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The Response of Local Residents to a Chemical Hazard Warning: Prediction of Behavioral Intentions in Greece, France and the Netherlands*

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In this study Greek, French and Dutch residents of a hazardous chemical complex were confronted with a simulated warning scenario for an industrial accident and intended functional and dysfunctional behaviours were measured. Intended functional behaviours were poorly predicted by our model, while dysfunctional behavioral intentions could be predicted rather well. Consequences for hazard communication in the European Community are discussed.

Introduction

In 1982 the Council of European Communities issued the Seveso Directive, concerning the major accident hazards involved in certain industrial activities. The directive states that the public should be adequately informed of the nature and extent of the hazard that exists, the safety measures being taken and correct behaviour in the event of an accident. The Directive is a legal policy guideline (directly addressed to states) for the European Community to effectively inform and prepare the public over a period of time. The underlying assumption of this policy is that active information dissemination will make the public better prepared to cope with

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industrial disasters. However, one of the most critical problems in warning response research is how to communicate effectively with the public in emergency situations. This is demonstrated by Ikeda (1982) who studied the factors which determine human behaviour in the case of a warning for an industrial fire in Ohbu city in Japan. In this study only about 64% of the respondents had received a warning. Eight out of nine residents received warning information that was insufficient to motivate them to evacuate.

Various factors may influence the response to hazard warnings. In recent years, a considerable amount of research has focused on emergency responses to large-scale natural disasters in the form of earthquakes (Mileti et al. 1981; Abe 1978; Mikami and Ikeda 1985, Turner et al. 1979; Turner 1983), fires (Abe and Kazama 1985), hurricanes (Baker 1991; Haas et al. 1976; Hodler 1982), floods (Irish and Falconer 1979) and volcanic eruptions (Greene et al. 1981; Perry 1983). The results of these studies indicate that in natural disaster situations the acute perception of direct threat is an important factor in determining psychological responses and coping behaviour. While the existing literature on the public's behaviour in these circumstances is extensive, research on reactions to industrial accidents is scanty. Sorensen (1991) studied individual variations in warning receipt and evacuation departures in the Nanticoke (Pennsylvania) hazardous material fire. In this study was found that the mode of the first warning and the proximity to the emergency site were significantly related to the time of the warning receipt. A psychological factor as perceived threat was not related to mobilization time.

We adapted a model developed by Perry et al. (1981) regarding the public's reaction to warnings for disasters. Although this model was developed to explain emergency responses specifically to natural hazards, research has shown that a similar model is applicable to the public's behaviour in response to a technological disaster agent (Wiegman et al. 1989; Wiegman et al. 1990). Perry et al. (1981) point out that when a disaster is unexpected and the level of emergency-preparedness is low, most people's immediate reaction to the first warning is disbelief and a continuation of normal routine behaviour. Some people may adapt a more active coping pattern of behaviour in response to the warning message. The most prevalent coping response in this respect is information seeking, in order to confirm the warning message and gathering further information to establish a warning belief. If a warning belief is established, further processes focus on the problem of assessing personal risk. The model distinguishes two processes with respect to the assessment of personal risk: primary and secondary appraisal (see Lazarus 1966). Primary appraisal focuses on the assessment of the threat and secondary appraisal on the perceived individual abilities

to avoid the risks of the situation by engaging in risk-eliminating actions. The secondary appraisal process is particularly relevant when, in the primary appraisal process, the situation has been judged dangerous and threatening. If the situation is perceived as threatening and the individual considers his abilities to be limited for immediate risk-eliminating actions, an emotional response (stress) will be evoked. This response is usually referred to as anxiety or fear. In order to reduce the level of anxiety the individual will undertake various behavioral actions. In this study we differentiate between intentions to functional behaviour and dysfunctional behaviour. As functional behaviour we consider types of behaviour (e.g. extinguishing open fires) which are obviously seen as appropriate in a disastrous situations (see Mikami and Ikeda 1985). Dysfunctional behaviour is all behaviour that might hinder the disaster relief organizations or lead to enhanced personal danger.

