DANISH MINISTRY
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Registration of chemical substances in cleaning agents used for cleaning after fire or smoke damage in private homes

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JobLiv Danmark Ltd.

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The reports are, however, published because the Danish EPA finds that the studies represent a valuable contribution to the debate on environmental policy in Denmark.

Contents

Preface

This report on registration of chemical substances in cleaning agents used for cleaning after fire or smoke damage in private homes is the product of a project under the Danish Environmental Protection Agency's program "Registration of chemical substances in consumer products".

Usually professional after-damage companies carry out the cleaning after a fire or smoke damage in a private home. The residents do not use the products and are therefore not in these cases exposed to the chemical substances in the cleaning agents during the cleaning. However, the residents may be exposed to the chemical substances after having shifted back to the residence. The objective of this project is to register the chemical substances in cleaning agents used for cleaning after fire or smoke damage and to estimate the quantity of products used in Denmark.

For this project, companies carrying out this type of cleaning jobs have delivered information on the products they use, and several companies have also allowed the project participants to observe their work. Thank you to all companies contributing to this work.

The project was carried out by JobLiv Danmark Ltd. during the period March to November 2006. Responsible for the project were:
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Contacts at the Danish Environmental Protection Agency were Sidsel Dyekjær and Anette Ejersted.

Before publication, the report was sent round for commenting to those producers, suppliers and cleaning companies, who participated in the survey.

Summary and conclusions

This project describes professional cleaning up in private homes after a fire or smoke damage.

The report includes registration of the after-damage companies carrying out cleaning after fire and smoke damage in private homes, the products used and their chemical substances according to the products' health and safety data sheets. Furthermore, the working methods in use have been observed and described.

In this project, 20 after-damage companies, some with several departments, have been registered. As a total per year, the companies carry out well over 11.800 cleaning jobs after fire or smoke damage in private homes. The cleaning companies carry out a varying number of jobs (from 5 to 5000 per year) and operate all over Denmark. Half of the registered companies carry out more than 100 cleaning jobs of this type per year. Through contact to the 20 companies, 82 products from 14 suppliers or producers have been registered. The products are partly ordinary daily household cleaning agents, partly ordinary or stronger basic cleaning agents and products especially designed for the tasks – including a range of odour-treatment products.

Some 43, i.e. approximately half, of the registered products are labelled with indication of danger. Of these, 13 are labelled C (Corrosive), 27 are labelled Xi (Irritant) and two products are labelled Xn (Harmful). One product is labelled R10 (Flammable). The proportion of labelled products is evaluated to be higher than among ordinary household cleaning products. The proportion of basic cleaning agents labelled C (Corrosive) is evaluated to be higher than among ordinary basic cleaning agents for cleaning in private homes.

The products' chemical substances are registered from the suppliers' health and safety data sheets. From these it appears that 23 substances are present in three or more products, while 45 substances are present in two or less products. Of the most frequent substances, five are organic solvents, four are acids (organic and inorganic), six are tensides and four are alkaline. Furthermore the products contain odorants – unspecified essential oils.

A series of different cleaning jobs have been observed, partly in smoke- and soot-damaged residences and partly in the after-damage companies' workshops in which household contents and other movables are cleaned and treated. Based on the observed working methods and the quantity of products used, it is evaluated that the ordinary household cleaning agents and the basic cleaning agents are not likely to affect the indoor climate after the cleaning after fire and smoke damage to any noticeable degree. However, there may be a risk that slowly evaporating odorants from cleaning agents or odour-treatment products will be released to the indoor climate over a period of time after the cleaning or the odour treatment and affect the indoor climate for the residents. No toxicological evaluations have been included in this project.

1 Background and objectives

The cleaning after a fire or smoke damage in a private home is often carried out by a professional after-damage company. The residents do not use the products themselves and are therefore not exposed to the chemical substances in the cleaning agents during the actual cleaning. However, the residents may be exposed to the chemical substances after having shifted back to the residence.

After a fire in a private home, the immediate damage control is carried out by the emergency service. This could for example include restoration of burnt-out parts of the building, which then takes place before the after-damage company is called in. Cleaning after a fire is a part of the third step of the after-damage service and is usually initiated by the insurance companies (1). Thus, it is the insurance companies who commission the professional after-damage companies to clean after fire or smoke damage, or they request the residents to make contact to the professional companies and the insurance companies then pay the costs. If the residents are not insured and the cleaning is carried out by a professional company, the residents will have to pay the costs.

The objective of this project is to register the chemical substances in cleaning agents used by professional after-damage companies for cleaning after fire or smoke damage and to estimate the quantity of these products used in Denmark. Based on this information, it is the aim to give a preliminary assessment of whether the use of cleaning agents involves a health risk for the residents after the cleaning. The project does not include a toxicological evaluation of the chemical substances.

2 Definitions and legislation

Definitions
In this project the chemical products used for cleaning after fire or smoke damage are registered. The registration does not include products used for cleaning after water damage (disinfectants) or products which are not typical cleaning products, for example ozone treatment agents which are sometimes used in severe cases of malodour.

Legislation
Cleaning agents, including agents used for cleaning after fire or smoke damage, are subject to rules and regulations. To be mentioned are:

Statutory order on classification, packaging, labelling, sale and storage of chemical substances and products. Statutory order No. 329 of May 16, 2002.

This statutory order is succeeded by the statutory order on the list of dangerous substances (Statutory order No. 439 of June 3, 2002). The statutory order on the list of dangerous substances also set limits to the content of some chemical substances in aerosol containers.

REGULATION (EC) No 648/2004 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 31 March 2004 on detergents (The Detergents Regulations).

