

PREVENTIVE PRODUCT SAFETY ANALYSIS
– HINTS ON RISK MINIMISATION IN
PRODUCT DESIGN BY EXPLORATIVE HLA
(EHLASS) DATA ANALYSIS

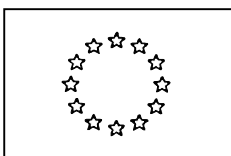
Final Report

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EXECUTIVE SUMMARY

EHLASS, the European Home and Leisure Accident Surveillance System, was originally meant for improving product safety by monitoring accidental injuries related to consumer products. The main **objective** of this project was to evaluate the potential of the current ISS, the EU Injury Surveillance Systems (formerly EHLASS) to serve this purpose.

In particular, the project team consisting of product safety experts from France, Greece, Netherlands, Sweden, and Austria conducted a comprehensive analysis and interpretation of product information in the current EHLASS / ISS data. This "Preventive Product Safety Analysis" consisted of:

1. a comparative review of product involvement or cause of accident classification in injury surveillance systems
2. the development and pilot software implementation of an EHLASS / ISS specific product involvement classification (Product Involvement Factor PIF and AUTO-PIF software, which is based on multi-lingual keyword search in the free text accident description of the EHLASS records)
3. the development and pilot application of a standard reporting scheme for EHLASS / ISS product information based on indicators of frequency, severity and product causality ("product safety priority table"; this table was complemented by a literature review of product safety research and initiatives)
4. the assessment of preventability and possible safety solutions for a sample of EHLASS case files produced by the PIF software ("product safety expert panel")

The proposed PIF classification (steps 1 to 2) consists of six distinct "factors" of product involvement (PIF 1-7). These factors provide both an implicit product definition and a qualification of product involvement; its automatic application to four national EHLASS data sets yielded the following **results** (AT, FR, NL, SE):

- in 85 % of cases a "Manufactured product was involved" (PIF 3-7; range 66-94%)
- in 19 % of cases the "Product role was clearly identified" (PIF 3-6; range 16-24%)
- in 5 % of cases "Product causality was likely" (PIF 4-6; range 1-11%)
- in 2 % of cases the "Product was potentially defective" (PIF 4; range 0,4-4%)

Within manufactured products only (PIF 3-7), 17% are proximity products and 5% are "causality products" (PIF 4-6: defective products, maladapted, high risk). In comparison to manual product involvement classification (from step 1: international review) the AUTO-PIF tends to underestimate the share of products "causality products" by a factor of two.

The proposed "Product safety priority table" (step 3) was applied to the same four EHLASS data sets and yielded the following top ten "priority product categories":

Product Category (top ten; EHLASS V.96 1. digit)	Rank [1-24] *			
	Fre- quency	Severity	Product Causality	Average (Priority)
Other and unspecified product	1	3	17	7
Electric equipment primarily for use in household	6	14	2	7
Human being, animals, animal articles	5	10	13	9
Part of building and stationary furniture	3	7	18	9
Food, beverages, tobacco	14	11	4	10
Chemicals, detergents, pharmaceutical products	16	4	10	10
Stationary equipm., processed and natural surface – outside	2	8	20	10
Medico-technical equipment, laboratory equipment	23	6	1	10
Natural element, plants and trees	15	9	8	11
Domestic appliances and equipment	12	15	6	11

* Rank 1 = highest, rank 24 = lowest; e.g.: Product Category "Electric equipment" has rank 6 in frequency, 14 in severity, 2 in causality and 7 on the average of all three indicators; possible ranks are 24, corresponding to the no. of product categories

After applying the PIF-intrinsic product definition to this table (excluding non-manufactured products, basically) and adding the indicator on information need (no. of publications) the following product categories und generic products have been exemplified as "priorities" for product safety research:

- Machinery for industry, handicraft and hobby: Manual garden tool, Mechanical Craft tool/implement, Chain saw
- Electric household equipment: Major electric household machine, Cooker/oven, Electric iron, Barbecue grill
- Domestic appliances and equipment: Coffee pot, Unsp. non-fixtures, Pressure cooker
- Furniture and textile: Cot/cot bed. Baby bouncer (hanging), Carpet strip/grip
- Industrial installations, stationary installations for water, sanitation and electricity: Boiler, stationary electric installation
- Packaging and containers: Aerosol spray, Container, Tins
- Medico-technical equipment, laboratory equipment: Thermometer
- Chemical products, detergents: Pharmaceutical products, Soap, polish and detergent

The causality indicator was derived from the Product Involvement Factor (PIF); products in accidents assigned to PIF categories 4 to 6 were considered to have a high likelihood of causal involvement (summarized as "product causality likely“):

PIF categories	Most frequent products in sample (% within PIF category)
PIF 1 – No product involved	-
PIF 2 - Product non-manufactured	-
PIF 3 - Product related to proximity	27% Stairs, indoors; 19% Processed surface, outdoors; 11% Floor, flooring, indoors, unsp.; 10% Pavement, snow/ice covered
PIF 4 - Product potentially defective	2% Bicycle; 2% Drinking glass; 1% Door with glass; 1% Bowl, dish; 1% Sledge; 1% Fireworks; 0% Boiler; 0% Swing
PIF 5 - Product potentially maladapted:	3% Bicycle (adult); 2% Angle grinder; 3% Passenger car, Car door; 1% Skate, unsp.; 1% Walking frame (with wheels); 1% Rugs, mats; 1% Slicing machine; 1% Sewing machine
PIF 6 - Product with high intrinsic risk:	4% Knife; 3% Firewood; 3% Fats and oils; 2% Electric iron; 1% Angle grinder; 1% Can; 1% Drinking glass
PIF 7 - Product identified but description inadequate to enable a judgment	-

In step 4 of the analysis the "product safety expert panel" assessed preventability and possible safety solutions in a sample of PIF case files (of four national EHLASS data sets):

- the majority of accidents (56%) was attributed predominately to behavioural causes
- 12% were considered to be preventable by a current technical safety solution,
- 4% by a potential technical safety solution
- the share of cases with "not enough information" was 16%

The highest share of accidents that were considered to have a "potential safety solution" was found in the PIF categories 4, 5 and 6 (product involvement likely to be causal). However, as the following examples show it was not possible to devise safety recommendations for specific cases beyond a very general level (mainly because of the limited information on product involvement in the accident description):

Product	Safety Recommendation (derived from free text description of cases in PIF categories 4-6 "product causality likely“)
Product unspecified	Use of safety glass in glass doors
Circular saw	Improve design of safety mechanism of saw
Moulding machine	Redesign of milling cutter? Safety adjustment on milling cutter
Other sp. fixed machine	Redesign of hydraulic wood cleaver; Redesign of wood cleaver
Electric heating blanket	Prevent blanket from overheating
El-grill, separate	improve stableness of product
Fireworks	Highlight fireworks safety information
Other sp. product	Risk assessment of Boiler for wood chips
Product unspecified	Place limit on temperature of hot water boilers
Sawing tool, mechanical	Redesign of product or better maintenance
Sledge	Manufacture all sledges with brakes and steering
Slicing machine	Improve product design to include safety features

Based on the results of the PIF analysis (steps 1-3) the expert panel drew the following **conclusions**:

- in general, the product information recorded in the current EHLASS / ISS data sets can be extremely useful for monitoring product involvement on a generic level. The "product safety priority table" is recommended as an indicator-based reporting tool (indicators of frequency, severity and causality). Used as such, it provides a broad empirical framework for product and consumer safety research. However, the lack of an underlying product definition, inconsistent product coding and little specific product information in the accident description impose major restrictions even on this "high level" reporting functionality.
- technically, the key-word based PIF procedure (PIF classification and AUTO-PIF software) is a practical and useful tool to preselect EHLASS / ISS cases by type of product (simple product definition) and product involvement (causality indicator). The rate of "false" PIF assignments is tolerable, and the accumulation rate of "true" (product relevant) cases is considerable. The multi-lingual and flexible design of the PIF software allows for easy adaptation to any national data set.
- product oriented assessment of preventability and specific safety solutions in individual records proved to be very difficult. The safety expert panel concluded that the EHLASS case files (free text description in combination with other data) in their present form contain little information, and certainly no systematic information, to classify the role of products unambiguously. Thus, in most cases (with likely causal product involvement) only very general safety recommendation could be given.

However, the literature review confirmed that EHLASS / ISS are the only available instrument to provide an empirical background in injuries related to (consumer) products on EU level. The following recommendations by the project team might help to overcome the structural and quality-linked restrictions (mentioned above) that currently keep EHLASS / ISS from being more widely used as a product safety tool (the recommendations are put as "instructions" to the product safety part of the EHLASS / ISS administration on EU level):

- introduce a product concept and a product definition that is linked to the EU product safety legislation
- reduce the number of products in the product list (e.g. to three digit level)

- instead, add a cause variable and/or product “flag” to the list of variables (e.g. like the PIF classification)
- only in case of product causality (product flag on), ask for some specific and standardized product information
- the “flagged” cases could immediately be forwarded to the scrutiny of the national data centers (and also to EU level subsequently – allowing for rapid reaction)
- generally, structure and standardize accident description (“free text”) to allow for better comparability and guarantee information *additional* to the codes

For the moment, also the tools developed by product safety expert panel might enhance the utility of the current EHLASS / ISS data:

- implement and “enforce” common coding and quality standards (through guidelines)
- provide all accident descriptions (free text) on HIEMS / ISS level in English (the feasibility of machine translation for this purpose is shown in this report)
- implement the EHLASS-based indicators on severity (SSDR) and causality (AUTO-PIF) on HIEMS/ISS level and use the "product safety priority table" as a reporting tool

The AUTO-PIF software **tool** for the automatic categorisation of EHLASS cases according to the PIF (Product Involvement Factor) will be available on the CIRCA website of DG SANCO: <http://forum.europa.eu.int/Members/irc/sanco/ehlass/home> (the current version features automatic PIF classification of EHLASS V.96 data, choice of either EHLASS product fields 1, 2 or 3 for PIF-classification, dynamic update of keywords, multi-lingual keyword search and output of case files for preventive safety analysis; for Win95, 98, NT, 2000).

Keywords: product safety, epidemiology, prevention

PROJECT MANAGEMENT

- **Project co-ordination:**

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- **Partners:** DK, FR, GR, NL, SE, DE (see following chapter for details)

- **Revised Timeline:** Dec. 2000 to June 2002

- **Proposed total budget:** 127.000 EUR

- **Contracted funding:** 70 % of total costs

- **Partner Involvement:**

- Two workshops (all)
- Two work packages (all)
- Software: engineering and programming (FR)
- Product safety expertise (NL, AT, SE)
- Review of results and final reports (all)

- **Proposed task list**

Phase I: Implementation of project co-ordination and task forces

- Data acquisition and retrieval task force (this project partners)
- Free text and linguistic analysis task force (this project partners + ext. experts)
- Product safety and risk assessment expert group

Phase II: Data acquisition and/or accession

- Acquisition and/or accession of HLA raw data (incl. free text)
- from partners states and the European HLA database (DG SANCO).

Phase III: Development of the Product Involvement Factor (PIF)

- Correlation analysis of product variables
- Free text analysis (French and Austrian data)
- Defining and operationalising “product-involvement” and “causality categories” (technical defects, inappropriate use, miss-use etc.)

- Programming of “PIF”-tool

Phase IV: Translation, pilot implementation and testing

- Translation of “product factor” tool, implementation and testing at partners’ HLA data collection centres

Phase V: Dissemination of PIF-software

- Upload of “product-involvement-factor” software to the DG SANCO IRC and dissemination of among the IPP HLA network

Phase VI: Expert risk assessment

- Evaluation of the “product-involvement-factor” for a selected group of products by expert opinion

Phase VII: Final report

- Final report on the general exploitability of HLA data in regard to product safety and the added value of the “PIF” in this respect

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INTRODUCTION

CONSUMER POLICY BACKGROUND

"EU consumer policy should provide essential health and safety requirements and safeguard economic interests to ensure a high level of protection and meet the expectations of citizens throughout the EU. **Products and services placed on the market should be safe** and consumers should receive the relevant information to make appropriate choices." This is how the scope of EU consumer policy is described in a recent communication of the Commission¹.

Specified in the "Consumer Policy Strategy 2002-2006" is a reinforcement of the rapid alert system and a continuation of data gathering of product-related injuries. The Commission values the Home and Leisure Accident database (EHLASS/EUPHIN HIEMS and Injury Surveillance System (ISS)) conducted by the Injury Prevention Program (IPP) to collect, assess, and exchange data on product-related injuries: "Collecting and exchanging at EU level such information is also important in order to contribute to ensuring a consistent enforcement of Community provisions on product and service safety"². Re-introducing injury data collection, namely EHLASS, as "a cornerstone for consumer policies" within the new Consumer Policy Action Plan has also been stipulated by European consumer safety agencies in the "report on policy modelling"³.

An implicit aim of this study is to propose recommendations on how to reconcile both consumer policy (former EHLASS) and public health requirements (ISS within the NHP 2002-2006) on home and leisure accident data collection.

SCIENTIFIC BASES AND AIMS

As a heritage of the former EHLASS (DG XXIV, Consumer Safety) which is referred to as the home and leisure accident (HLA) data collection within the IPP and the New Public Health Program subsequently, up to four product-related variables are recorded⁴. In fact, the current HLA or ISS data matches the former EHLASS data, owing most of their specificity to these product-related variables. The shortcomings of the EHLASS in terms of representativity, comparability, and quality control are well documented and are being addressed by various IPP projects⁵⁶⁷⁸.

The general objective of this study was to focus on EHLASS data specificity and to evaluate and review the potential of these data as a means of improving product safety – as required by consumer policy⁹¹⁰. We proposed a **post-hoc study on recent EHLASS data** to identify cases with relevant product involvement and to analyze case information for hints on reduction of product risks:

- to narrow in on accidents with an substantial contribution of a product („dangerous products“) – rather than referring to all EHLASS cases as product-related - accidents were to be classified into “causality categories” (e.g. technical defect or maladapted usage) by a **product-involvement-factor (PIF)** that accounts for the actual contribution of the product to the accident and/or the injury:
- the safety potential of „dangerous products“ identified and classified by the PIF was to be judged by expert opinion according to product causality and general preventability (**product safety priority matrix**).

Technically, the study resulted:

- in an **easy-to-use software for automatic classification of EHLASS / ISS cases** by multiple key words in the accident narrative (AUTO-PIF)
- and a **procedure to access multilingual EHLASS / ISS data** by unilingual key word search (AUTO-TRANS)

METHODS

REVIEW OF PRODUCT INVOLVEMENT CODING

As a basis and template for classifying product-related accidents into “causality categories” such as technical defect and general design deficiency, we performed an international review of available product involvement classifications in injury registration systems.

PRODUCT INVOLVEMENT CLASSIFICATION

GENERAL PRODUCT INVOLVEMENT CLASSIFICATION

Taking into account the results of the international review of available product involvement classifications the coding expert group (AT, NL, SF, DK, GR) "standardized" product involvement and proposed a general product involvement classification¹¹. This procedure comprised

- designing the classification: considering dimensionality, hierarchy and exclusivity
- defining categories: considering redundancy and operationability
- giving examples for categories: that are frequent, typical and unambiguous
- operationalising category definitions: this was done for the EHLASS / ISS by key-word-matching
- testing and evaluating of the classification was done by the safety expert panel in analysing the results of the AUTO-PIF software (Automatic Product Involvement Classification; see next Chapters).

PIF - PRODUCT INVOLVEMENT FACTOR FOR THE EHLASS / ISS

The EHLASS accident description ("free text" or narrative), consisting of a short description of the accident by the patient (up to 120 characters), has not yet been systematically analyzed for its added value in classifying and clustering cases by product safety criteria. Therefore, to implement the general product involvement classification for the EHLASS / ISS data (operationalisation of codes) the method of **key-word-matching** with the accident description field was chosen:

- pre-classified cases in the Austrian EHLASS 2000 data set (accident classified as due to 'technical cause' by the interviewer) were analyzed in order to devise a list of **keywords** for each product involvement category, **which indicated a tie between the product involvement category and the case.**
- to exemplify **multi-lingual usage** the key words were translated from **English** into the following languages: **German, French, Swedish, Greek, and Dutch**¹².

Data used

- standardized EHLASS V.96 data (all databases) for the years 1998 and 1999 was used for the descriptive analysis of product information and free text analysis (by permission of DG SANCO and by courtesy of the Landesinstitut für den Öffentlichen Gesundheitsdienst - Bielefeld)
- EHLASS Austria V.86 data for the year 2000 was used for the key-word-definition (by permission of Institute "Sicher Leben")

AUTO-PIF Software - Automatic Product Involvement Classification

One objective of the study was to identifying cases with relevant product involvement in the vast number of records in the EHLASS databases and to "feed" this case information to product safety experts for product risk assessment. In order to fulfil this objective we designed an **easy-to-use software for automatic classification of EHLASS / ISS cases** by multiple key words in the accident narrative or "free text" (AUTO-PIF). To our knowledge the free text has not yet been systematically "exploited" for this purpose so far. The software was realised in collaboration with the French partner, Marc Nectoux.

The AUTO-PIF software is a tool for the automatic categorisation of EHLASS cases according to the PIF (Product Involvement Factor), developed by the coding expert group. The AUTO-PIF assigns a PIF category to each case found according to an algorithm that makes use of the EHLASS product fields and applies the list of key words provided to the accident description field, also called "free text" or narrative). The list of key words is multilingual and interactive, meaning it can be updated, edited at any time by the user. **The complete features that the PIF software should finally show were**

- automatic PIF classification of EHLASS V.96 data
- choice of either EHLASS product fields 1, 2 or 3 for PIF-classification
- dynamic update of keywords
- multi-lingual keyword search
- output of case files for preventive safety analysis

The current version of the program can be run on Windows® operated PCs (Win95, Win98, 2000) and will be available on CD-ROM and as download from the CIRCA website:

- see chapter Products and Tools for an AUTO-PIF description and user manual
- to order the AUTO-PIF on CD-ROM contact: robert.bauer@sicherleben.at
- to download the AUTO-PIF from the internet go to:
<http://forum.europa.eu.int/Members/irc/sanco/ehlass/home> (available starting Oct. 2002)

AUTO-TRANS Procedure - Searching Multilingual Data

As mentioned above, the key words used in the AUTO-PIF software are multilingual because international data were used as input files. This enables the user to identify cases in a variety of languages (AUTO-PIF key words can currently be applied in German, French, Swedish, Greek, and Dutch to the respective EHLASS data sets). However, the limitation is that the even if a key word is known to the users in several languages they may not be able to read the entire free text in order to gain more details about the output cases.

To provide means for analysis of multilingual free text, as is the case in the ISS database, we investigated the possibilities of machine translation (automatic translation of words or text by a computer program) of the entire free text (accident description field) in a given national EHLASS data set. The goal: **make the multilingual free texts in the ISS data available in one language** (e.g. English).