Apart from psychological factors, cultural, experiential, spatial, and demographic factors may influence behavioral intentions to adopt measures to mitigate hazard consequences. Some countries (e.g. France or the Netherlands) are in general more industrialized, and have a greater density of hazardous plants, than other countries (for example Greece). This may lead to differences in mass media coverage of technological hazards among member states. It is our impression for example that, compared to France and the Netherlands, the mass media in Greece give less coverage to technological hazards. Some studies strongly support the hypothesis that perceptions of technological hazards are influenced by the mass media. Englander et al. (1986) established that Americans perceived a greater degree of risk than Hungarians and that they were especially concerned about the risks of new, high technology hazards. It was hypothesized that the Hungarians are less concerned about these risks because the media in that country give little coverage to hazards. It appeared that in the United States, newspapers carry some 2-4 times as many articles reporting deaths as did the major Hungarian paper they examined. Wiegman et al. (1989) analyzed in three studies the relation between mass media coverage of technological and environmental hazards and the reactions of readers of daily newspapers in the Netherlands. Readers of the newspaper with the highest hazard coverage, compared to those who read the newspaper with the lowest hazard coverage, had a more negative attitude towards these risks, perceived them as more threatening, showed more feelings of insecurity, were more inclined to seek information and less inclined to avoid the hazards. These differences in hazard perception may also exert an important influence on the public's reactions to emergency warnings in the event of an accident. Unfortunately, very little attention has been paid to

cultural differences with regard to public reactions to warnings about industrial hazards. In a study by Wiegman et al. (1992) was found that in Greece people did not believe a chemical hazard warning by an official source to the same extent as did people in other EC member states like France or the Netherlands. Very likely this difference is to be attributed to a large degree of scepticism among the Greek population towards official warnings.

It is reasonable to assume that regulatory and safety measures are better developed in countries which are densely industrialized with hazardous technologies. Hence in countries in which regulatory and safety measures are less well developed more nuisance will be experienced and more (near) accidents will occur. The level of nuisance and prior accident experience may influence the response to a hazard warning. Research has shown that residents inhabiting areas close to an existing nuclear power plant assess the hazards of this form of energy production as more acceptable than people residing in areas far away from the plant (Maderthaner et al. 1978; Nealey et al. 1983; Chiva 1980; Midden et al. 1983; Ester et al. 1983). Similarly, a study conducted in the Netherlands showed that people residing in the vicinity of a large chemical industrial complex rated the hazards lower than a control group residing at least 15 kilometres away (Wiegman et al. 1991). Compared to the control group, the residents of the industrial area perceived the chemical hazard as being less threatening and more acceptable; they had fewer feelings of insecurity and coped less actively with the risk. Wiegman et al. (1991) argue that these differences cannot be explained by the hypotheses found in the literature (see e.g. Rogers 1984). Furthermore, when the residents of the industrial area were subdivided into four groups depending on the proximity to the plants, it appeared that these groups did not differ in feelings of insecurity and the way of coping with the hazard. Apparently, the residents form a relatively homogeneous group in which the direct experiences of the individuals with the risk object are mutually comparable. It is unclear whether these findings apply to the response in the event of an industrial accident. It can be assumed that residents in the immediate vicinity of a hazardous industrial complex will be more inclined to evacuate the crisis area than people living somewhat further away because they might be the first victims. On the other hand in an earlier study we found that in a chemical hazard warning situation local residents were less inclined to believe the warning message than people living further away, while no differences were found in appraisal of the threat or fear reactions (Wiegman et al. 1992).

Procedure

Subjects

The study was performed simultaneously in Greece, France and the Netherlands. In 1989 face-to-face interviews were held with randomly drawn residents. In Greece, the residents were selected from three cities of Attica: Perama, Aspropyrgos and Drapetsona (n = 148). In Greece the largest concentration of major chemical industries of various types (oil refineries, chemical plants, ammunition industry) is located in these three cities (with about 50,000 inhabitants). In France, the subjects were inhabitants of Le Havre (with about 220,000 inhabitants), a heavily industrialized area with major chemical and petrochemical industries (n = 97). In the Netherlands, the subjects lived in the city of Hengelo (with about 76,000 inhabitants), near a major chemical plant, in which chloride is produced (n = 50).

