



# **PATHOGENS RISK ASSESSMENT FOR EMPLOYEES CARRYING OUT LANDSPREADING OF SEWAGE SLUDGE**

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## ABSTRACT

The French association for sludge landspreading has conducted in 2008 a risk assessment study to determine the exposure to pathogens of the employees in charge of landspreading operations.

The follow up of more than 200 participants divided in exposed and unexposed group has demonstrated that there is no risk increase of digestive disorders among employees in charge of sludge landspreading in comparison with the control population.

## KEY WORDS

Risk assessment, sludge, biosolids, pathogens, landspreading

## INTRODUCTION

Risk assessment is necessary to identify and classify the risks that may occur in any industrial or commercial activity. It is the initial step of any prevention approach and is required by the French regulation.

In 2005, the **SYPREA** carried out a risk assessment related to the spreading of sewage sludge. Part of this study was to estimate the exposure of farmers and residents to micro-organisms. At that time it was not possible to quantify precisely the risk level due to uncertainties into the modelling process.

Therefore the **SYPREA** launched in 2008 an epidemiological study to determine whether the employees in charge of sludge landspreading were exposed to an excess risk in comparison with a population of unexposed workers.

## MATERIALS AND METHODS

### Selection criteria

This risk assessment has been achieved through the participation of workers involved in landspreading operation and of a control population in charge of administrative tasks. These two groups were meeting the selection criteria described below:

Exposed group:

- Male or female age 20 to 60 years.
- Employee in charge of sludge landspreading (excluding those spreading exclusively paper mill, composted or dried sludge) over a period of at least 15 days during the 2008 campaign.
- Employee belonging to **SYPREA**'s members or to their subcontractor.

- Volunteer to participate in the study.

Unexposed group:

- Male or female age 20 to 60 years.
- Employee in charge of administrative tasks without any contact with sludge.
- Volunteer to participate in the study.

## Methodology

The recruitment of participants has been conducted on a voluntary basis, by sending a letter explaining the purpose of the study and its implementation modalities, and the return of the reply coupon.

Employees who agreed to participate were contacted before the landspreading campaign by telephone by the medical society **ABR Pharma** in order to complete the inclusion questionnaire describing their personal, professional and medical profile.

During the landspreading period (summer 2008), participants were asked to complete regularly a notebook whose objective was to gather all the health events of interest (digestive, respiratory, eye, dermal problems, headaches ...), and the landspreading conditions. These notebooks were meant to be the support for a second telephone contact scheduled two weeks after the end of the spreading operation.

The objective of the second telephone contact was to collect data on the modalities of the landspreading operations and to establish a balance of health events occurred.

## Results analysis

120 employees in charge of sludge landspreading operation had agreed to participate, 108 did respond to the telephone survey which corresponds to a participation rate of 90%.

100 administrative employees had agreed to participate, 97 did respond to the telephone survey which corresponds to a participation rate of 97%.

The data collected in each group were compared and the analysis results of the study included:

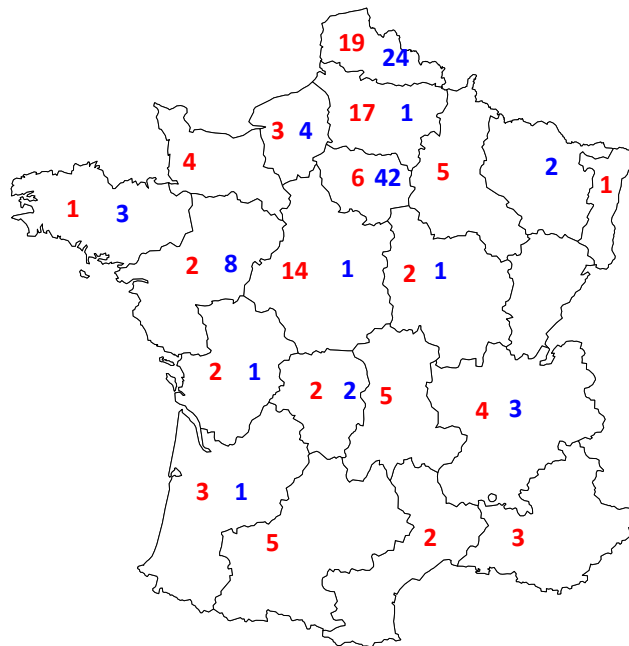
- The microbiological risk assessment among the employees in charge of the sewage sludge landspreading operation.
- The calculation of the incidence of health events during the landspreading period and during the 2 weeks after the end of the landspreading operations.
- The calculation of the relative risk of health events by comparing the exposed group (workers in charge of sludge landspreading) with the unexposed group (employees in charge of administrative tasks).