- we completed a search of multilingual machine translation software available on the market
- and also researched the translation tools used by the European Commission (Systran Machine Translation¹³)

Considering the ownership and future availability of the software we decided – if possible - to use the European Commission's Systran Machine Translation. Upon request the Commission allowed us to utilise the program for the duration of our project. This enabled us to translate the French, Dutch and Austrian free text cases into English. **As a pilot – the Dutch, French and Austrian EHLASS files – containing both the original free text and its English machine translation – are available for free text search in English within the current AUTO-PIF software.**

- see chapter Products and Tools for a description of the AUTO-TRANS procedure

EHLASS / ISS CASE STUDIES

THE PREVENTIVE SAFETY EXPERT PANEL

After narrowing in on accidents with a substantial contribution of a product („dangerous products“) by means the AUTO-PIF program, the **second objective** of this study was **to analyse the case information provided by the program for hints on improvements of "safety design" of involved products.**

We asked product safety experts in Sweden, the Netherlands and Austria to serve as our preventive safety expert panel:

- Dirk van Aken: Consumer Safety Institute, Technical Safety Unit. Amsterdam, Netherlands
- Henrik Nordin: Konsumentverket, Stockholm, Sweden
- Gert Adler, Ursula Bodisch: Institut "Sicher Leben", Vienna, Austria

The experts were presented the AUTO-PIF results and asked for recommendations on improving the safety of products identified by the PIF software. In order to summarise the various results gathered from analyses, the "Preventive Product Safety Matrix" was created.

PREVENTIVE SAFETY ANALYSIS - TASKS AND CRITERIA

In the USA, within the National Electronic Injury Surveillance System case information of a sample of accident and emergency-treated injuries is transmitted online on a daily basis to a central office of the Consumer Product Safety Commission for judgement of consumer product involvement - and immediate reaction if deemed necessary by the investigator¹⁴. In the EU, EHLASS / ISS data is collected in a similar way and immediate judgement of the role of a product (causal or not causal) in the recorded accidents was possible. However, no such (online) system has been established in a Member State nor at the EU level yet. For rapid reaction on "dangerous" consumer products (under the General Product Safety Directive that are reported to be on the market the EU uses the Rapid Alert System termed 'RAPEX', which is based on notification of the European Commission Directorate General for Health and Consumer Protection by a Member State.

Thus, the EHLASS / ISS in its current form is mostly used to gain insight into the "epidemiology" of product related accidents and injuries rather than to find and react on dangerous products. Frequent questions in product safety that are well answered by EHLASS / ISS data analysis are:

- which products and product categories are frequently reported to be involved in accidents and injuries?
- how often is a particular product recorded?
- who are the victims (age, sex)?
- what type and how severe was the injury (type of injury, treatment)?
- what were the circumstances of the accident (time, activity, mechanism)?

These questions can now be answered very comfortably by an online query to the ISS database (through DG SANCO or the national ISS data administrators). Therefore in this report these questions are only addressed in detail. In this study we focused on the specificity of the product information in the ISS data and quality or causality of product involvement in particular.

From the product safety experts we expected to gain more information on questions like the following ones:

- which of these product-related accidents could be prevented by current or potential safety solutions?
- how difficult (technically or economically) would it be to apply these safety solutions?
- are there specific safety recommendations for certain products or product categories?
- what are the "priority" products that product safety research should address in the future because they their safety standards can still be improved?

Within the expert panel four criteria were chosen to define "priority" product category for preventive safety research. These criteria were said to constitute the "**Preventive Product Safety Matrix**" for a particular product or product category: The indicators on frequency, severity and causality are all based on EHLASS data, so that no external information is needed for calculation. Preventability was assessed in a separate qualitative way (see next chapter). Each (of three) experts was provided with a sample of 50 cases for each PIF category randomly selected from the respective national EHLASS data sets (NL, SE, AT; see table below).

Product (or Product Category)			
Frequency of related accidents	Severity of related injuries	Causality / preventability	Information Need
Share in all products or product categories	Synthetic Score of Relative Dangerousity (SSDR)	Share of "causal" Product Involvement (% PIF cat. 4-6)	Relative quantity of published reports or safety initiatives
The frequency of a product (involved in the accident) is also taken into account by the severity indicator.	The SSDR indicates the average severity of all injuries that are attributed to a particular product (using hospitalization rate and length of stay).	Causality was derived from the distribution of PIF categories within product categories (percentage of PIF cat. 4-6).	Literature search on reports on product safety research and initiatives by product categories in the European Consumer Safety Association (ECOSA) library (www.ecosa.org).

Figure 1: Preventive Product Safety Matrix - criteria chosen to define a "priority" product for preventive product research

Creating a Priority Score: Partner feedback warned of the difficulty in creating a priority score from all the information gathered, and questioned the usefulness of such a score regarding practicality and function outside of the project. While taking this into account, we believe it is important to summarize the results of the analysis within one component. Therefore we proposed

- to rank each indicator within product categories (24)
- and average individual ranks into a "priority score"

EHLASS PREVENTABILITY CASE STUDIES

Preventability Categories

For the preventability criteria, we gathered partner feedback to create **categories of general preventability** (Figure 2). These were used by product safety experts to ascertain preventability of the accident, based primarily on reading of the EHLASS free text, and integrating this with the age, sex, mechanism of injury, activity at the time of the injury, and the products involved.

General Preventability Categories	Definition and Examples
Category 1: Current safety solutions available	A product modification is available (as part of the product or as a separate add-on) which makes the scenario less likely or impossible to happen but was not utilized at the time of the accident (for example: stove protector, blade cover, safety latch, etc.).
Category 2: Potential safety solutions could be created	Improvements in safety design would be possible to create which would make the scenario less likely or impossible to happen, depending on innovation, revision of standards, etc. (historical <u>example</u> : blade protective cover for lawnmowers, separation between blade and knife grasp)
Category 3: Behavioral solution	More careful behavior by the consumer with the product (including use of personal protective equipment) is feasible and could be promoted by consumer education (<u>example</u> : ignorance of use, misinformed in use, wearing gloves or glasses in do-it-yourself tasks)
Category 4: No solution	No potential safety modification is available and the product is viewed as intrinsically risky
Category 5: Not enough information	No judgment possible due to lacking or insufficient information in the EHLASS record

Figure 2: Preventability categories used by product safety experts to ascertain preventability of the accident, based on information within an EHLASS record.

We are aware that it is difficult to standardize between expert raters their judgment as to what is *easily preventable* versus *very difficult to prevent* from such limited information within an EHLASS record. Nevertheless, we feel it is important for assisting in prevention policy to supply information not only about general preventability of a particular accident

case but also about the potential effort involved. Therefore we proposed the following **preventability effort category** and asked the experts to qualify each case accordingly.

- Easily preventable
- Preventable with some effort
- Preventable at considerable cost or with difficulty
- Not preventable practically

PIF Case Files

An important criteria of a "priority" product for preventive product safety research is preventability. Obviously, only products that can – at all and by reasonable efforts - be improved in terms of safety design (including ergonomic, consumer information and restricted availability) should preferably be addressed.

The initial hypothesis on preventability was that it would be correlated to the causality of a product in an accident. Causality in turn, should be qualified by the PIF, with the PIF categories 4 ("defective product") and 6 ("product with high intrinsic risk") indicating a high probability of products being causally involved in the accident. In order to test this hypothesis preventability analysis was performed within each PIF-category rather than within product categories. Each (of three) experts was provided with a sample of 50 cases for each PIF category randomly selected from the respective national EHLASS data sets (NL, SE, AT).

CASE FILE INFORMATION					
PIF code = 4	Sweden / Case 1 / 50				
Sex:	2 Female				
Age :	38				
Mechanism:	10 Contact with moving object				
Activity:	28 Do-it-yourself work, other specified				
Product1:	A1000 Plank, piece of a wood plank				
Product2:	A0020 Firewood				
Product3:	X0000				
Free Text:	STAPLADE VED OCH GOLVPLANKAN GAV VIKA. TRAVET FOLL OCH JAG FICK VEDKUBB I HUVUDET				
PREVENTABILTY ASSESSMENT					
Safety Solution Category	1: Current SafeSol	2: Pot Safe Sol	3: Behav Sol	4: No Sol	5: No Info
Score	1: easy	2: with effort	3: cost, difficult	4: not	
Safety recommendation					

Figure 3: Examples of case file information (SE) generated by the AUTO-PIF software and provided to the expert panel for preventability assessment (EHLASS data V.96 std. NL, SWE, AT 1998).

RESULTS AND MAIN FINDINGS

REVIEW OF PRODUCT INVOLVEMENT CODING

We performed a literature search for classification of product involvement world-wide. This search yielded five examples of injury registration systems that include a cause of accident classification with product involvement categories or a cause oriented product involvement classification.

1. Austria: EHLASS Austria, permanent hospital registration system (Figure 5)
2. Australia: Hospital registration system¹⁵ (Figure 6)
3. France: Study based on "manual" assessment of EHLASS France cases, hospital registration system (Figure 7)
4. Germany: EHLASS Germany, population survey with extended product safety questionnaire (Figure 8)
5. Luxembourg: EHLASS Luxembourg, population survey with extended product safety questionnaire (Figure 9)

There were differences in product definitions and product involvement concepts underlying the registration systems 1 to 5. Also the individual categories had different definitions and scopes. To facilitate comparison of results we created the following meta-categories (Figure 4):

- Product involved [a]
 - Product role identified [d]
 - Product causality likely [b]
 - Defective product [c]

The share of "product causality likely" ranges from 8% (Germany) to 16% (France). The share of "defective product" as a cause for the accident ranges from 1% (Austria) to 6% (Australia).

Product Involvement category (percentage of total)	Austria (1.)	Australia (2.)	France (3.)	Germany (4.)	Lux'bg (5.)	ALL (mean)
Product involved [a]	-	79%	-	-	-	79%
Product role identified [d]	-	33%	-	30%	-	32%
Product causality likely [b]	12%	14%	16%	8%	10%	12%
Defective product [c]	1,4%	6%	3%	4%	5%	4%
detail (% from c):						
- construction, material deficit	0,3%	-	-	5%	-	-
- worn out	-	-	-	3%	-	-
- failure / malfunction	1,1%	-	-	2%	-	-
- external influence	-	-	-	1%	-	-

Figure 4: Range of product involvement categories in five different injury registration systems. See text for legend 1.-5. and Figure 5 to Figure 9 for original categories.

The results for each of the five product classification systems (1.-5.) are given below; characters [a] to [d] indicate into which meta-category of Figure 4 the original classification category has been summarized (and Figure 5 to Figure 9):

Cause of Accident Categories (technical cause categories only)	Percentage
Defective Product [b,c]	1,1%
Product with Material/Construction Mistake [b,c]	0,3%
Misuse of Product	1,6%
Ground-related	5,4%
Unsuitable shoe wear	1,3%
Poor lighting	0,8%
Other technical cause, specified	1,8%
Other technical cause, unspecified	0,0%
Total Technical Cause (n=1.090) [b]	12,3%
Total sample, all causes (n=8.870)	100,0%

Figure 5: Product involvement classification and classification results in the EHLASS Austria; see Figure 4 for explanation of [a,b..] (EHLASS Austria 2000)

Product Involvement Categories	Percentage
None or incidental	21%
Involved by proximity [a]	19%
Involved but degree unclear [a,d]	46%
Design solution available [a,b,d]	8%
Failure / malfunction [a,b,c,d]	6%
Total (n = 3.091)	100%

Figure 6: Product involvement classification and classification results in Australia; see Figure 4 for explanation of [a,b..] (Monash University, 1995)

Cause of Accident Categories	Percentage
Accident linked to activity	32%
Potential risk product [b]	8%
Product risk possible [b]	5%
Product risk explicit [b, c]	3%
Accident linked to risk behaviour of user	6%
Accident linked to risk behaviour of a third party	3%
Accident due to external cause/ not explicit	38%
Lack of information	0%
Unknown	6%
Total (n = 1.000)	100%

Figure 7: Product involvement classification and classification results in the EHLASS France; see Figure 4 for explanation of [a,b..] (IPP Project Miama¹⁶)

Cause of Accident Categories	Percentage
Cause due to human behaviour (incl. maladapted usage)	25%
Physical, psychological factor (e.g. carelessness)	13%
Environmental factor (e.g. ground surface, weather)	7%
Technical defect of product [b,c]	4%
Construction defect (e.g. floor) [b]	4%
Mistake or inattention by another person	4%
Organisational defect	1%
Other cause	1%
No Cause available	0%
Total "product related accidents" [d]	30%
Home and Leisure Accidents (EHLASS; N=2.550)	100%

Figure 8: Product involvement classification and classification results in the EHLASS Germany (accidents related to products under the German Product Safety Law, GSG, cp. Figure 22; four causes allowed per injury; see Figure 4 for explanation of [a,b..]; BAUA, 1998¹⁷)

Product Involvement Categories	Percentage
Product defective [b,c]	5%
Utilization maladapted [b]	5%
Did not pay attention / careless	58%
Error, negligence by another person	13%
Instruction manual poor	0%
Other or not known	18%
Total cases (n = 533)	100%

Figure 9: Product involvement classification and classification results in the EHLASS Luxembourg; see Figure 4 for explanation of [a,b..] (EHLASS Luxembourg, 1998¹⁸)

Main findings on Review of Product Involvement Coding

- Five examples of injury registration and surveillance systems that use explicit product involvement categories were found: EHLASS in Austria, Germany, Luxembourg, France (Pilot); VISS in Australia.
- Practically, all product involvement classifications are used to get a “post hoc epidemiology” of involved products, and not as “ad hoc marker” for preselection and further inquiry of relevant cases for product safety research.
- Differences in the classification systems seem to reflect different concepts of product involvement and causality of the product in an accident (whether behavioral or product features are considered more relevant). Only in the German study a multifactoral model was applied, allowing for up to four different causes.
- As a consequence categories for product involvement and causality vary from explicitly product oriented categories like "product defective" to categories like "product related to proximity” that only vaguely attribute a role to the product involved.
- General involvement of a product ("product somehow involved") in an accident ranges from 79% (Australia; including “proximity” and “unclear” involvement) to 30% (Germany, with products of a product that are covered by German product safety law, GSG).
- The involved product as a main cause of the accident ("product causality likely") is quantified with a range from 8% (Germany) to 16% (France) of all accident cases.
- "Defective product", the most comparable category still, ranges from 1% (Austria) to 6% (Australia) of all accident cases.
- The most detailed classification and analysis of product involvement can be found in the German study.

EHLASS / ISS DATA ANALYSIS

PRODUCT RELATED INFORMATION IN THE ISS DATA SET

Frequency of product related accidents

Product Category of product involved in the accident	%
Other and unspecified product	26%
Stationary equipment outside, processed surface outdoors and natural surface	15%
Part of building and stationary furniture	12%
Sports equipment	8%
Human being, animals, animal articles, human and animal tissue fluids	6%
Electric equipment primarily for use in household	6%
Furniture and textile	5%
Raw materials, structural elements	4%
Means of transport	3%
Machinery for industry, handicraft, and hobby	2%
Clothing, baby caring articles and personal effects	2%
Domestic appliances and equipment	2%
Part of building - Other stairs	2%
Food, beverages, tobacco	2%
Natural element, plants and trees	1%
Chemical products, detergents, pharmaceutical products	1%
Packaging, containers	1%
Industrial installations, stationary installations for water, sanitation and electricity	1%
Toys	0%
Office and shop furniture	0%
Medico-technical equipment, laboratory equipment	0%
Musical instrument, photographic/optical equipment	0%
Total (100%)	467.839

Figure 10: Cases in EHLASS V.96 std. product categories for "product 1" (product involved in accident). EHLASS AT, BE, DK, ES (prod 2), FI, FR, GR, IE, IT, NL (prod 3), PT, SE, UK, 1998.

The EHLASS data set comprises up to four product related variables:

- Product 1 "product involved in the accident"
- Product 2 „product causing the injury“
- Product 3 „other product“
- Free text description of accident

In the EHLASS coding manual V.96 about 1500 different hierarchical codes are available for fields product 1 to 3 (e.g. C0420 Sliding door), with its highest level comprising 21 categories (e.g. C Part of building and stationary furniture).

A descriptive analysis of the currently available product information from the EHLASS data was undertaken, to determine the usefulness of the present data for product safety research. The "product involved in the accident" (product 1) is generally considered to be the most relevant one in determining any causal effect of involved products. The analysis was therefore performed on product 1 ("product involved in the accident") for all countries except the Netherlands because it codes primarily product 3 („other product“) and for Spain in 1998 as it coded primarily product 2 („product causing the injury“).

Figure 10 and Figure 12 present the frequency of individual product codes (top 40) and product categories, for the EU 1998. Figure 11 shows the cumulative distribution of different codes, also for the EU 1998; indicating that about 300 different product codes account for 90% of cases.

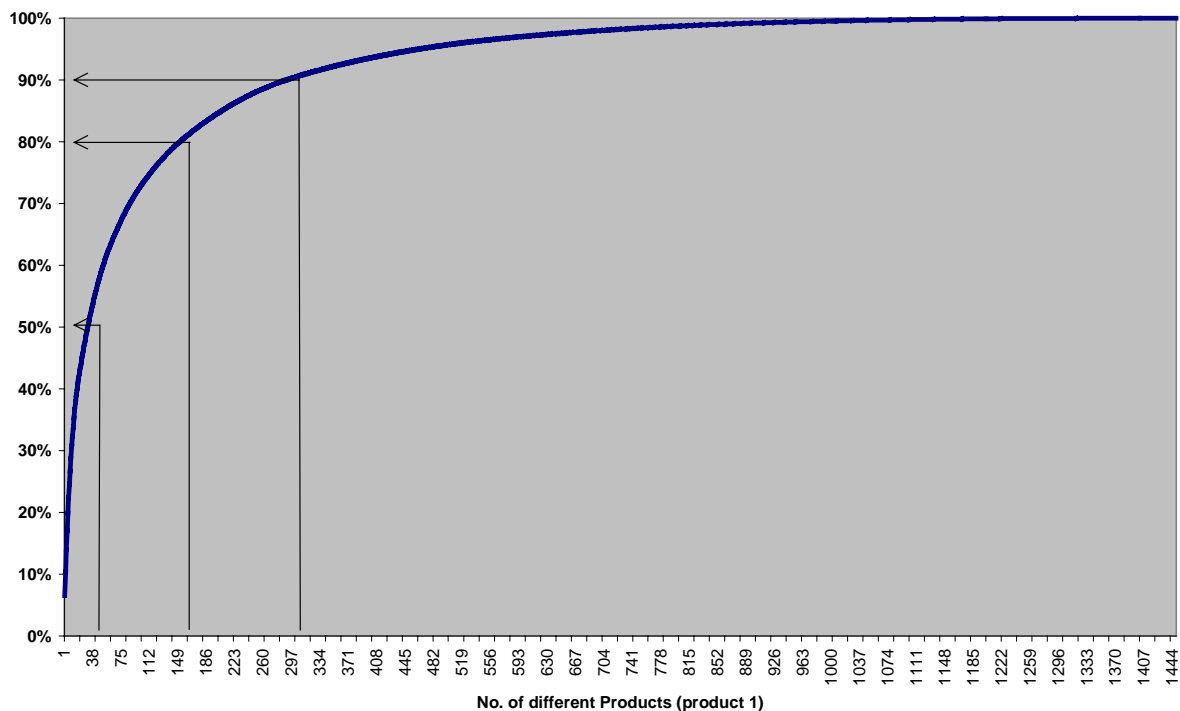


Figure 11: Distribution of different product codes (product involved in accident, without product unspecified) used in the EHLASS data. EHLASS V.96 std AT, BE, DK, ES, FI, FR, GR, IE, IT, NL (prod 3), PT, SE (prod 2), UK, 1998

Product involved in the accident	Cases	%
Product unsp.	104.056	22%
Floor polisher	23.834	5%
Person	13.930	3%
Floor, flooring, indoors, unsp.	13.244	3%
Processed surface, outdoors, unsp.	11.309	2%
Stairs, running straight	10.123	2%
Other sp. product	8.991	2%
Other stairs	8.016	2%
Other sp. sporting and recreational equipment	7.590	2%
Rail on/by road, sidewalk	7.470	2%
Other sp. processed surface, outdoors	7.277	2%
Ball, unsp.	5.587	1%
Dog	5.537	1%
Welding light	5.510	1%
Cement surface, outdoors	4.893	1%
Lawn, grass surface	4.535	1%
Wall-to-wall carpet, indoors	3.930	1%
Football, unsp.	3.803	1%
Gate in fence, wall, garden gate	3.180	1%
Door, entire or part hereof, unsp.	3.054	1%
Other sp. natural surface	2.803	1%
Stairs in walking area, outdoors, of other material	2.758	1%
Horse	2.703	1%
Asphalt surface, outdoors	2.691	1%
Crowd	2.612	1%
Bicycle (child)	2.610	1%
Bicycle (adult)	2.524	1%
Structural element of glass, unsp.	2.376	1%
Wall, unsp.	2.294	0%
Curb stone	2.290	0%
Bed, unsp.	2.255	0%
Other sp. surface outdoors	2.250	0%
Ceramic tiles, indoors	2.249	0%
Wooden floor, indoors	2.206	0%
Car door	2.070	0%
Surface, unsp.	2.029	0%
Other sp. settee	2.017	0%
Sliding door	1.973	0%
Roller skates	1.950	0%
Concrete floor, indoors	1.940	0%
Total Top 40 products	302.469	65%
Total all products	467.839	100%

Figure 12: Top 40 products ("prod 1", product involved in accident EHLASS V.96 std). EHLASS AT, BE, DK, ES, FI, FR, GR, IE, IT, NL (prod 3), PT, SE (prod 2), UK, 1998

Severity of product related accidents

The following list shows the top ten products for all EHLASS V.96 product categories, ranked by severity of the related injuries („Synthetic Score of Relative Dangerosity“, SSDR). The SSDR indicates the average severity of all injuries that are attributed to a particular product, utilizing number of accidents, hospitalization rate and length of stay and yields a score between 4 (low) and 64 (high) SSDR (Figure 13; continued on the following pages).

