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PUBLIC PERCEPTION OF SAFE USE OF EVERYDAY CHEMICALS . CASE STUDY "PROFESSIONALS USERS"

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INTRODUCTION

Abstract

Throughout the 20th century, the scientific world's views of the criteria for hazard communication worldwide have significantly changed. It is of foremost importance to mention that The United Nations Globally Harmonized System of Classification and Labelling of Chemicals (UN-GHS) has been developed to harmonize such criteria. The European Regulation on classification, labeling, and packaging of substances and mixtures [CLP Regulation (European Commission, EC) No 1272/2008] has aligned the existing European Union (EU) legislation to the UN-GHS. This CLP Regulation entered into force on January 20, 2009, and will, after a transitional period, replace the current rules on classification, labeling, and packaging for supply and use in Europe. Both old and new classifications will exist simultaneously until 2010 for substances and until 2015 for mixtures (until 2017 for some special cases).

AIMS AND METHOD: The main aim is to assess the comprehension among different workers of the hazard pictograms as defined by the Globally Harmonized System (GHS) of the United Nations, concerning the classification, labeling and packaging of substances and mixtures. The following study was conducted to test whether the presence of hazard pictograms and hazard and precautionary statetments to safety data sheets and product labels contribute to the successful transfer of the appropriate information to users. The experimental phase of the study, as I have written above, is addressed to different producers and downstream users. We tried to investigate their response to the following items:

- ✓ How they understand the labeling of the dangerous products
- ✓ What is their knowledge about the hazardous of the products they use
- ✓ To what extent they perceive the risk they are exposed to, daily, at work
- ✓ What protective measures they use or they believe they should use

All these results are compared to their age, educational level, occupation, work experience and health problems.

More specifically, 150 workers or owners were tested to determine any potential difference based on a questionnaire with demographic data, professions and 20 questions involving communication of chemicals risk and hazard pictograms. Along with the questionnaire, I have interviewed employees about how they feel and understand the extent of their exposure at work and how they think that should protect themselves. The SPSS 22 program was used in the statistical analysis of the results.

RESULTS

The effect of the presence of hazard pictograms to safety data sheets and labels was only partially statistically significant. A major benefit of adding the hazard pictograms in the questionnaire was that the responding time to the survey questions decreased. It is important to realize that GHS format (hazard pictograms) to the SDS and labels do provide benefits to users, but the system will need further enhancements and modifications to continue to improve the effectiveness of hazard communication. All in all, this study suggests that the presence of GHS hazard pictograms to SDS and labels may benefit the user.

PROLOGUE

Chemicals in our Life

Chemicals are the building blocks of life. They are present in us, all around us, and in every product we buy. Human beings and animals are made of chemicals; cooking food is all about chemistry; the drugs that prevent and treat illnesses are made of chemicals; and even the sun that enables life on earth is made of chemicals. Chemicals are both naturally occurring and manmade. Life would not exist without them.The manufacture and use of chemicals has brought innumerable benefits to modern society. But, like fire, chemicals are good servants but bad masters. Some pose a threat to safety from fire or explosion, others have the potential to harm the environment, and most can harm human health.

The hazards of chemicals can be classified using classification criteria that are based on physical, chemical and ecotoxicological endpoints. These criteria may be developed based on scientific or regulatory processes. A number of national and international schemes have been developed over the past 50 years, and some, such as the UN Dangerous Goods system or the EC system for hazardous substances, are in widespread use. However, the unnecessarily complicated multiplicity of existing hazard classifications created much unnecessary confusion at the user level, and a recommendation was made at the 1992 Rio Earth summit to develop a globally harmonized chemical hazard classification and compatible labelling system, including easily understandable symbols, that could be used for manufacture, transport, use and disposal of chemical substances. This became the globally harmonized system for the Classification and Labeling of Chemicals (GHS). The developmental phase of the GHS is largely complete. Consistent criteria for categorising chemicals according to their toxic, physical, chemical and ecological hazards are now available. Consistent hazard communication tools such as labelling and material safety data sheets are also close to finalisation. The next phase is implementation of the GHS. The Intergovernmental Forum for Chemical Safety recommends that all countries implement the GHS as soon as possible The world will finally have one system for classification of chemical hazards to protect workers, consumers and the environment by labelling that reflects a particular chemical's possible hazards. This results in making hazard communication more uniform and improving comprehension. It also addresses the notification of classifications, the establishment of a list of harmonised classifications and the creation of a classification and labelling inventory, as required by REACH. Before placing chemicals on the market, the industry must establish the potential risks to human health and the environment of such substances and mixtures, classifying them in line with the identified hazards. The hazardous chemicals also have to be labelled according to a standardised system so that workers and consumers know about their effects before they handle them. The CLP Regulation ensures that the hazards presented by chemicals are clearly communicated to workers and consumers in the European Union through classification and labelling of chemicals. Thanks to this process, the hazards of chemicals are communicated through standard statements and pictograms on labels and safety data sheets. For example, when a supplier identifies a substance as "acute toxicity category 1 (oral)", the labelling will include the hazard statement "fatal if swallowed", the word "Danger" and a pictogram with a skull and crossbones{1}

HAZARD CLASSIFICATION:

The new hazard classification will introduce new health hazard classes and categories, with associated new hazard pictograms, signal words, Hazard (H)-statements, and Precautionary (P)-statements as labelling elements. Furthermore, the CLP Regulation will affect the notification of product information on hazardous products to poisons information centers

1.1. European legislative framework

ECHA

The European Chemicals Agency (ECHA) is the driving force among regulatory authorities in implementing the EU's groundbreaking chemicals legislation for the benefit of human health and the environment as well as for innovation and competitiveness. ECHA helps companies to comply with the legislation, advances the safe use of chemicals, provides information on chemicals and addresses chemicals of concern.

REGULATIONS

The new EU chemicals legislation applies to all industry sectors dealing with chemicals along the entire supply chain. It therefore makes companies responsible for the safety of chemicals they place on the market.

Echa is coordinating through all the Member States of the European Union the following four fundamental regulations:

1. Regulation for the Registration, Evaluation, Authorization and Restriction of Chemicals - REACH
2. Regulation for the Classifiction, Labeling and Packaging - CLP
3. Biocidal Products Regulation - BPR
4. Prior Informed Consent Regulation - PIC

1. REACH

REACH is a regulation of the European Union, adopted to improve the protection of human health and the environment from the risks that can be posed by chemicals, while enhancing the competitiveness of the EU chemicals industry. It also promotes alternative methods for the hazard assessment of substances in order to reduce the number of tests on animals.

Moreover, REACH stands for Registration, Evaluation, Authorisation and Restriction of Chemicals. It entered into force on 1 June 2007.

A. Safety data sheets

Safety data sheets are the main communication tool between suppliers and users of substances and mixtures and it is an obligation for the industry according to the REACH Regulation.

The safety data sheets include information on the physical, chemical and hazardous properties of the substance or mixture as well as instructions for their handling, disposal and transport, and for first-aid, fire-fighting and exposure control measures.

- **Extentended data sheet**

Safety data sheets include information about the properties of the substance or mixture, its hazards and instructions for handling, disposal and transport and also first-aid, fire-fighting and exposure control measures. The format and content of the safety data sheets are specified in REACH. A safety data sheet should be provided to downstream users for:

- A substance or mixture that is classified as hazardous according to CLP.
- A substance that is persistent, bioaccumulative and toxic (PBT) or very persistent and very bioaccumulative (vPvB), or
- A substance that is included in the Candidate List of substances of very high concern (SVHCs

However, if the substance or mixture is also sold to the general public, an SDS does not need to be provided unless requested by a downstream user or distributor. For mixtures which are not classified as hazardous but which contain certain hazardous substances, an SDS should be provided if requested by downstream users or distributors.

The safety data sheet should be updated without delay if new information becomes available on the hazards or the need for more stringent risk management measures. When downstream users receive a safety data sheet, they need to identify and apply appropriate measures to adequately control the risks. Suppliers and recipients of SDSs are encouraged to check that the required information is provided. A checklist was developed by ECHA and enforcement authorities and is available for this purpose. Downstream users are encouraged to inform their suppliers about inaccuracies or inconsistencies in the SDS received.

When safety data sheets are not required, the supplier must still provide sufficient information for safe use. If restriction or authorisation applies to any substance, the necessary details should be provided. Suppliers of articles that contain more than 0.1% w/w of a substance included in the Candidate List have to provide enough information to allow the safe use of the article to downstream users and distributors.

- **Exposure scenarios**

Exposure scenarios provide information on how the exposure of workers, consumers and the environment to hazardous substances can be controlled during use. Relevant exposure scenarios should be included as an annex to the safety data sheet of a substance when a company in the supply chain has carried out a chemical safety assessment under REACH.

Harmonisation and automation are essential elements for efficient communication. To support this, a common layout format for the exposure scenarios was agreed and the ESCom catalogue of standard phrases and IT format (ESComXML) were developed. This allows an automated exchange of harmonised information on the safe use of chemicals between various actors in the supply chain and their own systems.

When downstream users receive exposure scenarios, they must check that they cover their own use of the substance and their conditions of use or take alternative action.