# RESULTS

## Geographical distribution of participants

The exposed participants are working mainly in the north of France and are living mainly in urban areas.

Figure 1 - Geographical distribution of exposed and unexposed participants.



Exposed population

Unexposed population

## Spreading conditions

### Tractor cabin

100% (n=97) of the spreading workers use a tractor equipped with a cabin. This cabin has air conditioning in 95% (n = 92) cases and an outdoor air filter in 75% (n = 72) cases.

### Landspreading method

Among the 55 workers who are spreading liquid sludge, 45% (n = 25) are working with a spreader equipped with spray booms and 40% (n = 22) on a spreader equipped with injection device.

9 participants work on a spreader with other optional equipment, like pumping arm, sludge premixing container, etc.

### Types of sludge

On average 8695 tons of sludge were applied per participant (min = 60 - max = 41 000), the median being 6,000 tons.

These sludges were mostly liquid and / or lime stabilized sludge.

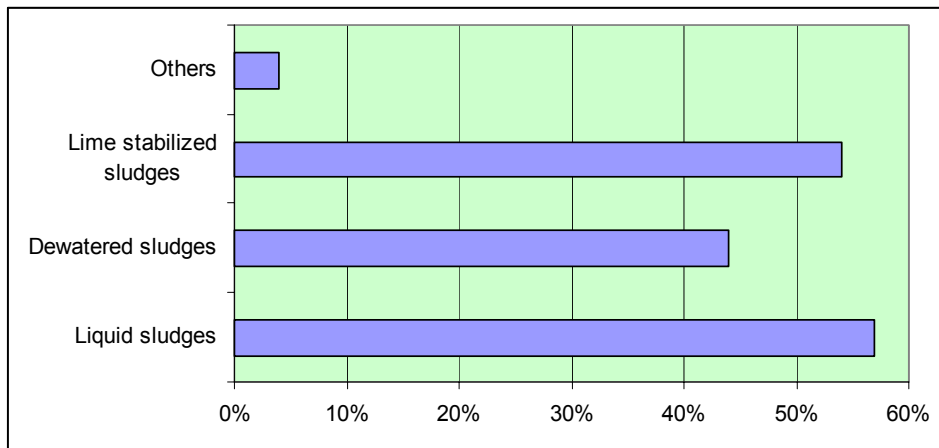
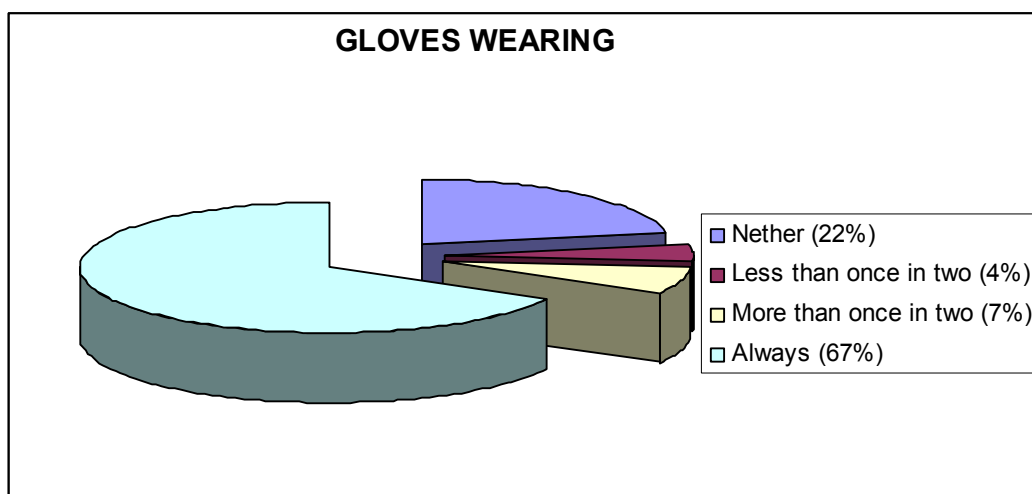
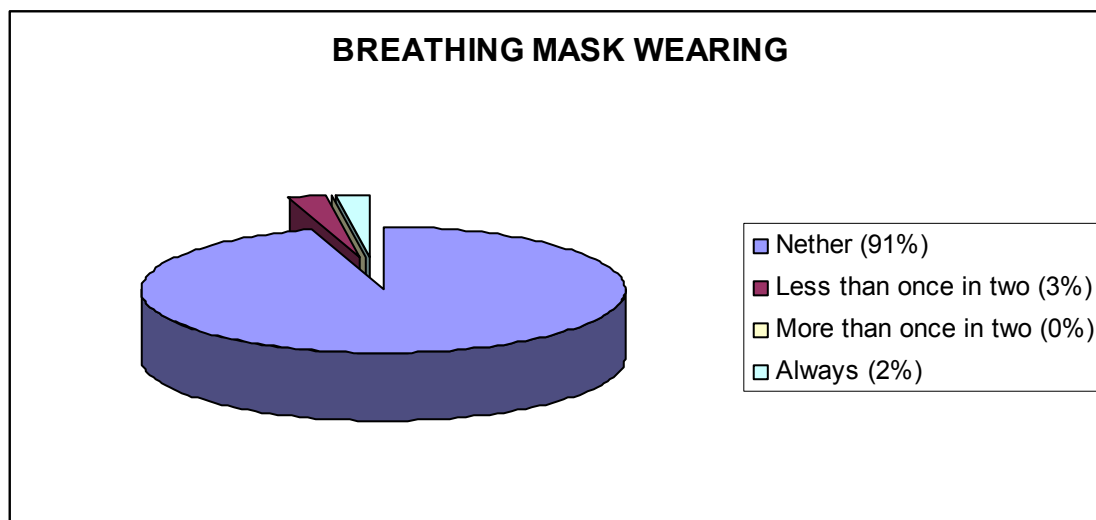
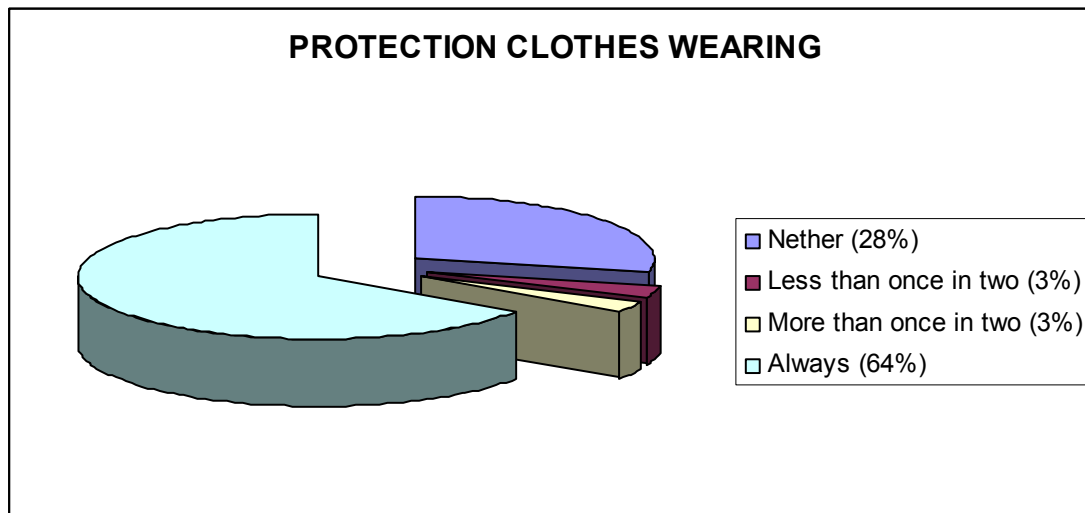


Figure 2: Types of sludge spreaded (% per participant, several answers possible)

### Prevention behaviour

The frequencies of wearing protective equipment during application are presented in the figures below:



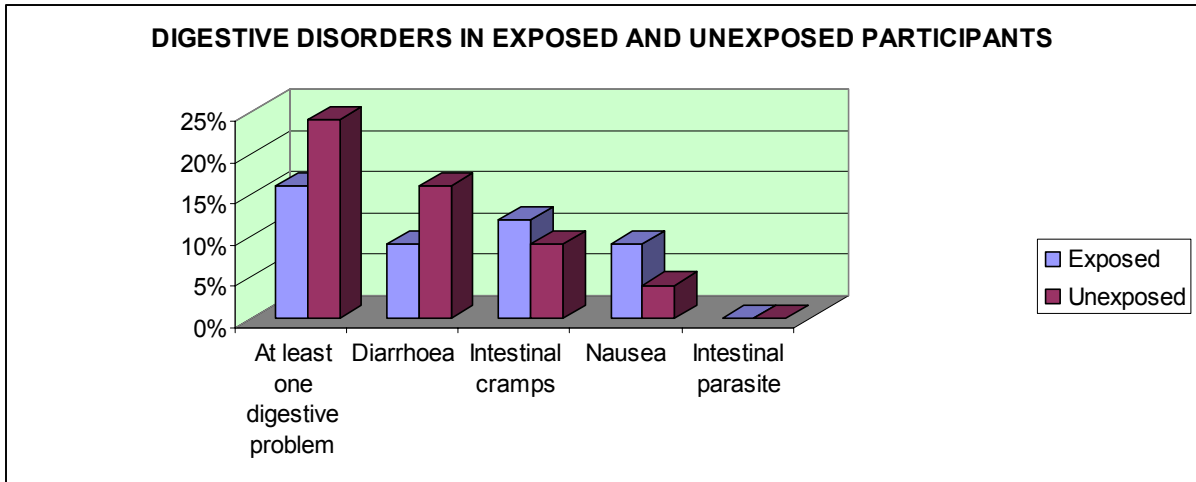


Regarding hygiene measures:

- 80.5% of participants always wash hands with soap after spreading operation, 4% more than once in two, 5% less than half of the time. 10.5% said they never wash hands.
- Only 32% of participants reported taking a shower in the workplace.
- The employees wearing gloves routinely generally follow better hygienic complementary measures (protection clothes, washing hands) and are more likely to take a shower in the workplace.

## Health events occurring during the spreading campaign

16% of the exposed participants were subject at least to one gastrointestinal symptom which they believed in relation with the spreading operations. The types of digestive problems identified and the comparison with the population of unexposed participants are presented in the following figure.



**We observed no increase in the occurrence of diarrhoea or digestive disorders in the exposed group.**

Other events during the monitoring period are mainly respiratory problems, headaches and sinusitis, without significant difference between the 2 groups of participants studied (see Table 1).

The non-exposed participants are more frequently subject to excessive tiredness than the exposed one (11% vs 3%,  $p < 0.05$ ).

26% of exposed participants had a medical consultation during the monitoring period against 34% of unexposed participants (ns).

1% of exposed participants experienced a hospitalization in comparison with 4% of unexposed (ns) during the same period.

The following table presents the other medical problems which occurred during the monitoring period.

Medical problem	Exposed participants	Unexposed participants	Comparison
Respiratory disease	25%	28%	Not significant
Eyes disease	9%	11%	Not significant
Skin disease	13%	14%	Not significant
Headaches	19%	21%	Not significant
Tiredness in excess	3%	10%	Significant
Fever	2%	3%	Not significant

## Health impact and risk excess

The calculation of the incidence of diarrhoea in the two groups and the calculation of the relative risk of experiencing a health event between the two groups are presented in the table below.

	Exposed participants	Unexposed participants
Initial population	108	97
Analysed population	97	92
Nb of days considered	6786	5458
Diarrhoea cases	8	12
Incidence ratio	$8 / 6786 = 1.18 \cdot 10^{-3}$	$12 / 5458 = 2.19 \cdot 10^{-3}$
Relative risk	RR = 0.53	

No excess risk of diarrhoea associated with the sludge landspreading operation has been demonstrated (relative risk of developing diarrhoea was not significantly different from 1).

## CONCLUSIONS

No significant increase in the occurrence of diarrhoea or digestive disorders has been highlighted in the group of exposed participants.

All episodes of diarrhoea in the exposed group occurred in separate sites spread over whole France (suggesting the lack of effect at a particular site).

No difference has been highlighted due to the type of spreading equipment, the quantity of sludge applied, and the compliance with hygiene measures. The relative risk of diarrhoea was not significantly different from 1, indicating the absence of excess risk due to sewage sludge landspreading.

The results are consistent with the literature data (see publication Tanner et al.)

The frequency of occurrence of respiratory problems, skin, eye, headache and sinusitis were not greater among the exposed participants.

**In conclusion this study did not reveal a risk increase of digestive disorders among employees in charge of sludge landspreading in comparison with the control population.**