

GLOUCESTERSHIRE HEALTH AUTHORITY

Health Impact on the Local Community following the Chemical Incident at Cleansing Services Group (CSG), Sandhurst

Key Findings

- This survey offers evidence that the physical and/or psychological health of a significant number of Sandhurst residents who replied to a questionnaire were affected following the fire at CSG.
- Some people experienced symptoms which persisted beyond the study period and it is planned that these will be followed up by a further survey.
- This report provides quantified information on the size of the incident's effect on health. It will be distributed to the local communities, health care professionals and organisations involved in emergency planning in the county.

Incident Summary

A fire began at the CSG chemical waste transfer site and treatment facility at 02.00 on Monday 30th October 2000. Over 100 tonnes of mixed chemicals were ignited. A plume of smoke from the fire was observed to be driven by the high south westerly winds in a predominantly north easterly direction over the village of Sandhurst. Subsequently this was supported by plume modelling evidence from the Meteorological Office. Some local residents were evacuated but allowed to return to their properties in the evening when the fire had been controlled. The clean-up operation that followed was complicated by further leaks of chemicals and major flooding of the site and surrounding area from the River Severn. Fourteen households were evacuated again on Sunday 5th November because the 'Emergency Services' were concerned that in the event of a further fire access to the site might have proved impossible due to the extensive flooding.

A major operation to detect environmental pollution from the fire and subsequent flooding of domestic properties was undertaken. Samples were taken of floodwater, air and soil. Blood and urine samples were taken from some members of the occupational groups involved in the incident. None of the results suggest that chemical contamination has extended beyond the site and an adjacent area which was subject to firewater run off. Local residents began to experience symptoms within the first 24 hours of the incident.

Questionnaire Design

The survey was designed as a descriptive health surveillance study to provide information about individuals who may have been exposed to the smoke from the fire on 30th October 2000. The study population of Sandhurst residents (believed to have been maximally exposed to the plume) was compared with two other groups: Maisemore (similar proximity to the site but not in the path of the plume during the fire) and Ashleworth (3 miles to the north, not in the path of the plume but still in the area affected by flooding). The study areas were defined by post-codes for an approximation of each village boundary using mapping software and information from Tewkesbury Borough Council and local knowledge. A small number of households south of Sandhurst village were included in the Sandhurst group.

The objectives of the questionnaire were:

- to assess the impact of the chemical fire on local health and to distinguish this from the health impact of the floods.
- to obtain descriptive baseline information on the levels of ill health in the community just prior to the incident and in the week following.
- to provide results which will inform the public, health professionals, the media and Public Health policy.

The questionnaire was not designed to address local concerns about the long term health impact of living near to this facility.

Questionnaires were sent to the organisations attending the incident and subsequent clean-up operation for distribution to staff.

A number of questionnaires were sent to other local residents who called an advertised freephone number and felt that they had been affected by the incident. 46 responses were received. Although the responses have been analysed as 'out of area' they form an epidemiologically un-representative and self-selected group and the results must be interpreted with caution.

The Questionnaire

The questionnaire was developed after consultation with a number of national and local experts. Questions were asked about physical symptoms present immediately before the incident and up to a week afterwards. The list of physical symptoms used in the questionnaire was informed by symptoms reported to General Practitioners, the Accident & Emergency dept, NHS Direct, Occupational Health departments and directly to GHA staff. Local people reported high levels of stress following the incident and it was decided to quantify the level of psychological ill health using the General Health Questionnaire (GHQ-12). This well validated tool is often used in general population surveys, and is sensitive to recent change in feelings or behaviour. It focuses on breaks in normal functioning rather than life-long traits and can be used as a screening tool for more severe conditions.

Methodology

Questionnaires were sent by first class post in envelopes addressed to "The Occupier" for each identified household with one questionnaire for each member of household as identified by the GHA database of those registered with a GP. For those under 16 the instructions asked for the questionnaire to be completed by an identifiable, responsible adult, and the GHQ-12 and smoking questions were excluded for those under 18. A covering letter was attached giving information about the survey and giving a freephone number to call to ensure a rapid response to any queries or requests for extra questionnaires. The returns were by a first class prepaid return envelope, that was provided, one per household. Special arrangements were made for questionnaires to be distributed by staff from the Department of Public Health and Health Services Planning (DPH&HSP) to those who had been evacuated from their homes.

All of the questionnaire returns were directed through the Research and Development Support Unit (RDSU). The DPH&HSP screened the questionnaires for serious medical complications or high GHQ-12 scores so that immediate action could be taken if necessary.

Reminders were sent after 14 days to non-responding households. One response from an address indicated a response therefore no reminders were sent for that address even if a full number of expected responses had not been received. No reminders were sent to those who requested questionnaires via the freephone number. No reminders were sent to the occupational groups.