The formulator of hazardous mixtures must identify the relevant information from the exposure scenarios to communicate, and also how best to communicate this information.

Two approaches have been developed by industry to identify the information to communicate. One approach, called "safe use of mixtures information" (SUMI), is where sector organisations identify the risk management measures for typical products and uses within the sector. They generate SUMIs giving this advice in a user-friendly way and based on an agreed template.

The formulators select the appropriate SUMI for their product, and check that it is consistent with the exposure scenarios received from their suppliers. An explanatory document has been published by DUCC, the Downstream Users of Chemicals Coordination group.

The second approach, called the "lead component identification" (LCID), is intended for situations when a suitable SUMI is not available. The formulator identifies the lead components in a mixture and derives safe use information for the mixture from the risk management measures for the lead components. Cefic has published a practical guide on the LCID methodology.

Formulators can choose to communicate the relevant information from the exposure scenarios of the ingredient substances in a number of ways:

- ✓ Integrate information into the main body of the safety data sheet

This is suitable when the recipients are end users and when there are a relatively small number of identified uses and/or consistent conditions of use and risk management measures.

- ✓ Attach safe use information for the mixture as an annex to the safety data sheet

This is suitable when there are a range of uses with different conditions of use. A harmonised format has been agreed among sector organisations, called SUMI template.

- ✓ Attach relevant exposure scenarios for the substances in the mixture in an annex to the safety data sheet

B. Effective communication in the supply chain

Effective communication between downstream users and suppliers at all stages in the REACH process helps to ensure that relevant information is provided in the supply chain.

When downstream users provide information regarding their uses and conditions of use to their suppliers, registrants can base the exposure scenarios in their chemical safety assessment on this information. Consequently, the advice on safe use that the registrant communicates to downstream users is likely to be relevant and realistic.

Industry sector organisations, Member States, and ECHA have worked together to improve and harmonise communication in the supply chain as part of the CSR/ES Roadmap and the Exchange Network on Exposure Scenarios (ENES). For communication upstream, "use maps" have been developed to provide information to registrants, often through sector organisations.

For communication downstream, a number of elements have been developed: exposure scenario templates have been agreed for substances; safe use of mixture information (SUMI) templates have been agreed for mixtures; phrases and IT communication of exposure scenarios have been harmonised; a methodology has been developed for identifying the lead component in mixtures.

2.CLP

The CLP Regulation ensures that the hazards presented by chemicals are clearly communicated to workers and consumers in the European Union through classification and labelling of chemicals.

Before placing chemicals on the market, the industry must establish the potential risks to human health and the environment of such substances and mixtures, classifying them in line with the identified hazards. The hazardous chemicals also have to be labelled according to a standardised system so that workers and consumers know about their effects before they handle them.

Thanks to this process, the hazards of chemicals are communicated through standard statements and pictograms on labels and safety data sheets. For example, when a supplier identifies a substance as "acute toxicity category 1 (oral)", the labelling will include the hazard statement "fatal if swallowed", the word "Danger" and a pictogram with a skull and crossbones.

CLP stands for **Classification, Labelling and Packaging**. The CLP Regulation entered into force in January 2009, and the method of classifying and labelling chemicals it introduced is based on the United Nations' Globally Harmonised System (GHS).

Classification

In most of the cases, suppliers need to decide on the classification of a substance or mixture. This is called self-classification.

There are normally four basic steps to self-classify a substance or a mixture:

- Collection of available information
- Evaluation of the adequacy and reliability of the information
- Review of the information against the classification criteria
- Decision on classification

If required by REACH, manufacturers and importers also need to classify substances which are not placed on the market, such as on-site isolated intermediates, transported intermediates or substances for product and process-orientated research and development (PPORD).

LABELLING/PACKAGING

Suppliers must label a substance or mixture contained in packaging according to CLP before placing it on the market either when:

- A substance is classified as hazardous.
- A mixture contains one or more substances classified as hazardous above a certain threshold.

CLP defines the content of the label and the organisation of the various labelling elements. The label includes:

- The name, address and telephone number of the supplier
- The nominal quantity of a substance or mixture in the packages made available to the general public (unless this quantity is specified elsewhere on the package)
- Product identifiers
- Where applicable, hazard pictograms, signal words, hazard statements, precautionary statements and supplemental information required by other legislation.
- **Child-resistant fastening and tactile warnings**

If substances or mixtures are supplied to the general public, then child-resistant fastenings and/or tactile warnings of danger have to be attached to their packaging in case these substances or mixtures display certain hazards or if the packaging contains methanol or dichloromethane. An overview of the different hazards that trigger this obligation is provided in the *overview table of hazards that trigger child-resistant fastening or tactile warnings*.

A. C&L Inventory

The Classification and Labelling (C&L) Inventory is a **database** that contains basic classification and labelling information on notified and registered substances received from manufacturers and importers.

This database contains classification and labelling information on notified and registered substances received from manufacturers and importers. It also includes the list of harmonised classifications (Tables 3.1 and 3.2 of Annex VI to the CLP Regulation) and the names of harmonised substances translated in all EU languages.

Companies have provided this information in their C&L notifications or registration dossiers. ECHA maintains the C&L Inventory, but does not review or verify the accuracy of the information.

Information in the C&L Inventory

Every manufacturer or importer must notify a substance to the Classification and Labelling (C&L) Inventory within one month from being placed on the market when:

- Manufacture the substance and it is subject to registration under the REACH Regulation or
- Import the substance and it is subject to registration under the REACH Regulation or
- Manufacture or import the substance and it is classified as hazardous, irrespective of the quantity or
- Import a mixture which contains the substance that is **classified as hazardous** and is present above the relevant concentration limit, which results in the classification of the mixture as hazardous according to the CLP Regulation or

- Import an article containing substances which are subject to registration under Article 7 of the REACH Regulation.

The notification should include:

- Name and contact details of the notifier;
- Identity of the substance, including the name and other identifiers, information related to molecular and structural formula, composition, nature and amount of additives;
- Classification of the substance according to the CLP criteria;
- Reason for "no classification" if the substance is classified in some but not all hazard classes or differentiations indicating whether this is due to a lack of data,inconclusive data, or data which is conclusive for non-classification;
- Specific concentration limits or M-factors, where relevant, including a justification for setting them; and
- Label elements, including hazard pictograms, signal words, hazard statements and any supplemental hazard statements.

Poison Centres

Under Article 45 of the CLP Regulation, economic operators placing certain hazardous mixtures on the market have to provide information (such as the composition of the mixture) to the national appointed bodies. This information is intented to used only by Poison Centres. The Poison Centres formulate preventive and curative measures in case of poisoning accidents. They provide medical advice to general consumers and physicians on health emergencies arising from exposure to hazardous chemicals or to other toxic agents. Poison centres in the EU answer on average 600 000 calls for support each year. Roughly half of the cases are related to accidental exposures involving children.

Poison Centre website is established by the European Chemicals Agency to host the tools and format to support the submission of information by companies to the appointed bodies and poison centre{2} .

1.2. OVERVIEW OF INTERNATIONAL LITERATURE

Below an analysis of the international literature related to data of interest found in foreign scientific articles is presented. There are several studies trying to elucidate the comprehension of the legislation on chemicals and the hazard communication among workers, professional workers and the general public. Use of chemicals in the working environment may have consequences on human health, which influences the protection measures that need to be adopted and the supportive system in case of accidents – poisonings and generally the relationship between the educational level, age and occupation and with the comprehension and perception of danger and the respective reactions from the part of the workers.

Companies or individual workers who use chemicals are called downstream users in REACH and CLP. This includes companies who manufacture goods or offer services, where chemicals are not the main element of their business, such as food, construction or cleaning companies. The chemicals used typically include paints, metals, adhesives, solvents, cleaning agents and many other classes. Downstream users have a key role to play in advancing the safe use of chemicals by implementing safe use at their own site and communicating relevant information both to their suppliers and their customers. It is very important that we understand the perception level of the working people regarding the use of hazardous substances both in European and in the rest of the world. Further down we are going to examine the examples from a lot of European and non-European countries, the USA included.