The Detergent Regulation stepped into force on October 8, 2005. It sets requirements to detergents on the market with regard to (aerobic) degradability of tensides and requirements to the declaration of chemical substances, including e.g. declaration of allergenic fragrances.

DIRECTIVE 98/8/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 February 1998 concerning the placing of biocidal products on the market (The Biocidal Product Directive).

The Biocidal Product Directive states that biocides used for biological control, including preservatives in cleaning agents and disinfectants, must be approved.

3 Registration – methods

A new database was created, storing information on the after-damage companies, the cleaning products and their chemical substances, and the producers of the cleaning products.

3.1 After-damage companies

The registration of after-damage companies cleaning private homes after fire followed this procedure:

- Contact to the trade association Braforska. The biggest after-damage companies are members of Braforska.
- Enquiries to the insurance companies (Alm. Brand, Tryg, Udflytternes Forsikring, Codan, Nykredit, DIBA and Top Danmark), requesting contact information on the after-damage companies they used in 2006 in relation to fire and smoke damage.
- Internet search using the yellow pages and Google.

This gave a list of 52 companies which might carry out this type of work.

3.2 Products on the market

The products were registered using the interview guide in Annex A.

The guide requests information on the name of the product, the producer or supplier, the product's special purpose and the annual quantity used. Several companies completed the form and returned it by E-mail. Some of the bigger firms sent spreadsheets with list of products. The database was updated with this information. Some of the smaller companies gave information through telephone interviews.

3.3 Quantity of products used

It was not possible to estimate the quantity of products specifically used for cleaning after fire damage in private homes. The after-damage companies use the same products for all kind of damages (water, fire, smoke, soot, others). Furthermore, the same products were used in both industrial areas and private homes, and the companies were not able to inform about the specific quantities used for cleaning in private homes. An estimate of the quantity of cleaning products used would therefore be very inaccurate. In addition to this, it turned out that it was very time-consuming for many companies to give information on the annual quantities used. Thus, the project does not include an estimation of the quantity of products used.

3.4 Chemical substances in the used products

Information on chemical substances used in the products where obtained from the Safety datasheets of the products. Products that are classified as dangerous must be followed by a health and safety datasheet from the supplier. This sheet contains information about the content of chemical substances which are classified with indication of danger. The health and safety datasheet can also include information about non-classified chemical substances, but does not have to.

The suppliers or manufacturers were contacted and the newest health and datasheet was requested. Information on each product's classification, labelling and chemical content was taken from here and entered into the database. Each chemical substance was, if possible, registered with its CAS number, Einecs number, and its classification and labelling. No further information on chemical substances in the products where obtained.

3.5 Working methods in use

The working methods used by the cleaning companies were registered by observing different companies carrying out cleaning jobs in both Sealand and Jutland. The cleaners were interviewed during the observations. Three observations took place in private homes and one in a company's workshop where movables were cleaned. In addition, visits were made to two other after-damage companies.

4 Results

4.1 After-damage companies

A total of 52 companies were registered as expected to carry out cleaning after fire. These companies were contacted by telephone, via email or personally. Most companies received an invitation to participate in the project, a short description of the project and a guide for the registration of products (Annex A).

Table 1: Registration of after-damage companies

	No. of after-damage companies
Carried out cleaning after fire and answered questions	20
Departments of other companies already registered.	8
Did not carry out this type of work. The companies cleaned for example only vent systems or in industrial areas.	14
No contact information could be obtained	1
Did not respond to the enquiry	9
In total	52

14 of the 52 companies did not carry out cleaning of private homes. 10 companies did not respond to the enquiry or could not be contacted. 8 companies showed out to be a department of a company already registered. The results from these 8 companies are included in the results from the head company. Thus, a total of 20 after-damage companies with several departments are included in the investigation. Table 2 shows the number of cleaning jobs per year and the number of products used by these 20 companies. Five of the 20 companies did not give information on their products. Only the number of cleaning jobs was reported.

Table 2: Cleaning jobs pr. year and number of products used

After-damage company	App. number of cleaning jobs in private homes per year	Number of products used
A	5000	20
B	3000	24
C	1000	Not registered.
D	800	11

After-damage company	App. number of cleaning jobs in private homes per year	Number of products used
E	535	Not registered
F	400	3
G	360	18
H	300	21
I	200	Not registered
J	100	3
K	50	4
L	30	10
M	15	Not registered
N	15	3
O	12	1
P	10	1
Q	10	1
R	10	Not registered.
S	10	4
T	5	6
In total	11.822	

In total, the registered companies carry out well over 11 800 cleaning jobs per year.

Ten companies carry out more than 100 cleaning jobs per year and thus have considerable experience in this type of work. Eight companies only have the occasional after-damage cleaning job, approximately once a month or less. There is no apparent difference in the geographical distribution of companies carrying out many or few jobs. Several of the larger companies operate all over Denmark.

A list of the registered companies is included as Annex B.

4.2 Cleaning products

4.2.1 Products used

A total of 82 products from 14 suppliers or producers were used.

Table 3: Suppliers included in the investigation

Supplier or producer	Number of products
Knud E. Dan	33
Novadan	22
Iduna	7

Supplier or producer	Number of products
NAC-europe	4
BI-RO A/S	3
DSS Dansk Service Selskab	3
Dan Drift A/S	2
Trøst Kemi	2
Dagligvarer	2
Protox	1
TG-clean	1
Green-Share	1
Clean Supply	1
In total	82

In addition, Alron Chemical AB produces a range of odour-treatment products, sold through several of the suppliers mentioned.