Prod Category (EHLASS V.96 level 1)	Top ten products involved in the accident	Mean SSDR
A Raw materials, structural elements	Structural element, unsp.	52
	Stone	50
	Other sp. raw material, semi-manufacture	49
	Other sp. Structural element	45
	Raw material, semi-manufacture, unsp.	37
	Plastic laminates	34
	Nail	33
	Brick	32
	Firewood	32
	Chip, splinter, piece, unsp.	30
	Average	34
B Stationary equipment outside, processed surface outdoors and natural surface	Earthen surface, unsp.	47
	Stone fence	45
	Other sp. Equipment in/on road, street, sidewalk	44
	Inflatable bouncer	44
	Swimming pool, indoors	44
	Other sp. equipment in recreational grounds	43
	Other sp. water, stream (incl. ice on water)	42
	Manhole cover	41
	Gate in fence, wall, garden gate	41
	Processed surface, outdoors, unsp.	40
	Fencing post	40
	Average	41
	C Part of building - Other stairs	Other sp. chimney, fireplace
Floor, flooring, indoors, unsp.		44
Ceiling, inside of roof, entire or parts hereof		42
Threshold, porch		41
Outside of roof, entire or parts hereof		41
Dais, stage, tribune		39
Other sp. door, entire or part hereof		39
Stairs, unsp.		39
Sleeping recess above the upper beams	38	

Prod Category (EHLASS V.96 level 1)	Top ten products involved in the accident	Mean SSRD
	Other stairs	37
	Average	40
D Industrial and stationary installations for water, sanitation and electricity	Boiler, container in industrial water/steam ins	39
	Unsp. stationary electric installation	35
	Toilet with seat	19
	Bathtub and fittings	16
	Cabinet shower and fittings	13
	Other sp. stationary electric installation	7
	Sauna furnace	3
	Average	31
E Electric equipment primarily for use in household	Other sp. Major electric household machine	51
	Electric iron	43
	Electric wire, extension cord	38
	Mixer	36
	Telephone with equipment	34
	Vacuum cleaner	32
	Lamp	30
	Cooker, hot plate	29
	Television	29
	Other sp. lighting equipment	25
	Average	32
F Furniture and textile	Cot/cot bed	42
	Baby bouncer (hanging)	41
	Carpet strip, grip	40
	Bed, unsp.	40
	Other sp. chair, bench	39
	Chair (not folding)	38
	Stool/pouf	37
	Table, unsp.	36
	Unsp. settee	36
	Infant chair (low)	36
	Average	37
G Domestic appliances and equipment	Coffee pot	48
	Unsp. non-fixtures	47
	Pressure cooker	45
	Cigarette lighter, petrol	43
	Candle	39
	Matches	38
	Kitchen utensils, other sp.	37
	Knife, unsp.	33
	Unsp. cutlery, tableware and kitchen utensils	32
	Vase	30
H Machinery for industry, handicraft, and hobby	Other sp. garden tool, manual	54
	Craft tool/implement, mechanical, unsp.	48

Prod Category (EHLASS V.96 level 1)	Top ten products involved in the accident	Mean SSRD
	Scaffold	46
	Chain saw, uncertain whether driven by petrol o	46
	Step ladder, household ladder	44
	Rotary cultivator, unsp.	44
	Machines for lifting, construction, transport a	43
	Machine for construction work, unsp.	43
	Lawn mower, manual	43
	Nail gun	41
	Average	42
I Office and shop furniture	Writing/drawing implement, unsp.	41
	Typewriter, non electric	30
	Pencil	23
	Other sp. writing/drawing implement	9
	Office machine/appliance, unsp.	7
	Ruler	3
	Average	21
J Medico-technical equipment, laboratory equipment	Thermometer	27
	Average	27
K Means of transport	Bicycle (adult)	39
	Passenger car, unsp.	38
	Wheel	38
	Other sp. bicycle and accessories	34
	Other sp. vessel with engine, without sail	33
	Bicycle (child)	32
	Motocross-bike	31
	Bus, unsp.	29
	Other sp. car	29
	Motor bike, motorcycle	28
	Average	34
L Toys	Other sp. toys on wheels carrying the weight of	38
	Scooter	34
	Construction kits	34
	Doll, teddy bear, unsp.	32
	Marbles	31
	Skipping rope, skipping string	26
	Balloon	20
	Other sp. toy	20
	Toys on wheels carrying the weight of a child,	18
	Pearl, bead	18
N Sports equipment	Other sp. rolling sports equipment	46
	Rolling sports equipment, unsp.	43
	Other sp. equipment for athletics	42
	Skate, unsp.	38
	Roller skates	37
	Slalom ski	36

Prod Category (EHLASS V.96 level 1)	Top ten products involved in the accident	Mean SSRD
	Hurdle	36
	Other sp. sporting and recreational equipment	35
	Football, unsp.	35
	Equipment for ball game, unsp.	34
	Average	36
P Clothing, baby caring articles and personal effects	Electric wheel chair	50
	Wheel chair	47
	Walking stick	47
	Baby changing mat	43
	Walking frame (with wheels)	39
	Other sp. carrying equipment for baby/child	39
	Carry cot	39
	Jewellery, unsp.	37
	Perfume	36
	Comforter, baby bottle'	36
	Average	37
Q Food, beverages, tobacco	Fats and oils, other	52
	Fats and hot liquids, other sp.	46
	Soup, stock, hot	45
	Alcoholic beverage, unsp.	40
	Fruit	35
	Tea	35
	Other sp. food	33
	Fish and shellfish, unsp.	31
	Nuts	31
	Distilled spirits	31
	Average	34
R Chemical products, detergents, pharmaceutical products	Other sp. pharmaceutical products	52
	Methylated spirits (denaturant not sp.)	48
	Caustic soda (lye)	48
	Chemical products, unsp.	47
	Tar, pitch	45
	Gas/steam/smoke, unsp.	44
	White spirit	42
	Other sp. agricultural chemicals, biocides	37
	Disinfectants	36
	Paraffin	36
	Average	40
S Packaging, containers	Container	39
	Aerosol spray	39
	Packaging, container, part of packaging, unsp.	37
	Tins, other	36
	Dust bin	35
	Bucket, pail	35

Prod Category (EHLASS V.96 level 1)	Top ten products involved in the accident	Mean SSRD
	Bottle	32
	Plastic container	30
	String, cord	28
	Other sp. packaging, container, part of packaging	27
	Average	26
T Human being, animals, animal articles, human and animal tissue fluids	Person	45
	Mammal, unsp.	42
	Dog	40
	Other sp. animal	40
	Animal's articles, unsp.	40
	Cat	37
	Horse	35
	Cow	28
	Tick	22
	Wasp	21
	Insect, unsp.	20
	Average	33
U Natural element, plants and trees	Branch, stick, unsp.	39
	Tree, trunk, unsp. (also during felling)	37
	Wind	37
	Solar rays	36
	Snow, ice, unsp.	35
	Tree, trunk, other, sp.	35
	Tree trunk	35
	Garden poles, sticks	32
	Water, unsp.	28
	Thick sheet of ice	27
	Average	33
V Other and unspecified product	Product unsp.	43
	Other sp. Product	40
	Stone, unsp.	21
	Edge	16
	Surface, unsp.	15
	Waste, unsp.	10
	Wheel	9
	Average	30

Figure 13: Top ten products of "Relative Dangerosity" (SSDR) for all EHLASS V.96 product categories. (EHLASS V.96 AT, DK, FR, SE, n=101.017)

Main findings on Product related Information in the ISS Data Set

Number one product category (26%) and product (22%) is "Other and unspecified product". As the data used has been standardised the category "product unspecified" includes also missing product codes (blanks); in these cases it is unknown whether this field has been left blank incidentally (missing) or whether no product involved in the accident has been identified.

Significant variation among countries was found in the use of specific product codes for EHLASS product 1 (involved in the accident); e.g. floor polisher vs. floor in cases of slipping. (Data not shown). Significant variation among countries was also found in the use of EHLASS product 1, 2 and 3.

From a quality point of view these findings indicates the need for more explicit coding guidelines or training (e. g. by a "Quality and Coding Guide" and training module); and in particular, an extra code for "no product involved".

Top 40 product codes (including "product unspecified") out of a total number of about 1500 different codes account for about two thirds of all cases (i.e. approx. 3% of codes represent 67% of cases; excluding "product unspecified" this ratio is 5% to 67%).

From a quality point of view this indicates the need for a reduction of the number of product codes; e.g. by reduction of hierarchical levels.

The EHLASS / ISS concept of a product is a very broad one, comprising humans, animals, plants, food, natural surfaces, materials, parts of materials, chemicals etc. next to consumer products. Even if hierarchical product categories allow for a selection of consumer products, this selection does not necessarily correspond to the definition of products covered within the EU product safety legislation (e.g. the General Product Safety Directive, as it is case in the German product safety survey).

From a quality point of view this indicates the need for an explicit definition of the term product or consumer product (e.g. as understood by the GPSD).

Ranking EHLASS product categories and individual products by severity of the related injuries („Synthetic Score of Relative Dangerosity“, SSSDR) is a first and easy means of a product oriented reporting of the EHLASS data.

GENERAL PRODUCT INVOLVEMENT CLASSIFICATION

PIF Code	Category	Definition	Example
PIF 1	No product involved	No product recorded for "product involved in the accident"	-
PIF 2	Product non-manufactured	Non-manufactured product recorded for "product involved in the accident"	animal, person, beverage
PIF 3	Product related to proximity	A product involved in the accident only due to its physical presence, as a stationary object	ground, radiator, stone
PIF 4	Product potentially defective	A product no longer functional due to a malfunction or failure during routine use or a product in need of maintenance service	Boiler explodes, object breaks during routine use
PIF 5	Product potentially maladapted	A product purposefully used in a manner which was not its intended / normal / standard use or a product misused due to ignorance or lack of customer information on safety instructions	Knife used as screw driver, chair used as ladder
PIF 6	Product with high intrinsic risk	A product known to have a high risk associated with its use	Knife, saw, electric iron etc.
PIF 7	Product identified but description inadequate to enable a judgment	None of the above categories	Fell off bike, bumped into door

Figure 14: Product Involvement Factor (PIF) Categories and Definitions – Trying to come up with a general product involvement classification

The reason to develop a "general" product involvement classification was

- to provide a "standardized" scheme that could be implemented in existing injury registration systems; also facilitating rapid reaction (like NEISS), e. g. in PIF 4 cases. The PIF classification could also be part of a more general cause variable.
- and that enhances comparability of product involvement qualifications among systems

Based on the results of the international review of available product involvement classifications the coding expert group (AT, NL, SF, DK, GR) "standardized" product involvement and proposed a general product involvement classification (Figure 14)¹⁹.

The proposed categories of the classification represent a compromise between the desired level of detail and the required practicability. As the focus of the project was on automatic post hoc coding of product involvement an actual testing of the classification was not foreseen.

AUTOMATIC PRODUCT INVOLVEMENT CLASSIFICATION (AUTO-PIF SOFTWARE)

AUTO-PIF Algorithm and Implementation

Automatic product involvement classification was closely linked to the development of the general product involvement classification²⁰. In fact, it consisted of implementing the general PIF category definitions for the EHLASS / ISS data. A respective algorithm was developed for the "AUTO-PIF software" by our French partners (Figure 15).

A comprehensive description of the algorithm is given in the chapter "Products and Tools"). Operationalisation of category definitions was done by key-word-matching and the inclusion or exclusion of certain product categories (Figure 16). Testing and evaluating of the classification was done by the safety expert panel in analysing the results of the AUTO-PIF software (see chapter "Preventive Safety Expert Panel").

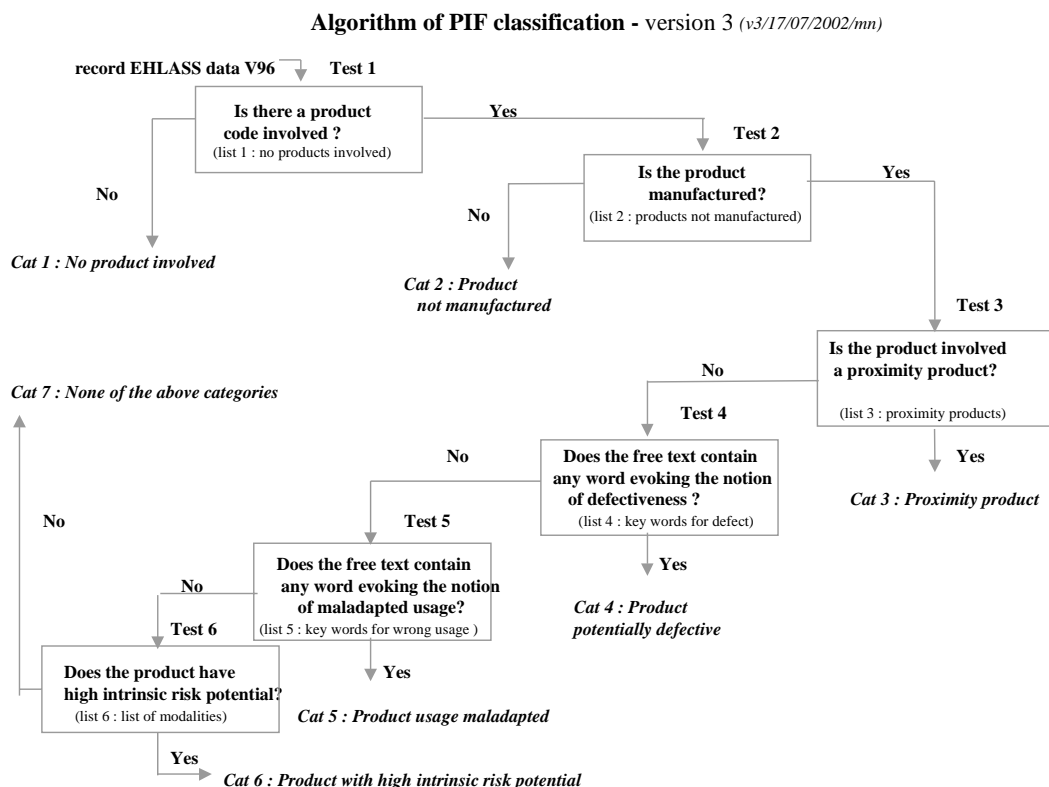


Figure 15: Algorithm for automatically classifying EHLASS cases into product involvement categories (implemented in the PIF software; see chapter PIF Software Reference and User Guide for more information)

PIF Code	Category	Definition	Operationalisation by Key Word (KW) or Code (C); English
PIF 1	No product involved	No product recorded for "product involved in the accident"	<u>C</u> : Missing Value in "product involved in the accident"
PIF 2	Product non-manufactured	Non-manufactured product recorded for "product involved in the accident"	<u>C</u> : "T0" / Human being "T1" / Animal "T2" / Human and animal tissue fluids etc. (see software for full list)
PIF 3	Product related to proximity	a product involved in the accident only due to its physical presence, as a stationary object	<u>C</u> : "A1" / Structural element "B00" / Stationary equipment on roads, etc. "B1" / Stairs and processed surface, outdoors "C00" / Stairs, part of building etc. (see software for full list)
PIF 4	Product potentially defective	A product no longer functional due to a malfunction or failure during routine use or a product in need of maintenance service	<u>KW</u> : Defect, faulty, broken, etc. (see software for full list)
PIF 5	Product potentially maladapted	A product purposefully used in a manner which was not its intended / normal / standard use or a product misused due to ignorance or lack of customer information on safety instructions	<u>KW</u> : Careless, mistake, unsafe, etc. (see software for full list)
PIF 6	Product with high intrinsic risk	A product known to have a high risk associated with its use	<u>KW</u> : Poison, burn, corrosion, etc. (see software for full list)
PIF 7	Product identified but description inadequate to enable a judgment	Self-explanatory	<u>KW</u> : less than three key words or in none of the above categories

Figure 16: Implementation of Product Involvement Factors (PIF) for automatic classification of EHLASS cases by selection of certain product codes and by matching certain keywords with the accident description (here examples of keyword set I are shown)

Product causality is not mutually exclusive; this means that a product-related accident may result from a variety of causes, i.e. the product was defective (Category 4) and was not used as intended (Category 5). Therefore a product may be found in multiple categories in the classification; this procedure also makes the algorithm insensitive to the order of "climbing" through the decision tree (see Figure 15).

AUTO-PIF Results

Each EHLASS case was assigned one or more out of seven Product Involvement Factors (PIF) according to the algorithm applied by the AUTO-PIF Software. Results represent a specific set of keywords and codes (set I) used for automatic classification of EHLASS cases (Figure 17).

It is **important to note** that another set of keywords would produce another distribution of cases by PIF categories. The expert group does therefore not claim that the results in Figure 17 reflect the true proportion of, e.g., accidents caused by defective products. Rather, the PIF table provides a roughly quantified preselection of EHLASS cases according to the type of product involvement.

PIF code	Product involvement / Country (A to D)	A	B	C	D	Total A-D	Total A-C
PIF 1	No product involved	0%	0%	30%	84%	38%	4%
PIF 2	Product non-manufactured	6%	19%	3%	1%	7%	10%
PIF 3	Product related to proximity	14%	13%	12%	6%	10%	14%
PIF 4	Product potentially defective	0%	4%	3%	1%	1%	2%
PIF 5	Product potentially maladapted	0%	1%	3%	0%	0%	1%
PIF 6	Product with high intrinsic risk	1%	6%	0%	0%	2%	3%
PIF 7	Product identified but description of event inadequate to enable a judgment	78%	57%	48%	7%	41%	66%
PIF 3-7	Manufactured product involved	94%	81%	66%	14%	55%	85%
PIF 3-6	Product role identified	16%	24%	19%	7%	14%	19%
PIF 4-6	Product causality likely	1%	11%	6%	1%	4%	5%

Figure 17: AUTO-PIF categories 1-7 for keyword set I on "product involved in the accident" ("product causing the injury" for country "D").