Occupational exposure limits (OELs) are tools to help employers protect the health of those who may be exposed to chemicals in their workplaceThey define adequate control by inhalation only. OELs are set by the Nationally Regulatory Authorities after public consultation and do not have EU wide application, but only a nationally based application. Thus they are consensus limits which have the support of both sides of industry. . In Great Britain, airborne standards for the workplace were established for a few substances such as cotton dust and asbestos back in the 1930s, but the history of systemic setting of OELs began when the American Conference of Governmental Industrial Hygienists (ACGIH) published the first list of

OELs, known as threshold limit values (TLVs), in 1948. Subsequently the list has been updated annually. {5}

There are two types of OEL: the occupational exposure standard (OES) and the maximum exposure limit (MEL). OESs are set for substances for which it is possible to identify a concentration at which there is no significant risk to health. Employers are required to meet the limit, there is no requirement to go below it, and it can be exceeded provided steps are taken to meet it as soon as reasonably practicable. MELs are set for substances which have serious health implications and for which an OES cannot be set. Most of the substances with MELs are either carcinogens or causes of occupational asthma. Employers must not exceed an MEL and must reduce exposure as far below it as is reasonably practicable. MELs are set at concentrations achievable by good occupational hygiene practice such that risks to workers are judged to be reduced to a tolerable level. It is considered as a more preferable approach to use mathematical models to generate risk estimates, which inevitably gives a spurious appearance of accuracy. The MEL/OES system is poorly understand by many employers who use chemicals, is not comprehensive as some substances meet neither the OES nor MEL criteria, and does not mesh well with indicative occupational exposure limit values which will increasingly be set under the European Union Chemical Agents Directive (COSHH). The problems with the current system have prompted actions to set up a legislative subgroup at an EU level to review the OEL framework{5,7}

During the past decade the European Union has established its own procedure for setting OELS. A Scientific Committee on Occupational Exposure Limits (SCOEL) has the remit to make recommendations for OELS for inhalation exposure, based solely on current scientific evidence, such that exposure repeated for 8 hours a day, 5 days a week over a working lifetime will not result in adverse eVects to workers or their progeny. Members of SCOEL are scientific experts nominated by member states for their expertise, they do not represent national positions. To guide their deliberations SCOEL has developed a series of key documents which set out the general principles and approaches taken by SCOEL in dealing with setting OELs. These have been summarised in Methodology for the derivation of occupational exposure limits [9].

In the European Union legislation, OELs broadly fall into two categories

1.“Health based” OELs: where the total available scientific data base leads to the conclusion that it is possible to identify a clear threshold dose below which exposure to the substance in question is not likely to lead to adverse health eVects. These become indicative occupational exposure limit values (IOELVs).

2.“Pragmatic” OELs: where for some adverse eVects—for example, genotoxicity, carcinogenicity, and respiratory sensitisers it is not possible on present knowledge to define a threshold of activity and therefore any level of exposure represents a risk. These become binding limit values (BLVs)

Since their introduction 50 years ago, OELs have been valuable tools for occupational hygienists responsible for implementing and monitoring workplace controls on chemicals. There is no doubt they will continue to be so. However, there have been other major changes which suggest the need to look at the role of OELs. There is now an agreed European Union chemical hazard classification system, with the possibility of a globally harmonised system on the horizon; a rapid growth in electronic information storage and retrieval systems means that more information can be made readily available, and workers have diVerent expectations relative to protection against risks to health. These changes and the problems with the current system have promoted ACTS to set up a subgroup to review the OEL framework. The subgroup will be considering how OELs can be developed to provide a robust system for the 21st century, which will eVectively contribute to the management of chemicals in the workplace. {10}

Back in 1995, Fairhurst discussed the uncertaintities in defining a safe occupational exposure limit, no matter how this will be called [6]. Such limits will involve considering whether employees can inhale the substance or come into skin contact with it. The OELs define adequate control by inhalation and provide consistent standards across industry. They have been set for around 600 of the several thousand chemicals in regular use. Thus the COSHH Directives moved OELs from being tools for occupational health and safety professionals to legal limits which all employers have to understand and applycts can vary from mild irritation of the airways occurring at high doses to cancer from exposure to tiny quantities. The challenge is to use chemicals to maximum social and economic benefit while protecting workers and the public. Occupational exposure limits (OELs) are an important tool for achieving health protection COSHH uses two types of occupational exposure limit—the occupational exposure standard (OES) and the maximum exposure limit (MEL). Both are expressed as airborne concentrations averaged over a period, either a long term exposure limit (8 hour time weighted average (TWA)) or a short term exposure limit (15 minute reference period). The short term exposure limits are used for substances for which short term peaks of exposure could result in serious health eVects -for example, respiratory irritants such as chlorine. The OES is considered to be a “safe” concentration and employers are required to meet the standard. They do not have to go below it and it is permissible to exceed it provided the employer takes appropriate action to remedy the situation as soon as is reasonably practicable. By contrast, for the MEL exposure is only considered adequate if it is reduced so far as is reasonably practicable and in any case below the MEL {6}

Having arrived at a putative OES two other factors have to be considered. As employers are allowed to exceed OESs, excursions above the limit which could occur in practice have to be unlikely to produce serious eVects on health and finally compliance has to be reasonably practicable. There is no point in setting a limit at a level that industry cannot comply with. In these circumstances an MEL is considered. There are two main groups of substances for which an NOAEL cannot be identified, respiratory sensitisers and genotoxic carcinogens. For respiratory sensitisers the paucity of data on dose-response relations which typically exists means that it is not possible to identify with reasonable certainty a concentration at which workers will not become sensitized For genotoxic carcinogens the United Kingdom Committee on Carcinogenicity of Chemicals in Food, Consumer Products, and the Environment have concluded in their guidelines for the evaluation of chemicals for carcinogenicity. “It is prudent to assume that genotoxic carcinogens have the potential to damage DNA at any level of exposure and that such damage may lead to tumour development. Thus for genotoxic carcinogens it is assumed that there is no discernible threshold and that any level of exposure carries a carcinogenic risk.”This view is also reflected in the European Union Carcinogens Directive which requires exposure to be reduced in so far as is technically possible for substances Guidelines for the evaluation of chemicals for carcinogenicity{7}

Larger chemical companies and the health and safety professionals have no difficulty with the requirements of COSHH to assess chemical hazards, in order to decide on suitable control measures and implement and monitor them. The following survey by the Health and Safety Executive (HSE) investigated the awareness of small companies. The HSE carried out a market research to find out how companies decide what controls to use and measure their understanding of the COSHH regulations and OELS{8}

Managers responsible for health and safety were interviewed at 1000 firms that use chemicals. 400 interviews were conducted with firms engaged in occupations which involve partial exposure to chemicals (all user group) and 600 interviews with firms in which chemicals are used on a daily basis (heavy user group). Most of the respondents (75% from the all user group and the 57% from the heavy user group) were from firms with 10 or fewer employees. The results of the survey were encouraging as most users take measures to control their employees' exposure, without information on the suitability of the controls that are used. This suggests that any failure to control chemical exposure arises mostly from a lack of knowledge and not from unwillingness to protect the workers' health. However, the respondents' knowledge of COSHH and OELS was very limited. Only 16% of the all-user group and 30% of the heavy-user group were aware of legal requirements and compliance. Study findings show that although approximately two out of three respondents claimed they understand the term "occupational exposure limit", only 12% of the all user group and 28% of the heavy user group mentioned monitoring (either regular or when necessary) when asked how they would assess whether an OEL was being met {8}

Several approaches have been published in prder to analyze the comprehensibility of chemical hazard communication tools at the industrial workplace

In a study conducted by Bouchard in 2007, a meta-analysis of nine research studies published from 1983 to 2005 evaluating the relationship between literacy and hazard communication was performed. In 1983 the Occupational Safety and Health Administration in the USA first promulgated the Hazard Communication Standard to ensure that workers were informed of the hazardous chemicals with which they work. It is worth noting that in the USA more than 30 million American workers are exposed to hazardous chemicals in their workplace.. The results of this study identified. three main gaps: lack of learner involvement to improve hazard communication, lack of employer assessment of employee understanding of training provided, and lack of studies assessing retention of the material taught and its application at the worksite. The need to involve learners, assist employers in assessing employees' understanding of the material taught, and assess retention and application of the material at a later date is identified. it is found that some workers may have low health literacy levels. The authors believe that nurses that in the USA are often the only health care providers at worksites, should become responsible for teaching hazard communication content, or possibly reinforcing material covered during training, according to the study author. and provide workers with hazard communication training they understand, retain, and can apply at the worksite {3}

In another study of 2011 by Morita and Morikawa the 20 years implementation of the Globally Harmonized System of Classification and Labeling of Chemicals (GHS) is assessed from a theoretical point of view. Intoxication as a result of chemical accidents has been proven to be a major issue in industrial health. The GHS provides a framework for hazard communication on chemicals using labelling or safety data sheets. The GHS has been expected to reduce the number of chemical accidents by communicating the hazards posed and prompting safety measures to be taken. The authors suggest that one of the issues which may be a barrier to effective implementation of the GHS results from discrepancies in GHS classifications of chemicals across countries/regions. The main reasons are the differences in information sources used and in the expertise of people making the classification (Classifiers). In addition the authors point out that the GHS requests expert judgment in a weight of evidence (WOE) approach in the application of the criteria of classification. A WOE approach is an assessment method that considers all available information bearing on the determination of toxicity. The quality and consistency of the data, study design, mechanism or mode of action, dose-effect relationships and biological relevance should be taken into account. Therefore, expert review should be necessary to classify chemicals accurately. However, the GHS does not provide any information on the required level of expertise of the Classifiers, definition of who qualifies as an expert, evaluation methods of WOE or data quality, and the timing of expert judgment and the need for updating/re-classification as new information becomes available {4}