The Simulated Warning for a Chemical Accident

In the structured face-to-face interview, residents were confronted with a scenario[1] in which the development of a fire in a chemical plant was depicted. First, the early signs of the industrial accident were described.

> It is 6:30 a.m. The sun inches its way across the sky. Most of the city windows are already open, yet the children are still in bed. Your day starts routinely with a cup of coffee and, as you leisurely approach the window, you experience an odour which is different and more noxious than the one you experience daily. Although the sun is shining, the sky appears murky and as you look directly ahead you spot on the horizon over the industrial site a mass of smoke. You wonder what is happening; you open the window and you hear your neighbours conversing from balconies and windows with people gathered in the street, exchanging various interpretations of the phenomenon. The sirens of fire brigade vehicles are suddenly heard at a distance.
>
> A young neighbour volunteers to go to the site from which the smoke is being emitted and bring back reliable news; he mounts his motorcycle and leaves. After half an hour the young neighbour returns with his motorcycle from the industrial site and, as he stops the engine, all the neighbours assemble around him. The young man announces that:

- The guards of the industrial installation prohibited him from approaching the entrance on the east side.
- He saw a number of fire brigade vehicles and an ambulance enter, one by one, the west side of the site.
- He saw that a small fire had erupted in one of the chemical plants.

The second part stated:

A neighbour approaches the crowd gathered around the young man with the motorcycle. He carries a transistor radio tuned to a state station, which broadcasts the 7 o'clock news. The radio announcer, as he reads the news summaries, reports that:

- There has been a small fire in one of the chemical plants in (insert name) and that, although the fire is confined to the plant, a chemical cloud which resulted from the fire is still hanging above the affected site.
- The residents of the area are given the following instructions:
  (1) To remain indoors and to ensure that all windows and doors are tightly closed, blocking all large apertures with a wet cloth.
  (2) To keep all children away from school.
  (3) To stay tuned to the radio.
  (4) Not to leave their homes as this will add to both traffic congestion and pollution.

The announcer further reports that a First Aid Center has been temporarily set up at the City Hall; should physical symptoms become evident, such as:

- Itching of the eyes
- Dizziness
- Nausea
- Difficulty in breathing
- The public should immediately call the number 06-11 for medical treatment.

Questionnaire

After reading the scenario, the residents were asked several questions measuring behavioral intentions subdivided into functional and dysfunc-

tional behaviours. This subdivision is based on the perspective of the disaster relief organisations in which behaviours are classified as functional when they lead to a better personal protection and not hinder disaster relief activities (e.g. Commissie Voramp 1989; Rich and Conn 1991). On the other hand dysfunctional behaviours are those actions which might endanger the individual and/or hinder the relief organisations in their work. From this perspective it is usual to consider closing doors and windows as functional behaviour. Calling the police or other relief organisations to ask for information is commonly seen as dysfunctional because it will eventually obstruct these organisations in performing their duties.

The residents indicated whether, in such a situation, they would turn on the radio, whether they would close all doors and windows and whether they would extinguish all open fires (e.g. the cooker). These reactions we assumed are functional because they lead to better personal protection. Moreover we also questioned whether people were inclined to dysfunctional behaviours; whether they would go out into the street to find out what was going on, whether they would call the police or the fire brigade and whether they would wait no longer but leave immediately. Both functional and dysfunctional behavioral intentions were measured on five-point scales with the extremes "definitely no" and "definitely yes."

