HAZARD IDENTIFICATION AND EVALUATION IN A LOCAL COMMUNITY



A publication of UNEP IE/PAC'S APELL Programme AWARENESS AND PREPAREDNESS FOR EMERGENCIES AT LOCAL LEVEL



LINEP

UNITED NATIONS ENVIRONMENT PROGRAMME

INDUSTRY AND ENVIRONMENT Programme Activity Centre (IE/PAC)

39-43 QUAI ANDRÉ CITROEN 75739 PARIS CEDEX 15, FRANCE TEL 33 (1) 40 58 88 50 FAX 33 (1) 40 58 88 74 TELEX 204 997F This is the twelfth publication in a Technical Report Series that regroups the Guidelines, Overviews, Technical Reviews, and Workshop Proceedings previously published by UNEP IE/PAC. The regrouping into a single series will ensure a greater cohesion among future publications, and allows a single document to include the various elements of IE/PAC work that had earlier been presented separately.

As before, the Technical Report Series aims to meet the needs of a wide range of government officials, industry managers and environment protection associations, by providing information on the issues and methods of environmental management relevant to various industrial sectors.

Copyright 1992 UNEP

All Rights Reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or any means: electronic, electrostatic, magnetic tape, mechanical, photocopying, recording or otherwise, without permission in writing from copyright holders.

First edition 1992

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the United Nations Environment Programme concerning the legal status of any country, territory, city or area or of its authorities, or concerning delimitation of its frontiers or boundaries. Moreover, the views expressed do not necessarily represent the decision or the stated policy of the United Nations Environment Programme, nor does citing of trade names or commercial processes constitute endorsement.

UNITED NATIONS PUBLICATION

Sales N°: E92 - III - D - 3

ISBN · 92 - 807 - 1331 - 0

ACKNOWLEDGEMENTS

This Handbook is based on the 1989 Swedish Rescue Services Board Handbook on risk analysis, called "To Protect and Save Lives, Property and the Environment".

Work on both Swedish and English versions has been co-ordinated by Tommy Rosenberg, Rescue Director, Swedish National Rescue Services Board. UNEP would like to express its gratitude to him and to the Swedish National Rescue Services Board and the Swedish government for making his expertise available to APELL users worldwide

The Handbook draws upon the work of many people in the field, some of which is also acknowledged in the text.

UNEP would also like to acknowledge the most valuable comments and suggestions on the text which have been provided by the following people:

Mr. R. Garnty Baker Chemical Manufacturers Association (CMA) Washington D.C - USA

Mr. Duncan Ellison Senior Adviser, Health and Welfare Ottawa - Canada

Dr. O. A. El Kholy Professor Emeritus - Cairo University

Mr. John Gustavson US Environmental Protection Agency Washington DC - USA

Mr. Stefan Lamnevik Swedish National Defence Research Centre Stockholm - Sweden

Mr. Jacques Lochard Director, Research Center for Risk Assessment and Management, (CEPN) Fontenay aux Roses, Paris - France

Ass Professor Genandrialine L. Peralta National Engineering Center University of the Philippines Quecon City - The Philippines

Ir. Chris Pietersen
The Netherlands Organisation for Applied Scientific
Research, (TNO), Apeldoorn - The Netherlands

UNEP IE/PAC staff involved in this project were:

Mrs Jacqueline Aloisi de Larderel, Director

Mr CR (Bob) Young, APELL Senior Industry Consultant, 1989-1991

Mrs Janet Stevens, APELL Consultant, who co-ordinated the project.

FOREWORD

Awareness and Preparedness for Emergencies at Local Level (APELL) is a programme aimed at increasing prevention of technological accidents and improving emergency preparedness. It offers assistance to decision-markers in government, local authorities and industry, through providing relevant information and documents, training activities and technical support.

The APELL programme was launched in 1988 by the United Nations Environment Programme's Industry and Environment Programme Activity Centre (UNEP IE/PAC), in cooperation with governments and the chemical industry. This initiative followed various major technological accidents, in both industrialized and industrializing countries. As a first step the APELL Handbook was published. This describes a ten-stage process to guide local communities in strengthening their accident prevention and emergency response capability. APELL calls for leaders of industry, government and the community to co-operate, with the objective of identifying and evaluating hazards in the locality and of initiating plans to respond to the emergencies which could result from them.