In the next study, the authors investigated chemical classification and labelling systems which ,despite their similarities in several countries , are significantly different as well. This study took place 15 years ago and analyses the comprehensibility of chemical hazard communication tools in the industrial workplace. In order to harmonize various chemical classification systems and ultimately provide consistent chemical hazard communication tools worldwide, the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) was endorsed by the United Nations Economics and Social Council (ECOSOC). Several countries , including Japan, Korea, Taiwan and Malaysia, got involved in the process of implementing GHS. It is essential to ascertain the comprehensibility of chemical hazard communication tools that are described in the GHS documents, namely the chemical labels and Safety Data Sheets (SDS). The sample used in the study consisted of 150 industrial workers in Malaysia. Comprehensibility Testing (CT) was carried out with a mixed group of industrial workers. The ability of the respondents to retrieve information from the SDS was also tested in the study. The conclusion of this study, just like in plenty of other studies which are shown next, shows that almost all the GHS pictograms meet the ISO comprehension criteria . It has been concluded that the underlying core elements that enhance understanding of the GHS pictograms and which are also essential in developing competent people in the use of SDS are training and education{11}

It is very interesting to see the results of a research published in the "Aging Clinical and Experimental Research" magazine, in 2014. The study authors worked on the effect of age and educational level on the cognitive processes used to comprehend the meaning of pictograms. The aim of this study was to evaluate the nature of the cognitive processes underlying the meaning of pictograms and to test the effect of aging and educational level. Older adults had lower pictogram assessment scores and abstraction and logical abilities when compared with young adults. Consequently, the poorer performances of older adults to determine the meaning of pictograms could be explained by the decline of abstraction ability in elderly. The authors found out that pictograms are not the universal communication system as we formerly thought . It is not uniformly understood by everyone. This study confirmed that age and educational level may influence the performance in determining the meaning of pictograms. This is also proven through the experimental part of my thesis as it is shown below after statistical interview analysis {12}

In 2015, a study was conducted by Marti Fernandez F. , van Der Haar R, Lopez Lopez JC, Portfolio M, Former Sole A. which was applied to cleaning workers to make it clear to what degree the workers understand the pictograms. There was a questionnaire answered by a sample of 118 workers and in the end, there was a calculation of the percentage of the correct answers and the degree to which they reflected the criterions set by the International Organization for Standardization (ISO) and the American National Standards Institute involving a minimum level of comprehension. The workers that were not familiar with the pictograms had not been properly informed on the safe usage of chemicals. All of the above lead to the conclusion that only two pictograms exceeded the minimum comprehension standards. All in all, to interpret the hazard symbols correctly, especially in groups with greater comprehensional difficulties, there has to be training {13}

I would like to refer to a large number of hospital employees like doctors, nurses, paramedical staff, sterile services technicians, cleaners etc. As far as doctors are concerned, their exposure to dangerous chemicals is not high. Nurses, on the other hand, get exposed to medicines every day. They dissolve simple antibiotics but also very toxic cytostatic medicines. They use very few protective measures- such as gloves and masks but not always. The problem comes from the lack of knowledge on these matters but mostly from the lack of labeling on the medicine packaging, especially those of toxic medicine vials. It seems most of the nurses assume that the medicines might harm their health since they throw them away in special red bags for hazardous toxic waste. The situation is tragic if you really think about it. On the other hand , in most public hospitals, there are short seminars aimed at the hospital cleaners, organized by the department of infection control , with very little information about their protection. Based on the interviews I have conducted with hospital cleaners, one can assume that 90% of them do not use proper protection measures, do not read the labels and are not aware of the dangers involved in continuous exposure to cleaning and disinfecting substances. Most of them suffer from various illnesses. It would be really useful to study the relation of these illnesses to substances that are released into the working environment. Also - a very significant point- there are no clear instructions for the quantity of the disinfectants and cleaners that have to be used, leading to overuse of these substances, improper usage and contamination of the hospital environment since the staff and the patients inhale toxic substances coming from the evaporation of the toxic products used on the floors, the walls, the bedside tables, the bathrooms etc This worsens the condition of already weak patients.

In 2016, a group of scientists, Vallancourt R. , Pouliot A, Shreitenberg K, Hyland S, who are health professionals and use dangerous toxic drugs, have carried out a study regarding the pictograms used by health care workers for safer medication management.

A key aspect of medication safety is to ensure safe medication management practices. The study sample consisted of 87 health professionals (pharmacists, pharmacy technicians, nurses, doctors). 30 of them took part in all 3 phases. A total of 55 situations that could potentially benefit from safety pictograms were initially generated. Through the Delphi process, they were narrowed down to 10 situations where medication safety might be increased with the use of safety pictograms. For most of the retained issues, between 3 and 6 pictograms were designed, based on the results of the semiotic analysis. The main point here is that the subjects participating reached consensus and identified 10 medication administration safety issues that might benefit from the development and implementation of safety pictograms. In follow-up studies, the results above are to be validated in terms of comprehensibility and evaluated regarding their effectiveness {14}

This new 2015 study refers to the investigation of gasoline distributions in gas stations: spatial and seasonal concentrations, sources, mitigation measures and occupationally exposed symptoms. The authors Samrat T, Homwuttiwong S, Homwuttiwong, Ongwandee M, based their findings on the measuring of the levels of volatile organic benzene concentrations in gas stations. It has been proven that high-level contours of benzene were found not only at the storage tank refilling points, open drainage areas where gasoline-polluted wastewater was flowing, and the auto service center located within the station area. An assessment of the benzene to toluene ratio contour plots implicates that airborne benzene and toluene near the fuel dispenser area were attributed to gasoline evaporation although one of the studied stations may be influenced by other VOC sources besides gasoline evaporation. Additionally, during the routine refilling of the underground fuel storage tanks by a tank truck, the ambient levels of benzene and toluene increased tremendously. If source control is implemented by replacing old dispensers with new fuel ones at fuel delivery & sale points , increased speed delivery can reduce spatial benzene concentrations by 77%. Furthermore, a questionnaire survey on 63 service attendants in 10 stations revealed that a 32% mentioned headaches and a 20% suffered from fatigue. Naturally, all these symptoms are directly related to benzene inhalation {15}

What comes next is a study which took place in 6 cities of Brazil in 2014 by the authors Moura-Correa MJ, Jacobins AJ, Dos Santos SA, Pinheiro RD, Menezes MA, Tavares AM, Pinto NF. It is an analytical report of the observation of gas station employees and the impact of their occupation on their health.

This particular study was based on the prospect of action and operated by the circulation of information, national meetings, discussions of specific strategies and shared experiences, methodologies and common tools. After inspections and individual evaluation of hazardous conditions in terms of environmental exposure, there was an evaluation of 564 gas station employees working at 1,311 gas stations. ALL employees were found to be exposed, regardless of their job position. The integrated and complementary features of this surveillance were implemented at the workplace and the wider environment of the participants. As a result, it was realized that interventions in these areas should be extended to a broader and network-linked territory between individual and collective practices, services and education, becoming an example of action for assessment and mitigation of the impact on health workers. It is time for action practices to be established in the sections of health, environment and cross-sectional connection to achieve greater efficiency in hazard management {16}

The next study took place in Gaza governorates in 2013, attempted to identify the possible health effects of liquefied petroleum gas on workers at filling and distribution stations. The authors studied the Liquefied Petroleum Gas (LPG) that is widely used in the Gaza Strip for domestic ,agricultural and industrial purposes and ,illegally, in cars, too. A questionnaire was used on 30 apparently healthy workers. Venous blood samples were collected for haematological and biochemical analysis. Statistically significant differences were found in all self-reported health-related complaints among LPG workers. LPG workers had significantly higher values in red blood cell counts, haemoglobin, mean corpuscular hemoglobin and platelet counts. Furthermore, they had significantly higher values in kidney function tests and liver function enzyme activities. The authors wish to point out that all LPG workers at Gaza Strip petroleum stations are at a higher risk for health-related symptoms and clinical abnormalities {17}

The following study was performed in Shiraz, southwest of Iran, in 2014 as an attempt to investigate restrictive patterns of pulmonary symptoms among photocopy and printing workers. The sample consisted of 150 photocopy and printing workers who were surveyed as the exposed group along with a group of 114 office employees who were the unexposed group.The respiratory standard questionnaire was used to evaluate the prevalence of respiratory symptoms among the selected staff. Pulmonary function indexes including VC, FVC, FEV1 and the FEV1/FVC ratio were calculated. Finally, t-test, Chi Square and multiple logistic regressions were conducted. The study revealed that the prevalence of excess respiratory symptoms along with pattern of pulmonary restrictive sings in photocopy and printing workers means that the specific workplace conditions can result in occupational respiratory diseases {18}

There was a new study conducted in 2016 to enquire into the effect of nanomaterial laser printers on the employees' health. It is a case study of toxicological implications from nanomaterials released during consumer use and it was based on researching the effects of intratracheally instilled laser printer-emitted engineered nanoparticles in a mouse model. Incorporation of engineered nanomaterials (ENMs) into toners used in laser printers has led to countless quality and performance improvements. However, the release of ENMs during printing (consumer use) has raised concerns about their potential adverse health effects. The aim of this study was to use "real world" printer-emitted particles (PEPs), rather than raw toner powder, and assess the pulmonary responses following exposure by intratracheal instillation. Nine-week old male Balb/c mice were exposed to various doses of PEPs (0.5, 2.5 and 5 mg/kg body weight) by intratracheal instillation. The results are in agreement with findings from previous in vitro cellular studies and suggest that PEPs may cause immune responses in addition to modifications in gene expression in the murine lung at doses that can be comparable to real world exposure scenarios, thereby raising concerns of deleterious health effects. In a few words, according to this study, the increasing concern about the toxicity of the nanomaterial in use and their impact on printing workers is completely justified. [19}

TOO MUCH PROFESSIONAL DEVELOPMENT STUDIES INDICATES CHOLANGIOCARCINOMA!!!!!