A number of psychological factors adapted from the model of Perry et al. (1981) were measured on five-point scales with the extremes "definitely no" and "definitely yes." We assessed *warning belief, primary and secondary appraisal* and *emotional response*. Warning belief was measured with 3 questions. The residents indicated their degree of belief in the information broadcast by the radio, the amount of importance that should be attached to such a message, and how important the instructions given in such a message would be. These three items formed a reliable scale (Cronbach's $\alpha = .84$). Primary appraisal was measured with 3 questions. The residents indicated whether, if such a situation happened in their neighbourhood, they would be in danger, whether they or their family would be threatened by this situation and whether something serious was happening in such a situation. These three items formed a reliable scale ($\alpha = .86$). Secondary appraisal was measured with 4 questions. The residents indicated whether, in such a situation, the authorities would be able to evacuate them quickly enough, whether they would be able to get themselves to safety in time, whether the safety instructions given would be sufficient to prevent the danger and whether they could prevent the danger in such a situation by taking measures. These four items formed a sufficiently reliable scale ($\alpha = .65$). Emotional response was measured with 4 questions. The residents indicated

whether they would feel tense, nervous, afraid or anxious. These four items formed a very reliable scale ($\alpha = .90$).

At the end of the interview the residents indicated on five-point scales with the extremes "definitely not" and "definitely yes" the degree of *nuisance* they experienced as caused by the industrial complexes in their neighbourhood, such as stench, noise, dust, water pollution or air pollution, and whether they had *prior accident experience* with fires, explosions or the release of a toxic cloud by the industrial complexes. Furthermore, demographic variables such as *age*, *sex* and *level of education* were assessed. The *proximity* to the chemical plant was assessed by the interviewer in hectometres.

Results

Sample Characteristics

The residents from the different countries were comparable with regard to age ($\chi^2 = 7.78$, d.f. = 4, $p = .10$) and with regard to gender ($\chi^2 = 1.54$, d.f. = 2, $p = .45$). About 46% of the residents were male. About 29% were younger than 30 years, 51% were between 31 and 50 years, and about 20% were older than 50 years. There was a difference between the groups from the three countries with regard to educational level ($\chi^2 = 47.47$, d.f. = 4, $p < .000$), i.e. in general the subjects in France had a higher educational level than the subjects in the Netherlands, who in turn were better educated than the Greek subjects. In general, 47% of the subjects had a low educational level, 25% had a medium educational level and about 28% had a high educational level.

It was also found that the subjects from Greece had more experience with accidents ($\bar{X} = 3.3$) than the subjects from France ($\bar{X} = 2.5$) and the Netherlands ($\bar{X} = 2.5$) ($F_{2,279} = 36.50$, $p < .001$). The degree of nuisance experienced by the subjects differed from country to country ($F_{2,277} = 69.52$, $p < .001$), with the Greeks experiencing a higher degree of nuisance ($\bar{X} = 3.7$) than the subjects from France ($\bar{X} = 3.3$) and the Netherlands ($\bar{X} = 2.4$)[2].

The Prediction of Behavioral Intentions

The behavioral intentions were predicted in multiple regression models with country, psychological factors, experiential factors, proximity and demographic factors used as predictors. In Table 1 (left panel) the results for the separate functional behaviours are presented.

Table 1. Multiple Regression Analysis with Intentions for Functional or Dysfunctional Behaviours as Dependent Variables and Nationality and Psychological, Experiential and Demographic Variables as Predictors

	Intentions to Functional Behaviours			Intentions to Dysfunctional Behaviours		
	Radio	Close doors	Fires	Go into street	Call police	Leave immed.
Country	ns	ns	ns	-.17*	ns	-.40***
Warning belief	.21**	.24***	ns	-.28***	.35***	ns
Primary appraisal	ns	ns	ns	-.13*	ns	.15*
Secondary appraisal	ns	ns	ns	ns	ns	ns
Emotional response	ns	ns	ns	.14*	ns	ns
Nuisance	-.20**	-.17*	ns	.18**	ns	ns
Experience	ns	ns	.27***	.12*	ns	.27***
Proximity	ns	ns	ns	ns	ns	.23**
Gender	ns	ns	ns	ns	-.12*	-.15*
Age	ns	ns	ns	ns	ns	ns
Education	ns	ns	ns	-.17**	ns	ns
Multiple R	.34	.34	.35	.66	.46	.54
R^2	.12	.12	.12	.43	.21	.29
$F_{13,252}$	2.68**	2.61**	2.62**	14.73***	5.29***	8.10***