For reasons of comparability country D was excluded from averaging individual country results, and total A-C in Figure 17 taken as the most reliable PIF estimate. To facilitate comparison of results of the manual and the automatic product involvement classification, AUTO-PIF categories were arranged into the same meta-categories as in Figure 4 (Figure 18).

Product Involvement category	Manual PIF classification	Automatic PIF classification
Product involved (PIF 3-7)	79%	85%
Product role identified (PIF 3-6)	32%	19%
Product causality likely (PIF 4-6)	12%	5%
Defective product (PIF 4)	4%	2%

Figure 18: Comparison of manual and automatic product involvement classification categories (taken from Figure 4 and Figure 17)

Main Findings on AUTO-PIF Results

Most striking is the high variation of PIF 1 and / or PIF 7 among countries. To some extent these findings are directly linked to the quality aspects of the data:

Variation in PIF 1 (0-84%) reflects different coding practice and interpretation of the EHLASS fields "product involved in the accident", "product causing the injury" and "other product".

PIF 7 indicates the lack of specific keywords; high percentage of PIF 7 also indicates "redundant free text" style that means that only parts of the coded information are repeated and no extra information is given.

Less variation among countries is found in "specific" PIF categories 2-6, indicating that in principle the PIF procedure is a useful approach for extracting EHLASS / ISS product data.

The current PIF procedure yields the following hierarchical quantification of product involvement categories in EHLASS cases (average of three countries):

- 85 % Manufactured product involved (PIF 3-7), range 66-94%
- 19 % Product role identified (PIF 3-6), range 16-24%
- 5 % Product causality likely (PIF 4-6), range 1-11%
- 2 % Product potentially defective (PIF 4), range 0-4%

These results reflect a specific set of key words with a specific error rate and a rather high variation among countries. As this variation is also due to different conventions among member states how to record free text both in quantity and quality, the results can only be interpreted very cautiously. Again, quality of the free text (accident description) should be

improved by more explicit coding guidelines

Therefore, these results should be interpreted as a quantified preselection of EHLASS cases according to the type of product involvement and not necessarily as the "true" share of product involvement in injuries.

In comparison to the results of the manual product involvement classification (from the international review) the AUTO-PIF tends to underestimate the share of products with a "clear role" in the accident, e. g. defective product, by a factor of two.

In summary, the AUTO-PIF software allows for "post hoc" causality analysis, combining product codes and "free text" for a consumer-product oriented presentation of the "EHLASS" data. The big number of cases allows for a rather reliable account on the epidemiology of product related accidents and injuries.

Usually no in depth information of products and product information is recorded in the free text; the PIF cannot overcome this deficiency, however, it can extract "suspect cases" from the abundant information, serving as a search and screening tool.

AUTO-PIF Results by Product Categories

In addition to a general classification of product involvement of all cases the PIF results are also available by product categories and individual products. For a specific set of keywords (set I) the following tables show

- the frequency of cases in the "PIF by product category table" (Figure 19)
- the distribution of PIF 3-7 within product categories (Figure 20)
- the distribution of product categories within PIF 3-7 (Figure 21)

The PIF by product category cross tables also allows for a first assessment of the quality of PIF assignments; e.g. product category "Human being, animals, ..." should not contain many cases of PIF category "defective products" (multiple PIF assignment is possible). Eventually, due to the different interpretation and coding practice among participating data centres as to the roles of products 1 to 3 (cp. chapter "Product related Information in the ISS Data Set") PIF assignment can be evaluated by reading the respective case files only.

Product Category	PIF Code						Total
	2 Not manufactured	3 Proximity	4 Defective	5 Maladapted	6 Intrinsic risk	7 No judgment	
Sports equipment			129	36	73	11131	11369
Other and unspecified product			142	23	192	10569	10926
Stationary equipment outside, processed surface outdoors and natural surface	1597	5366	160	36	59	2085	9303
Human being, animals, animal articles, human and animal tissue fluids	5458		188	48	115	61	5870
Furniture and textile		425	64	23	34	5037	5583
Part of building and stationary furniture		2824	92	16	47	1958	4937
Means of transport			86	32	57	4230	4405
Raw materials, structural elements	290	1815	50	17	150	1271	3593
Machinery for industry, handicraft, and hobby			54	35	160	2757	3006
Clothing, baby caring articles and personal effects			32	23	33	2463	2551
Part of building – Stairs unspecified		1922	11	2	3		1938
Part of building – Other stairs		1810	14	28	2		1854
Domestic appliances and equipment			70	6	142	1460	1678
Food, beverages, tobacco			14	6	255	1275	1550
Natural element, plants and trees	1071		60	10	83		1224
Chemical products, detergents, pharmaceutical products			21	3	58	1018	1100
Electric equipment primarily for use in household			23	10	120	483	636
Packaging, containers			35	6	60	439	540
Toys			5	1	8	474	488
Industrial and stationary installations for water, sanitation and electricity			10	1	16	139	166
Office and shop furniture			1	1	6	102	110
Musical instrument, photographic/optical equipment			1			17	18
Medico-technical and laboratory equipment				1	3	5	9
Total	8416	14217	1267	365	1678	46977	72920
Total %	12%	19%	2%	1%	2%	64%	100%

Figure 19: PIF by product category - frequency of cases (EHLASS V.96 std. Product Categories; Austria, France, Netherlands, Sweden, 1998)

Product Category	PIF Code					Total
	3 Proximity	4 Defective	5 Maladapted	6 Intrinsic risk	7 No judgment	
Sports equipment	0%	1%	0%	1%	98%	100%
Furniture and textile	8%	1%	0%	1%	90%	100%
Part of building and stationary furniture	57%	2%	0%	1%	40%	100%
Means of transport	0%	2%	1%	1%	96%	100%
Machinery for industry, handicraft, and hobby	0%	2%	1%	5%	92%	100%
Clothing, baby caring articles and personal effects	0%	1%	1%	1%	97%	100%
Part of building – Stairs unspecified	99%	1%	0%	0%	0%	100%
Part of building – Other stairs	98%	1%	2%	0%	0%	100%
Domestic appliances and equipment	0%	4%	0%	8%	87%	100%
Chemical products, detergents, pharmaceutical products	0%	2%	0%	5%	93%	100%
Electric equipment primarily for use in household	0%	4%	2%	19%	76%	100%
Packaging, containers	0%	6%	1%	11%	81%	100%
Toys	0%	1%	0%	2%	97%	100%
Industrial and stationary installations for water, sanitation and electricity	0%	6%	1%	10%	84%	100%
Office and shop furniture	0%	1%	1%	5%	93%	100%
Part of building – Stairs	87%	8%	2%	3%	0%	100%
Musical instrument, photographic/optical equipment	0%	6%	0%	0%	94%	100%
Medico-technical equipment, laboratory equipment	0%	0%	11%	33%	56%	100%
Total	17%	2%	1%	2%	78%	100%

Figure 20: PIF by Product Categories - distribution of PIF within product categories (EHLASS V.96 std. Product Categories; Austria, France, Netherlands, Sweden, 1998)

Product Category	PIF Code					Total
	3 Proximity	4 Defective	5 Maladapted	6 Intrinsic risk	7 No judgment	
Sports equipment	0%	20%	16%	9%	35%	28%
Furniture and textile	6%	10%	10%	4%	16%	14%
Part of building and stationary furniture	40%	14%	7%	6%	6%	12%
Means of transport	0%	13%	14%	7%	13%	11%
Machinery for industry, handicraft, and hobby	0%	8%	16%	19%	9%	7%
Clothing, baby caring articles and personal effects	0%	5%	10%	4%	8%	6%
Part of building - Stairs unspecified	27%	2%	1%	0%	0%	5%
Part of building - Other stairs	26%	2%	12%	0%	0%	5%
Domestic appliances and equipment	0%	11%	3%	17%	5%	4%
Chemical products, detergents, pharmaceutical products	0%	3%	1%	7%	3%	3%
Electric equipment primarily for use in household	0%	4%	4%	15%	2%	2%
Packaging, containers	0%	5%	3%	7%	1%	1%
Toys	0%	1%	0%	1%	1%	1%
Industrial and stationary installations for water, sanitation and electricity	0%	2%	0%	2%	0%	0%
Office and shop furniture	0%	0%	0%	1%	0%	0%
Part of building - Stairs	1%	1%	0%	0%	0%	0%
Musical instrument, photographic/optical equipment	0%	0%	0%	0%	0%	0%
Medico-technical equipment, laboratory equipment	0%	0%	0%	0%	0%	0%
Total	100%	100%	100%	100%	100%	100%

Figure 21: PIF by Product Categories - distribution of product categories within PIF (EHLASS V.96 std. Product Categories; Austria, France, Netherlands, Sweden, 1998)

For a first evaluation of AUTO-PIF results by product categories were compared to the results from EHLASS Germany, the most elaborate study on product involvement found in our review. To enable comparisons of product categories PIF categories 4-6 were pooled as a new category "product causality likely" (Figure 22).

Product Category (GSG)	%
1. Sports equipment	40%
2. Electric equipment primarily for use in household	12%
3. Bicycles	11%
4. Cutting machinery	8%
5. Equipment for handicraft and hobby	5%
6. Ladders	5%
7. Electric Machinery for dyi	4%
8. Furniture and textile	3%
9. Gardening tools and machinery	3%
10. Playground equipment	2%
11. Toys	2%
Total (n=2.213)	100%

Figure 22: Product Categories according to Geräte-Sicherheits-Gesetz (GSG, Product Safety Law) of Products involved in accidents (EHLASS Germany, BAUA 1998)

Product Category (EHLASS V.96)	%
1. Machinery for industry, handicraft, and hobby	18%
2. Sports equipment	17%
3. Domestic appliances and equipment	16%
4. Means of transport (including Bicycles)	13%
5. Electric equipment primarily for use in household	11%
6. Furniture and textile	9%
7. Packaging, containers	7%
8. Clothing, baby caring articles and personal effects	6%
9. Industrial installations and installations for water, sanitation and electricity	2%
10. Toys	1%
11. Office and shop furniture	1%
12. Medico-technical equipment, laboratory equipment	0%
13. Musical instrument, photographic/optical equipment	0%

Figure 23: PIF 4-6 "product causality likely" by EHLASS V.96 std. Product Categories (Austria, France, Netherlands, Sweden, 1998)

Findings on AUTO-PIF Results by Product Category

PIF classification of cases by Product Categories yields a comprehensive product oriented view on EHLASS / ISS data and an aggregation of cases by type of product and type of product involvement:

- PIF categories 1 and 2 provide an implicit product definition: non manufactured products are sorted out
- PIF categories 3, 4, 5 and 6 represent causality classes, proposing on the role of the product in the accident

Technically, the PIF table by product categories and product (see below) also helps to evaluate the correctness of automatic PIF assignment. Because multiple PIF categories can be assigned, seemingly wrong assignments appear in some non-manufactured product classes; e.g. defective product (PIF 4) in product category "Natural elements, plants, trees".

Comparisons of top ranking PIF product categories (categories 4-6 were pooled as a new category "product role identified") with the results of EHLASS Germany categories (defined by the German Product Safety Law, GSG) yielded a similar ranking in both systems.

The following five Product categories represent 75% of cases within the pooled PIF category " product causality likely" (PIF 3-6):

1. Machinery for industry, handicraft, and hobby
2. Sports equipment
3. Domestic appliances and equipment
4. Means of transport (including Bicycles)
5. Electric equipment primarily for use in household

AUTO-PIF Results by Products

The following tables show the top 20 products for each of PIF categories 2 to 7 (Figure 24 to Figure 29). More than the PIF tables by product category these tables on individual products allow for an assessment of the quality of PIF assignments (e.g. product "Person" should not show up in PIF category "defective products", even though multiple PIF assignment is possible). Due to the different interpretation and coding practice among participating data centres as to the roles of products 1 to 3 (cp. chapter "Product related Information in the ISS Data Set"), eventually, PIF assignment can be evaluated by reading the respective case files only.

As PIF categories 2 and 3 are defined by product codes no wrong assignments should occur here (Figure 24 and Figure 25):

- Top products of PIF 2 "Product non-manufactured" indicate "factors" contributing to accidents with „third parties“ (persons, animals) and „natural environment“ (lawn, etc.). Top 20 results for PIF 2 cover about 90% of different products found (Figure 24).
- Top products of PIF 3 "Product related to proximity" indicate the "factors" contributing to falls (stairs, pavements). Top 20 results for PIF 3 represent about 90% of different products found (Figure 24).

PIF categories 4 to 6 are defined by keywords; thus wrong PIF assignments can happen through misleading or ambiguous keywords (PIF 4 to 6 identified by keyword set I; Figure 26 and Figure 28):

- Top products of PIF 4 "Product potentially defective" (top 40 shown) are supposed to identify types of products that have very likely actually caused the accident. At a first glance, and correct coding provided, about 30% of PIF 4 cases have been assigned to this PIF category wrongly by keyword set I (e.g. person, horse, dog etc.). Top 40 products represent less than 50% of different products found in PIF 4 (Figure 26).
- Top product types of PIF 5 "maladapted usage" indicate "factors" (top forty shown) contributing to accidents by purposeful or unintended misuse. As "maladapted usage" was the most difficult category to define by keywords, certainly wrong assignments did occur (e.g. Person). However, as the list shows, most products seem to be likely hits (e.g. angle grinder, walking frames, slicing machine). Top 40 results represent less than 50% of different products found in PIF 5 (Figure 27).

- Top product types of PIF 6 "high intrinsic risk" show various devices known to have a high risk associated with its use. Despite possible wrong assignments (e.g. Person) most „products“ listed can plausibly be expected in this PIF category (e.g. knives, fire wood, electric iron, [hot] fat). Top 40 results represent less than 50% of different products found in PIF 5 (Figure 28).

PIF Code	Product	Cases	%
PIF 2 Product non-manufactured	Person	2.409	29%
	Dog	1.115	13%
	Horse	1.081	13%
	Natural surface, unsp.	787	9%
	Lawn, grass surface	370	4%
	Other sp. natural surface	218	3%
	Thick sheet of ice	217	3%
	Cat	200	2%
	Tick	192	2%
	Firewood	158	2%
	Branch, stick, unsp.	148	2%
	Water, unsp.	122	1%
	Wasp	110	1%
	Tree, trunk, unsp. (also during felling)	93	1%
	Snow	91	1%
	Tree trunk	79	1%
	Insect, unsp.	79	1%
	Other sp. animal	73	1%
	Tree, trunk, other, sp.	71	1%
	Other sp. snow, ice	56	1%
Total top 20		7.669	91%
Total PIF 2		8.416	100%

Figure 24: Top 20 Products (EHLASS V.96 std) for PIF 2 "Product non-manufactured"

PIF Code	Product	%	Cases
PIF 3 Product related to proximity	Processed surface, outdoors, unsp.	16%	2.339
	Stairs, unsp.	14%	1.922
	Other stairs	13%	1.810
	Floor, flooring, indoors, unsp.	11%	1.577
	Pavement, snow/ice covered	10%	1.369
	Plank, piece of a wood plank	3%	362
	Wall, unsp.	3%	358
	Curb stone	2%	259
	Wood beam, timber beam, rafter	2%	255
	Ceramic tiles, indoors	2%	255
	Equipment in/on road, street, sidewalk	2%	243
	Glass panes	2%	235
	Rugs, mats	2%	221
	Processed stone surface, outdoors	2%	221
	Stairs in walking area, outdoors	1%	201
	Other sp. processed surface, outdoors	1%	199
	Gravel surface, outdoors	1%	154
	Other sp. structural element	1%	149
	Other sp. structural element of wood	1%	145
	Floor covering, other unsp.	1%	142
Total top 20		87%	12.416
Total PIF 3		100%	14.217

Figure 25: Top 20 Products (EHLASS V.96 std) for PIF 3 "Product related to proximity"

PIF Code	Product	Cases	%
PIF 4 Product potentially defective	Person	11%	135
	Product unsp.	9%	114
	Football, unsp.	3%	41
	Bicycle (adult)	2%	30
	Drinking glass	2%	24
	Processed surface, outdoors, unsp.	2%	23
	Pavement, snow/ice covered	2%	20
	Other sp. product	1%	19
	Horse	1%	19
	Dog	1%	19
	Bottle	1%	18
	Lawn, grass surface	1%	17
	Branch, stick, unsp.	1%	17
	Other sp. chimney, fireplace	1%	15
	Other stairs	1%	14
	Floor, flooring, indoors, unsp.	1%	14
	Door with glass	1%	14
	Moped	1%	12
	Bowl, dish	1%	12
	Stairs, unsp.	1%	11
	Sledge	1%	11
	Roller skates	1%	11
	Plank, piece of a wood plank	1%	10
	Chip, splinter, piece, unsp.	1%	10
	Chair, bench, unsp.	1%	10
	Water, unsp.	1%	9
	Threshold, porch	1%	8
	Other sp. bicycle and accessories	1%	8
	Furniture, unsp.	1%	8
	Ball, unsp.	1%	8
	Curb stone	1%	8
	Tree, trunk, unsp. (also during felling)	1%	7
	Stairs in walking area, outdoors, unsp.	1%	7
	Asphalt surface, outdoors	1%	7
	Other sp. natural surface	1%	7
	Fireworks	1%	7
	Door, entire or part hereof, unsp.	1%	7
	Boiler, container in industr. water install.	0%	6
	Tree, trunk, other, sp.	0%	6
	Swing	0%	6
	Bicycle (child)	0%	6
Total top 20		57%	755
Total PIF 4		100%	1.276

Figure 26: Top 40 Products (EHLASS V.96 std) for PIF 4 "Product potentially defective"

PIF Code	Product	Cases	%
PIF 5	Person	30	8%
Product potentially maladapted	Other stairs	28	8%
	Product unsp.	15	4%
	Bicycle (adult)	10	3%
	Angle grinder	7	2%
	Passenger car, unsp.	6	2%
	Motor bike, motorcycle	6	2%
	Lawn, grass surface	6	2%
	Dog	6	2%
	Skate, unsp.	5	1%
	Walking frame (with wheels)	4	1%
	Rugs, mats	4	1%
	Roller skates	4	1%
	Rake	4	1%
	Plank, piece of a wood plank	4	1%
	Other sp. product	4	1%
	Horse	4	1%
	Firewood	4	1%
	Ball, unsp.	4	1%
	Stairs in walking area, outdoors, of unsp. material	3	1%
	Slicing machine, bread slicer, mechanical	3	1%
	Sewing machine, electric	3	1%
	Car door	3	1%
	Processed stone surface, outdoors	3	1%
	Drilling/grinding machine, hand-held, unsp.	3	1%
	Curb stone	3	1%
	Chair, bench, unsp.	3	1%
	Wall, unsp.	2	1%
	Tree, trunk, unsp. (also during felling)	2	1%
	Tree trunk	2	1%
	Tile	2	1%
	Threshold, porch	2	1%
	Step ladder, household ladder	2	1%
	Stairs, unsp.	2	1%
	Slippers	2	1%
	Sledge	2	1%
	Shoe with high heel	2	1%
	Rats, mice	2	1%
	Pavement, snow/ice covered	2	1%
	Other sp. structural element of wood	2	1%
	Other sp. sporting and recreational equipment	2	1%
	Fence, wall with equipment, unsp.	2	1%
Total top 20		223	54%
Total PIF 5		365	100%