Results

623 symptom questionnaires were sent by post to the residents of Sandhurst, 449 to the residents of Maisemore, 543 to the residents of Ashleworth, 328 were sent to the occupational groups and 53 were sent out on direct request. The overall response rate was 57% (61% Sandhurst, 56% Maisemore, 57% Ashleworth). The response rate for the occupational groups was 48%. 46 responses were received from those who had asked for a questionnaire (Out of Area), a response rate of 87%.

We analysed the data for differences between Sandhurst residents and the other groups and then looked at the results for Sandhurst residents only in more detail; this report presents a summary of those findings. A number of indicator symptoms were selected and grouped for the analysis (see box 1).

Box 1 - Symptom group definitions

<i>Irritant symptoms:</i>	<i>Sore eyes, sore/itchy skin, tingling sensation of lips</i>
<i>Gastric symptoms:</i>	<i>Feeling sick, diarrhoea, vomiting</i>
<i>Respiratory symptoms:</i>	<i>Sore throat, chest pain, cough, wheezing, shortness of breath</i>

1. Baseline Characteristics of the Populations

Respondents from Sandhurst, Ashleworth and Maisemore were similar in terms of age, sex, levels of pre-existing illness and smoking habits (table 1 and 2).

Table 1 - Baseline characteristics

	Male %	Female %	Smokers (adults) %	Any chronic illness %
Ashleworth	47	53	13	24
Maisemore	49	51	20	20
Sandhurst	50	50	13	25
Out of area	48	52	20	13

Table 2 - Age groups

	Under 5 %	5 to 17 %	18 to 44 %	45 to 64 %	65+ %
Ashleworth	7	14	30	30	20
Maisemore	11	7	22	39	22
Sandhurst	10	8	23	35	24
Out of area	45	10	24	11	10

Members of the occupational groups were more likely to be younger, fitter and male. The Out of Area group was younger and less likely to be suffering from long term illness. Respondents from Sandhurst were less likely to have had their homes flooded or to have had other contact with floodwater than other respondents (table 3).

Table 3 - Exposure to floodwater

	House flooded %	Splashed by water %	Falling into water %	Swallowing water %
Ashleworth	7	23	<1	1
Maisemore	3	28	1	0
Sandhurst	3	17	1	0
Out of area	2	11	0	0
Occupational groups	1	<i>na</i>	<i>na</i>	<i>na</i>

na = not available

2. Exposure to the Smoke Plume

Forty-four (13%) Sandhurst respondents left the area during the fire because they were advised to do so or because they felt it was necessary. Sandhurst respondents spent more hours in an area affected by smoke than other respondents and were also more aware of odours and dust during the fire and afterwards. Some Maisemore residents also reported odours and dust after the fire but in smaller numbers. The prevailing winds during this time remained south westerly but there was some recorded fluctuation. Out of area respondents also reported high levels of odour detection and this may have triggered their decision to participate in the survey.

Table 4 - Action taken by respondent during fire

	Stayed at home %	Left the area %	Went out as usual %
Ashleworth	49	0	51
Maisemore	55	<1	45
Sandhurst	45	13	42
Out of area	43	0	57

Table 5 - Number of hours spent in affected area on day of fire

	None %	Less than 1 hour %	1 to 4 hours %	4 to 8 hours %	8 hours or more %
Ashleworth	41	1	7	12	38
Maisemore	28	1	5	15	50
Sandhurst	10	4	14	17	55
Out of area	24	0	7	27	42
Occupational groups	35	14	20	16	14

3. Health Impact

Prevalence of Symptoms

Almost 50% of Sandhurst residents reported respiratory symptoms following the fire. This is significantly more than the residents of Maisemore and Ashleworth. The respondents from the occupational groups experienced similar levels of symptoms to Sandhurst respondents. Patterns were similar for irritant symptoms and also present, but less marked for gastric symptoms.

Table 6 - Main symptom groups by area

	Ashleworth %	Maisemore %	Sandhurst %	* Significance of Result
Any irritant symptom	9	25	39	Very high
Any respiratory symptom	17	27	49	Very high
Any gastric symptom	12	19	22	High

* 'Significance of Result' refers to a statistical test of whether there is a trend in symptom levels from Sandhurst to Maisemore to Ashleworth. All these 3 symptom groups show a significant trend.

For Sandhurst residents the peak onset for most symptoms is in the 24 hours following the fire. The peak is less well marked for Maisemore respondents and occurs 48 hours later. Ashleworth respondents do not show this effect. The respondents from the occupational group also show peak onset of symptoms at 24-48 hours.

Larger than expected numbers of Sandhurst residents were reporting the onset of respiratory symptoms in particular, at the end of the survey period. In addition a

number of people reported on the questionnaires that they were continuing to experience symptoms.

Severity of Symptoms

Sandhurst respondents were more likely to have consulted a general practitioner about their symptoms than other respondents. This may reflect the severity of the symptoms experienced.

Ten members of the occupational groups were seen in A&E on the day of the fire, none of whom were admitted. A few people rang NHS Direct for advice. This facility had been set up only recently in the county, but its number was given to the public in a letter as a source of advice. Nearly a third of the (self-selected) Out of Area group had obtained advice on the health effects of the fire and may reflect the widespread concern generated by this incident for some people in the wider community.