* $p < .05$; ** $p < .01$; *** $p < .001$

From Table 1 can be concluded that functional behavioral intentions are poorly predicted with the predictors used. For all intentions the multiple R is about .34. Further analysis revealed that this poor prediction may be due to a ceiling effect, because most respondents indicated that they would perform the functional behaviours ("turn on the radio," $\overline{X} = 4.6$, $sd = 0.7$; "close all doors and windows," $\overline{X} = 4.5$, $sd = 0.8$; "extinguish open fires," $\overline{X} = 4.2$, $sd = 1.0$), so there is little variance left in the variables to be

predicted. Warning belief is a significant predictor of the intention to turn on the radio and to close all doors and windows. Residents who expressed low belief in the warning were less inclined to turn on the radio ($F_{1,289}$ = 11.4, $p < .01$) and close the doors ($F_{1,289} = 26.0$, $p < .001$) than residents who expressed high belief in the warning.[3] Residents who had experienced a low level of nuisance in the past were more inclined to turn on the radio ($F_{1,282} = 9.8$, $p < .01$) and close the doors ($F_{1,282} = 5.2$, $p < .05$) than residents who had experienced a high level of nuisance in the past. Residents with a high level of prior accident experience were more inclined to extinguish open fires ($F_{1,284} = 18.0$, $p < .001$) than residents with a low level of prior accident experience. Country, primary and secondary appraisal, emotional response, proximity and the demographic variables sex, age and educational level were not relevant in the prediction of the functional behaviours.

In Table 1 (right panel) the results for the separate dysfunctional behaviours are presented. The dysfunctional behavioral intentions were fairly well predicted. For these intentions the multiple R varies from .46 to .66. The factor of country played a significant role with the intention to go into the street to ask what has happened and the intention to leave immediately. In general, the Greek and Dutch residents were more inclined to go into the street ($F_{2,289} = 171.8$, $p < .001$) and to leave immediately than the French residents ($F_{2,289} = 18.4$, $p < .001$). Warning belief had a negative influence on the intention to go into the street and a positive influence on the intention to call the police or the fire brigade. Residents who expressed high belief in the warning were less inclined to go into the street ($F_{1,289}$ = 77.8, $p < .001$) and more inclined to call the police ($F_{1,289} = 52.6$, $p < .001$) than residents who expressed low belief in the warning.

Primary appraisal had a negative influence on the intention to go into the street and a positive influence on the intention to leave immediately. Residents with a high level of primary appraisal who assessed the situation as threatening were less inclined to go into the street ($F_{1,289} = 14.0$, $p < .001$) than residents with a low level of primary appraisal. Degree of nuisance and prior accident experience had a positive influence on the intention to go into the street and the intention to leave immediately. Residents who had experienced a low level of nuisance in the past were less inclined to go into the street ($F_{1,282} = 24.5$, $p < .001$) than residents who had experienced a high level of nuisance in the past. Residents with a high level of prior accident experience were more inclined to go into the street ($F_{1,284} = 22.4$, $p < .001$) and were also more inclined to leave immediately ($F_{1,284} = 21.5$, $p < .001$) than residents with a low level of prior accident experience. Distance from the chemical complex had a positive influence on the intention to leave immediately. Residents living within 1500 meters from the chemical com-

plex were less inclined to leave immediately than residents living between 1500 and 3000 meters from the complex ($F_{1,290} = 5.7$, $p < .05$. Females were less inclined to leave immediately than males ($F_{1,289} = 4.3$, $p < .05$). Residents with a higher level of education were less inclined to go into the street than residents with lower or intermediate levels of education ($F_{1,282} = 21.0$, $p < .001$).

Table 2 presents the results of hierarchical multiple regression analysis for each country separately. In Table 2 multiple correlations (R) are presented for a model based on the psychological variables (warning belief, primary and secondary appraisal and emotional response), for a model in which the behavioral intentions are predicted by the psychological variables and experiential variables (nuisance, experience, distance), and finally for a model in which also demographic variables are used as predictors.