Let's take a look at a study that was carried out in 2014 in Japan where printing companies are flourishing. The study focused on different carcinogenic processes in cholangiocarcinoma cases epidemically developing among workers of a cholangiocarcinoma. Over the last few years, cholangiocarcinoma has been developing rapidly among young adult workers of a printing company in Japan. There has been thorough research on exposure to organic solvents including 1.2 dichloropropane and/or dichloromethane showing an association with the carcinoma development. The metabolism of dichloromethane proceed has been implicated in genotoxicity and carcinogenicity . This study examines features of the carcinogenic process of the cholangiocarcinoma developed in the printing company environment. Surgically resected specimens of the cholangiocarcinoma cases were analyzed and all cases were associated with precursor lesions such as billiard intraepithelial neoplasia. These results revealed different carcinogenic process of the printing process in the printing company cases, suggesting that the exposed organic solvents might act as a carcinogenic for bilary epithelial cells by causing DNA damage.All these facts lead to the conclusion that organic solvents can cause carcinoma{20}

A research by Caudle WM in 2015 analysed the relationship between occupational exposures and parkinsonism. The employees' exposure to toxic substances at their workplace contributes to the etiopathogenesis of parkinsonism.There has been an analysis on how the exposure to pesticides, metals,solvents used in manufacturing processes, as well as flame-retardant chemicals used in consumer and commercial products has received the greatest attention as possible risk factors.The aim of this particular study is the vulnerable population , individuals who are exposed to these compounds at high concentrations or for prolonged periods of time in an occupational setting appear to be one of the more vulnerable populations to these effects. As a result, we can see that there are still hundreds of chemicals that we are exposed to in the environment for which there should be information on their potential neurotoxicity on the nigrostriatal dopamine system. The author has come to the conclusion that using past accomplishments as a blueprint, future endeavors should focus on elaborating upon these initial findings in order to identify specific and relevant chemical toxicants in our environment that can impact the risk of parkinsonism and work towards a means to attenuate or abolish their effects on the human population [21]

A remarkably extended study has shed light on how the human environmental exposure to human carcinogens in teenagers are associated with DNA damage. This study was done in 2016 on teenagers through defining increased oxidative DNA damage which leads to increased oxidative DNA damage. Six hundred 14-15-year-old youngsters were recruited all over Flanders (Belgium)including in two areas with important industrial activities. Personal exposure to potentially carcinogenic compounds was measured in urine, namely: chromium, cadmium, nickel, 1-hydroxypyrene as a proxy for exposure to other carcinogenic polycyclic aromatic hydrocarbons (PAHs), organophosphate pesticide metabolites, and di(2-ethylhexyl) phthalate (DEHP) metabolites. In blood, arsenic, polychlorinated biphenyl (PCB) congeners 118 and 156, hexachlorobenzene (HCB), dichlorodiphenyltrichloroethane (DDT) and perfluorooctanoic acid (PFOA) were analyzed. Levels of methylmercury (MeHg) were measured in hair.. This cross-sectional study found associations between current environmental exposure to (potential) human carcinogens in 14-15-year-old Flemish adolescents and short-term (oxidative) damage to DNA. There is an urgent need for a p rospective follofollow-up further investigate whether long-term effects may occur due to complex environmental exposures[22]

A European study published in 2016 is worth our attention as it is a meta-analysis of issues that concern Occupational Exposure to Endocrine-Disrupting Chemicals and Birth Weight and Length of Gestation.This study refers to pregnant women of reproductive age who are exposed to endocrine-disrupting chemicals (EDCs) at work. Exposure to EDCs in pregnancy may affect fetal growth. The object of study is the association of this exposure to birth weight, term low birth weight (LBW), length of gestation, and preterm delivery. The authors used individual participant data from 133,957 mother-child pairs in 13 European cohorts spanning births from 1994 through 2011. Maternal job titles are linked with exposure to 10 EDC groups as assessed through a job exposure matrix. For each group, we combined the two levels of exposure categories (possible and probable) and compared birth outcomes with the unexposed group (exposure unlikely). In this study, there was usage of performed meta-analyses of cohort-specific estimates by experts. The study results indicate that employment during pregnancy in occupations classified as possibly or probably exposed to EDCs was associated with an increased risk of term {23}

Next comes a study that refers to textile industry workers. They are considered to be a high risk group as dye solvents used in these industries are associated with different health related hazards including cancer. In previous studies on textile and iron industries, the authors have reported genotoxicity among them and observed occurrence of cancer deaths among textile industry workers.The textile industry workers are in continuous exposure to these dyes, solvents, fibre dusts and various other toxic chemicals. The authors Singh Z and Chacha P ,as a conclusion, confirmed the association of textile industry and different types of cancer including lung, bladder, colorectal and breast cancer. This study was carried out in 2016, based on data collected in the previous years {24}

The following study was conducted in Northern Sweden from 2002 to 2004 and was published in 2016. The study investigated the degree to which occupational exposure to chemicals drives the increased risk of asthma and rhinitis . There was observation of exposure to vapours, gas, dust and fumes. The participants were divided into 3 population-based groups suffering from obstructive lung disease. In total, 4036 participated in a structured interview and answered a questionnaire on occupational exposures. The study authors found out that occupational exposure to VGDF increased the risk of asthma, concomitant asthma and rhinitis, taking into account factors such as age, smoking habits, body mass index and sex. The authors came to the conclusion that the association between exposure to chemicals and asthma and rhinitis remains independent of exposure to dust even when excluding exposure to isocyanates and welding fumes. The results were similar for women and men, as well as for non-smokers and participants without a history of allergy{25}

Below we are going to see in what ways the cleaning staff is affected by exposure to organic dry cleaning solvents. The "Occupational exposures of the cleaning stuff" study was published in 2016 and refers to new dry cleaning solvents: high-flashpoint hydrocarbons and butylal. The study reports occupational exposures to two alternative dry cleaning solvents, butylal and high-flashpoint hydrocarbons,, both of which have not been well characterized. Evaluated four dry cleaning shops that used these alternative solvents. In all shops, the highest personal airborne exposures occurred when workers loaded and unloaded the dry cleaning machines and pressed dry cleaned fabrics. The air concentrations of formaldehyde and butanol in the butylal shops were well below occupational exposure limits. Likewise, the air concentrations of high-flashpoint hydrocarbons were also well below occupational exposure limits. However, there have been potential skin exposures to these chemicals. Appropriate work practices and selection and use of personal protective equipment are strongly recommended. These recommendations are consistent with those derived using control banding tools for butylal. To date, there is insufficient toxicological and health information to determine the safety of butylal in occupational settings{26}

Next, let's have a look at a case study about construction painters by Park H, Park HAD, Jang JK. The objective of this study was to evaluate the exposure levels of total volatile organic compounds (TVOCs) for painters in the construction industry. Construction painters have not been studied well in terms of their exposure to the materials they use. Activity-specific personal air samplings were carried out in three waterproofing activities [polyurethane (PU), asphalt, and cement mortar] and three painting activities (epoxy, oil based, and water based) by using organic-vapor-monitor passive-sampling devices. Finally, the study authors reached the conclusion that construction painters are exposed to various solvents, including carcinogens and reproductive toxins, and the levels of TVOC concentration in many of the painting tasks exceeds the exposure limits. All in all, the study makes it clear that construction workers must be protected from chemical agents at work by using personal protective devices and taking sufficient protective measures{27}

This article refers to the two most frequently used values, i.e. Acute Exposure Guidance Levels (AEGL) and Emergency Response Planning Guideline (ERPG). The study was conducted in 2010. The authors compared the two values in qualitative and quantitative terms. There was no significant difference between the general level of AEGL and ERPG values, suggesting the two systems are equally precautious. . Key factors for broad international acceptance of harmonized values include transparency of the decision process, agreement on definition of toxicological tiers, and a target population including sensitive groups of the general population. In addition, development of purely health based values is encouraged. Risk management issues, such as land use and emergency response planning should be treated separately, as these rely on national legislation and consideration{28}