Knud E. Dan and Novadan are thus the most dominant producers on the market.

4.2.2 Labelling and classification of the used products

The health and safety data sheet for each product was obtained from the supplier or the producer. Information on the classification and labelling was registered from here.

Table 4 shows the products used for cleaning, etc., after fire or smoke damage. The table shows the product's labelling with indication of danger according to the health and safety data sheet, i.e. the labelling and the R-phrases.

Table 4: Products used for cleaning

	Product name	Producer	Labelling	R-phrases
1	A-11 grov rens	Knud E. Dan	Corrosive	R 34
2	A-16 Grundrens	Knud E. Dan	Irritant	R 36/38
3	A-21 mild rens	Knud E. Dan	None	
4	AbScent Lugtfjerner	Protox	Harmful	R 36 - 20/21/22 - 31
5	Alron B.O.C tør	Novadan	None	
6	Alron B.O.C våd	Novadan	None	
7	Alron Biofresh	Knud E. Dan	None	
8	Alron Citrus tør	Novadan	None	
9	Alron Citrus Våd	Novadan	None	
10	Alron Fyrrenåle Tør	Novadan	None	
11	Alron Fyrrenåle Våd	Novadan	None	
12	Alron kanalforsegler	Knud E. Dan	None	
13	Alron Mint Tør	Novadan	None	
14	Alron Odox	Knud E. Dan	Irritant	R 37
15	Alron Puttes Special	Novadan	Irritant	
16	Alron tør lugtsanering	Knud E. Dan	None	
17	Alron våd lugtsanering	Knud E. Dan	Irritant	R 37

	Product name	Producer	Labelling	R-phrases
18	Anti-grafitti "15"	Knud E. Dan	None	
19	Anti-kim	Knud E. Dan	Irritant	R 36/38
20	Aqua petrosol	Knud E. Dan	None	
21	Aqua-plus	Knud E. Dan	None	
22	BI-RO Toiletrens	BI-RO A/S	Irritant	R 36/38
23	CIP Kassevask	Iduna	Corrosive	R 35
24	Combi-cid	Knud E. Dan	Irritant	R 36/38
25	Combi-plus	Knud E. Dan	None	
26	Eddikesyre	dagligvarer	Corrosive	R 34
27	Fiber Extraction	Novadan	Corrosive	R 34
28	Folie-fjerner	Knud E. Dan		
29	Glasrens	Dan Drift A/S	None	
30	Graffiti-stop	Knud E. Dan	None	
31	Grill- og Ovnrens	Iduna	Corrosive	R 35
32	Grundrens	Iduna	None	
33	H10	DSS Dansk Service Selskab	Harmful	R 65
34	H-21	DSS Dansk Service Selskab	None	
35	H50	DSS Dansk Service Selskab	None	
36	Hydrosol	Knud E. Dan	None	
37	Kalcedon 1	Trøst Kemi	Corrosive	R 34
38	Kalcinol ekstra	Knud E. Dan	Corrosive	R 34
39	Kalcinol-kalk/rustfjerner	Knud E. Dan	Corrosive	R 34
40	Klinkeolie/seal-oil nr. 17	Knud E. Dan	None	
41	Lugtfjerner (BI-RO)	BI-RO A/S	None	
42	Lugtfjerner (Dan Drift)	Dan Drift A/S	None	
43	Lugtfjerner/desinfektion med/duft	Novadan	Irritant	R 36/38
44	Maling-fjerner ny	Knud E. Dan	Irritant	R 36 - 37
45	Mug fjerner	TG-clean	Irritant	R 36/38 - 31
46	Mur-rens	Knud E. Dan	Irritant	R 36/38
47	Nautilus	Knud E. Dan	Irritant	R 36/38
48	Novis 119	Novadan	Irritant	R 41
49	Novis 125	Novadan	Irritant	R 36
50	Novis 128	Novadan	Irritant	R 36/38
51	Novis 130	Novadan	Irritant	R 36/38
52	Novis 135	Novadan	Irritant	R 36/38
53	Novis 139	Novadan	Corrosive	R 34
54	Novis 15	Novadan	Corrosive	R 34
55	Novis 6	Novadan	Irritant	R 36/38
56	Novis 7	Novadan	Irritant	R 36
57	Novis 800 Aqua	Novadan	None	
58	O2 tabs	Knud E. Dan	Irritant	R 36/38
59	Perma Puran	Iduna	Irritant	R 36/38
60	Poler-mix	Knud E. Dan	None	
61	Profi grundrens med salmiak	Clean Supply	None	
62	Pure4sure	Green-Share	None	
63	Rodalon	Knud E. Dan	Irritant	R 36/38

	Product name	Producer	Labelling	R-phrases
64	S-71rustfjerner	Knud E. Dan	None	
65	Salmiakspiritus- 3 dobbelt	dagligvarer	Corrosive	R 34
66	Sapur Pulver Tæpperens	Novadan	None	
67	Silcolapse	Knud E. Dan	None	
68	Skyggefjerner KOH	Knud E. Dan	Corrosive	R 35
69	Sæbespåner	Knud E. Dan	None	
70	Tenozid 12	Iduna	Irritant	R 36/38
71	Tenozid 15	Iduna	Corrosive	R 34 - 22
72	Tenozid 8	Iduna	Irritant	R 36/38
73	Toilet-rens & kalkfjerner	Knud E. Dan	Irritant	R 36/38
74	Tusch/graffitifjerner mild	Knud E. Dan	None	
75	Tæpperens	Novadan	Irritant	R 36
76	Vaportek Neutrox Gamma Oil	NAC-europe	Flammable	R 10
77	Vaportek SOS	NAC-europe	None	
78	Vaportek Ecoz	NAC-europe	None	
79	Varpotek gamma bricks og discs	NAC-europe	None	
80	Vinduespudser sæbe	Knud E. Dan	None	
81	WE Grundrens	Trøst Kemi	Irritant	R 38 - 41
82	Windus	BI-RO A/S	None	

The relevant r-phrases are written out in Annex C.

