Cedre Chemical Response Guides

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Abstract

In the early 1990s, *Cedre* published a series of 61 "Mini Response Guides", available in French only, each focusing on a particular chemical. The aim of these documents was to provide the essential information urgently needed in the event of a chemical spill.

In 2004, it was decided to revamp this series and to develop a new version of these chemical response guides with more operational and experimental content (solubility in seawater, modelling of behaviour at sea…). These guides are designed to allow rapid access to the necessary initial information, in addition to providing relevant bibliographical sources to obtain further information. They also contain scenarios relating to accidents in the Channel and in rivers and ports. They can be used, for instance, to assist in an emergency response centre in an incident involving a vessel carrying hazardous substances liable to release its cargo.

These guides are intended primarily for specialists who are familiar with chemicals and the techniques to be used in the event of an emergency as well as with the relevant operational response measures. The main priority is to provide relevant information to manage the emergency and to mitigate the consequences of a chemical incident occuring at sea, including information on health and safety (responders, population) and the impact on the environment.

This collection now includes 17 guides and continues to expand. The guides are available in English in PDF format and in French in both PDF and printed format. They are funded by the chemical industry (Arkema [1], Total Petrochemical, Grande Paroisse) and the French Navy.

1. Objectives

Recent incidents involving container ships transporting various chemicals have once again reminded us of the importance of having concise, operational information that can be rapidly consulted in an emergency.

Thus in August 2012, *Cedre* [2] contributed to the assessment of the potential dangers of the cargo of the *MSC Flaminia* (Fig. 1). Some months previously, our experts were focusing on the products transported by the *Rena* (Fig. 2) which grounded in New Zealand in October 2011.

Quintin, K., S. Ravailleau, and F. Cabioch, Cedre Chemical Response Guides, Proceedings of the Thirty-sixth AMOP Technical Seminar on Environmental Contamination and Response, Environment Canada, Ottawa, ON, pp. 381-389, 2013.

Figure 1: *MSC Flaminia*. Source: Smit Salvage

Figure 2: *Rena.* Source: Maritime New Zealand

This need for access to information in an emergency situation is in no way new. Thus, in the early 1990s, *Cedre* published a series of 61 "Mini Response Guides", available in French only, each focusing on a particular chemical. The aim of these documents was to provide the essential information urgently needed in the event of a chemical spill.

In 2004, it was decided to revamp this series to develop a new version of these chemical response guides with more operational content (solubility in seawater, modelling of behaviour at sea…).

The main aim of this collection of guides is to provide readily usable information to deal with a chemical risk. The content must therefore be concise and operational. The reader must be able to rapidly understand how the substance involved will behave if it is spilt in water in order to define the response strategy (Fig. 3).

Figure 3: Decision-making process in case of a spill.
Source: *Cedre*/Transport Canada. Design: Hippocampe.com

These guides are intended primarily for specialists familiar with chemicals and crisis management and who know about the techniques to be used in the event of an emergency in addition to the relevant operational response measures.

This collection of guides focuses on hazardous and noxious substances transported in bulk or packaged.

2. Methods

The process begins with an in-depth critical literature review of documents from recognised sources in the field of chemistry (manufacturer, institutional websites). Data taken from Material Safety Data Sheets and institutional reference websites (Ineris[1], Cefic[2], CHRIS[3], CSST[4], ECHA[5], HSDB[6], ICSC[7], INRS[8], NIOSH[9], CANUTEC[10]…) are compiled and analysed [3, 4, 5, 6, 7].

Experiments are conducted at *Cedre* to obtain specific data on spills into seawater. This involves for instance the study of the substance's solubility in seawater, information which is rarely available in the literature. Experiments geared towards a better understanding of the behaviour of substances spilt at sea are then performed in the Bay of Brest, using 9 m² floating cells (Fig. 4 & 5).

[1] Institut National de l'Environnement Industriel et des RISques
[2] Conseil Européen des Fédérations de l'Industrie Chimique
[3] Chemical Hazards Response Information System
[4] Commission de la Santé et de la Sécurité du Travail
[5] European CHemicals Agency
[6] Hazardous Substances Data Bank
[7] National Institute for Occupational Safety and Health
[8] Institut National de Recherche et de Sécurité pour la prévention des accidents du travail et des maladies professionnelles
[9] National Institute for Occupational Safety and Health
[10] Canadian Transport Emergency Centre

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Figure 4: Field trials in floating cells in the Bay of Brest. Source: ***Cedre***

Figure 5: Spill of methanol dyed with fluorescein. Source: *Cedre*

Research is carried out into past spills in the *Cedre* database, as well as through bibliographical research, enabling feedback to be provided on real incidents involving the substance in question. What was the cause of the spill or threat? What measures were taken in terms of prevention, response and environmental impact?