Table 2. Multiple Correlations (R) for each Country Separately, Hierarchically Testing Three Theoretical Models* in Predicting Functional and Disfunctional Behavioural Intentions as Response to a Chemical Hazard Warning

		Intentions to Functional Behaviours			Intentions to Dysfunctional Behaviours		
		Radio	Close doors	Fires	Go into street	Call police	Leave immed.
Netherlands	Block 1	.22	.37	.28	.26	.41	.31
	Δ 1 + 2	.13	.16	.06	.09	.02	.18
	Δ 1 + 2, 3	.16	.23	.20	.20	.16	.19
Greece	Block 1	.25	.26	.16	.27	.44	.36
	Δ 1 + 2	.06	.06	.22	.02	.01	.19
	Δ 1 + 2, 3	.11	.09	.23	.13	.10	.22
France	Block 1	.26	.52	.24	.35	.27	.32
	Δ 1 + 2	.05	.01	.01	.03	.01	.04
	Δ 1 + 2, 3	.07	.03	.09	.12	.13	.17

* Block 1: Warning belief, primary and secondary appraisal, emotional response.
Block 2: Nuisance, experience, distance.
Block 3: Demographic variables.

In Table 2 we can see that for each country the average multiple correlations between the psychological variables and the behavioral intentions are about the same in all countries and lie between .30 and .32. In the Netherlands and Greece the additional multiple correlation of the experiential variables is about .11, while in France this is about .02. The additional multiple correlation between demographic variables and behavioral intentions is .10 in France, .14 in Greece and .19 in the Netherlands. Our conclusion is that the theoretical model we used leads to comparable results in the three countries.

Discussion

We studied functional and dysfunctional behavioral intentions after a warning for a simulated chemical accident in Greece, France and the Netherlands. Generally speaking, the intended dysfunctional behaviours are rather well, while the intended functional behaviours are poorly predicted. The factor of country was rather important in the prediction of the intentions for dysfunctional behaviours, but not for functional behaviours. With regard to dysfunctional behaviours, we established that in general the Greek and Dutch subjects were more inclined to go into the street and to leave immediately than the French subjects. The differences between the countries cannot be explained by differences in educational level, prior accident experience and degree of nuisance encountered. It is plausible that differences in habits, patterns of reactions and physical resources influence the primary reactions to an acute emergency situation in these countries. The differences between the countries may also be explained by a different government policy in educating subjects living in the neighbourhood of a hazardous industry. Another possible explanation is that the mass media are responsible for these differences. In a preliminary analysis of mass media coverage we established that especially in Greece the mass media give a lower coverage of technological hazards. On the basis of the study of Wiegman et al. (1989), in which was found that coverage of technological hazards in the mass media negatively increases cognitive and affective reactions towards these hazards; it ought to have been possible to assume that in the event of an accident the Greek subjects would show fewer emotional feelings and less dysfunctional behaviour than the subjects from France or the Netherlands. However, just the contrary was found. The Greek—and also the Dutch—subjects displayed more dysfunctional behaviour than the subjects from France. So these results are not in line with the mass media effect hypothesis and hence it is not plausible to attribute our results to mass media effects. It is more plausible that differences in habits,

patterns of reactions and physical resources, etc. influence the primary reactions to an acute emergency situation. The differences between the countries can also be explained by a different government policy in educating subjects living in the neighbourhood of a hazardous industry.