OCCUPATIONAL PROTECTION

Personal protective equipment (PPE) is a daily essential for healthcare workers (HCWs) to protect them from infection by highly virulent pathogens. «Personal protective equipment and improving compliance among healthcare workers in high-risk settings» is the title of a study conducted in 2016. It is widely known there have been numerous contagious infectious diseases worldwide, including Ebola virus and Middle Eastern respiratory syndrome. There is urgent need for further research to determine optimal PPE use in high-risk settings. Given the recent outbreaks of contagious infectious diseases worldwide, including Ebola virus and Middle Eastern respiratory syndrome, there is urgent need for further research to determine optimal PPE use in high-risk settings. This review intends to provide a general understanding of PPE and guidelines for appropriate use based on current evidence. Recent studies have examined the dangers to HCWs during removal of PPE when risk of contamination is highest. Access to adequate PPE supplies is crucial to preventing transmission of pathogens, especially in resource-limited settings. Adequate training is needed about personal protective equipment, it's proper use and tolerability of PPE in the workplace. The study authors strongly believe that, in the future , new strategies must be formed aiming at ameliorating this situation including redesigning PPE which remains the most important strategy for protecting HCW from potentially fatal pathogens. {29}

Next comes a study that was conducted in Croatia, in 2015. This study attempted to answer the following question: How compliant are technicians with universal safety measures in medical laboratories in Croatia? The authors investigated the use of personal protective equipment (PPE) and compliance to the code of conduct (rules defined in institutional, governmental and professional guidelines) among laboratory technicians in Croatian medical laboratories. In addition, the differences in compliance were explored between participants of different age groups, laboratory ownership and accreditation status. A considerable percentage of laboratory technicians in Croatian medical laboratories do not comply with safety measures. Lack of compliance is observed in all personnel regardless laboratory accreditation and participants' age. It was observed by the authors that those working in private laboratories adhere more to the code of conduct. {30}

The next study which was published in 2014 was conducted on nurses to investigate improving compliance with personal protective equipment use through the model for improvement and staff champions. Even though it is a fact that nurses are exposed to various dangerous drugs , there are numerous obstacles preventing the use of personal protective equipment, even during chemotherapy. At Dana-Farber Cancer Institute, a program was developed that incorporated not only monitoring and reporting compliance of the use of PPE, but also engaged the staff in audit and reporting activities. The study authors discovered that compliance rates improved dramatically over time and have remained at high levels. {31}

One more study was completed in 2013 about the healthcare staff which reveals how health care workers' perceptions predicts uptake of personal protective equipment, how they comply with infection control measures and what this compliance has to do with organizational, environmental and individual factors. However, it is unknown whether HCWs' perceptions of transmission risk and protectiveness of infection control measures influences the uptake of infection control measures.The conclusion of this study is that the intention of using a facemask was poor when providing care in single rooms but improved if patient contact was expected, especially in multibed rooms. The study authors revealed that HCWs attending pediatric patients measured a smaller transmission risk zone than what is currently recommended under droplet precautions{32}

This 2011 study deals with factors that influence respirator use at work in respiratory patients. According to the study, when ventilation is not sufficient to prevent hazardous exposures in workplaces, respiratory protective devices (RPDs) may be provided to decrease workers' exposures. It also refers to usage of protective devices (RPD). Often, workers do not use RPDs consistently when required. The aim of the specific study was to determine important factors associated with RPD usage in workers with respiratory disease exposed to airborne hazards at work. Forty-one per cent reported always wearing RPDs whenever a hazard was present; 33% never wore RPD. Compliance was highest among healthcare workers (72%)

and lowest among workers in food and service industries (13 and 22%, respectively. The compliance of co-workers, conveniently located RPDs, safety training discussing the use of RPDs, fit testing available at the workplace and age were positively associated with compliance. Experiencing symptoms of shortness of breath and nasal stuffiness were negatively associated with compliance. The study led to the conclusion that addressing company factors and workers' symptoms can optimize RPD usage $_{\{33\}}$

This is a study that investigates εstimated exposure of hands inside the protective gloves used by non-occupational handlers of agricultural pesticides. It was published in 2016. Δημοσιεύθηκε το 2016. Water-resistant gloves commonly used by non-professional gardeners were evaluated for permeation of Acetamiprid, Pirimicarb, and Chlorpyrifos-methyl pesticides by means of in vitro testing. As a result, if used repeatedly, gloves contaminated in this way , lose their protective function but give the user a false sense of security. The study authors explain that water-resistant gloves are not necessarily pesticide resistant. Disposable latex gloves commonly worn by non-professional gardeners provide inadequate protection even for a short-time contact with pesticides. The authors believe that in order to assess the efficiency of reusable gloves, not only BT value but also the reservoir/release effect of parent pesticide and its degradation products should be evaluated. Conclusively, there should be more emphasis given on awareness-raising activities to protect non-occupational handlers of pesticides $_{\{34\}}$

Below there is an example of exposure to heavy metals and pesticides from agricultural activities. The study under discussion was conducted in an agrochemical factory in a Salvadoran rural community.

Pesticide handling in farming activities involves substantial hazards for the rural population and for the environment. In Latin America, it is estimated that the population at risk of being affected by heavy metals is over 4 million. This research describes the different types of exposure to pesticides and heavy metals in a rural population (Loma del Gallo), considering both environmental and occupational exposure. During the study there was inspection in a former pesticide factory (QUIMAGRO), analysis of heavy metals in samples from surface and ground water in the community close to the factory, and a survey to the local population about their perceptions of pesticide exposures. Containers with 34.6 tons of chemicals improperly stored were identified in the former factory and removed by the government. Arsenic and cadmium were found in groundwater, and the highest values were 0.012 and 0.004 mg/l, respectively. Eighty-two percent of the farmers did not use personal protective equipment. Pesticide containers were removed from the QUIMAGRO area, but the pollution was still present at time of sampling and it is evident by the odor of the site. Surface water had higher concentration of heavy metals than the groundwater. Loma del Gallo population has been exposed to toxic pesticide from QUIMAGRO and agriculture for many years. According to the study, even though the farmers are overexposed to pesticides toxicity, they do not use PPE {35}

This study's aim was to understand workers' low PPE compliance by analyzing their risk perceptions of herbicide use, working conditions and socio-cultural context. Research methods included ethnographic observations, informal interviews, visual media, questionnaires and a focus group. Study results indicated that low PPE compliance persists despite workers' awareness of herbicide exposure risks and as a result of the influence from workers' socio-cultural context (i.e. gender dynamics and social status), herbicide risk perceptions and working conditions (i.e. environmental and logistical). Teams consisting mostly of women had the highest compliance rate. These findings highlighted that given the complexity of PPE compliance, especially in countries with several economic and social constraints, exposure reduction interventions should not rely solely on PPE use promotion. The authors suggest that other control strategies requiring less worker input for effectiveness should be implemented, such as elimination and substitution of highly hazardous pesticides, and altering application methods {36}

The following study deals with the development of a new categorization system for pesticides exposure to support harmonized reporting between EU Member States.The study presents the new categorization system and is aimed at enabling Member States to gather comparable data and provide standard reporting on pesticide poisoning exposures. European legislation requires reporting from Member States on acute poisoning incidents involving pesticides. but there are no rules and regulations about collecting and submitting such reports.The new categorization system which is presented in the study helps these requirements to be met.

Data on selected pesticide exposures collected by Poison Control Centers in six EU countries were reviewed, categorized and reported according to the proposed system. The resulting pesticide categorization system has two dimensions. The first part identifies the main category of use, i.e. biocide/plant protection pesticide/unknown, and the secondary category of use, e.g. Rodenticides, Insecticides and acaricides. The second part of the system is organized into two levels: level one identifies chemical grouping, e.g. Coumarins, Pyrethrins/pyrethroids, while level two identifies the active compound by using its Chemical Abstract Service Registry Number. The results indicate that a special effort should be dedicated to support detailed data recording at national level on selected pesticide exposures collected by Poison Control Centers in six EU countries were reviewed, categorized and reported according to the proposed system. The resulting pesticide categorization system has two dimensions. The first part identifies the main category of use, i.e. biocide/plant protection pesticide/unknown, and the secondary category of use, e.g. Rodenticides, Insecticides and acaricides. The second part of the system is organized into two levels: level one identifies chemical grouping, e.g. Coumarins, Pyrethrins/pyrethroids, while level two identifies the active compound by using its Chemical Abstract Service Registry Number. The results indicate that a special effort should be dedicated to support detailed data recording at national level. This study leads to the conclusion that providing common tools to systematically report to the EU Commission hazardous exposures to pesticides, as well as to other selected categories of products, could allow for data comparability between Member States and greatly improve post marketing surveillance and alerting systems in Europe [37]

Now, let's take a look at the case study of American workers and their protection. This study was conducted in 2010 by Haviland A, Burns R, Gray W, Ruder T, Mendeloff J. and attempted to answer the following question: What kinds of injuries do OSHA inspections prevent? OSHA's enforcement program is one of the major public efforts to protect American workers. Two things have been examined: the scope of injury prevention that inspections can contribute and the types of standards that contribute the most. Inspections with penalties did affect injury types unrelated to standards as well as those related. Inspections with penalties did affect injury types unrelated to standards as well as those related. It was also found that citations for violations of the standard requiring personal protective equipment had the largest impact on preventing injuries in both cases. This study led to the conclusion that consultants and inspectors ought to pay more attention to the applying of programs requiring protective equipment [38]