Figure 27: Top 20 Products (EHLASS V.96 std) for PIF 5 "Product potentially maladapted"

PIF Code	Product	%	Cases
PIF 6 Product with high intrinsic risk	Product unsp.	134	8%
	Other sp. product	48	3%
	Person	46	3%
	Firewood	45	3%
	Meat and poultry, unsp.	39	2%
	Knife, non domestic	33	2%
	Knife, unsp.	30	2%
	Fats and oils, other	27	2%
	Electric iron	27	2%
	Vegetables, roots and mushrooms	21	1%
	Plank, piece of a wood plank	19	1%
	Fats and hot liquids, other sp.	19	1%
	Bread	19	1%
	Beverage, unsp.	19	1%
	Angle grinder	18	1%
	Branch, stick, unsp.	18	1%
	Can	16	1%
	Drinking glass	15	1%
	Coffee	15	1%
	Water, unsp.	14	1%
	Pan, all kinds	14	1%
	Other sp. part of car	14	1%
	Metal sheet	14	1%
	Electric wire, extension cord	14	1%
	Dog	14	1%
	Other sp. bicycle and accessories	13	1%
	Petrol	12	1%
	Pavement, snow/ice covered	12	1%
	Axe/chopper	12	1%
	Soup, stock, hot	11	1%
	Snow	11	1%
	Berries, fruit, nuts, almonds, unsp.	11	1%
	Other sp. pharmaceutical products	11	1%
	Casserole, cooking pot	11	1%
	Snowboard	10	1%
	Glass chip, splinter	10	1%
	Bottle	9	1%
	Pressure cooker	9	1%
	Lamp	9	1%
	Fruit	9	1%
	Cooker, hot plate	9	1%
	Cigarettes	9	1%
Total top 20		870	52%
Total PIF 6		1.678	100%

Figure 28: Top 40 Products (EHLASS V.96 std) for PIF 6 "Product with high intrinsic risk"

PIF Code	Product	%	Cases
PIF 7 Product identified but description	Product unsp.	14%	6.521
of event inadequate to enable a	Other sp. sporting, recreational equipm.	10%	4.786
judgment	Other sp. product	8%	3.893
	Bicycle (child)	2%	1.099
	Bicycle (adult)	2%	836
	Ball, unsp.	2%	832
	Other sp. door, entire or part hereof	2%	784
	Chip, splinter, piece, unsp.	2%	731
	Furniture, unsp.	1%	680
	Knife, unsp.	1%	633
	Football, unsp.	1%	598
	Step ladder, household ladder	1%	508
	Bed, unsp.	1%	497
	Other sp. bed	1%	482
	Table, unsp.	1%	450
	Chair (not folding)	1%	410
	Roller skates	1%	390
	Sports shoe/boot, gym shoes unsp.	1%	385
	Other sp. rolling sports equipment	1%	380
	Other sp. bicycle and accessories	1%	370
Total top 20		54%	25.265
Total PIF 7		100%	46.831

Figure 29: Top 20 Products (EHLASS V.96 std) for PIF 7 "Product identified but description of event inadequate to enable a judgment"

Main findings AUTO-PIF Results by Product

In PIF 3 category "Product related to proximity" four generic products account for 2/3 of all accidents:

27% Stairs, indoors

19% Processed surface, outdoors

11% Floor, flooring, indoors, unsp.

10% Pavement, snow/ice covered

Obviously these objects (or obstacles) are frequently leading to falls and are calling for better understanding of the requirements for safe walking in public and private premises.

In each PIF categories 4 to 5 a variety of products with no clear leading position was found (disregarding possible wrong PIF assignments). Top five products and percentage within

- PIF category 4 "Product potentially defective" (Figure 26): 2% Bicycle, 2% Drinking glass, 1% Door with glass, 1% Bowl, dish, 1% Sledge
- PIF category 5 "maladapted usage" (Figure 27): 3% Bicycle (adult), 2% Angle grinder, 3% Passenger car, Car door, 2% Motor bike, motorcycle, 1% Skate, unsp., 1% Walking frame (with wheels), 1% Rugs, mats
- PIF category 6 "high intrinsic risk" (Figure 28): 4% Knife, 3% Firewood, 3% Fats and oils, 2% Electric iron, 1% Angle grinder

PIF categories 4 to 5 can be summarized into a meta category "Product causality likely". Thus the products listed above for PIF categories 4 to 5 represent sources of injuries in every day life with a possible potential for safety design improvements.

AUTO TRANS-PROCEDURE – PROCEDURE AND SEARCH TOOL FOR MULTILINGUAL DATA

In addition to the case file information provided by the PIF software (see chapter „**Error! Reference source not found.**“) we considered it useful to also have a general search tool available. The AUTO-TRANS software provides a search tool for the EHLASS data in V.96 data structure. To demonstrate the possibility of an "international" data set, the free text of the Austrian, Dutch, French and Danish EHLASS data 1998 has been machine translated into English and is provided with this software.

Findings on the AUTO TRANS-Procedure

In general, with some variation among languages, the results of the machine translation do not produce a reliable English version of the original text. This, however, is also attributable to the (poor) quality of the input texts (abbreviations, incorrect grammar and incomplete sentences).

However, as a kind of „short hand style“ information, correctly translated nouns and verbs often yield a sufficient picture of the accident. Translated nouns in particular are helpful for finding products and other information that is not available through the codes.

The AUTO TRANS-Procedure – machine translation of free text into English and search tool is recommend for the ISS database as an easy means for making the enormous amounts of free text information internationally available (in English).

PREVENTIVE SAFETY EXPERT PANEL

To complement the findings of the automatic PIF analysis, we asked three product safety experts in the Netherlands, Austria, and Sweden

- to review a sample of the PIF case studies and to provide us with general comments on the software procedure (appropriateness of the PIF category to the case, additional key words missing in the list to identify PIF cases, and finally, usefulness of the PIF software),
- as well as to state, given their expert opinion, preventability categories and scores for a sample of 50 cases per PIF category.
- Additionally, we requested from the Consumer Safety Institute in Netherlands which has an extensive product-related information library, to identify what research was being conducted in the field of product safety.

The partners completed a National Summary Report and below are summaries of their feedback.

Review form The Netherlands

Literature Review The literature review was performed using the library of the Consumer Safety Institute. For assessing the amount of safety research we have carried out searches in our own catalogue which contains over 22,000 entries. The search terms were adapted to the product categories.

It is not feasible to determine the *quality* of every individual source: some are complete research reports, others information leaflets based on various literature, yet others are expert opinions, e.g. editorials. Similarly, the distinction between *research reports and descriptions of safety initiatives* can only be made by studying each title individually, which was not feasible in this project. Therefore, we have made a general estimate of the quality and of the amount of research. We have classified these as A (several hundreds of sources), B (in the range of 100 – 200 sources), C (in the range of 20 –100 sources) and D (less than 20). For some product categories we had to use the class U, ‘unknown’.

One might expect that there is a bias in the Consumer Safety Institute catalogue: subjects that we have actively addressed in the past could appear more often in the library than other subjects. However, it seems safe to conclude that the class A subjects have been extensively reported by many authors. Subjects in class D may have been very little investigated **or** may have been outside our priorities; but it seems unlikely that we have not given much attention to subjects that appear often in literature.

Product Categories (EHLASS V.96 std.; 1. level)	Available Information (Product Safety Research / Initiatives)
Clothing, baby caring articles and personal effects	A
Furniture and textile	(in particular flammability): A
Toys	A
Part of building and stationary furniture	Building: A Parts: B
Chemical products, detergents, pharmaceutical products	Chemical products: A Detergents: C Drugs: A
Stationary equipment outside, processed surface outdoors and natural surface	Playground equipment: A Pavement: D
Electric equipment primarily for use in household	(overlap with domestic appliances) B
Packaging, containers	B
Means of transport	B
Sports equipment	B
Part of building – Stairs	B
Part of building – other stairs	(but includes all stairs) B
Raw material, structural elements	other materials: C Building materials: B
Domestic appliances and equipment	Appliances: C Equipment: C
Industrial installations, stationary installations for water, sanitation and electricity	C
Natural element, plants and trees	Poisonous plants: C
Machinery for industry, handicraft and hobby	Machinery: C handicraft and hobby: D
Food, beverages, tobacco	Food: C Drinks: D Tobacco: C
Office and shop furniture	D
Other and unspecified product	U

Figure 30: Results of literature review on Product Safety Research / Safety Initiatives by product categories. Legend: A = several hundreds of sources, B = in the range of 100 – 200 sources, C = in the range of 20 –100 sources, D = less than 20, U = unknown

Summarizing the results, it is clear that much research has been done and many safety initiatives have been taken on the following subjects:

- building safety. A closer look shows that the literature addresses both constructional safety (buildings should not collapse and be safe in case of fire) and safety in use (slipperiness of floors, safe stairs, preventing child injuries, accessibility for elderly people and people with handicaps);
- playing and playgrounds;
- furniture (in particular flammability);
- child care articles;
- chemicals and pharmaceutical products;
- toys.

Subjects that are hardly addressed by literature or safety initiatives include:

- pavements;
- machinery for handicraft and hobby;
- beverages;
- office and shop furniture;
- dust, dirt particles;
- knives and kitchen utensils;
- jewelry.

PIF classification Working with the PIF classification was an interesting experience. Incorrect assignments of PIF class did occur. For example, class 1 (no product involved) contained a few cases where product involvement was inferred, and class 2 (non-manufactured product) contained a few cases where natural surface was mentioned but where impact attenuating surfaces might have prevented the injury; the latter example illustrates that the absence of a suitable protective product will be difficult to infer from the HLA record.

In the PIF classes 3 to 7, products may have been involved in many cases, but their role was often not clear from the description. This makes it very difficult to assess preventability. We have indicated this with 'no clear product role'.

Our conclusion is that the free text description is often too vague, even in combination with other data from the HLA record. In general, we can conclude that the HLA databases in their present form contain little information, and certainly no systematic information, to classify the role of products unambiguously. A solution could be to include the instruction in the HLA coding manual that the free text field should always briefly mention the contributing factors in a fixed order, e.g. person's behavior, specific product features, physical environment.

Preventability Category / PIF Category	1: Current SafeSol	2: Pot Safe Sol	3: Behav Sol	4: No Sol	5: No Info
PIF 1, no product involvement (n=50)	6%	2%	36%	20%	36%
PIF 2, non-manufactured product (n=50)	8%	0%	26%	60%	6%
PIF 3, proximity product (n=50)	10%	2%	14%	8%	66%
PIF 4, product potentially defective (n=50)	14%	6%	26%	24%	30%
PIF 5, product usage potentially maladapted (n=8)	0%	0%	13%	88%	0%
PIF 6, product with high intrinsic risk (n=50)	18%	2%	64%	14%	2%
ALL PIFS	11%	2%	33%	27%	27%

Figure 31: Preventability Category - EHLASS The Netherlands

Preventability Score / PIF Category	1:easy	2: with effort	3: cost, difficult	4: not	missing
PIF 1, no product involvement (n=50)	16%	24%	4%	56%	0%
PIF 2, non-manufactured product (n=50)	12%	22%	2%	64%	0%
PIF 3, proximity product (n=50)	8%	18%	2%	72%	0%
PIF 4, product potentially defective (n=50)	20%	12%	14%	54%	0%
PIF 5, product usage potentially maladapted (n=8)	13%	0%	0%	88%	0%
PIF 6, product with high intrinsic risk (n=50)	34%	28%	24%	14%	0%
ALL PIFS	18%	20%	9%	53%	0%

Figure 32: Preventability Score - The EHLASS Netherlands

On the following pages examples of cases files for preventability categories "Current Safety Solution" and "Potential Safety Solution" for the Dutch data set are given ("Product 3" and free text was used for the PIF procedure).

50 first records with PIF code = 1, no product involved	Preventability Category					Preventability Score			
	1: Current SafeSol	2: Pot Safe Sol	3: Behav Sol	4: No Sol	5: No Info	1: easy	2: with effort	3: cost, difficult	4: not
Sex : 1 Male Age : 19 Mecanism: 99 Mechanism of injury, unspecified Activity: 69 Vital activity, unspecified Product1: V9999 Product unsp. Product2: Product3: THUIS VAN DE TRAP GEVALLEN	x						x		
safety recommendation: fall from stairs may be avoided by more careful walking or easier stairs									
Sex : 1 Male Age : 18 Mecanism: 99 Mechanism of injury, unspecified Activity: 59 Sports, athletics, exercise, unspecified Product1: V9999 Product unsp. Product2: Product3: WAS OP DE IJSBAAN,VIEL DOOR GLAZEN DEUR EN VERWONDDE ZIJN HAND AAN HET GLAS	x						x		
safety recommendation: avoid glass doors in public buildings									
Sex : 1 Male Age : 44 Mecanism: 99 Mechanism of injury, unspecified Activity: 69 Vital activity, unspecified Product1: V9999 Product unsp. Product2: Product3: VAN EEN TWEE METER LOSSE TRAP GEVALLEN BIJ HET OPGAAN VAN DE ZOLDER EN SCHOUDERFRACTUUR OPGELOPEN	x							x	
safety recommendation: install safe stairs for reaching attic									

50 first records with PIF code = 2, non-manufactured product	Preventability Category					Preventability Score			
	1: Current SafeSol	2: Pot Safe Sol	3: Behav Sol	4: No Sol	5: No Info	1: easy	2: with effort	3: cost, difficult	4: not
Sex : 1 Male Age : 2 Mecanism: 99 Mechanism of injury, unspecified Activity: 49 Play and leisure activity, unspecified Product1: V9999 Product unsp. Product2: Product3: B2999 Natural surface, unsp. VAL UIT KLIMREK,SUBDURAAL HAEMATOOM	x						x		
safety recommendation: fall from climbing frame. Install protective surfacing material									
Sex : 2 Female Age : 11 Mecanism: 99 Mechanism of injury, unspecified Activity: 49 Play and leisure activity, unspecified Product1: V9999 Product unsp. Product2: Product3: B2999 Natural surface, unsp. TIJDENS SPELEN UIT KLIMREK GEVALLEN. FRACTUUR POLS	x						x		
safety recommendation: fall from climbing frame; install adequate protective surface material									
Sex : 2 Female Age : 17 Mecanism: 99 Mechanism of injury, unspecified Activity: 69 Vital activity, unspecified Product1: V9999 Product unsp. Product2: Product3: B2999 Natural surface, unsp. VAN BUITEN NAAR BINNEN GELOPEN, TRAP NAT, GEVALLEN, POLSFRACTUUR	x							x	
safety recommendation: slippery stairs. Build more convenient stairs									
Sex : 2 Female Age : 5 Mecanism: 99 Mechanism of injury, unspecified Activity: 49 Play and leisure activity, unspecified Product1: V9999 Product unsp. Product2: Product3: B2999 Natural surface, unsp. VAN GLIJBAAN GEVALLEN. WOND BEHAARDE HOOFD	x						x		
safety recommendation: fall from slide difficult to prevent; adequate surfacing material may reduce risk									

50 first records with PIF code = 3, product related to proximity	Preventability Category					Preventability Score			
	1: Current SafeSol	2: Pot Safe Sol	3: Behav Sol	4: No Sol	5: No Info	1: easy	2: with effort	3: cost, difficult	4: not
Sex : 1 Male Age : 19 Mecanism: 99 Mechanism of injury, unspecified Activity: 59 Sports, athletics, exercise, unspecified Product1: V9999 Product unsp. Product2: Product3: B1099 Processed surface, outdoors, unsp. MET SKATEBOARDEN GEVALLEN, CONTUSIE HAND EN POLS	x					x			
safety recommendation: Skateboard accident. Wear wrist protectors during skateboarding									
Sex : 2 Female Age : 1 Mecanism: 99 Mechanism of injury, unspecified Activity: 49 Play and leisure activity, unspecified Product1: V9999 Product unsp. Product2: Product3: B1099 Processed surface, outdoors, unsp. VAN 3 HOOG OP STRAAT GEVALLEN, BREUK BOVENBEEN	x					x			
safety recommendation: Fall from 3rd floor. Either behaviour (keeping window closed, using window barrier?) or product design (balcony barrier).									
Sex : 2 Female Age : 21 Mecanism: 99 Mechanism of injury, unspecified Activity: 99 Unspecified activity Product1: V9999 Product unsp. Product2: Product3: B1099 Processed surface, outdoors, unsp. VAL OP STRAAT DOOR KUIL; DISTORSIE ENKEL	x							x	
safety recommendation: fall on street due to uneven surface. No clear product role									
Sex : 2 Female Age : 85 Mecanism: 99 Mechanism of injury, unspecified Activity: 99 Unspecified activity Product1: V9999 Product unsp. Product2: Product3: B1099 Processed surface, outdoors, unsp. OP STRAAT GEVALLEN; BOVENARM FRACTUUR, DIV. SCHAAFWONDEN KNIE ,ELLEBOOG, BLAUW OOG	x						x		
safety recommendation: older lady fell on street. Possible solution: use walking aid									
Sex : 1 Male Age : 14 Mecanism: 99 Mechanism of injury, unspecified Activity: 39 Educational activity, unspecified Product1: V9999 Product unsp. Product2: L0099 Toys on wheels carrying the weight of a child, unsp. Product3: A1899 OP SCHOOL MET DE VINGER TUSSEN EEN AS VAN EEN SPEELGOEDVRACHTAUTO GEKOMEN		x					x		
safety recommendation: More a PIF 4 case. Finger entrapped behind axis of toy truck									

50 first records with PIF code = 4

Sex : 2 Female Age : 40
 Mecanism: 99 Mechanism of injury, unspecified
 Activity: 99 Unspecified activity
 Product1: V9999 Product unsp.
 Product2:
 Product3:

THUIS OP EEN NATTE VLOER UITGEGLEDEN EN GEVALLEN EN STUITJE GEBROKEN

Preventability Category				
1: Current SafeSol	2: Pot Safe Sol	3: Behav Sol	4: No Sol	5: No Info
x				

Preventability Score			
1: easy	2: with effort	3: cost, difficult	4: not
		x	

safety recommendation: wet floor, slipping: Replace existing flooring (current criteria sufficient to prevent slipping, but costly solution)

Sex : 1 Male Age : 46
 Mecanism: 99 Mechanism of injury, unspecified
 Activity: 69 Vital activity, unspecified
 Product1: V9999 Product unsp.
 Product2:
 Product3:
 THUIS OP BADKAMERVLOER GEVALLEN; 2 RIBBEN GEBROKEN

x				
---	--	--	--	--

		x	
--	--	---	--

safety recommendation: fall bathroom floor. Install more slip resistance flooring

Sex : 1 Male Age : 65
 Mecanism: 99 Mechanism of injury, unspecified
 Activity: 99 Unspecified activity
 Product1: V9999 Product unsp.
 Product2:
 Product3:
 THUIS VAN LADDER GEVALLEN; BEIDE ENKELS GEBROKEN

	x			
--	---	--	--	--

		x	
--	--	---	--

safety recommendation: fall from ladder. Design more stable ladders

Sex : 2 Female Age : 92
 Mecanism: 99 Mechanism of injury, unspecified
 Activity: 69 Vital activity, unspecified
 Product1: V9999 Product unsp.
 Product2:
 Product3:
 IN TOILET UITGEGLEDEN. HEUP GEBROKEN

x				
---	--	--	--	--

		x	
--	--	---	--

safety recommendation: install more slip resistant flooring

Sex : 1 Male Age : 55
 Mecanism: 99 Mechanism of injury, unspecified
 Activity: 69 Vital activity, unspecified
 Product1: V9999 Product unsp.
 Product2:
 Product3:
 IN HUIS VAN TRAP GEVALLEN. ENKEL GEBROKEN

	x			
--	---	--	--	--

		x	
--	--	---	--

safety recommendation: fall from stairs. Build more convenient stairs (current building regulations allow rather steep stairs)