Table 7 - Did you ask anyone for advice on the effects of the fire?

	Yes %
Ashleworth	3
Maisemore	7
Sandhurst	26
Out of area	30
Occupational groups	17

4. Health Impact on Sandhurst residents

The responses from Sandhurst residents only were then analysed in more detail. Table 8 shows that respondents who left the area (evacuated during the night) were more likely to have experienced symptoms than those who stayed indoors or who went to work as normal and that this difference is highly statistically significant.

Table 8 - Symptoms by location on day of fire (Sandhurst residents only)

	Stayed at home % n=149	Left the area % n=44	Went out as usual % n=139	* Significance of Result
Any irritant symptom	37	73	35	Very high
Any respiratory symptom	47	73	46	Medium
Any gastric symptom	17	50	19	Very High

* 'Significance of Result' refers to a statistical test of whether there is a difference in symptom levels between the 3 groups 'stayed at home', 'left the area' and 'went out as usual'. All these 3 symptom groups showed significant differences.

The duration of exposure to smoke (i.e. the number of hours spent in the area affected by smoke) was not related to the development of symptoms. Sandhurst residents who detected a smell were significantly more likely to have developed symptoms.

Table 9 - Symptoms by whether noticed smell on day of fire (Sandhurst residents only)

	Yes % n=189	No % n=192	* Significance of Result
Any irritant symptom	53	25	Very high
Any respiratory symptom	64	33	Very high
Any gastric symptom	28	16	Medium

* 'Significance of Result' refers to a statistical test of whether there is a difference in symptom levels between those who noticed a smell and those who did not. All these 3 symptom groups showed significant differences.

Sandhurst residents were exposed to the effects of both the fire and flooding. Table 10 compares symptom levels in the Sandhurst respondents who reported splashing by floodwater and those who did not. Significantly higher levels of irritant and respiratory symptoms were found in Sandhurst residents who were splashed by floodwater.

Table 10 - Symptoms by whether splashed by floodwater (Sandhurst residents only)

	Yes % n=66	No % n=315	* Significance of Result
Any irritant symptom	61	34	Very high
Any respiratory symptom	65	45	Medium
Any gastric symptom	29	20	None

* 'Significance of Result' refers to a statistical test of whether there is a difference in symptom levels between those who were splashed by flood water and those who were not. In this case the irritant and respiratory symptom groups showed a significant difference.

There was no relationship between cigarette smoking and developing symptoms. However symptoms were reported more frequently in very young children but there was not a similar peak in the older age groups.

Table 11 - Symptoms by age group (Sandhurst residents only)

	0 to 4 % n=32	5 to 17 % n=27	18 to 44 % n=77	45 to 64 % n=115	65+ % n=79	Significance of Result
Any irritant symptom	56	26	33	53	34	Medium
Any respiratory symptom	63	52	48	55	43	None
Any gastric symptom	50	22	10	31	11	Very high

* 'Significance of Result' refers to a statistical test of whether there are differences in symptom levels between people in different age groups. In this case gastric and irritant symptoms showed significant differences.

Table 12 shows the proportion of responders with a GHQ-12 score of 4 or more (83% of adults completed this section). It shows that the impact of the incident on the psychological well being was more pronounced for Sandhurst responders and concerned people living out of the area than for other groups. For comparison in 1999 the standardised rate for Gloucestershire was 17.2% (*source: Health Survey for England*).

Table 12 - Proportion with higher GHQ-12 score (4+)

	Yes %	Significance of Result
Ashleworth	8	Very high
Maisemore	16	
Sandhurst	24	
Out of area	21	
Occupational groups	11	

* 'Significance of Result' refers to a statistical test of whether there is a trend in higher GHQ-12 scores from Sandhurst to Maisemore to Ashleworth. A significant trend was found.

Discussion

It is important to acknowledge that there are potential sources of error within these results. For example the contents and path of the plume could not be clearly defined and a number of residents did not respond to the questionnaire. However, some patterns can be discerned:

- This survey provides an assessment of the symptoms experienced by a small community following a major incident combining natural and man-made elements.
- There appears to be a higher level of reported symptoms in those who left the area at the height of the incident compared with those who sheltered indoors.
- The symptoms which have been reported are compatible with low level acute exposure to a large number of volatile agents which have been identified as involved in the fire. However, levels of reported symptoms were higher in those who were also splashed by floodwater.
- These symptoms are generally thought to be self-limiting but the later onset of symptoms for a number of Sandhurst responders merits further investigation of the duration of symptoms. A follow-up questionnaire is being developed with the help of community representatives.
- We recognise that people experienced a wide range of other symptoms but this survey was unable to show that they were related to the fire.
- It is perhaps surprising that the elderly people were not affected more in view of the effects on young people but this may be due to bias in the reporting.

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