The guide also presents the results of modelling obtained using behaviour simulation software. To do so, CHEMMAP software from ASA (Fig. 6) is available at *Cedre*. This is a chemical discharge model designed to predict the trajectory, fate, impacts and biological effects of a wide variety of chemical substances. This software is used to model the behaviour of a product over time, as well as its movement in the water and atmosphere relating to incidents in the Channel, the Mediterranean and in rivers and ports. An interface has been developed in order to provide access to numerical data from atmospheric forecasts by Météo France or the US Navy.

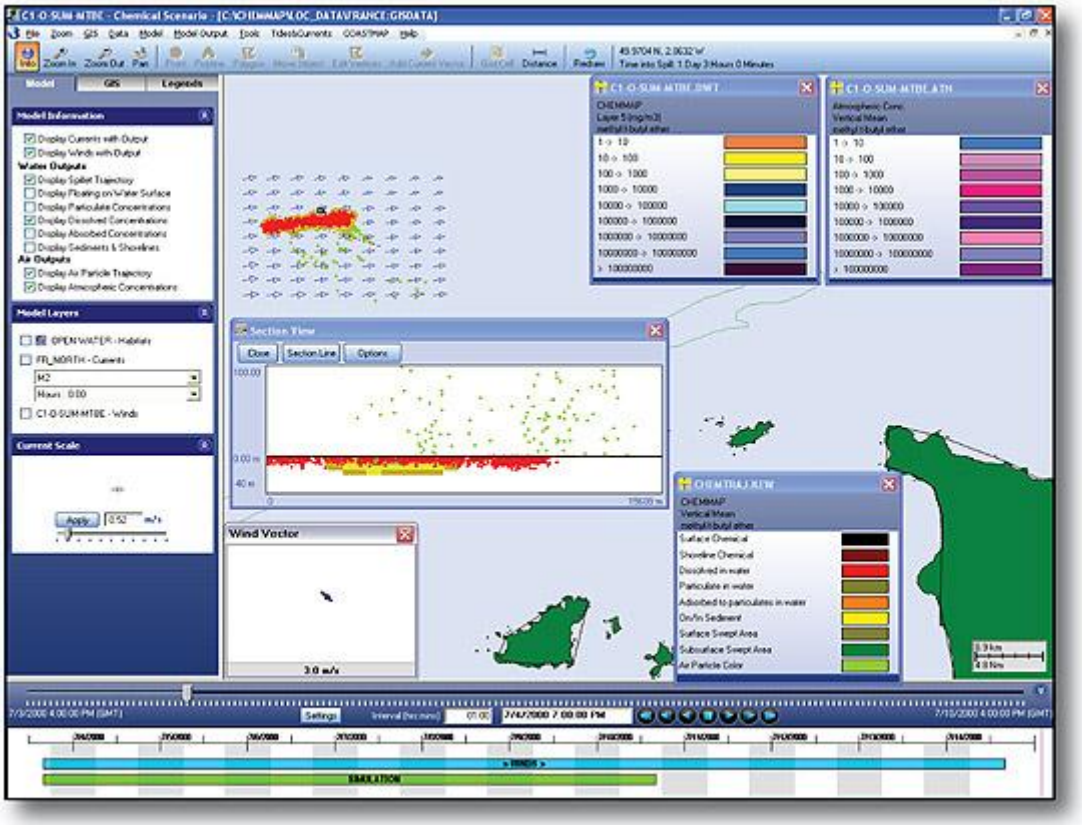

Figure 6: Screenshot of the CHEMMAP software. Source: ASA

3. Results

Since 2004, 17 chemical response guides have been produced: Acrylic acid; Ammonia; Benzene; Chloroform (Fig. 8); 1,2-Dichloroethane; Dimethyl disulphide; Ethyl acrylate; Gasoline; Methanol; Methyl Ethyl Ketone; Methyl Methacrylate; Phosphoric acid; Sodium hydroxide 50% solution; Styrene; Sulphuric acid; Vinyl chloride; Xylenes.

Each guide is divided into 5 sections. The first provides rapid access to the basic initial information. Here we find the substance's definition, its uses, its risks and its behaviour in the environment.

The second section presents physical, chemical, toxicological and ecotoxicological data on the substance. It is supplemented by information on its classification (IMO, SEBC, MARPOL, EU and GESAMP - Fig. 7), transportation (land, inland waters, sea, air), handling and storage.