In a study that was carried out in Pakistan from July 2013 to April 2014 and published in 2016 there was research on the need for creating drug and poison information centers and the demand for health care professionals. This cross-sectional study was conducted at 3 public and 3 private tertiary care hospitals of Karachi, from July 2013 to April 2014, using a self-administered, multi-item questionnaire to determine the need of drug and poison information centers in public and private hospitals in that area. Of the 307 physicians, 282(92%) highlighted the need for a 24/7 drug and poison information centre and 206(67%) suggested opening a drug information centre at the hospital. Besides, 215(70%) respondents said they took at least 15 minutes for searching information about the drug while managing a case. Regarding the poisoning case management, 160(52%) physicians complained about the unavailability of medicines in hospitals. The study points out that there is a vital need to create several drug information centers with specialized professional staff able to provide health care professionals and the public with direct information {39}

One more study was published in 2013 by Brekelmans P, de Groot R, Desel H, Mostin M, Feychting K, Meulenbelt J examines the harmonization of product notification to poisons centers in EU member states. In the European Union (EU), notification of product information by industry to poisons centers and/or competent authorities is a legal obligation for mixtures classified as hazardous. However, EU legislation does not specify the precise information needed for this product notification. Varying requirements have been developed by each EU member state.This is why an assessment of harmonization of product notification was carried out by the European Commission (EC). The main issue here was whether non-classified ingredients should be notified only above a concentration threshold and on the use of defined, narrow concentration ranges instead of exact concentrations for hazardous ingredients. All stakeholders agree to the development of an electronic data exchange format for product notification and identify the extensible Markup Language (XML) as the most appropriate format {40}

European product database: Instead of multiple notifications to national databases, the EC will analyze the benefits, feasibility and costs of a European product database to provide a centralized portal for companies to upload their product information. Poisons centers and competent authorities need to have access to this information.

Unique product identifier: A Unique Product Identifier (UPI) on the product label can unambiguously identify the product and its formula and links it to the corresponding notified product information. A procedure for the creation of a UPI by companies has already been proposed.

Product category system: There is broad support for the development of a hierarchical product category system to facilitate statistical analyses and comparability of poisoning incidents in EU Member States. The EC concluded that harmonisation of product notification is an achievable goal. In order to draft an Annex to the CLP Regulation concerning this topic, a new working group with representatives of EU Member States, European Association of Poisons Centers and Clinical Toxicologists (EAPCCT) and other stakeholders will attempt to find consensus on harmonization of product notification.

2. EXPERIMENTAL WORK

2.1. QUESTIONNAIRE

THE PRESENT STUDY CONDUCTED BY CHRISTINA TSITSIMPIKOY AND ELENI FOYFA WITHIN THE MSC IN “TOXICOLOGY” OF THE UNIVERSITY OF THESSALY. THE RESULTS CAN BE USED BY THE GENERAL CHEMICAL STATE LABORATORY AS COMPETENT NATIONAL AUTHORITY FOR THE REACH & CLP REGULATIONS. THIS IS THE FIRST ORGANISED ATTEMPT TO INVESTIGATE THE LEVEL OF AWARENESS AND COMPREHENSION OF THE LEGISLATION AMONG THE GREEK PROFESSIONAL USERS OF CHEMICALS**.**

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ
ΠΜΣ ΤΟΞΙΚΟΛΟΓΙΑ

SERIAL NUMBER QUESTIONNAIRE #

DEMOGRAPHICS

- **Sex:**
- **Age:**
- **Occupation:**
- **Work experience:**
- **Education**:
  - o Compulsory Education
  - o Public Education
  - o Technological Education
  - Undergraduate (bachelor) degree
  - o Postgraduate (master) degree
- **Diagnosed health problems**
  - Cardiovascular problems
  - o Hypertension
  - o Kidney disease
  - o Dermatological problems
  - o Respiratory problems
  - o Musculoskeletal problems
  - Other (Please specify)

RISK COMMUNICATION OF CHEMICALS

1. Classification "dangerous for humans" on a product means that it:

o Can cause death
o May cause cancer
o Is toxic
o May cause damage to various -organs (eyes, skin, liver, etc)
o All of the above depending on the degree of risk

2. Classification "dangerous for the environment" on a product means that it:

o Can cause immediate or long-term death of animals and plants
o May cause cancer to humans
o Is toxic to humans o May cause damage to various organs of animals and plants o May cause damage to various organs of humans

3. Do you utilize products potentially dangerous for humans in your professional activity?

o Yes
o No
o I don't think so
o I don't know

4. Do you utilize products potentially dangerous for the environment in your professional activity?

o Yes
o No
o I don't think so
o I don't know

5. How would you conclude that a product is dangerous to humans and/or the environment?

o Being informed by my provider
o Being informed by my colleague
o Being informed by the competent public service (please name the service)
o Searching for information on the Internet or in other sources
o Reading the safety data sheet of the product
o Reading the label

6. When using a product for the first time, do you read the instructions printed on the label?

o Yes, in detail
o Superficially, focusing only on aspects causing me concern for potential risks that may arise from the use of the product
o Sometimes Yes
o No

7. Which of the following personal protective equipment do you use at your work?

o Gloves
o Protective mask
o Protective outfit
o Protective goggles
o All of the above
o None of the above
o Other (Please specify)

8. How often do you use personal protective equipment at work?

o Always
o Often
o When being informed on
o When I consider necessary
o Rarely/Never

9. Which personal protection equipment do you commonly use? are you using?

o Gloves
o Protective mask
o Goggles
o Protective outfit
o All of the above
o Other (Please specify)

10. When do you use personal protective equipment when contacting a chemical in your professional activity?

o When the product is dangerous for humans
o When the product is dangerous for the environment
o When the relevant recommendation is printed on the label
o When the relevant recommendation is listed in the safety data sheet
o When being told by my employer
o When being told by my colleague
o When being told by the responsible service (the service)
o When I being told by my supplier

11. What do you do with work clothes upon your return home:

o Take it off before entering the house
o Take it off inside the house and ventilate
o Take it off inside the house and store it together with the other clothes (in the bedroom, closet, unwashed, etc)

12. How do you clean your Work clothes (including any protective outfit) after use?

o Hand Wash separately from other clothing
o Wash separately from other clothing
o Wash together with the rest of your clothes
o Clean in the laundry
o Have it cleaned by a specialist workshop

13. What does the sign  **(GHS05) on the label of a chemical product mean ?**

o It is dangerous for metal objects
o It is dangerous for hands
o It is dangerous to health in General
o You must wear gloves
o You should not smell
o Not to be poured down the drain

14. What does the sing  **(GHS07) on the label of a chemical product mean?**

o It is dangerous for the environment
o It is dangerous for health in General
o You must wear gloves
o Should be kept away from children
o You should not smell it
o Not to be poured down the drain

15. Which of the signs  **(GHS08)**  **(GHS06) on the label of a chemical which causes you bigger concern?**

o  (GHS08)
o  (GHS06)
o both
o neither

16. What does the sign  (GHS09) on the label mean?

o It is dangerous for the environment in general
o It is dangerous for plants and fish
o It is dangerous for human health
o You must wear gloves
o It should be kept away from children
o Not to be poured down the drain

17. The chemicals you use are usually

o Flammable
o Oxidants
o Explosives
o Gases under pressure
o Corrosive/irritant to the skin and/or breathing
o Carcinogens
o Toxic
o Dangerous for the environment
o Harmless to humans and the environment
o I don't know

18. Have you noticed any changes on the labels of the Chemicals that you have received used?

o Yes
o Not

19. Which pictogram sign do you see on the chemical products you use more often?

20. Are you aware of the regulation 1272/2008/EC- CLP for the classification/labeling/packaging of chemical substances and mixtures?

o Yes
o No

In our study we have attempted to draw conclusions about the Hellenic territory regarding the perception from the professional users (workers) of chemicals on the use of hazardous substances in everyday occupational conditions in the framework of the European Union legislation.

PART 1. DEMOGRAPHICS

The questionnaire was completed by 150 people at a ratio of 90 men and 60 women

SEX

	Frequency	Percent
MALE	90	60,0
FEMALE	60	40,0
Total	150	100,0

And ages of 21-61 years .The mean of variable “Age” is 42 approximately with 7,5 std. Deviation

AGE

Valid	150
Missing	0
Mean	41,89
Std. Deviation	7,507
Minimum	21
Maximum	61

We have the following professions allocation
OCCUPATIONAL

		Frequency	Percent
Valid	**AGRICULTURIST**	12	8,0
	BIOLOGIST	2	1,3
	DIGITAL PRINTING	19	12,7
	ELECTRICAL ENGINEER	1	,7
	FARMER	15	10,0
	FEED MANUFACTURING UNIT	8	5,3
	GAS STATION	13	8,7
	HAIRDRESSER	5	3,3
	LAUNDRY	26	17,3
	MECHANICAL	1	,7
	MICROBIOLOGY LABORATORY	7	4,7
	NURSE	2	1,3
	PAINTING WORKS	7	4,7
	PELLET	2	1,3
	PLASTICS FACTORY	9	6,0
	STUDENT OF AGRICULTURE	1	,7
	TEACHER	1	,7
	TIMBER PROCESSING	9	6,0
	TRANSPORTATION OF CHEMICAL PRODUCTS	2	1,3
	VETERINARY	8	5,3
	Total	150	100,0

