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ABSTRACT

The issue of accidental environmental contamination of homes and businesses has been of increasing concern. Actual costs to state and federal governments for relocation of persons and restoration of habitats have run into the tens of millions of dollars. In addition to these real costs, there have been more illusive costs to public health. These costs are found both in increased levels of negative physiological and psychological effects. The two sources thus far identified as causes of these effects are toxic agents and stress. Since, up to this point, research has focused upon toxic agents, this paper addresses issues related to the effects of stress. Adult residents (N=396) living adjacent to the only Class I sanitary landfill in southern California participated in a survey which asked for demographic information (including educational levels), health-related information (such as frequency of colds and sleep problems), and questions about stress-related issues (demoralization, current upset, perceived threat to physical health, attitude toward quality of life, and trust in authorities). Although significant correlations were noted (such as between educational level and demoralization), overall results suggest that while a toxic waste receiving landfill generates some degree of stress, it is insufficient to produce recognizable levels of behavioral effects. (JN)

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STRESS EFFECTS RELATED TO TOXIC WASTE

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A Paper Presented at the Convention of the Western Psychological Association, 1985

The issue of accidental environmental contamination of homes and businesses has been of increasing concern in the past few years. Millions of Americans now recognize the names "Love Canal" and "Three Mile Island", and associate those names with environmental catastrophe. More recently, Times Beach, Missouri, "dioxin", "superfund", and "toxic wastes" have been added to the list of concerns. The actual costs to state and federal governments for relocation of persons and restoration of habitats have run into the tens of millions of dollars. Billions of dollars have been allocated to a "Superfund" for the cleanup of toxic sites which threaten additional thousands of Americans. In addition to these real costs has been the more illusive costs to public health. These costs are found both in increased levels of negative physiological effects and higher levels of negative psychological effects (Dzegede, Pike, & Hackworth, 1981; Gortmaker, Eckenrode, & Gore, 1982). The two sources thus far identified as causes of these effects are toxic agents and stress. Up to this point, the research has focused upon toxic agents, with little information being reported on the effects of stress.

Erikson (1979) found that a disaster leaves in its wake serious psychological effects- termed the "disaster syndrome". Another study (Shippee, Burroughs, & Wakefield, 1980) determined that the mere perception of hazard left effects nearly as powerful and negative as those of experiencing a disaster. These findings were replicated by Hansson, Noulles, and Bellovich (1982). McGlen, Milbrath, and Yoshii (1979) have also stated the importance of psychological effects, and noted in their cross cultural study that where people saw the system as the cause, they looked to the system for the cure. Governments, local, state, and national, have been seen as responsible for alleviating whatever negative conditions are created by environmental mishaps. This responsibility has been acknowledged in the area of the real costs cited above. However, there is at present too little information on psychological and physiological costs to enable governments to determine what allocation of resources (if any) would be appropriate to mitigate the negative effects of toxic waste facilities.

The most thoroughly studied environmental catastrophe has been the nuclear accident at Three Mile Island nuclear plant in Pennsylvania. Bromet, Schulberg, and Dunn (1982) found increased levels of distress as well as increases in physiological disturbances among those of the population living near (within five miles) the power plant. Davidson, Baum, and Collins (1982) and Fleming, Baum, Gisriel, and Gatchel (1982) rsported increased levels of symptoms remained among subjects with low perceived control and low support one and one-half years following the accident. Even more extensive

was the Staff report of the President's Commission on the Accident at Three Mile Island (Dohrenwend, Dohrenwend, Fabrikat, Karl, & Warheit, 1979). About ten percent of the sample studied reported severe demoralization attributable to the accident. The overall level of demoralization did decline in the ensuing months, but remained higher than that of a control sample. Also expressed was a very strong level of distrust of authorities, again declining somewhat in the months following. Finally, women, particulary mothers of preschool children, were found to be more affected in all areas. This finding was confirmed by Shippee et al. (1980) and Dzegede et al. (1981).