Warning belief was important to predict the intentions for both functional and dysfunctional behaviour. The results of our study are consistent with Perry et al. (1981) who stated that warning belief is an important factor in the emergency warning process. Without the development of a belief in the warning, emergency communication will not be effective. Increasing the credibility of emergency warnings is of vital importance. This can be achieved by increasing the credibility of the organisations involved in public warning systems and by public education on possible emergency situations. Primary appraisal and emotional response are only significant predictors for some intentions to dysfunctional behaviour. The more people feel threatened by the accident or feel afraid, the more they are inclined to leave immediately. It should be noted that the factor secondary appraisal was not at all important with respect to the prediction of the two types of behavioral intentions, although in the scenario a number of measures were depicted, with which the public could relieve the emergency situation. This is not consistent with theoretical notions (e.g. Lazarus 1966), which state that feeling oneself more able to prevent the danger by taking measures is an important predictor of behaviour in emergency situations. However, in our study a ceiling effect may have caused these results, so we would like to recommend further research on the influence of secondary appraisal on the effectiveness of technological hazard warnings in the three countries.

We assumed that the level of nuisance and prior accident experience may influence the response to a hazard warning. With regard to nuisance we found that residents who had experienced a higher degree of nuisance were less inclined to perform functional behaviour. On the other hand they were more inclined to dysfunctional behaviour. This leads to the conclusion that the degree of nuisance encountered inhibits the intentions to functional behaviour, probably because a high degree of nuisance makes residents less sensitive to the irregularities in the normal functioning of the chemical plant.

Prior accident experience is not related to the adoption of the recommended functional behaviours (turn on the radio or close the doors and windows) but is positively related to some dysfunctional behaviours. This can be explained by assuming that people who have prior accident experiences are convinced that the dysfunctional behaviours are appropriate in these acute emergency situations. Nuisance and prior accident experience also differed between the countries. Our impression is that these results can

be explained by differences in strictness of regulations between these countries. This applies to governmental rules and restrictions regarding the establishment of chemical installations and the maintenance of production processes. Residents in Greece, for example, in general live much closer to hazardous chemical plants than in the Netherlands. Proximity to the hazardous plant was not of importance in predicting functional behaviour but had a major impact on the tendency to leave immediately. The perception of the hazard of residents who lived in the immediate surroundings of an industrial complex was also studies by Wiegman et al. (1990). In this study it was found that residents who lived very close to the plant did not perceive the hazards different than residents living somewhat further away. The present study shows that proximity also has no effect on the intentions to functional behaviour in response to a chemical hazard warning. Prior accident experience and the degree of nuisance the population encountered with regard to the industrial activities must be taken into consideration in the design of local emergency warning systems.

Our general conclusion relating to policy in warning for chemical hazards is as follows. For the fulfillment of the Seveso Directive a general publicity strategy within the European Community with uniform behaviour instructions is not quite sufficient. In order to communicate effectively with the public under emergency circumstances the local situation must be taken into account. We established that the nationality of the residents predicted the reactions to our simulated warning scenario with regard to dysfunctional reactions, while for the functional reactions the nationality of the residents was not a significant predictor. This result indicates that a simple and uniform set of behaviour instructions, according to guidelines of the EC, could be equally effective adopted in the various countries to prompt people living in the neighbourhood of hazardous industries to adopt functional behaviour. With regard to dysfunctional behaviours a more differentiated approach seems appropriate, since in the more southern countries people are more inclined to some dysfunctional behaviours.

Notes

1. The scenario was adapted from the scenario used by Komilis in a pilot study (Komilis 1988).

2. With respect to degree of nuisance and prior accident experience the subjects were compared with control groups, consisting of people who lived at least 10 kilometres from the chemical plants. The Greek control group lived in Pireas (n = 50), the French control group came from Caen (N = 81) and the Dutch control group came from the city of Enschede (N = 50). In

all countries we found that the subjects had more experience with accidents in the industrial installation such as fires, explosions and releases of toxic clouds and experienced a higher degree of nuisance as caused by stench, noise and dust from the industrial installations than the control group. The conclusion is that the encountered degree of nuisance and prior accident experience were assessed adequately.

3. In these additional analyses the median was computed for the variables warning belief, primary and secondary appraisal, emotional response, degree of nuisance, prior accident experience and living distance. On the basis of the median, the subjects were divided into two groups with a high or low warning belief, high or low primary appraisal, high or low secondary appraisal, high or low emotional response, high or low degree of nuisance, many or few prior accident experiences and living within 1500 meters or further than 1500 meters away from the complex.

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