4.2.3 Product application

The registered products are used for different types of after-damage cleaning jobs. Just a few products are especially designed for removing smoke and soot, while several of the remaining products are what could be referred to as ordinary household cleaning agents, i.e. agents used for cleaning sanitary appliances, glass surfaces, etc.

A special group of products not known from ordinary cleaning jobs are the odour-treatment products, which in this context are used for removing odour from smoke; in other contexts the products are used to remove other kinds of malodour, for example odour caused by organic decay. The use of these products is described in Section 4.4.

Of the 82 products, 43 are labelled with indication of danger: 13 are labelled C - Corrosive, 27 are labelled Xi – Irritant, and two products are labelled Xn – Harmful. One product is labelled R10 - Flammable. The remaining 39 products are not labelled with indication of danger.

The proportion of products labelled with indication of danger is presumed to be higher than among ordinary household cleaning agents. Reading of the product descriptions - which are often included with the health and safety data sheets - reveals that many of the products essentially are basic cleaning agents. Such products are usually labelled Xi – Irritant, whereas a larger proportion of the products used for cleaning after fire and smoke damage are labelled C – Corrosive. The corrosive products have a higher

concentration of strong alkaline such as NaOH, KOH or sodium metasilicate. Several products also contain strong acids.

4.3 Chemical substances

The chemical substances of the products are registered from the supplier's or the producer's information on the health and safety data sheets.

Table 5 lists the chemical substances found in more than two products.

Table 5: Chemical substances found in more than two products.

Chemical substance	Cate-gory	CAS no.	Einecs no.	Number of products	R-phrases
Butoxydiglycol	O	112-34-5	203-961-6	16	R 36
Propylene glycol	O	57-55-6	200-338-0	12	None
Ethanol	O	64-17-5	200-578-6	10	R 11
Fatty alcohol ethoxylate	T			10	R 41
Phosphoric acid	A	7664-38-2	231-633-2	10	R 34
Anionic tensides	T			8	None
Sodium hydroxide	B	1310-73-2	215-185-5	8	R 35
Essential oils (Xi)	OD	No further specification		8	R 36/37/38
Ammonia, aqueous	B	1336-21-6	231-635-3	7	R 50 - 34
Sodium metasilicate	B	6834-92-0	229-912-9	7	R 34 - 37
Citric acid	A	77-92-9	201-069-1	6	R 36
Polypropylene glycol		9003-13-8	500-003-1	6	None
Propanol	O	67-63-0	200-661-7	5	R 11- 36 - 67
EDTA		60-00-4	200-449-4	5	R 36/37/38 - 52/53
Fatty alcohol ethoxylate C9-C11	T	9002-92-0	500-002-6	5	R 37/38
Potassium hydroxide	B	1310-58-3	215-181-3	5	R22 - 35
Alcohol ethoxylate (R22-41)	T	69011-36-5	500-241-6	4	R 22 -41
Benzalkonium chloride	D	68391-01-5	269-919-4	4	R 34-21/22 - 50
Ethyl diglycol	O	111-90-0	203-919-7	3	R 36
Fatty amine ethoxylate	T	61791-10-4		3	R 41- 36 - 51/53
Glycolic acid	A	79-14-1	201-180-5	3	R 34
Alcohol ethoxylate C9-11	T	68439-46-3		3	R 22 - 41
Hydrochloric acid	A	7647-01-0	231-595-7	3	R 35 - 37

Five of the chemical substances are organic solvents (O), four are acids (A), six are tensides (T), four are alkaline (B), two are not purpose-registered and one is a disinfectant (D). Essential oils are registered as odorant (OD). The term "essential oil" covers more than one chemical substance, but these are not further specified in the health and safety datasheets.

Table 6 shows another 45 chemical substances or groups found in less than three products.

Table 6: Chemical substances found in less than three products

Chemical substance	Category	CAS no.	Einecs no.	Number of products	R-phrases
Alcoholethoxylate (R41)	T			2	R 41
Alkyl imidazolinium carboxylate	T			2	R 36
Dipropylene glycol methylether	O	34590-94-8	252-104-2	2	None
Acetic acid	A	64-19-7	200-580-7	2	R 10 - 35
Cationic tenside (R36)	T			2	R 36
Sodium hypochlorite (solution)		7681-52-9	231-668-3	2	R 31 - 34
Sodium metasilicate	B	10213-79-3		2	R 34 - 37
Nonionic tenside (R38-41)	T			2	R 38 - 41
Oxalic acid	A	144-62-7	205-634-3	2	R 21/22
Phosphonobutane-tricarboxylic acid	A	37971-36-1	253-733-5	2	R 36/38
Phosphoric acid ester				2	R 34
Tertiary alkylamine		2372-82-9	219-145-8	2	R 22 - 50-34
2-Aminoethanol		141-43-5	205-483-3	1	R 20/21/22 - 34
Propyleneglycol monomethyl ether acetate	O	108-65-6	203-603-9	1	R 36 - 10
Alcohol ethoxylate (R22-38-41)	T			1	R 22 – 38 - 41
Alkylimino dipropionate		94441-92-6	305-318-6	1	R 41
Alkyl polyglucoside	T			1	R 41
Amphoteric tenside (R36-52)	T			1	R 36 -52
Amine oxide	T	68955-55-5	273-218-2	1	R 50 - 41-38
Ammonium hydrogen fluoride		1341-49-7	215-676-4	1	R 25 -34
Benzyl alcohol	O	100-51-6	202-859-9	1	R 22 - 20
(1-Methylethyl)benzene, monosulfo derivate, sodium salt	T	32073-22-6	250-913-5	1	R 36
Diethanolamine		111-42-2	203-868-0	1	R 41 - 38 - 48/22
Diisobutylketone	O	108-83-8	203-620-1	1	R 10 - 37
Dodecylbenzene sulfonic acid	T	85536-14-7	287-494-3	1	R 22 - 34
EDTA (R36-52/53)		64-02-8	200-573-9	1	R 36 - 52/53
Eucalyptus oil	OD	8000-48-4		1	R 10 - 38
Fatty alchol ether sulfate	T	68891-38-3	500-234-8	1	R 36/38
Fatty alcohol ethoxylate	T			1	R 41 - 50
Fatty acid amine (R22-34-50)	T	25307-17-9	246-807-3	1	R 22 – 34 - 50