In addition to these dramatic incidents, there are more numerous accidents and errors which have not received as extensive a media coverage. There were hundreds of documented cases of environmental damage as long ago as 1980 (Wilkes, Keifer, & Levine, 1980). In a 1980 report, the Oil and Special Materials Control Division of the EPA listed 168 contaminations of water supplies, 74 instances of polluted habitats, 43 soil contaminations, and 27 incidents of damage to human health. Even less publicized are potential and perceived environmental threats. Some of these are beginning to be reported, such as the problems of closed toxic waste facilities (Jones, 1983). Baum, Singer, and Baum (1981) noted increased levels of stress caused by perceived environmental threats. They found that the "ability to avoid the threat" and "viewing the issue in terms of a challenge rather than a threat" were important factors in reducing the levels of stress. Shippee et al. reported that visual clues and territoriality were also important factors in the levels of effects reported.

Many questions remain as to the nature and strength of the psychological effects of perceived environmental threats and the accompanying physical symptoms. Are the effects for long-term perceived threats as great as those for actual catastrophic events? Are the effects of demoralization and quality of life similar to those of actual events? Do perceived threats result in significantly increased levels of physical symptoms? Are women in general, and mothers of preschool children in particular, more effected by perceived threat (as they have been found to be by actual events)? This study seeks to provide information about these fundamental questions.

In addition, there are a series of questions regarding the mitigation of the presumed effects. If these effects exist, are they lessened by distance from the potential threat, impl/ing that toxic waste receiving facilities should be located outside of urban areas? Are they lessened when fewer visual stimuli pertaining to the threat are present, so that landfills could operate in urban areas if they are little seen and if trucks used back roads? Are they lessened by increased openness and informativeness of officials, so that more knowledge would result in less stress? By addressing these questions, this study also seeks to provide information which could guide officials in the reduction of stress effects from both existing and planned toxic waste facilities through improvements in location and provision of health services. An added benefit would be information which could apply to other facilities seen as environmental threats.

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Local Significance of The Research

The specific impetus to this project was exposure to local reports concerning the only Class I sanitary landfill in Southern California. As a Class I landfill, the Ben K. Kazarian Sanitary Landfill (known as BKK) is uniquely qualified to accept toxic wastes. Within the last five years, homes have been built within one thousand feet of the boundaries of the landfill. Beginning in 1980, increasing concern has been expressed by those living close to the landfill.

The city government determined that the state agencies had jurisdiction, and requested that those agencies verify that BKK was not a health hazard. The City Council is still seeking answers to the questions it posed two and one-half years before. It has recently filed a lawsuit to obtain those answers. Several minor spills of toxic materials from incoming trucks have occured. And while no lethal levels of toxicity have been found and there seem to be no susceptible groundwater sources, trucks are continually found to be unsafe and emmissions exceeding state regulation by as much as 500% have been reported (Smithberg, 1983).

The summer before data gathering began, nineteen families were evacuated from their homes on a street adjacent to the landfill. This evacuation was due to methane gas, part of normal operations and NOT due to toxic wastes. The resulting publicity helped pressure the landfill to voluntarily cease accepting toxic wastes about two weeks before the study began. However, some residents are still concerned about the toxic wastes which had been delivered over the previous ten years and which still remain.

Methodology

Sample

The sample for this study consisted of 396 adult residents of the area surrounding the landfill. Phone lists were obtained from the General Telephone Company. Lists of random numbers generated calling lists stratified by distance from the landfill. Three hundred and fifty persons were surveyed in this manner, roughly one-third located within one and one-half miles of the boundaries of the landfill, one-third located between one and a half and five miles from the landfill, and one-third living five to ten miles from the site. In addition, oversampling of mothers of preschool children was desired. This was accomplished by visiting parent-child classes in the area and requesting signups. These persons were then telephone surveyed to maintain similar methodolgy. Only English speaking residents were surveyed. Characteristics of the sample are displayed in Table 1.