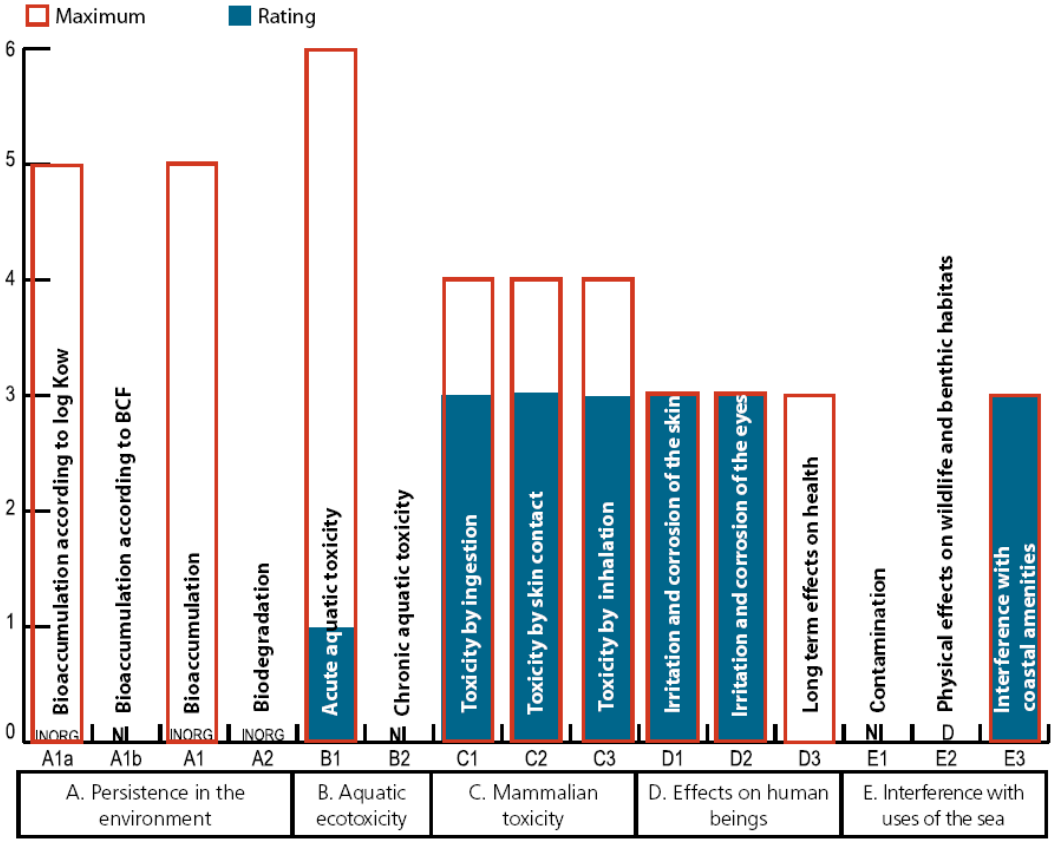

Figure 7: GESAMP classification of Phosphoric acid

The third section gives the results of scenarios from the modelling of a spill of the substance using CHEMMAP software.

Response recommendations, suitable response techniques, choice of PPE, appropriate measurement devices and the most suitable waste treatment options are presented in the fourth chapter.

To complete the guide, a glossary and list of relevant documentary sources are provided to help readers with any further research.

Figure 8: Front cover of the Chloroform Chemical Response Guide

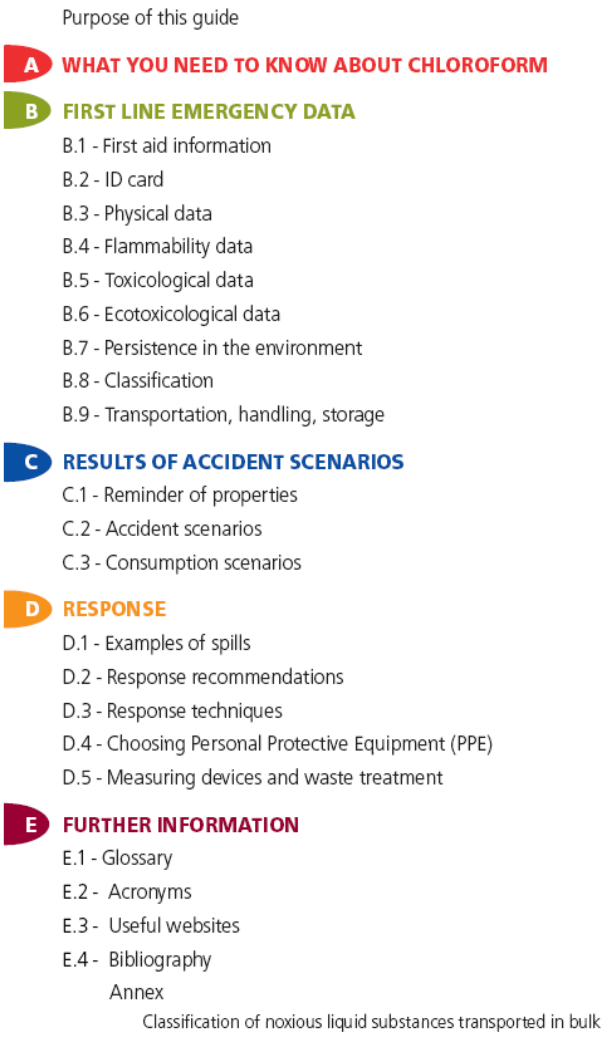

Figure 9: Example of a table of contents - Chloroform

All the guides can be downloaded from www.cedre.fr in PDF format in both French and English. The Internet users are from all around the world. The graph below (Fig. 10) shows the countries which downloaded the most guides between the 1st of January 2013 and the 24th of April 2013.