Chemical substance	Category	CAS no.	Einecs no.	Number of products	R-phrases
Hydrogen peroxide		7722-84-1	231-765-0	1	R 20/22 - 34
Distillates (petroleum) hydroteated light	O	64742-47-8	649-422-00-2	1	R 65
Potassium monopersulfate		37222-66-5	233-187-4	1	R 36/38
Complex binder (R36)				1	R 36
Maleic acid	A	110-16-7	203-742-5	1	R 22 - 36/37/38
Lactic acid	A	50-21-5	200-018-0	1	R 36
Sodium laurylether sulfate	T	3088-31-1	221-416-0	1	R 36/38
Sodiumcarbonate	B	497-19-8	207-838-8	1	R 36
Sodiumchlorite		7758-19-2	231-836-6	1	R 8 - 23/24/25 - 31 - 34
Sodiumsilicate	B	1344-09-8	215-687-4	1	R 34
N-methyl-2-pyrrolidone	O	872-50-4	212-828-1	1	R 36/38
Octyldodecanoate (fatty acid ester)	T	5303-24-2	226-149-3	1	None
Pentylacetate	O	628-63-7	211-047-3	1	R 10 - 66
Polyvinylalcohol		9002-89-5	209-183-3	1	None
Tetrapotassium pyrophosphate		7320-34-5	230-785-7	1	R 36

Of the 45 chemical substances, seven are organic solvents (O), 15 are tensides (T), five are acids (A), three are alkaline (B) and one is an odorant (OD). 14 are not registered in relation to function.

4.3.1 Diskussion

The registered chemical substances include organic solvents, acids, alkaline, tensides, odorants and disinfectants.

Of the 68 chemical substances, 21 are tensides (T), 12 are organic solvents (O), 9 are acids (A), 7 are alkaline (B), and 1 is a disinfectant. 2 is an odorant or a mixture of non-specified odorants. 16 are not registered in relation to function.

The organic solvents are typical alcohols and glycols, and a few products also contain hydrocarbons and N-methylpyrrolidone. Alcohols and glycols, which are known from basic cleaning agents and products used for cleaning windows and mirrors, have a dissolving and therefore cleaning effect on oily and fatty substances. N-methylpyrrolidone is found in only one product, a paint- and varnish remover.

The acids are typically used in cleaning products for removing rust and chalk deposits, for example for cleaning sanitary appliances.

Most alkaline are sodium and potassium hydroxide, silicate and ammonia. The alkaline are typically found in the basic cleaning agents. Alkaline increase the pH value, which enhances the cleaning effect, especially the removal of fatty substances.

There are tensides in practically all cleaning products. Many different tensides are used. The common property of tensides is a reduction of water's surface tension, which helps loosen the dirt.

4.4 Working methods

Three observations have been made with registration of how the inside of a dwelling is cleaned for smoke and soot. In addition, the cleaning of movables in a company's workshop has been observed. All observations are with large companies; this is because it was difficult to find suitable times with the smaller companies because of the low number of after-damage cleaning jobs carried out by these.

During the visits, the cleaning agents used by the specific company were registered. The descriptions below are all based on the observations; the working methods in the companies not visited may well be different.

4.4.1 Cleaning of flat slightly damaged by smoke

The flat is on the upper floor in a block of flats of four storeys. The fire starts on the third floor and all flats on the upper floor are more or less damaged by smoke.

The inspected flat is only slightly damaged by smoke.

The specific after-damage company is called out to this flat only, while the other flats, the staircase and the lift shaft are cleaned by another company. The after-damage cleaning job is commissioned by an insurance company.

Only the clothes (cleaned in a dry-cleaner shop) and the Oriental carpets (cleaned in the after-damage company's workshop) are taken out of the flat. All other movables are cleaned on-site. After this, the cleaning job is essentially a washing down of all surfaces, furniture and equipment.

The cleaning products are from Knud E Dan, primarily A-16 Grundrens. In addition, Tæpperens is used.

A Vaportek Restorator is run outside working hours. This is a kind of odour treatment. The machine has a cartridge with odour, which is released through a ventilator in the machine. Because of the light degree of pollution the flat is not odour-treated further. The insurance company informs that fog-systems for removing malodour are used rarely and only in severe cases of smoke damage, or in buildings where other cleaning methods are not effective because of the way the building is constructed.

Photo 1: Mild odour treatment used in flat only slightly damaged by smoke. See text for explanation.