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TABLE 1

DEMOGRAPHIC CHARACTERISTICS

Area		Sex		Age	
0 to 1.5 miles	125	female w/child	71	under 30	136
1.5 to 5 miles	126	male w/child	36	30-39	117
5 to 10 miles	145	female w/o child	137	40-49	48
		male w/o child	147	50-59	48
				60 and up	47

Residence		Education	
0 to 3 years	111	high school	120
3 to 5 years	64	some college	147
5 to 9 years	75	B.A. degree	83
10 or more	145	grad. work	45

The sample was fairly equally divided among areas, with somewhat more in the outermost area. The additional sampling of mothers of preschool children resulted in achieving about 24 cases in each area. As the table indicates, most of the sample was young. however all ages were sufficiently represented. Both education levels and years of residence were broadly distributed. About 40% of the sample were professional persons, 16% were housewives and annther 15% were retired.

The Instrument

The survey used was adapted from two other surveys previously utilized by researchers studying stress related issues. Bromet et al. (1982) and Fleming et al. (1982) utliized portions of the Hopkins Life Checklist (the SCL- 90 symptomology scale). Questions from the somatization and anger-hostility subscales were used. In addition, several questions were asked regarding frequency of colds, eating problems, sleep problems, number of doctor visits and number of lost workdays.

The survey utilized by Dohrenwend et al. (1979) for the President's Commission on the Accident at Three Mile Island (found in Appendix A of the Staff Report on Psychological Effects), Bromet et al. (1982) and Fleming et al. (1982) was modified to pertain to the issue of toxic waste landfills. This produced the following scales:

A) Demoralization- thirteen items of the twenty-six item scale were used. This overlapped completely with the questions from the anxiety scale of the SCL-90;

B) Rating of Current Upset- a single item scale, this scale was related to the upset reported on three other life events from a standardized Life Event Scale (designed by Thomas Holmes, University of Washington School of Medicine);

C) Perceived Threat to Physical Health- a four item scale;

D) Attitude toward Quality of Life- three items;

E) Trust in Authorities- four items.

It should be noted that no mention of the landfill was made until Scale B (Current Upset) was reached. Therefore, it was expected that

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answers to behavioral effects and demoralization questions were not affected by attitudes towards the landfill operations.

Another series of questions were asked to ascertain the frequency of visual stimuli regarding the landfill and toxic waste (e.g., How often do you pass by the landfill? Have you seen truck inspections occuring near the landfill? Have you ever been in the landfill?). Finally, respondents were asked if they had any further comments.

Combining these surveys resulted in a seventy item instrument which permitted comparisons between the levels of the above factors existent in subgroups of a population exposed to a potential environmental threat to determine the effects of distance, parental status, sex, and visual exposure. In addition, comparisons can be made to the levels of these factors present in a population exposed not only to an ongoing threat but also having recently been affected by an actual catastrophe (the accident at Three Mile Island). The use of this survey will also begin a standardization process in the study of the psychological and behavioral effects of environmental hazards.

Completion of the surveys averaged about thirteen minutes. Most subjects were contacted over a five week period around the first part of the year.

Results

Totals were computed for five different dependant variables: bodily effects, anger-hostility, demoralization, total effects and perception of physical threat. Table 2 reports the frequencies of various levels of these variables.

TABLE 2

Frequencies of Effects

Level	Body	Anger	Demoral.	Total effects	Threat
very low	56%	68%	17%	15%	26%
low	30%	18%	36%	25%	12%
moderate	9%	10%	25%	25%	7%
high	5%	4%	13%	20%	12%
very high	x	x	6%	10%	4%
incomplete	x	x	3%	4%	39%

The scale for Bodily Effects had almost everyone in a low or very low level. Very few persons reported being bothered by more than three symptoms with any frequency. Likewise, few reported much trouble with Anger or Hostility. The scale of demoralization was much more evenly distributed and, when doctor visits and missed workdays was added, the final distribution of Total Effects was also dispersed with slightly more persons in the lower ranges than in the higher. The distribution of the Threat scale was also spread across all categories, although there were a large number of cases which had incomplete data. Among the completed cases, the very low level predominated.