This Technical Report on "Hazard Identification and Evaluation in a Local Community", prepared with the support of the Swedish Government and its National Rescue Services Board, will help all those concerned with the identification and evaluation of hazards in the community: particularly local government; police, fire and rescue services, and industry. The report consist of three parts. The introduction provides a general background to the handbook and gives some definitions. The second part describes the hazard analysis method and gives concrete examples of how to implement it. The third part consists of a series of Annexes, which provide more information to enable local communities to identify and evaluate hazards.

The UN Conference on Environment and Development's Agenda 21 calls for further implementation of and support for APELL. UNEP IE/PAC hopes that governments, communities and industries around the world which are putting APELL into pratice will find the Guide useful and a source of continuing help.

TABLE OF CONTENTS

Acknowledgements

Table of contents

1 1.1 1.2 1.3 1.4 1.5	ntroduction The Scope of the Handbook Some Definitions Dealing with Risks. Benefits of Hazard Identification and Evaluation How to use the Handbook	7 7 8 10 13 15
2.1 2.2 2.3 2.3.1 2.3.2 2.3.3 2.3.4 2.3.5	Hazard Analysis Method with Examples Analysis and Organisation Basis and Background for the Analysis Procedure Basis Inventory Identification Evaluation Classification Ranking Presenting the Results of the Analysis	17 17 18 23 23 23 24 24 24 24
3 Ar 3.1 3.2 3.2.1 3.2.2 3.2.3 3.2.3 3.2.4	nnexes Natural Disasters Fires Fire - Risk Objects and Threatened Objects Factors Raising the Risk Level Factors Reducing the Risk Level Examples of Serious Fires	48 49 51 52 53 53
3.3.1 3.3.2 3.3.2.1 3.3.2.2 3.3.3.3 3.3.4 3.3.5	Explosions Definitions Hazards Explosions Caused by Physical Processes Explosions Caused by Chemical Reactions Consequences Examples of Serious Explosions Hazard Analysis Methods	57 57 58 58 58 61 62
3.4 3.4.1 3.4.2 3.4.3	Chemical leakages Chemical Accidents How dangerous are chemicals? Hazards Examples of accidents caused by leakage of chemicals	65 65 65 67 .69

3.5	Combination Accidents	74
36	Selected Examples of Accidents in Various Countries 1970-1989	76
37	Other Risk Analysis Methods	78
3.7.1	Overview methods	78
3 7.1.1	Checklists (comparative analysis)	78
3 7.1.2	"Rough Analysis"	79
3.7.1.3	"What If? analysis"	79
3 7.2	More detailed methods	79
3 7.2.1	Relative ranking (Dow and Mond Index)	79
3 7.2.2	Risk and reliability analysis (HazOp)	80
3 7.3	Operator and competence analysis	80
3 7.3.1	Human reliability analysis	80
3 7.3.2	Malfunction, effect and consequence analysis	80
3 7.4	Tree methods	80
3.7.4.1	Fault Tree analysis	81
3.7.4.1		81
	Cause and effect analysis	81
		81
3.7.4.4	Consequence analysis	0.
38	References and Other Useful Information	84
LIST OF	FIGURES	
2.1	Hazard identification and evaluation form	26
2.2	Examples of risk objects and common hazards	27
23	Examples of threatened objects and consequences	29
24	Factors affecting hazards and risks	30
2.5	Classification of potential consequences, speed of development and	
	probability	31
2.6	Risk matrix	33
2.7	Ranking of risk objects and hazards from a local viewpoint	
,	(comments on Figure 2.6)	34
2.8	Risk-Map - an example	36
2.9	Hazard Identification and evaluation form - "Hardware Store and	
2.3	Builders Merchant"	37
2 10	Hazard Inventory - "Hardware Store and Builders'Merchant"	38
2 11	Hazard Identification and Evaluation Form - "Plastics Factory"	41
	Map - "Plastics Factory"	42
2 12		44
2.13	Map - "Oil Depot"	45
2.14 2.15		
2 10	Hazard Identification and evaluation form - "Oil Depot", overall view	
	Hazard Identification and evaluation form - "Oil Depot", in depth	46
3 3.1		
	Hazard Identification and evaluation form - "Oil Depot", in depth	46
	Hazard Identification and evaluation form - "Oil Depot", in depth Diagram of radius for explosion shock wave damage	46