The cleaning agents are mixed by eye. The quantities for each specific task are not registered, but they are restricted to the smallest possible. The cleaners inform that the quantity of applied Tæpperens, for example, is minimal for each specific task because it is the foam that cleans the carpets. The only chemical substances in this product labelled with indication of danger are tensides.

The immediate evaluation is that the amount of cleaning agent left-overs in the flat after cleaning is very limited. All surfaces cleaned with basic cleaning agents are subsequently rinsed with water and no odour treatment using fog-system or similar methods are applied - only mild odour treatment.

The applied basic cleaning agent is labelled “irritant”. It contains strong alkaline (NaOH, metasilicate), tensides, glycols and citrates. The product contains only small amounts of organic solvents (glycols), and the applied quantity is assessed as being small. However, the actual quantity is not given.

4.4.2 Cleaning of soot-damaged flat

The flat has two rooms (app. 70 m^2) and is slightly damaged by soot caused by smoke entering an open window. The after-damage service job is commissioned by an insurance company. The windows are replaced before the cleaning takes place. During the cleaning, all movables are either stored in boxes in the flat or covered by sheets. Carpets have been removed from the floor. The residents live in the flat after the fire and are also present now and then during the cleaning.

The cleaning

All rooms are cleaned. There were two cleaners on the job, which is estimated to take one working day.

The living room and the bedroom are first vacuumed and all woodwork is washed down. After then it is decided whether it is necessary to wash down the walls.

In the kitchen, the bathroom and the corridor all surfaces are washed with mop or cloth. For the washing, Hydrosol is mixed with water in a ratio of approximately 1:20. Hydrosol is an alkaline cleaning agent without labelling with indication of danger. The product contains tensides, soap, citrates, glycolic ether and alkaline. 20 l of the Hydrosol solution is mixed with 30 ml Vaportek SOS to be used for odour treatment. At the end it is evaluated whether it is necessary to use Nautilus in a few places. The cleaners inform that Nautilus burns off the soot that has not been removed by the washing. This hinders the soot to come through the new cover of paint. Nautilus is an alkaline cleaner labelled “irritant”. It contains strong alkaline (NaOH, metasilicate), glycols, tensides and phosphates. Kalcinol, which removes chalk and rust, is used to remove chalk deposits in the bathroom. This product contains phosphoric acid, glycols and tensides. At last Polermix is used to polish mirrors and windows. This product is not labelled with indication of danger. It contains alcohols, glycols, tensides and a small amount of ammonia.

Photo 2: Cleaning of ceiling in soot-damaged flat.

Photo 3: Soot has got in cupboards and drawers – here some loose shelves from a kitchen cupboard.

All walls and some of the woodwork are going to be painted by a professional painter.

The cleaners estimate the total amount of cleaning products for the whole flat to be: 3 litres of Hydrosol, no Nautilus and ¼ litres of Vaportek. For a very soot-damaged flat of the same size, it is estimated that the cleaning would require 10-15 litres of Nautilus.

The cleaners inform that if the fire-damage is severe, then it will usually take 3-4 months before the residents can move back into the flat after the fire. In this case the cleaning takes place relatively soon after the damage. After the cleaning the carpenters get called in. All surfaces are usually painted at the end. Typically for soot damages, it will take at least 14 days after the cleaning before the residents can move back in.

4.4.3 Cleaning of villa after fire

The damages have started in a corner of the living room, where the ceiling and some of the rafters are burnt out. The living room is therefore severely soot-damaged. The kitchen, which is the closest to the living room, is less soot-damaged, and the other rooms in the house are the least damaged.

The cleaning is commissioned by an insurance company. There is only this one company on the job. The residents often stopped by while the renovations and the cleaning took place. It took several weeks before the family could move back into the villa.

The living room is emptied for movables. Some movables cannot be restored according to the insurance evaluation (these are placed in a waste

container to be burnt); the rest are transported in a closed container to the after-damage company's workshop for cleaning or treatment.

Carpenters have then removed the ceiling in the living room and repaired the rafters, after which the after-damage company has commenced the cleaning of the villa.

Photo 4: The fire started in the living room and burnt the ceiling. The carpenters have just repaired the damaged rafters.

The cleaning job then involves the washing down of all surfaces in the villa: walls, ceilings, cupboards, windows, window frames, etc.

For this primarily alkaline products are used in varying concentrations. Novis 139 (oil and soot remover) and Novis 128 (basic cleaning agent). The labelling of these products are "corrosive" and "irritant". The content is strong alkaline, glycols, tensides and furthermore 2-aminiethanol and ammonia. The product "Odour treatment with scent and disinfection", which includes acetic acid and scent among other substances, is added to the cleaning water. According to the cleaner, this gives a better result because it reduces the smell of smoke and soot. No other odour treatment, such as the release of scents, is used.

Novis 15 (corrosive acidic cleaning agent containing phosphoric acid, amine oxide and tertiary alkyl amine) is used for washing tiles and sanitary appliances. Odour is treated using Lugtfjerner with scent and disinfection (labelled "irritant", containing tertiary amine, fatty acid amine and perfume).

The cleaning agents are mixed by eye. The quantities of cleaning agents for each specific task are not registered.

Practically the same cleaning agents are used for the cleaning of movables in the workshop as in the villa. In addition, there are a few special products

available, and it is also possible to use ozone treatment of furniture and similar items.

At the time of the visit it was not clear whether it was necessary to apply odour treatment in the villa after renovation.

Photo 5: The skirting board is being cleaned.

Photo 6: The stone-washed wall is being cleaned using broom and cloth.

4.4.4 Cleaning of movables

Some movables are transported to the company for cleaning. The same cleaning agents are used here as in the residences.