Sex : 2 Female Age : 94
 Mecanism: 99 Mechanism of injury, unspecified
 Activity: 69 Vital activity, unspecified
 Product1: V9999 Product unsp.
 Product2:
 Product3:
 IN BEJAARDENHUIS IN BADKAMER UITGEGLEDEN. ENKEL GEBROKEN

x				
---	--	--	--	--

		x	
--	--	---	--

safety recommendation: fall in bathroom of institute for elderly. Install more slip resistant flooring

Sex : 2 Female Age : 47
 Mecanism: 99 Mechanism of injury, unspecified
 Activity: 69 Vital activity, unspecified
 Product1: V9999 Product unsp.
 Product2:
 Product3:
 IN HUIS VAL VAN TRAP. ENKEL GEBROKEN

	x			
--	---	--	--	--

		x	
--	--	---	--

safety recommendation: fall from stairs. Build more convenient stairs (current building regulations allow rather steep stairs)

Sex : 1 Male Age : 67
 Mecanism: 99 Mechanism of injury, unspecified
 Activity: 69 Vital activity, unspecified
 Product1: V9999 Product unsp.

x				
---	--	--	--	--

		x	
--	--	---	--

safety recommendation: fall in institute for elderly. Install more slip resistant flooring

50 first records with PIF code = 6, product with high intrinsic risk potential	Preventability Category					Preventability Score			
	1: Current SafeSol	2: Pot Safe Sol	3: Behav Sol	4: No Sol	5: No Info	1: easy	2: with effort	3: cost, difficult	4: not
Sex : 2 Female Age : 42 Mecanism: 99 Mechanism of injury, unspecified Activity: 19 Domestic work, unspecified Product1: V9999 Product unsp. Product2: Product3: BIJ POETSEN POLS GESNEDEN AAN GLASPLAAT. SNYWOND POLS	x					x			
safety recommendation: avoid sharp glass edges									
Sex : 2 Female Age : 20 Mecanism: 60 Hot liquid Activity: 99 Unspecified activity Product1: V9999 Product unsp. Product2: Product3: Q3999 Beverage, unsp. HEETWATER VERBRANDING ENKEL, 2DE GRAADS	x					x			
safety recommendation: hot water scald injury, no clear product role									
Sex : 1 Male Age : 75 Mecanism: 57 Poisoning, unspecified Activity: 99 Unspecified activity Product1: V9999 Product unsp. Product2: Product3: KOOLMONOXIDEVERGIFTIGING	x						x		
safety recommendation: carbon monoxyde poisoning, no clear product role									
Sex : 1 Male Age : 25 Mecanism: 60 Hot liquid Activity: 99 Unspecified activity Product1: V9999 Product unsp. Product2: Product3: Q3999 Beverage, unsp. HEET WATER VERBRANDING TWEE VINGERS MEER NIET BEKEND	x					x			
safety recommendation: hot water scald; no clear product role									
Sex : 1 Male Age : 40 Mecanism: 57 Poisoning, unspecified Activity: 99 Unspecified activity Product1: V9999 Product unsp. Product2: Product3: BLOOD GESTAAN AAN GIFTIGE GASSEN (CHLOOR, PVC EN KOOLMONOXIDE) DOOR BRAND IN MACHINE KAMER OP BINNENSCHIP		x						x	
safety recommendation: inhalation of fumes during fire on board ship. Possible prevention: sprinklers in machine room									
Sex : 2 Female Age : 2 Mecanism: 62 Hot objects Activity: 99 Unspecified activity Product1: V9999 Product unsp. Product2: Product3: MET HANDJE TEGEN HETE PAN AANGESLAGEN, 2E GRAADS VERBRANDING 3 VINGERS	x						x		
safety recommendation: keep babies away from hot cooking pans.									
Sex : 2 Female Age : 61 Mecanism: 99 Mechanism of injury, unspecified Activity: 19 Domestic work, unspecified Product1: V9999 Product unsp. Product2: Product3: TIJDENS POETSEN VAN HUISHOUDTRAPJE GEVALLEN. ENKEL GEBROKEN	x						x		
safety recommendation: fall from household steps. Develop steps with better possibilities to retain equilibrium (handholds etc.)									

Review from Austria

PIF 2: non-manufactured product

General remarks. PIF category 2 was found not relevant for product safety because it is related to non-manufactured products, for example natural surface or animals. Accidents related to that category can be prevented through the following aspects:

- Change behaviour (for example don't pet a dog if you don't know it)
- Use protective clothing, shoes with a sole resistant to slipping
- Learn to fall without hurting when practicing sports like horse riding

Results of example table. In the example table each accident indicated in the table below is related to PIF 2. From these 28% of the accidents were classified with the Preventability Category „Current Safety Solution available” because the accidents could have been prevented through the use of other products such as shoes with slip resistant soles. 72% was classified in Category 3 “Behavioural solution”, because these accidents could have been prevented if the consumer would have acted differently (for example treat dogs with safety in mind).

The preventability category score is most of the time “Easy” because a change in behaviour would change the situation. 16% of the answers were “not preventable practically” because some of the accidents like falling from a horse when riding is difficult to prevent. On the other hand the person need not be hurt. The use of protective clothing for example would help.

PIF 3: proximity product

General remarks. PIF 3 is a category which is related to product safety in that the involved products like stairs or floors could be improved; for example by using slip resistant surfaces. The accidents in this category are typically accidents which happen every day. The prevention of these accidents is rather difficult because the products involved are not very specific.

Results of example table. Most of the accidents in the example are related to stairs. The description did not yield much information; it was difficult to determine if the injuries happened because of, for example poorly constructed stairs, or other factors. What is clearly shown is that a general improvement of stairs is needed as people have a high frequency of falling on stairs.

46% of the accidents were classified with the Preventability Category „Current Safety Solution available” because the accidents could have been prevented through the use of other products like stairs with slip resistant surfaces. 30% was classified with “no info”, because the information given in the description was not sufficient for a rating. 20% of the accidents were classified Category 3 “Behavioural solution”. These were a result of a classification of accidents when people jumped or ran on stairs for example.

32% of the accidents were not able to be classified with a preventability score as there was too few information about the accident available in the description. 24% was classified with the preventability score “easy” and 22% with “cost, difficult” depending on the accident.

PIF 4: potentially defective product

General remarks. Injuries listed under this category should be due to defective products. This category is therefore very important referring to product safety. Safe products should not be defective.

Results of example table. Only 2 accidents in the example table are related to defective products. The keyword “Gefahr” was sometimes found in “gefahren”, meaning driven in German. This keyword should be changed because “gefahren” as a verb has nothing to do with defective products.

PIF 5: maladapted usage

General remarks. Products in this category could be relevant for product safety, when the product itself can be improved due to technical applications. This can only be clarified when the description is detailed enough.

Results of example table. The word “Eile” in the list of keywords should be changed as it is part of other words too. It was found 14 times in the word “steiler” and 1 time in the word “pfeiler”. Both words are not related to maladapted usage. The other keywords worked well. The injuries were caused due to sickness, carelessness, or bad luck. They were not related to the product itself.

76% of the accidents were classified with the Preventability Category 3 “Behavioural solution” and 12% with the category “Not enough info”. These accidents were not really related to product safety. They could sometimes be prevented due the use of other products like for example shoes with slip resistant soles.

The accidents were classified with 50% Preventability Score “easily preventable” and 50% “not preventable practically”. The accidents which were caused due to hurry etc., could easily be prevented. But those accidents which were related to illness cannot be prevented.

PIF 6: high intrinsic risk

General remarks. Products in this category have a high intrinsic risk. These products are particularly interesting for product safety. Such products should be designed in a way, that it is not possible to hurt oneself during regular use.

Results of example table. Some of the accidents mentioned in this category should really be in this category. Others had little to do with intrinsic risk. This is because of keywords that have double meanings in German. For example “brennen” could be related to intrinsic risk when it is related to a barbecue for example. But it could also be used in “brennender Schmerz”, which is not related to a product. This is why it is rather difficult to find keywords which are only related to intrinsic risk.

In the example table 7 accidents were found which could have been prevented due to improvement of the products. This is an very important fact, which makes that PIF category particularly important for product safety.

The example table shows 24 cases. 29% were classified with the Preventability Category “Current safety solutions available” or “potential safety solution could be created”. Because those accident were caused by products which could be improved. 54% were classified as “Behavioural solution”.

54% of the cases were classified with the Preventability Category Score “Easily preventable”, because the accidents were related to behaviour. 30% with “Preventable with some effort “ or “Preventable at considerable cost or with difficulty” because these accidents were caused by products which could be improved by costly redesign.

PIF 7: not enough information

Products in this category are not related to one of the other categories. The accidents are various and cannot be classified generally.

Results of example table. Most of the accidents (74%) were classified with the Preventability Category 3 “Behavioural solution”. So most accidents collected under PIF 7 were not very relevant for product safety. But there were also products mentioned which could be improved. That accidents were classified with the preventability category 1 or 2. Generally it can be said that accidents summarised under PIF 7 must be seen case by case. Most of the time “easy” was chosen as preventability score.

Preventability Category / PIF Category	1: Current SafeSol	2: Pot Safe Sol	3: Behav Sol	4: No Sol	5: No Info
PIF 2, non-manufactured product (n=50)	28%	0%	72%	0%	0%
PIF 3, proximity product (n=50)	46%	2%	20%	2%	30%
PIF 4, product potentially defective (n=50)	18%	4%	72%	0%	6%
PIF 5, product usage potentially maladapted (n=8)	2%	2%	76%	8%	12%
PIF 6, product with high intrinsic risk (n=24)	8%	21%	54%	0%	17%
PIF 7, not enough information (n=50)	10%	6%	74%	0%	10%
All PIFs	20%	4%	62%	2%	12%

Figure 33: Preventability Category - EHLASS Austria

Preventability Score / PIF Category	1:easy	2: with effort	3: cost, difficult	4: not preventable	5: not enough info
PIF 2, non-manufactured product (n=50)	76%	2%	2%	16%	4%
PIF 3, proximity product (n=50)	24%	1%	22%	21%	32%
PIF 4, product potentially defective (n=50)	48%	16%	2%	28%	6%
PIF 5, product usage potentially maladapted (n=8)	50%	0%	0%	50%	0%
PIF 6, product with high intrinsic risk (n=24)	54%	17%	13%	0%	17%
PIF 7, not enough information (n=50)	80%	10%	0%	0%	10%
All PIFs	53%	10%	6%	19%	12%

Figure 34: PreventabilityScore Austria - EHLASS Austria

Review from Sweden

We find the **PIF software** useful in facilitating the finding of product related cases in the HLA data. It is important to use not only the quantitative aspect of data by producing statistics, but also the qualitative aspect by finding individual cases that may help to reveal dangerous products. This being said, we must add that the material we analysed fell somewhat short of our (rather high) expectations. Not as many records as we had hoped matched their PIF categories. However, this may be a consequence of the manner in which the records were selected. As the first fifty records in each PIF category were chosen, the material was somewhat homogeneous concerning the products involved, hence also concerning the type of accident. For example, in PIF category 4 a great majority of the cases were related to broken or breaking glass, as glass splinter is in product category A. A random sample of fifty records might have given a different picture of the category matching. The somewhat biased selection also makes it difficult to give hints on where to focus for preventability.

We found that the vast majority of accidents were mainly attributable to behavioural factors (prev. category 3), and not possible to prevent with any reasonable effort (prev. score 4). This was true not only for the records in PIF category 5 (maladaptation) but to an equal extent to records in categories 4 and 6. Contrary to this there were in fact one or two cases in PIF category 5 that were attributable to defective products. One conclusion might be that whereas the keywords are helpful to identify product related cases, they are not always well suited to predict the causality of the cases. Another conclusion is that the number of accidents that are caused by defective products and could be prevented through technical measures is probably small. But here, again, it would have been interesting to have a randomly selected set of records.

Also, it should be mentioned that the keywords did not always refer to the products involved, but in several cases e.g. to the injury or the treatment, e.g. “thought” referring to a misconception of the injury, or “removed” referring not to a safety device, but to a foreign object in the eye. This is what we pointed out already as we delivered the Swedish keywords. The problem is limited, as most of these cases are product related anyway.

Assessing preventability categories and preventability scores is, of course, a highly subjective activity. However, we found your definitions of the preventability categories helpful in making assessments less subjective. Such definitions are necessary, and they might perhaps be developed to give guidance for a wider variety of accidents (e.g. falls due to poor lighting at outdoor steps).

Concerning the preventability score we found that the result often depended on whether you took the viewpoint of the individual or of society. For example, the use of protective goggles is an easy enough measure for the individual, but for an organisation active in injury prevention to enforce the general use of goggles in different areas of work is of course a lot more difficult. In most of these cases we ended up in the “with effort” column, but we cannot promise that we have been absolutely consistent. So a little more guidance concerning preventability scoring might have been helpful.

Preventability Category / PIF Category	1: Current SafeSol	2: Pot Safe Sol	3: Behav Sol	4: No Sol	5: No Info	Excl.
PIF 4, product potentially defective (n=50)	0%	8%	86%	0%	0%	6%
PIF 5, product usage potentially maladapted (n=50)	0%	6%	90%	0%	4%	0%
PIF 6, product with high intrinsic risk (n=50)	0%	4%	96%	0%	0%	0%
ALL PIFS (n=150)	0%	6%	91%	0%	1%	2%

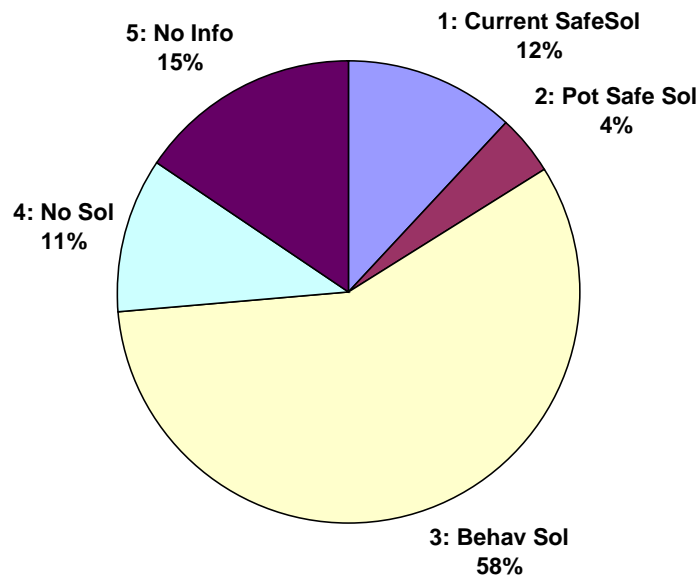
Figure 35: Preventability Category - EHLASS Sweden PIF 4-6 only

Preventability Category / PIF Category	1:easy	2: with effort	3: cost, difficult	4: not	excluded, wrong PIF
PIF 4, product potentially defective (n=50)	2%	4%	8%	80%	6%
PIF 5, product usage potentially maladapted (n=50)	2%	32%	14%	52%	0%
PIF 6, product with high intrinsic risk (n=50)	2%	50%	0%	48%	0%
ALL PIFS (n=150)	2%	29%	7%	60%	2%

Figure 36: Preventability Score - EHLASS Sweden PIF 4-6 only

SUMMARY OF NATIONAL REVIEWS AND CASE FILE ANALYSIS

Preventability



Preventability Category / PIF Category	1: Current SafeSol	2: Pot Safe Sol	3: Behav Sol	4: No Sol	no Info
PIF 1, no product involvement (n=50)	6%	2%	36%	20%	36%
PIF 2, non-manufactured product (n=100)	18%	0%	49%	30%	3%
PIF 3, proximity product (n=100)	28%	2%	17%	5%	48%
PIF 4, product potentially defective (n=150)	11%	6%	61%	8%	12%
PIF 5, product usage potentially maladapted (n=108)	1%	4%	78%	10%	7%
PIF 6, product with high intrinsic risk (n=124)	9%	6%	75%	6%	4%
PIF 7, not enough information (n=50)	10%	6%	74%	0%	10%
ALL PIF (n=682)	12%	4%	58%	11%	15%

Figure 37: Preventability Categories for individual PIF categories (EHLASS 1999 V.96 STD: AT, SE, NL)

The highest share of accidents that were considered to have a "potential safety solution" was found in the PIF categories 4, 5 and 6 where product involvement is likely to be causal.

Findings on National Reviews of The PIF Procedure by Product Safety Experts

Evaluation of PIF assignments: Through the manual assessment of cases and respective PIF assignments it became obvious that a number of false PIF assignments occurred due to ambiguous search strings. This type of error (type I: accepting false cases) leads to an over-estimation of the size of the respective categories. Obviously, manual assessment of PIF assignments is necessary to refine keywords through truncation and wildcard techniques.

Only rare cases of actual product causality have been found within PIF categories other than 4 to 6 (defective product, maladapted usage, high intrinsic risk); therefore, a low rate of error type II (rejecting "true cases") is assumed for PIF procedure.

Thus, we conclude that the PIF procedure is practical and useful to preselect EHLASS / ISS cases for causal product contribution by the accident description. With a tolerable rate of "false" cases, the accumulation rate of "true" cases is considerable.

Assessing preventability: To decide post hoc whether a safety solution was available for a particular case and whether the accident was preventable proved even more difficult than judging product involvement. Again, this is mainly because of the limited information available in the EHLASS / ISS records.

However, the share of cases with "not enough information" was much lower (16%) than within the PIF analysis (67%). Of the remainder the majority of accidents were attributed to behavioural causes (56% behavioural solution); more than 10% were considered to be preventable by a current (12%) or a potential (4%) technical safety solution.

The highest share of accidents that were considered to have a "potential safety solution" was found in the PIF categories 4, 5 and 6 where causal product involvement is likely.

In conclusion, preventability of an accident proved to be an ambiguous concept and could not be interpreted in the same manner by the product safety experts. Due to the limited and not uniform information available in the EHLASS records, for most of the cases hardly any specific safety recommendations could be given. But also the list of products for which a general safety recommendation was given is small and also comprises a number of "unspecified products". This again shows mayor coding deficiencies, but also demonstrates the importance of the free text in finding uncoded products.

Preventability Score

Preventability Score / PIF Category	1: easy	2: with effort	3: cost, difficult	4: not	no info
PIF 1, no product involvement (n=50)	16%	24%	4%	56%	0%
PIF 2, non-manufactured product (n=100)	39%	13%	2%	43%	2%
PIF 3, proximity product (n=100)	15%	14%	12%	42%	16%
PIF 4, product potentially defective (n=150)	22%	11%	8%	55%	4%
PIF 5, product usage potentially maladapted (n=108)	24%	18%	7%	52%	0%
PIF 6, product with high intrinsic risk (n=124)	16%	35%	20%	25%	3%
ALL (n=632)	28%	18%	8%	41%	5%

Figure 38: Preventability Score. Source: IPP 1999 V.96 STD. Data (AT, SE, NL).

Findings on Preventability Score

Scoring preventability, i.e. to judge the effort to realise a possible solution was critically received by the product safety experts. Diverging conceptions on the chances of behavioural solutions, whether to be scored "easily" or "not preventable", lead to contradictory results in the category ("no solution" = 11%) and the scoring table ("not preventable" = 41%).

