chen, Y. C. and O ' Yang, L. J. (2006). The application of ESI maps with GIS technique to coastal oil-spill cleanups in Taiwan. Environmental Problems in Coastal Regions VI - Including Oil and Chemical Spill Studies: 33-43, Coastal Environment 2006 Conference, Rhodes, Greece.
- 5.Doerffer, J.W. (1992). Oil Spill Response in the Marine Environment. NY: Pergamon Press.
- 6.Exxon Production Research Company (1999). Exxon General Oil Response Plan. Chad-Cameroon Pipeline Project, Exxon Chad Development Project. Houston, TX: Exxon.
- 7.Fingas, M. (2001). The Basics of Oil Spill Cleanup. 2nd ed., Boca Raton, FL: Lewis Publishers.
- 8.Graham, G. (2003). Expert Systems for Marine Oil Spill Response Operations. Georgia Basin/Puget Sound Research Conference Proceedings, Vancouver, B.C.
- 9.Huynh, N.D., D.D. Manh, and N.Q. Huy (2007). Oil Spill Incidents in Vietnam. International Workshop on Exchanging Experiences in Discovery, and Emergency Response for Oil Spill on Sea, 2007, Hanoi, Vietnam.
- 10.National Oceanic and Atmospheric Administration (NOAA) (2000). Characteristic Coastal Habitats - Choosing Spill Response Alternatives. Seattle, WA: NOAA.
- 11.National Oceanic and Atmospheric Administration (NOAA) (2002). Environmental Sensitivity Index Guidelines. NOAA Technical Memorandum NOS OR&R 11, Seattle, WA: NOAA.
- 12.Nordvik, A.B (1999). Time window-of-opportunity strategies for oil spill planning and response. Pure Appl. Chem., 71(1): p.5-16.
- 13.Pourvakhshouri, S.Z. and B.M. Shattri (2003). Decision support system in oil spill management. Journal of Disaster Prevention and Management (literature review). 12 (3): p.217-221.
- 14.Pourvakhshouri, S. Z., Shattri, B. M., Zelina, Z. I., and A. Noordin (2006). Decision support system in oil spill management. International Archives of Photogrammetry, Remote Sensing, and Spatial Information Sciences Vol. XXXVI - Part 2: 93-96, ISPRS Technical Commission II Symposium, Vienna.
- 15.Raiffa, H. with J. Richardson and D. Metcalfe (2003). Negotiation Analysis: The Art and Science of Collaborative Decision Making, Cambridge: Belknap Press.
- 16.Slap, A.J., D. Hillman, and D. Moore (2002). Expert Systems in Emergency Response. 2002: The EIIP Virtual Forum. (access: <http://www.emforum.org/varena/er2.htm>)
- 17.The International Tanker Owners Pollution Federation Limited (ITOPF)(2000a). Country Profiles: A Summary of Oil Spill Response Arrangements & Resources Worldwide - Taiwan – R.O.C. London, UK: ITOPF. (access: http://www.itopf.com/_assets/country/taiwan.pdf)
- 18.The International Tanker Owners Pollution Federation Limited (ITOPF) (2000b). Country Profiles: A Summary of Oil Spill Response Arrangements & Resources Worldwide - United Kingdom. London, UK: ITOPF. (access: http://www.itopf.com/_assets/country/uk.pdf)
- 19.The International Tanker Owners Pollution Federation Limited (ITOPF) (2000c). Country Profiles: A Summary of Oil Spill Response Arrangements & Resources Worldwide - Vietnam. London, UK: ITOPF. (access: http://www.itopf.com/_assets/country/vietnam.pdf)
- 20.The International Tanker Owners Pollution Federation Limited (ITOPF) (2008). Fate of Marine Oil Spills. Technical Information Papers No.11. London, UK: ITOPF.
- 21.The International Tanker Owners Pollution Federation Limited (ITOPF) (2009a). Country Profiles: A Summary of Oil Spill Response Arrangements & Resources Worldwide- Australia. London, UK: ITOPF. (access: http://www.itopf.com/_assets/country/australi.pdf)
- 22.The International Tanker Owners Pollution Federation Limited (ITOPF) (2009b). Country Profiles: A Summary of Oil Spill Response Arrangements & Resources Worldwide- United State of America. London, UK: ITOPF. (access: http://www.itopf.com/_assets/country/usa.pdf)
- 23.The Marine Hydro-meteorological Center (MHC) (1996). The Final Report of Vietnam Vulnerably Assessment Study. Hanoi, Vietnam: MHC.
- 24.The Prime Minister of Vietnam (2001). Decision No. 129/2001/QD-TTg ratifying the national plan on coping with oil spill incidents in the 2001-2010 period, approved by The Prime Minister of Vietnam, August 29, 2001. (access: <http://www.asianlii.org/vn/legis/laws/rtnpocwosit20012010p684/>)
- 25.The Prime Minister of Vietnam (2005). Decision No. 103/2005/QD-TTg promulgating the Regulation on oil spill response, approved by The Prime Minister of Vietnam, May 12, 2005. Vietnam Official Gazette No. 18: pp. 27-33, May 2005, Vietnam.
- 26.Trinh. H. L. and Chen Y.C. (2008). A Decision Support Procedure for Proper Cleanups of Coastal Oil-Spill Applied in Vietnam. Proceeding of the 30th Ocean Engineering Conference in Taiwan, National Chiao Tung University, November 2008, Taiwan.
- 27.Turban, E. and Aronson, J. E. (2001). Decision Support Systems and Intelligent Systems. 6th ed., Boston, Prentice Hall Publisher.