Carpets are usually removed completely. Oriental carpets to be kept are sent to subcontractors.

Clothes are often sent to a dry-cleaner shop, but sometimes they are washed in washing machines in the after-damage company's workshop.

4.4.5 Odour treatment

Odour treatment of residences
One way of treating odour is to add odour-treatment products to the cleaning water during the actual cleaning. Another is to place odour bricks (e.g. Vaportek Neutrox Gamma Bricks, no classification) in the house after cleaning. These will dry out gradually and be removed by the residents. Finally, scents can be released from small or medium-sized machines with odour cartridges and a simple ventilator releasing the odour to the room.

If there is still a smell of soot after cleaning, an odour treatment is carried out. This involves an odorant, for example "tør lugtsanering (dry odorant)", which is vaporised in a machine to form a dense aerosol in the air.

The operator of the odour treatment machine uses a respirator, and the residents are not in the residence during the operation. The first step is to block all air passages to the residence. Then the fog (aerosol) is dispersed into the air for 15-20 minutes. After this the house is left for 24 hours. The after-damage company then airs the house and the residents can move back in immediately after. Odour treatment using the fog system as described above develops quite a lot of smoke, which is why the local fire service is informed prior to the event.

In severe cases of malodour, ozone created by generators can be applied.

Odour treatment of movables
Some movables, for example sofas, textiles, clothes, textiles and books, are odour-treated in the after-damage companies' workshops. Alron tør lugtsanering, citrus, containing unspecified essential oils, is being used. The movables are placed in a room or a container. Then the fog (aerosol) is dispersed into the room or container, which is then closed for 24 hours. After a good airing the movables are ready for delivery. However, often it will take longer before the house is renovated and the movables can be returned. Ozone produced by ozone generators can also be used.

Photo 7: Odour treatment can be carried out using a so-called fogger. The machine is a kind of petrol-driven jet engine, where the scent is added under pressure to the engine's exhaust pipe, generating a fog of small particles in the air.

Photo 8: Movables with a smell of smoke is being treated in this container. Note the strong development of smoke from the fogger.

4.4.6 Discussions

The after-damage companies' use of cleaning agents varies largely. Some companies use a very limited number of products, while other companies have a wider range of products, including more specialised products. The wider range of products reflects the fact that the cleaning involves both

treatments of soot and fire damages as well as ordinary basic cleaning of the entire residence, including for example the removal of chalk deposits in the bathroom.

The applied cleaning agents can be divided into three categories:
1. Ordinary household cleaning products.
2. Harsher cleaning products used for basic cleaning.
3. Products developed specifically for the task.

The cleaning is carried out largely by use of ordinary daily cleaning aids such as cloth, bucket, broom, vacuum cleaner, microfiber cloths. Only limited quantities of cleaning products were used during the observations.

The residents were present and the movables were in the home, while two of the observed cleaning jobs were carried out.

The companies inform that in most cases all surfaces in the home are painted after the cleaning. Thus, the cleaned surfaces will get a cover of paint before the residents move back in. Usually it takes at least 14 days before the residents can return.

Many companies use a so-called odour treatment, which is part of the after-damage cleaning. The degree of odour treatment depends on the severeness of the damage. The applied scents (essentially oils) are made up of several chemical substances. Essential oils evaporate over a long period of time and are often known to cause allergic reactions, and many are irritant for the airways.

Quantities of cleaning agents
The observations showed that the applied cleaning agents generally were not measured precisely. A few did, however, use the recommended mixing ratios given by the suppliers.

One company has indicated estimated quantities of cleaning agents for cleaning a soot-damaged flat at two different degrees of damages (light and severe). For the cleaning of a smaller, but severely smoke-damaged flat, the estimate amounts to 10-15 litres of basic cleaning agents of a type which is labelled Xi – Irritant.

None of the companies visited registered the quantities of used cleaning agents, odorants, etc. for each specific cleaning job.

It has not been possible within this project to give a general overview of the total amount of used cleaning agents.

How "dangerous" are the used agents?
The proportion of products labelled with indication of danger is estimated to be higher than among ordinary household cleaning agents. Of a total of 82 products, 43 are labelled with indication of danger. Of these 43 labelled products, 13 are labelled C – Corrosive.

This means that the exposure of the cleaners to dangerous chemical products can be higher than for cleaners doing traditional cleaning jobs. It is important for the cleaners to avoid skin and eye contact during the cleaning when working with irritant and especially corrosive products.

Fifteen of the not labelled products are odorants. All these products contain a larger or smaller amount of essential oils (scents). Their purpose is to remove, reduce or mask the smell of smoke. Many odorants are known to be able to cause allergic reactions. However, none of the odorants in the registered products are given the r-phrase R43 “Can cause allergic reactions at skin contact” by the producer or supplier.

Effect on the indoor climate
A possible chemical effect on the indoor climate after the cleaning after fire or smoke damage can come from:

- Tensides
- Alkaline
- Acids
- Solvents
- Odorants

Tensides
Tensides are non-volatile. However, there might be remnants on surfaces and in textiles, from where they can be released either as pure substances or bound to the surfaces of dust particles.

Most of the registered tensides are labelled Xi – Irritant, and a potential release of dust containing remnants of tensides would therefore be able to irritate eyes and mucous membranes.

Alkaline
The alkaline are corrosive, and remnants of alkaline on surfaces and in textiles would therefore be able to irritate eyes and mucous membranes. Of the alkaline used only ammonia is volatile.