Taken at face value about 45% of cases were considered to be preventable reasonably (28% with ease, 18% with some effort). However, this includes also "behavioural solutions".

The highest share of reasonably preventable cases was found in PIF category 6 (high risk product; 16% with ease, 35% with some effort). However, this includes also "behavioural solutions".

Safety recommendations

Which safety solutions for which products or product categories can be derived from the case file analysis? This was the most interesting question that the expert panel hoped to be able to answer by combing the PIF case file information with their expert knowledge. However, as the following table shows it was not possible to devise safety solutions for specific cases beyond a very general level. Again, this was mainly because of the scarce picture produced by the case record information as far as product involvement is concerned.

No.	Product	Safety Recommendation
3	Product unspecified	Use of safety glass in glass doors
2	Circular saw	Safety mechanism of saw; Improve product design to avoid
2	Moulding machine	Redesign of milling cutter? Safety adjustment on milling cutter
2	Other sp. fixed machine	Redesign of hydraulic wood cleaver; Redesign of wood cleaver
1	Electric heating blanket	Prevent blanket from overheating
1	El-grill, separate	improve stableness of product
1	Fireworks	Highlight fireworks safety information
1	Other sp. product	Risk assessment of Boiler for wood chips
1	Product unsp.	standards for tether
1	Product unspecified	Install protective surfacing material
1	Product unspecified	Use certified safety ladder
1	Product unspecified	Improve design of balcony barrier
1	Product unspecified	Improve design of toy
1	Product unspecified	Improve landing mat for gymnastic activities
1	Product unspecified	verify settings ski bindings
1	Product unspecified	Place limit on temperature of hot water boilers
1	Product unspecified	Use of stove guards in homes with children
1	Sawing tool, mechanical	Redesign of product or better maintenance
1	Sledge	Manufacture all sledges with brakes and steering
1	Slicing machine	Improve product design to include safety features

Figure 39: Safety recommendations on consumer products for cases classified under preventability categories 1 (current safety solution) and 2 (potential safety solution)

Findings on Safety recommendations

Case file analysis by product safety experts was based on a random sample of 50 cases for each PIF category. As on the average only 10% of cases were classified to have either a current or a potential safety solution the actual number of cases to derive safety recommendation from was quite small. This situation was still aggravated by a number of wrong PIF assignments.

Therefore, the list of products for which safety recommendations could be given is small and can only serve as a first draft and example.

Furthermore, due to the limited und mostly unspecific information contained within the case files recommendations remained very general.

Interestingly, recommendations were also given for products coded as "unspecified". On one hand, this shows mayor coding deficiencies; on the other hand, it demonstrates the importance of the free text in finding uncoded products.

SUMMARIZING RESULTS OF THE EHLASS / ISS DATA ANALYSIS

The original concept was to summarize the results of the EHLASS / ISS data analysis through all five proposed indicators in one table, the Preventive Safety Table. Thus, this table should comprise scores for the following **relative indicators** by product categories and individual products:

- **Frequency:** Indicating the general "epidemiology" of involved products
- **Severity:** indicating the outcome of all accidents related to a certain product
- **Product causality:** indicating in a qualitative way the extent of product causality
- **Preventability:** indicating in a qualitative way whether the accident was preventable
- **Information need:** indicating the amount of research on certain product categories

For technical reasons preventability and information need could not be included in the Preventive Safety Table, but remain a separate indicator (information need; as product categories could not be exactly matched) or a general complementary "qualifier" to Product causality (preventability; as the assessment was done manually and not all products or products categories could be considered).

"Preventive Safety Priority Table" - Product Categories

The indicators on frequency, severity and product causality were summarized in the following table according to their ranking in the product category list (EHLASS V.96, "product involved in the accident"):

Product Category	Frequency Rank [1]	Severity Rank [2]	Product Causality Rank [3]	Combined Rank (1-3)
Other and unspecified product	1	3	17	7
Electric equipment primarily for use in household	6	14	2	7
Human being, animals, animal articles	5	10	13	9
Part of building and stationary furniture	3	7	18	9
Food, beverages, tobacco	14	11	4	10
Chemicals, detergents, pharmaceutical products	16	4	10	10
Stationary equipm. outside, processed surface outdoors and natural surface	2	8	20	10
Medico-technical equipment, laboratory equipment	23	6	1	10
Natural element, plants and trees	15	9	8	11
Domestic appliances and equipment	12	15	6	11
Furniture and textile	7	5	22	11
Part of building – Other stairs	13	2	21	12
Raw materials, structural elements	8	16	12	12
Means of transport	9	13	15	12
Packaging, containers	17	17	3	12
Machinery for industry, handicraft, and hobby	10	19	9	13
Clothing, baby caring articles and personal effects	11	12	16	13
Part of building – Stairs unspecified	20	1	24	15
Sports equipment	4	18	23	15
Industrial and stationary installations for water, sanitation and electricity	18	23	5	15
Office and shop furniture	22	22	11	18
Toys	19	20	19	19
Musical instrument, photographic/optical equipment	24	21	14	20

Figure 40: Preventive Safety Table – ranking indicators on Frequency, Severity and Product Causality from 1 (high) to 24 (low) by product categories (EHLASS V.96). [1] Frequency: count (n=467.839), [2] Severity: SSDR (n=101.017), [3] Causality: share of PIF4-6 of all PIF (n=72.917)

Product Category (EHLASS V.96)	Severity Rank [2]	Causality Rank [3]	mean	mean dev.
Medico-technical equipment, laboratory equipment	6	1	4	3
Chemicals, detergents, pharmaceutical products	4	10	7	3
Food, beverages, tobacco	11	4	8	4
Electric equipment primarily for use in household	14	2	8	6
Natural element, plants and trees	9	8	9	1
Other and unspecified product	3	17	10	7
Packaging, containers	17	3	10	7
Domestic appliances and equipment	15	6	11	5
Human being, animals, animal articles	10	13	12	2
Part of building - Other stairs	2	21	12	10
Part of building and stationary furniture	7	18	13	6
Part of building - Stairs unspecified	1	24	13	12
Furniture and textile	5	22	14	9
Stationary equipment outside, processed surface outdoors and natural surface	8	20	14	6
Raw materials, structural elements	16	12	14	2
Means of transport	13	15	14	1
Machinery for industry, handicraft, and hobby	19	9	14	5
Clothing, baby caring articles and personal effects	12	16	14	2
Industrial installations, stationary installations for water, sanitation and electricity	23	5	14	9
Office and shop furniture	22	11	17	6
Musical instrument, photographic/optical equipment	21	14	18	4
Toys	20	19	20	1
Sports equipment	18	23	21	3

Figure 41: Preventive Safety Table – ranking indicators on Severity and Product Causality from 1 (high) to 24 (low) by product categories (EHLASS V.96). [2] Severity: SDR (n=101.017), [3] Causality: share of PIF4-6 of all PIF (n=72.917)

Findings on "Preventive Safety Priority Table" - Product Categories

The "Preventive Safety Priority Table" on Product Category level allows for a comprehensive view of Product Involvement (in the EHLASS data set), comprising indicators of frequency, product involvement and injury severity.

Combining indicators for accident frequency, product causality and injury severity ranks the following product categories top five in the "Preventive Safety Priority Table" (disregarding unspecific and non-manufactured product):

1. Electric household equipment
2. Chemical products
3. Medico-technical equipment
4. Domestic appliances and equipment
5. Furniture and textile

When only indicators for Product Causality (share of PIF categories 4-6) and Injury Severity (SSDR) are considered (no explicit indicator for accident frequency) only one new categories (Medico-technical equipment) enters the top five list:

1. Medico-technical equipment, laboratory equipment
2. Chemical products
3. Electric household equipment
4. Packaging and containers (S)
5. Domestic appliances and equipment (G)

The correlation between "product causality" and "injury severity" is weak and tends to be negative; i.e. when injury severity ranks high, Product causality tends to be low (as indicated by the high values of "mean deviation").

Summarizing the results of the literature review it is clear that much research has been done and many safety initiatives have been taken on the following subjects:

- building safety (both constructional safety and safety in use: slipperiness of floors, safe stairs, playing and playgrounds)
- furniture (in particular flammability);
- child care articles;
- chemicals and pharmaceutical products;
- toys.

Findings on "Preventive Safety Priority Table" - Product Categories

Subjects that are hardly addressed by literature or safety initiatives include (C and D categories in Figure 30, alphabetic order):

- Chemical products, detergents, pharmaceutical products
- Domestic appliances and equipment
- Food, beverages, tobacco
- Industrial installations, stationary installations for water, sanitation and electricity
- Machinery for industry, handicraft and hobby
- Natural element, plants and trees
- Office and shop furniture
- Raw material, structural elements

Combining finally the results of the intrinsic EHLASS / ISS data indicators (frequency, severity, product causality) with the indicator on information need (no. of publications) the following product categories have been identified as "priorities" for product safety research (EHLASS V.96 product category in parentheses):

- Domestic appliances and equipment (G)
- Electric household equipment, .. (E)
- Machinery for industry, handicraft and hobby (H)
- Furniture and textile (F)
- Industrial installations, stationary installations for water, sanitation and electricity (D)
- Packaging and containers (S)
- Medico-technical equipment, laboratory equipment (J)
- Chemical products, detergents, ... (R)

"Preventive Safety Priority Table" – Individual Products

Which individual products have been discriminated by the indicators of the "Preventive Safety Priority Table"? The answer to that question can be given in two ways:

- choosing products from top ranking product categories of the "Preventive Safety Priority Table" (EHLASS V.96 categories G,E,H,F,D,S,J,R) with a high SSDR score (cp. Figure 13), regardless of their individual PIF score (Figure 42)
- choosing products that have both a high SSDR and PIF score, regardless of product categories (Figure 43)

Product Code	Product involved in the accident – name	n	SSDR
<i>G</i>	<i>Domestic appliances and equipment</i>		
G0140	Coffee pot	20	48
G3999	Unsp. non-fixtures	20	47
G0130	Pressure cooker	24	45
G3110	Cigarette lighter, petrol	20	43
G3000	Candle	22	40
G3100	Matches	5	38
G0298	Kitchen utensils, other sp.	52	37
G0210	Knife, unsp.	666	33
G0999	Unsp. cutlery, tableware and kitchen utensils	8	32
G3910	Vase	13	30
<i>E</i>	<i>Electric household equipment, ..</i>		
E0098	Other sp. major electric household machine	39	51
E0019	Cooker, oven, unspecified	49	48
E0170	Electric iron	43	43
E5030	Barbeque grill	23	41
E0009	Cooker, hot plate, hob, unspecified	25	38
E2000	Electric wire, extension cord	77	38
E0106	Mixer	8	36
E3060	Telephone with equipment	45	34
E0200	Vacuum cleaner	54	32
E2025	Lamp	85	30
<i>H</i>	<i>Machinery for industry, handicraft and hobby</i>		
H7198	Other sp. garden tool, manual	102	54
H3999	Craft tool/implement, mechanical, unsp.	117	48
H3318	Chain saw, uncertain whether driven by petrol o	24	46
H6020	Scaffold	50	46
H6000	Step ladder, household ladder	639	44
H1998	Machines for lifting, construction, transport a	9	44
H7000	Rotary cultivator, unsp.	9	44
H1199	Machine for construction work, unsp.	21	43
H7100	Lawn mower, manual	18	43
H1999	Machines for lifting, construction, transport a	25	43

Product Code	Product involved in the accident – name	n	SSDR
<i>F</i>	<i>Furniture and textile</i>		
F0005	Cot/cot bed	167	42
F0026	Baby bouncer (hanging)	31	41
F4300	Carpet strip, grip	6	40
F1299	Bed, unsp.	896	40
F1098	Other sp. chair, bench	266	39
F1005	Chair (not folding)	498	38
F1030	Stool/pouf	189	37
F1399	Table, unsp.	599	36
F0022	Infant chair (low)	29	36
F1199	Unsp. settee	234	36
<i>D</i>	<i>Industrial, stationary installations for water, sanitation, electricity</i>		
D0010	Boiler, container in industrial water/steam installation	16	39
D4099	Unsp. stationary electric installation	18	35
D5007	Toilet with seat	38	19
D5012	Bathtub and fittings	21	16
D5014	Cabinet shower and fittings	12	13
D4098	Other sp. stationary electric installation	6	7
D5020	Sauna furnace	5	3
<i>S</i>	<i>Packaging and containers,</i>		
S0120	Aerosol spray	16	39
S0510	Container	8	39
S0999	Packaging, container, part of packaging, unsp.	10	37
S0130	Tins, other	99	36
S0400	Bucket, pail	9	35
S0410	Dust bin	19	35
S0000	Bottle	126	32
S0210	Plastic container	10	30
S0932	String, cord	31	29
<i>J</i>	<i>Medico-technical equipment, laboratory equipment</i>		
J0080	Thermometer	5	27
<i>R</i>	<i>Chemical products, detergents, ..</i>		
R6998	Other sp. pharmaceutical products	245	52
R0000	Methylated spirits (denaturant not sp.)	14	48
R0200	Caustic soda (lye)	13	48
R0999	Chemical products, unsp.	50	47
R0920	Tar, pitch	229	45
R3998	Soap, polish and detergent, other specified	14	45
R0399	Gas/steam/smoke, unsp.	32	44
R0130	White spirit	13	42
R0228	Strong acid, other	8	41
R0336	Carbon, monoxide	25	40

Figure 42: Products leading to high severity injuries in the top five product categories of the "Preventive Safety Priority Table" (taken from SSDR data in descending order of severity, SSDR).
EHLASS V.96 AT, DK, FR, SE 1998.

Product involved in the accident – Name	SSDR
Angle grinder	52
Other sp. chimney, fireplace	51
Beverage, unsp.	49
Bicycle (adult)	47
Chair, bench, unsp.	47
Electric iron	43
Product unsp.	43
Drinking glass	43
Processed surface, outdoors, unsp.	40
Bottle	39
Passenger car, unsp.	39
Stairs, unsp.	39
Roller skates	37
Electric wire, extension cord	35
Floor, flooring, indoors, unsp.	35
Horse	35
Other sp. bicycle and accessories	34
Knife, unsp.	33
Fats and hot liquids, other sp.	32
Firewood	31
Sledge	31
Coffee	30

Figure 43: Products with both a high severity (SSDR > 30) and causality score (PIF 4-6). EHLASS V.96 AT, DK, FR, SE 1998.

Findings on "Preventive Safety Priority Table" – Individual Products

Owing to the EHLASS coding system the coded product information even in its most detailed form only represent a generic product name; i.e. it still remains a product category rather than a special type or brand of product.

The following list of household items represent a selection of the most "dangerous" products primarily in respect to injury severity but also (and / or) to causality of the product in the accident (Figure 42):

- Coffee pot
- Pressure cooker
- Cigarette lighter, petrol
- Cooker, oven
- Electric iron
- Chain saw
- Cot/cot bed
- Baby bouncer (hanging)
- Boiler
- Aerosol spray
- Tins, other
- Thermometer
- Caustic soda (lye)

The following list gives a selection of 10 "priority" products for potential safety design improvements, as these items were found to have both a high causality in the accident and a high injury severity score (Figure 43):

- Angle grinder
- Other sp. chimney, fireplace
- Beverage, unsp.
- Bicycle (adult)
- Chair, bench, unsp.
- Electric iron
- Product unsp.
- Drinking glass
- Processed surface, outdoors, unsp.
- Bottle

CONCLUSIONS AND RECOMMENDATIONS

Tools and Methods A review of international product involvement classifications in injury surveillance systems and the pilot implementation of an automatic procedure to qualify product involvement in the EHLASS / ISS data set yielded the following "general purpose" achievements:

1. a recommendation for a standardised Product Involvement Coding in injury registration systems - The Product Involvement Factor (PIF):

PIF categories
PIF 1 – No product involved
PIF 2 – Product non-manufactured
PIF 3 – Product related to proximity
PIF 4 – Product potentially defective
PIF 5 – Product potentially maladapted:
PIF 6 – Product with high intrinsic risk:
PIF 7 – Product identified but description inadequate to enable a judgment

2. A software tool for the post hoc application of the PIF for the EHLASS / ISS data set - The AUTO-PIF software.
3. Recommendations for a comprehensive and indicator based reporting of the product information contained in the EHLASS / ISS data set: The "Preventive Product Safety Table":

Product Category (top ten; EHLASS V.96 1. digit)	Rank [1-24] *			
	Fre- quency	Severity	Product Causality	Average (Priority)
Other and unspecified product	1	3	17	7
Electric equipment primarily for use in household	6	14	2	7
Human being, animals, animal articles	5	10	13	9
Part of building and stationary furniture	3	7	18	9
Food, beverages, tobacco	14	11	4	10
Chemicals, detergents, pharmaceutical products	16	4	10	10
Stationary equipm., processed and natural surface – outside	2	8	20	10
Medico-technical equipment, laboratory equipment	23	6	1	10
Natural element, plants and trees	15	9	8	11
Domestic appliances and equipment	12	15	6	11

* Rank 1 = highest, rank 24 = lowest; e.g.: Product Category "Electric equipment" has rank 6 in frequency, 14 in severity, 2 in causality and 7 on the average of all three indicators; possible ranks are 24, corresponding to the no. of product categories

The pilot application of these tools to four national EHLASS data sets by the product safety expert panel has demonstrated:

- the PIF classification and the "product safety priority table" are valuable and useful instruments for monitoring product involvement and reporting EHLASS product information on a generic level;
- the keyword based PIF procedure (PIF classification and AUTO-PIF software) is a practical and useful tool to preselect EHLASS / ISS cases by type of product (simple product definition) and product involvement (causality indicator). The rate of "false" PIF assignments are tolerable, and the accumulation rate of "true"(product relevant) cases is considerable. The multi-lingual and flexible design of the PIF software allows for easy adaptation to any national data set.
- technically, the current AUTO-PIF software version features automatic PIF classification of EHLASS V.96 data, choice of either EHLASS product fields 1, 2 or 3 for PIF-classification, dynamic update of keywords, multi-lingual keyword search and output of case files for preventive safety analysis; for Win95, 98, NT, 2000).
- the "product safety priority table" provides a broad evidence-based framework for product and consumer safety research by comprising indicators of frequency, severity and causality of product related accidents. The "product safety priority table", as an extension of the PIF classification, is recommended as a management level reporting format for the product information contained in the EHLASS / ISS data set.

However, the lack of an underlying product definition, inconsistent product coding and little specific product information in the accident description still impose mayor restrictions even on this "high level" reporting functionality. Recommendations to overcome this restriction include more explicit coding guidelines and training modules, a reduction of the number of product codes, a structured free text and last but not least an underlying definition of the term product that corresponds to EU product safety legislation.

Product Involvement Factor (PIF) results. The PIF classification of cases yields a product oriented view on EHLASS / ISS data and a preselection of cases by type of product and type of product involvement. PIF categories 1 and 2 provide an implicit product definition: non manufactured products are sorted out. PIF categories 3, 4, 5 and 6 represent causality classes, proposing on the role of the product in the accident. The pilot implementation of the PIF procedure to four national data sets (AT, FR, NL, SE) yielded the following results on product involvement in accidents:

- in 85 % of cases a "Manufactured product was involved" (PIF 3-7; range 66-94%)
- in 19 % of cases the "Product role was identified" (PIF 3-6; range 16-24%)
- in 5 % of cases "Product causality was likely" (PIF 4-6; range 1-11%)
- in 2 % of cases the "Product was potentially defective" (PIF 4; range 0,4-4%)
- within manufactured products only, 17% are proximity products and 5% are "causality products" (PIF 4-6: defective products, maladapted, high risk)

In comparison to the results of the manual product involvement classification (step 1: international review) the AUTO-PIF tends to underestimate the share of products with a "clear role" in the accident, e. g. defective product, by a factor of two.