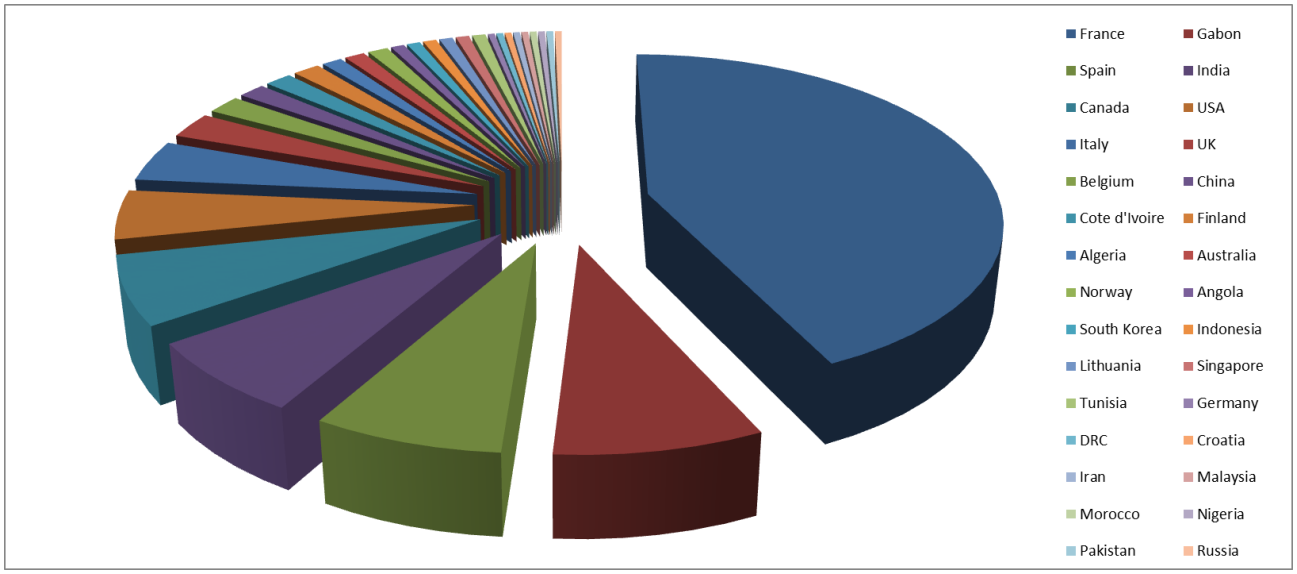

Figure 10: Proportion of guides downloaded by country for the period 1/01/13 – 24/04/13

4. Conclusions

This collection of chemical response guides, revamped in 2004, has found its place in the corpus of operational documentation. The French versions of the guides are available in printed format. PDF files of the guides can also be downloaded from www.cedre.fr in French and English.

Since the creation of this collection, the content has regularly evolved, drawing upon specifically designed experiments as well as the experience acquired by *Cedre* over the past 35 years.

The collection continues to be developed with the support of the French chemical industry. The focus for the coming years will be to revise and update a number of the existing guides using new experimental tools available at *Cedre*. We are also currently exploring the possibility of developing new international partnerships for the addition of new guides to the collection.

5. References

ARKEMA, Retrieved March, 2013 from www.arkema.fr

Cedre (Centre de Documentation, de Recherche et d'Expérimentations sur les pollutions accidentelles des eaux), Retrieved March, 2013 from www.cedre.fr

Centers for Disease Control and Prevention (CDC), *NIOSH Pocket Guide to Chemical Hazards*, Retrieved March, 2013 from www.cdc.gov/niosh/npg/npgsyn-a.html

CSST (Commission de la Santé et de la Sécurité au Travail), Retrieved March, 2013 from www.reptox.csst.qc.ca

ECHA (European CHemicals Agency), Retrieved March, 2013 from www.echa.europa.eu/home_en.asp

INERIS, *Portail Substances Chimiques*, Retrieved March, 2013 from http://www.ineris.fr/substances/fr/

Transport Canada, *Guide des mesures d'urgence*, 2012. Retrieved March, 2013 from www.tc.gc.ca/fra/canutec/guide-menu-227.htm