Acids
Phosphoric acid, citric acid and glycolic acid are the most common acids in products used for cleaning after fire or smoke damage. Acids are much more common in products used for sanitary cleaning. Effects on the indoor climate could possibly happen if there are remnants of the cleaning agents on the surfaces and these are not rinsed properly before use.

Solvents
Small amounts of solvents can reduce the quality of the indoor climate. The applied solvents are alcohols and glycols. The applied alcohols are all volatile, and it is therefore expected that they will be fully released from cleaned surfaces relatively quickly. Glycols, however, evaporate slowly, and there is therefore a risk that cleaned surfaces will slowly release cleaning agents to the indoor air and in this way reduce the indoor climate during a shorter or longer period.

Odorants
Odorants (essential oils) is used in cleaning water with the purpose of removing the smell from sot. Furthermore the oil is evaporated or mechanically distributed to the surrounding as dust or aerosols. This is done in residents and in treating movables as well. Odorbricks can be left in the resident and can be present when the residents move back. Odorants are usually not very volatile and release of odorants from cleaned surfaces,

odour-treated rooms or from odour-treated movables can in principal affect the indoor climate during a longer period.

4.4.7 Overall evaluation

Remnants of tensides, alkaline and solvents from basic cleaning agents used for cleaning surfaces can in principal possibly affect the indoor climate by being released to the air as particles or bound to the surfaces of dust particles.

Based on observations, it is evaluated that the cleaners are efficient at rinsing and drying surfaces and in this way avoiding leaving remnants of cleaning agents on the surfaces; otherwise the surfaces would not look clean. The same evaluation is valid for the acidic sanitary cleaning agents, which in theory can leave remnants of non-volatile acids on the surfaces of the toilet and in the bathroom.

It is evaluated that there may be a certain risk that slowly evaporating odorants from cleaning agents and odour treatment products can be released to the indoor climate during a period of time after the cleaning, or after the odour treatment. Furthermore, there is a risk that people with allergic reactions to smell (Multiple Chemical Sensitivity MSC) (4) will be affected by the odour possibly left after the cleaning or after the odour treatment. It should be noted that The Environmental Protection Agency recommends consumers to use cleaning agents without odorants. It has also during several years been recommended to avoid perfume and scents in professional use of cleaning agents in order to reduce the risk of skin problems among cleaners.

It is evaluated that the largest effect on the indoor climate will happen after cleaning of a residence severely damaged by soot, where:

- surfaces and movables are not damaged to such a degree that they will be replaced
- everything is washed down.
- contents, including many textiles, are cleaned and odour treated
- and the residence is finally odour treated.

5 Further investigations

This project has shown that if a more in-depth assessment of the effect of cleaning agents on the indoor climate where to be made, it would be crucial to include the odorants and evaluate their evaporation rate and health effects.

It could be relevant to carry out a closer investigation of the applied odorants' health effects, for example by literature search, toxicological assessment and by evaluation of the time that the odorants will be present in the indoor air, for example by measuring the contents of volatile and semi-volatile organic compounds (VOCs and SVOCs) in the indoor climate.

6 Literature

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3. Rengøringsbranchens APV og den gode arbejdsmiljø standard – Industri- og skadeservice. Branchearbejdsmiljørådet for service- og tjenesteydelser. 2002.

4. Miljøprojekt nr. 741, Duft- og kemikalieoverfølsomhed, Miljøstyrelsen 2002

Use of cleaning agents in cleaning after fire or smoke damage – concerning the cleaning of private homes only

After-damage company_____**Department**_____

How many after-damage cleaning jobs after fire in private homes do you carry out per year?_____

Cleaning agent - name	**Supplier – where do you buy the product (possibly own import from abroad)**	**Address and telephone number of supplier**	**In which concentration do you use the product?**	**How many litres of concentrate are used per cleaning job?**	**How many litres of concentrate do you use per year?**	**Product purpose** ***See the list on the next page***

Date_____**Completed by:**_____

List of product purposes

- Chalk and rust remover
- Cleaning agents – acid and alkaline
- Floor soap
- Glass polish
- Toilet cleaner
- Scouring powder
- Soot remover
- Disinfectant
- Paint and graffiti remover
- Foam reducer
- Odour or perfume
- Oil remover
- Odour treatment
- Other

Annex A

Cleaning companies

Cleaning companies included in this project
Dansk Industri & Skadeservice ApS
Dansk Ventilation- & Industrirengøring ApS
H. H. Totalrengøring I/S
Industri Skadeservice VEST
ISS Skadeservice
JS Industri- & Skadeservice ApS
Lev-Rent ApS
NERIS Skadeservice
Nordic Industri & Skadeservice
Polygon/Munters A/S
Røsva Skadeservice
Skadeservice Danmark
SSG/SkadeServiceGruppen A/S
Super 1 Skadeservice
Thorøs Industri- og skadeservice ApS
Totalrengøring ApS
Totalservice Industri- og Skadeservice
Tune Skadeservice
VSS Vestjysk Service Selskab ApS
Wax Rengøring

R-phrases

R-phrases	Text
R10	Flammable
R22	Harmful if swallowed
R23	Toxic by inhalation
R31	Contact with acids liberates toxic gas
R34	Causes burns
R35	Causes severe burns
R36	Irritating to eyes
R37	Irritating to respiratory system
R38	Irritating to skin
R41	Risk of serious damage to eyes
R65	Harmful: may cause lung damage if swallowed
R20/21/22	Harmful by inhalation, in contact with skin and if swallowed
R36/37	Irritating to eyes and respiratory system
R36/38	Irritating to eyes and skin
R36/37/38	Irritating to eyes, respiratory system and skin
R37/38	Irritating to respiratory system and to skin