Products and product categories assigned to PIF categories 4-6 represent the most interesting cases for "preventive safety research". However, the distinction between individual categories 4, 5 and 6 by keywords matching the accident description proved very difficult. In many case multiple assignments of PIF categories as well as wrong assignments occurred. Therefore, in order to implement the PIF software for a new language (currently available for English, Dutch, French, German and Swedish) tests for different keyword-sets are recommended (sensitivity analysis by manual assessment of PIF assignments, and refinement of keywords through truncation and wildcard techniques).

A comparisons of EHLASS V.96 products in PIF categories 4-6 (pooled as "product causality likely") with EHLASS Germany, the most elaborate study on product involvement found in our review, yielded a similar ranking in both systems. This underlines the generally validity of the PIF procedure.

"Product Safety Priority Table" Products and product categories of the "Preventive Safety Priority Table" have been discriminated by indicators of frequency of occurrence, severity of the injury and degree of causality. After excluding non-manufactured products and adding the indicator on information need ("research coverage", i.e. no. of publications) the following product categories and generic products have been exemplified as "priorities" for product safety research:

- Machinery for industry, handicraft and hobby: Manual garden tool, Mechanical Craft tool/implement, Chain saw
- Electric household equipment: Major electric household machine, Cooker/oven, Electric iron, Barbeque grill
- Domestic appliances and equipment: Coffee pot, Unsp. non-fixtures, Pressure cooker
- Furniture and textile: Cot/cot bed. Baby bouncer (hanging), Carpet strip/grip
- Industrial installations, stationary installations for water, sanitation and electricity: Boiler, stationary electric installation
- Packaging and containers: Aerosol spray, Container, Tins
- Medico-technical equipment, laboratory equipment: Thermometer
- Chemical products, detergents: Pharmaceutical products, Soap, polish and detergent

These products should – in theory – reflect best the original intention of the PIF procedure and the "Preventive Safety Priority Table": to come up with specific products that have a potential for safety design improvements. In practice, even though most of these products confirm the common knowledge on dangerous products the quality deficiency of the data imposed major restrictions on the AUTO-PIF procedure.

Thus, this list should be looked at as a proof for the general feasibility of the "Preventive Safety Priority Table" by the proposed indicators, rather than a comprehensive and exhaustive list of all "high priority" products registered in the EHLASS data.

The items of this list lack specificity and are by themselves reflecting a broad range of "sub-products". However, being generic products these items point to well defined problem zones of every day life, to be looked at more intensely by consumer safety policy. And compared to the total of 1500 available EHLASS product codes this selection of a few products represents a "priority" choice based on objective criteria, allowing for decisions informed by empirical evidence.

Preventability and possible safety solutions The potential for safety design improvements should be addressed in step 4 of the analysis: the "product safety expert panel" assessed preventability and possible safety solutions in a sample of PIF case files (of four national EHLASS data sets):

- the majority of accidents (56%) was attributed predominately to behavioural causes
- 12% were considered to be preventable by a current technical safety solution,
- 4% by a potential technical safety solution
- the share of cases with "not enough information" was 16%

The highest share of accidents that were considered to have a "potential safety solution" was found in the PIF categories 4, 5 and 6 (product involvement likely to be causal). However, it was not possible to devise safety recommendations for specific cases beyond a very general level. This was mainly because of the limited information on product involvement in the accident description; but also, preventability of an accident proved to be an ambiguous concept and could not be interpreted in the same manner by the product safety experts.

Conclusions Based on the results of the PIF analysis the expert panel drew the following conclusions:

- in general, the product information recorded in the current EHLASS / ISS data sets can be extremely useful for monitoring product involvement on a generic level. The "product safety priority table" is recommended as an indicator-based reporting tool (indicators of frequency, severity and causality). Used as such, it provides a broad empirical framework for product and consumer safety research. However, the lack of an underlying product definition, inconsistent product coding and little specific product information in the accident description impose mayor restrictions even on this "high level" reporting functionality.
- technically, the key-word based PIF procedure (PIF classification and AUTO-PIF software) is a practical and useful tool to preselect EHLASS / ISS cases by type of product (simple product definition) and product involvement (causality indicator). The rate of "false" PIF assignments are tolerable, and the accumulation rate of "true" (product relevant) cases is considerable. The multi-lingual and flexible design of the PIF software allows for easy adaptation to any national data set.
- product oriented assessment of preventability and specific safety solutions in individual records proved to be very difficult. The EHLASS case files (free text description in combination with other data) in their present form contain little information, and certainly no systematic information, to classify the role of products unambiguously. Thus, in most cases (with likely causal product involvement) only very general safety recommendation could be given.

The AUTO-PIF software highlighted some of the known structural problems of the EHLASS / ISS database, in particular those relevant for its product safety part. It was concluded that the EHLASS databases in their present form contain little information, and certainly no systematic information, to classify the role of products unambiguously:

1. National differences in product coding and recording of free text are considerable: More specific guidelines and tools for "Common Coding Standards" are encouraged, and are presented for recording of free text.
2. Product codes are characterized by a high share of unspecific codes: Revision of product codes (less codes and provision of specific information in case of relevant product involvement) and quality assurance is encouraged

3. The free text description is often too vague, even in combination with other data from the EHLASS record. A practical solution could be to include the instruction in the EHLASS coding manual that the free text field should always briefly mention the contributing factors in a fixed order, e.g. person's behavior, specific product features, physical environment (see chapter "Products and Tools" for a recommendation for ISS Free Text Recording).
4. For data analysis on EU level (within the ISS database) it is recommended to provide the free text also in an international version: by machine translation of national free texts into English; the feasibility of this procedure was demonstrated within this study (see chapter "AUTO-TRANS procedure").

Recommendations The literature review confirmed that EHLASS / ISS is the only available instrument to provide an empirical background in injuries related to (consumer) products on EU level. The following recommendations by the project team might help to overcome the structural and quality-linked restrictions (mentioned above) that currently keep EHLASS / ISS from being more widely used as a product safety tool:

- introduce a product concept and a product definition that is linked to the EU product safety legislation
- reduce the number of products in the product list (e.g. to three digit level)
- instead, add a cause variable including a product involvement classification (product "flag") to the list of variables (e.g. like the PIF classification)
- only in case of "product causality" (e. g. PIF category 4-6), ask for specific and standardized product information
- the "product causality cases" (flagged cases) could immediately be forwarded to the scrutiny of the national data centers (and also to EU level subsequently) – allowing for rapid reaction
- generally, structure and standardize accident description ("free text") to allow for better comparability and guarantee information *additional* to the codes

Tools For the moment, also the tools developed by product safety expert panel might enhance the utility of the current EHLASS / ISS data:

- implement and "enforce" common coding and quality standards (through guidelines)

- provide all accident descriptions (free text) on HIEMS / ISS level in English (the feasibility of machine translation for this purpose is shown in this report)
- implement the EHLASS-based indicators on severity (SSDR) and causality (AUTO-PIF) on HIEMS/ISS level and use the “product safety priority table” as a reporting tool

PRODUCTS AND TOOLS

AUTO-PIF: SOFTWARE FOR AUTOMATIC PRODUCT INVOLVEMENT CLASSIFICATION (PIF)

SOFTWARE REFERENCE AND USER GUIDE

(Marc Nectoux, Mathilde Sector)

Objectives of PIF procedure

This computer based procedure aims at creating a tool able to sort out automatically in ISS files (former EHLASS files) edited on V96 format the potentially “interesting” cases in terms of prevention. Therefore each case is assigned one or more PIF codes qualifying the case according to the product’s dangerousness. We use both the information delivered by the free text (120 character zone reserved for accident description) and the nomenclature of the product codes (V96).

The Classification Algorithm

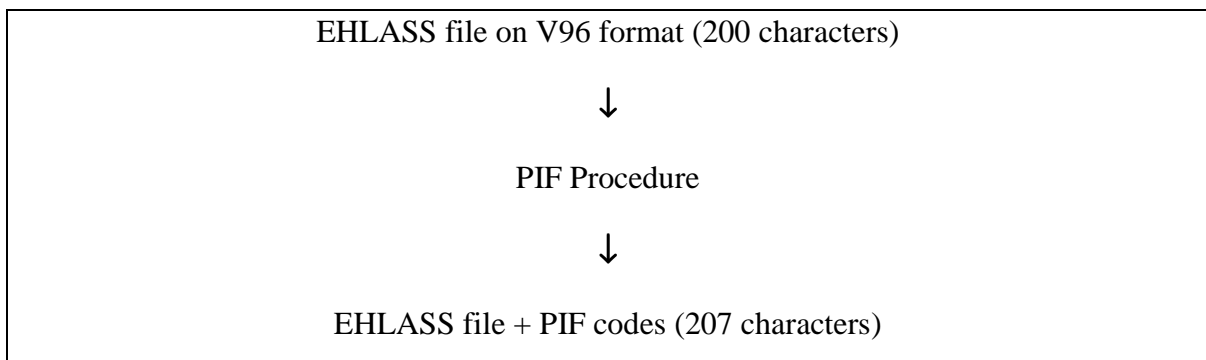
The PIF codes are classified as follows:

- Code 1: No product involved
- Code 2: Product non manufactured
- Code 3: Proximity product
- Code 4: Product potentially defected
- Code 5: Product usage maladapted
- Code 6: Product with high intrinsic risk potential
- Code 7: None of the above categories

With regard to our objectives we consider codes 4, 5, and 6 to be the most interesting. The first three categories refer to the classification by the product codes, and the following three categories are linked to certain key-words appearing in the free text²¹²²²³.

The interactive PIF procedure

We have first developed a programme following the PIF algorithm (version 3) as described in the figure above. We use the EHLASS file edited on V96 format (200 characters) as input file and rewrite the output file with seven additional characters: the PIF codes (yes/no)



According to the PIF classification based on the analysis of each registration and the determination of the PIF codes, one product might be classified by different code combinations. Therefore, as a next step, a count has to be installed in order to show how many times a product has been classified in a different category. What we aim at is to put eventually into evidence a “spectrum/range of dangerousness for the category of a given product. Assuming that we find 141 accidents with a pressure cooker involved, the research result for this product category could be as follows:

- Cat 3: Product defective: 3 times
- Cat 4: Product usage maladapted: 1 time
- Cat 6: Product with high intrinsic risk potential: 137 times

In our software EPI-INFO, we prolonged the data file by adding a column for the PIF code.

In addition to the programme we have developed an interactive interface by using VISUAL BASIC which enables to parameterize

- the name of the input file
- the labels of the test tables

- ⇒ Test 1: No product involved (according to product code list V96)
- ⇒ Test 2: Product non-manufactured (according to product code list V96)
- ⇒ Test 3: Proximity product (according to product code list V96)
- ⇒ Test 4: Product potentially defective (according to multi-lingual key word list)
- ⇒ Test 5: Product usage maladapted (according to multi-lingual key word list)
- ⇒ Test 6: Product with high intrinsic risk potential (according to multi-lingual key word list)

- the tables corresponding to each test were put into separate files from the rest of the procedure so that modifications can be easily carried out by the user. Respecting the presentation format the user is able to dynamically cancel, modify or add a label line.

Example:

(French)	(English)	(German)
«XXXXXX»	«XXXXXX»	«XXXXXX»
BRULURE	;«BURN»	
;«BRENN»		
«XXXXXX»	«XXXXXX»	«XXXXXX»

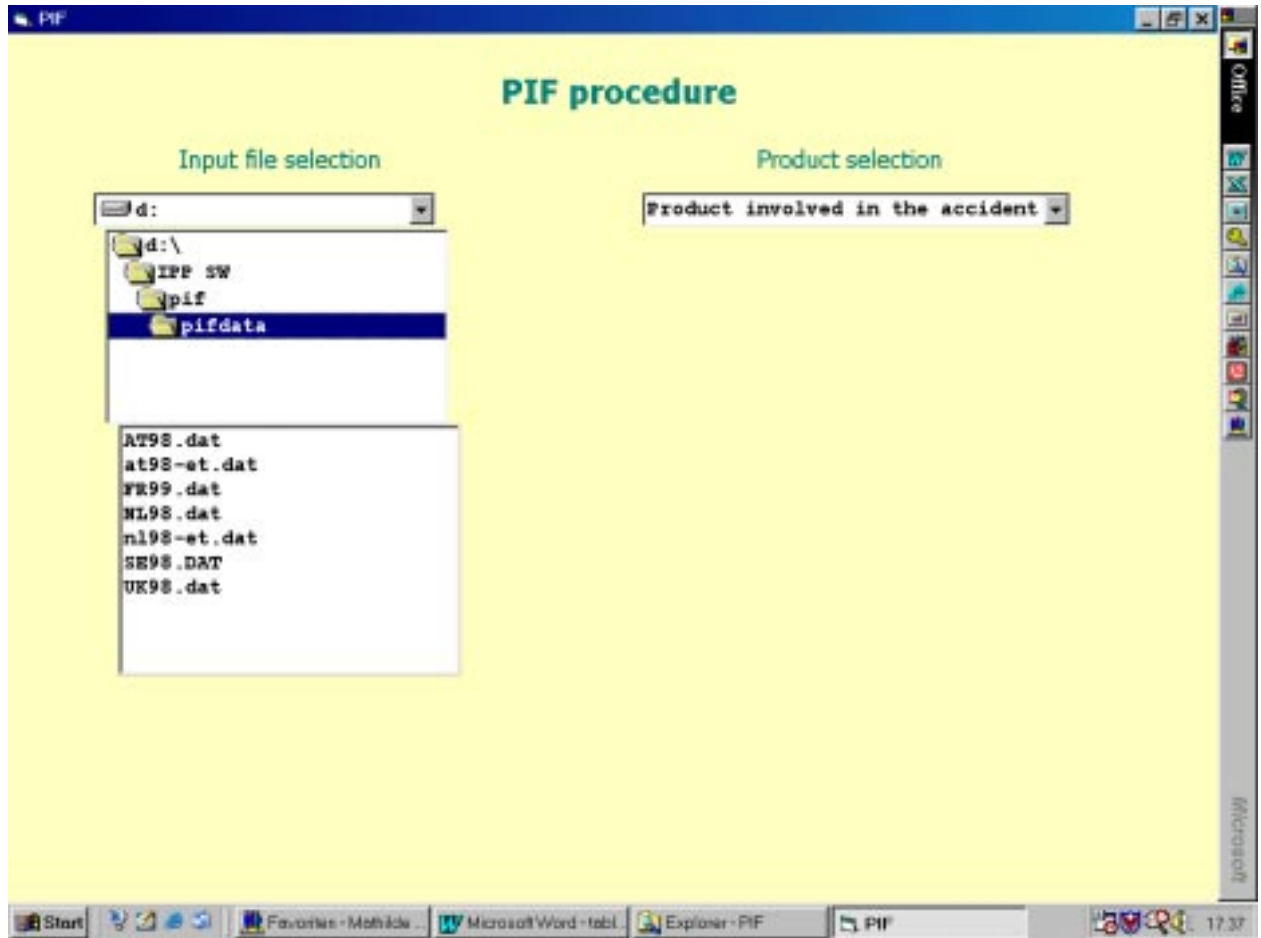
With the country code registered by EHLASS (the first two letters of registration) the procedure will determine which column of the tables has to be considered. The research can be run on the free texts in capital letters without accents.

Once the parametric procedure is run, the user is able to launch the (execution of) procedure on the chosen file which is able

- to count for each registration the respective PIF code
- to rewrite the output file (\$OUTPUT.DAT) edited on Excel format
- to show the first 50 cases of each PIF code
- to deliver the global result of the procedure (absolute figure and percentage of each PIF code)

AUTO-TRANS – PROCEDURE AND SEARCH TOOL FOR MULTILINGUAL CASE ANALYSIS

The free text from the original EHLASS data files (AT98.dat, NL98.dat) were sent for machine translation at the Commission into English (at98-et, nl98-et). The user can then choose via 'Input File Selection' which data file to use (see screen shot below).



RECOMMENDATION FOR ISS (PRODUCT SPECIFIC) FREE TEXT RECORDING

Structure

- body of free text: 2 zones
- zone 1: description of the circumstances, should always briefly mention the contributing factors in a fixed order, e.g. person's behavior, physical environment, product involvement by the PIF classification; in case of PIF 3, 4 or 6 ("product causality likely") also fill in zone 2.
- zone 2: specific product features, only if product is likely to be causal to the accident (see example for the Austrian Product Safety Survey on next page).

Quality Management and Control

- provide detailed instructions in the ISS Coding Manual for use of free texts / to minimize redundancy between the coding labels and the text
- provide in the ISS Coding Manual examples of good and bad free texts
- all words in CAPITAL letters, with no accents
- no use of abbreviations specific to each site or country
- systematic use of spell check prior to sending data
- machine translation of free text on EU ISS level (see chapter "Methods")

Product Safety Support

- Zone 2 information can be used for tracing of the case in which the accident is particularly interesting and would benefit from further analysis / re-interview the case, while respecting confidentiality
- an national or EU-level informational pamphlet which specifies European product safety legislation (see two examples below) should be given to patients who have experienced "a product causality likely" accident (PIF 3-6).

Example for specific product features that could be recorded in cases where product involvement is likely to be causal to the accident (taken from the Austrian Product Safety Survey, which is an add-on to the standard ISS questionnaire and can also be used as a reporting fax to the national consumer authority for cases relevant under the GPSD):

Produktsicherheit/Meldeformblatt (EHLASS - Sonderprogramm 01/03)

Name: _____ Tel. Nr.: _____

Adresse: _____

An das

Bundesministerium für Gesundheit, Sport
und Konsumentenschutz
Produktsicherheit

Radetzkystraße 2, 1030 Wien

1. Beschreibung des Produkts

Bezeichnung: _____ Marke: _____

Normkennzeichnung vorhanden: Ja Nein

Bedienungsanleitung vorhanden? Ja Nein

Alter des Produkts: 0-2 Jahre 2-5 Jahre älter als 5 Jahre

2. Wo wurde das Produkt erworben?

Österreich Ausland: _____

Firmenname und Adresse: _____

3. Falls erforderlich: Wer führte die Montage des Produkts durch?

Fachmann Laie Sonstige Person: _____

4. Wo haben sie sich über die Handhabung des Produkts informiert?

Beratung bei Kauf Einschulung durch Fachpersonal

Bedienungsanleitung gelesen Privat (z.B. durch Bekannte, Verwandte) informiert

Sonstiges: _____

5. Falls erforderlich: Schutzausrüstung

Schutzvorrichtung beim Kauf am Produkt vorhanden? Ja Nein

Ist bei der Verwendung eine persönliche Schutzausrüstung erforderlich? Ja Nein

Wurde beim Unfall eine persönliche Schutzausrüstung verwendet? Ja Nein

6. Allgemeiner Umgang mit dem Produkt vor dem Unfall

Wo wurde das Produkt gelagert? _____

Wann wurde das Produkt zuletzt gewartet? Jahr: _____

Wurde das Produkt eigenmächtig verändert? Ja Nein

Wie oft pro Jahr wurde das Produkt cirka verwendet? _____

Below is an example from Germany of informational pamphlet²⁴ which specifies European product safety legislation that should be given to patients who have experienced “a product causality likely” accident:



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