Oneway analyses were then performed on each of four dependant variables (a separate analysis of Anger was omitted). Six

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independant variables were utilized: distance from the landfill (the three areas were described above), sex (four groupings: female with child under five, male with child, other female, other male), age (in five year age categories between 25 and 60), education, whether a homeowner or renter, and length of residence. In addition, a correlation was determined between the four dependant variables and the variable Stimuli (a combination of six questions regarding frequency of exposure to visual and olfactory stimuli). The results of these tests are displayed in Table 3.

TABLE 3

Significance of Effects

Variable	Bodily Effects	Demoral-ization	Total Effects	Perceived Threat
(F statistic)				
DISTANCE	1.3668	0.3279	0.1939	37.3412***
SEX	3.8419**,	0.6755	4.8096**	4.5791**
AGE	1.1555	6.6694***	3.0879**	5.9639***
EDUCATION	1.8350	4.3407***	3.3678**	0.8610
OWNER/RENTER	4.3884*	27.1458***	16.2197***	0.9507
LNGTH-RESIDE	0.9452	0.7409	0.1065	1.7275
(Pearson's r)				
STIMULI	-.014	-.081	-.060	-.339***

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

There were significant effects found for Bodily Effects only among the four sex groupings (p<.01) and between owners and renters (p<.05). Demoralization was highly significant between levels of age, education, and ownership (all p<.001). Total effects were significant (p<.01) among sexes, ages and education levels, and highly significant (p<.001) between owners and renters. Threat was highly significant by area, age and stimuli and was significant for sex.

Further analysis of the means of the variables with significant relationships with Total Effects and Perceived Threat revealed that females with preschool children had the highest level of effects (37.2), but that males without children were the most different (and lowest- 27.8). For age, the youngest group reported a higher level of effects (41.7) than the other groups (25.5 to 32.5). This was also true for the least educated group (46.4) relative to the other groups (basically decreasing with increasing education from 36.2 to 28.1). Finally, renters reported quite a few more symptoms (39.2) than homeowners (30.2).

The means for Perceived Threat revealed that those in the closest area felt much more threatened (13.22) than those in the other areas (10.45 and 10.25). For the sexual groupings, males with children under 5 felt most threatened (12.58) followed by females

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with children <5 (12.10), females without children <5 (11.36) and males without children <5 (10.62). There was less of a pattern among the age groupings, but older persons (50 and above) felt least threatened (mean about 10.1) while those under 35 felt most threatened (mean about 12.2). For stimuli the negative correlation indicated that increased perceived threat was moderately correlated with increased frequency of visual and olfactory stimuli.

Discussion

The overall conclusion derived from the above results is that while a toxic waste receiving landfill generates some degree of stress within a population surrounding it, this stress is insufficient to produce recognizable levels of behavioral effects. Higher levels of stress, as characterized by feeling threatened, were found in all three of the anticipated variables. Those living closest to the facility and those presented with more reminders of the facility felt significantly more threatened than the rest of the population. Those more susceptible to stress (mothers of young children) also felt most threatened, although it would be more accurate to say that males without young children felt significantly less threatened.

These feelings of threat did not carry over into stress effects, neither cognitive nor somatic. Neither Area nor Stimuli demonstrated significant differences for Bodily Effects, Demoralization, or Total Effects. Only in sexual groupings did effects appear, and then only for Bodily Effects and Total Effects. In addition, the difference was mostly that males without young children had lower effects, rather than the expected difference that females with young children would show much higher effects. Of course, there is nothing to link these gender differences to the toxic waste facility.

This population gave evidence that it was more stressful to be a young, little-educated renter with small children. Living in proximity to a toxic waste receiving landfill added little to these other factors in producing stress effects.

The data did indicate that living in proximity to this facility was capable of producing significant perceived effects (found thus far for Perceived Threat). Further analysis of the data will included perceptions of Degree of Upset, changes in Quality of Life, and Trustworthiness of Authorities. Both the continued presence of persons at City Council meetings and the comments appended to our survey indicate that some people feel strongly effected by the landfill. While these feelings do not appear to carry over to stress-related physical effects, they are sufficient to warrant continued investigation.

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