WORK EXPERIENCE

The mean of variable “Work experience” is 12 approximately with 8,7 std. Deviation. The minimum work experience is 1 year and the maximum 40 years

Work experience

Valid	150
Missing	0
Mean	11,99
Std. Deviation	8,798
Minimum	1
Maximum	40

EDUCATION

		Frequency	Percent
Valid	Compulsory Education	31	20,7
	high school	55	36,7
	technological education	35	23,3
	Undergraduate (bachelor) degree	16	10,7
	Postgraduate Master degree	13	8,7
	Total	150	100,0

DIAGNOSED HEALTH PROBLEM

		Frequency	Percent
Valid	no problem	43	28,7
	Cardiovascular problems	4	2,7
	Hypertension	7	4,7
	Kidney disease	2	1,3
	Dermatological problems	49	32,7
	Respiratory problems	28	18,7
	Musculoskeletal problems	15	10,0
	Other	2	1,3
	Total	150	100,0

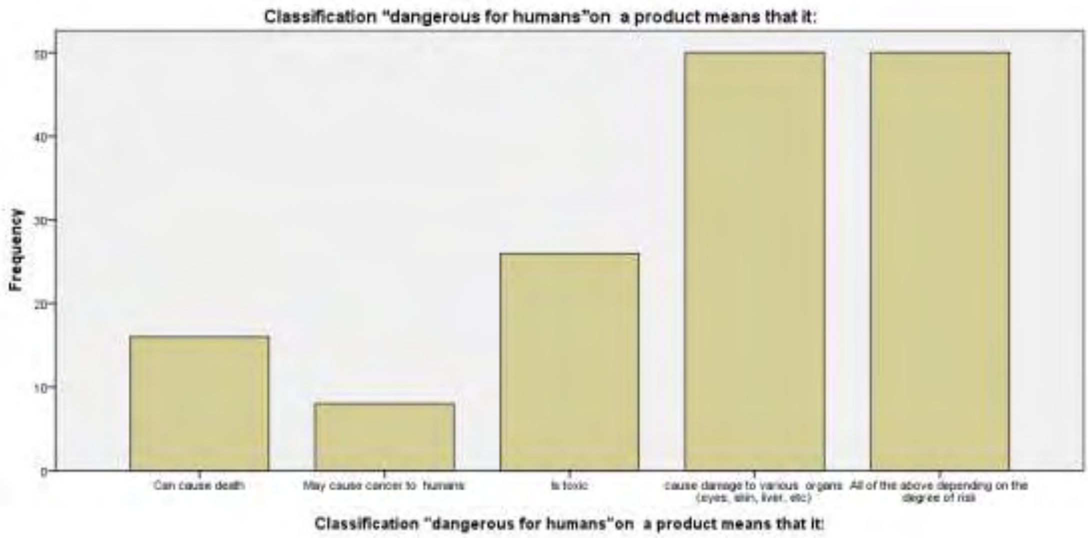
Most people are suffering from Dermatological problems(allergies, eczema)-49 persons , and respiratory problems (allergic cough, rhinitis) -28 .But large percentage did not complain for diagnosed health problems **,** These were people on young age or with relatively little experience

IN THE FOLLOWING CHARTS COLLECTED THE RESULTS OF ANSWERS DURING THE QUESTIONNAIRE ARE PRESENTED

PART 2. RISK COMMUNICATION OF CHEMICALS

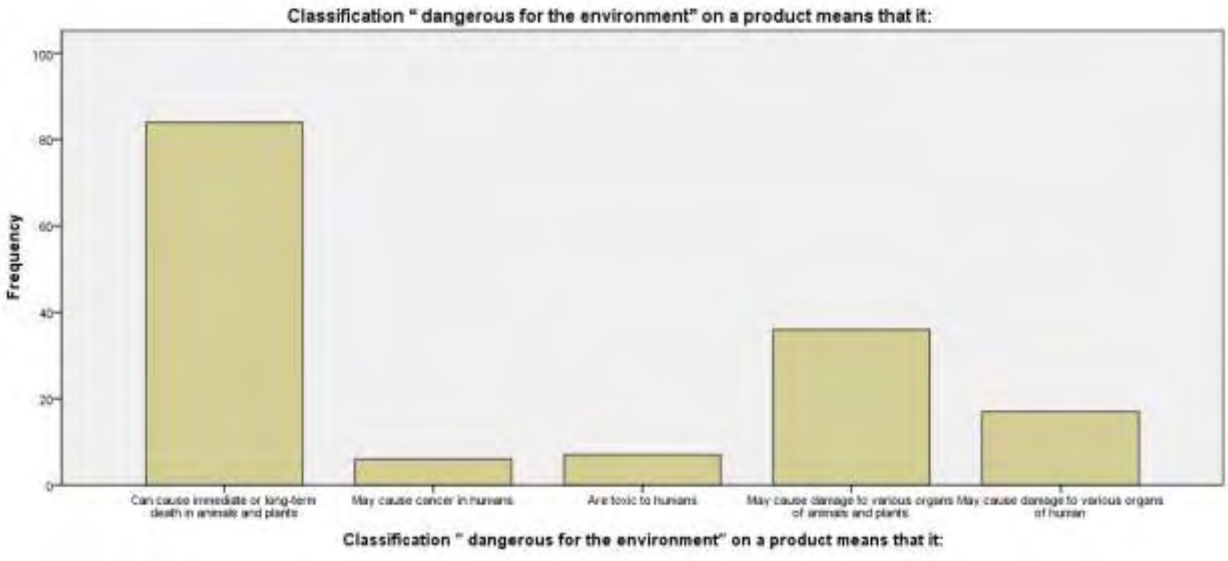
Question 1.

50 out of 150 workers believed that the "dangerous for humans" classification on a product means that it causes damage to various organs (eyes, skin, liver, etc)-33,3%. 50 workers answered that " all of the above depends on the degree of risk"-33,3%. As we can see , we have an equal distribution of these answers. A smaller percentage of 5,3% (8 people) answered "It may cause cancer to humans".



Question 2.

The 56% (84) of workers answered that the " dangerous for the environment" classification on a product can cause immediate or long-term death to animals and plant" whereas a lower percentage of 4%(6 people) said that it may cause cancer to humans.

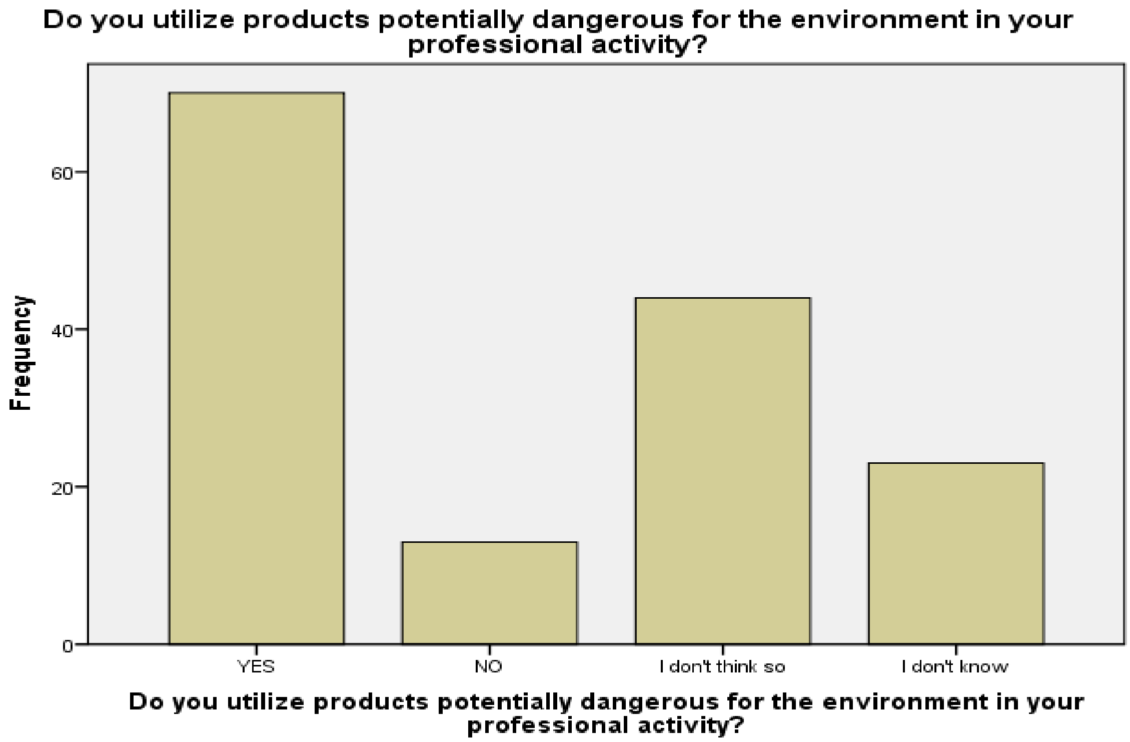


Question 3

The 64,7%(97 workers) said they utilized products potentially dangerous for humans in their professional activity and only a 5,3% (8 workers) answered “No” to this question

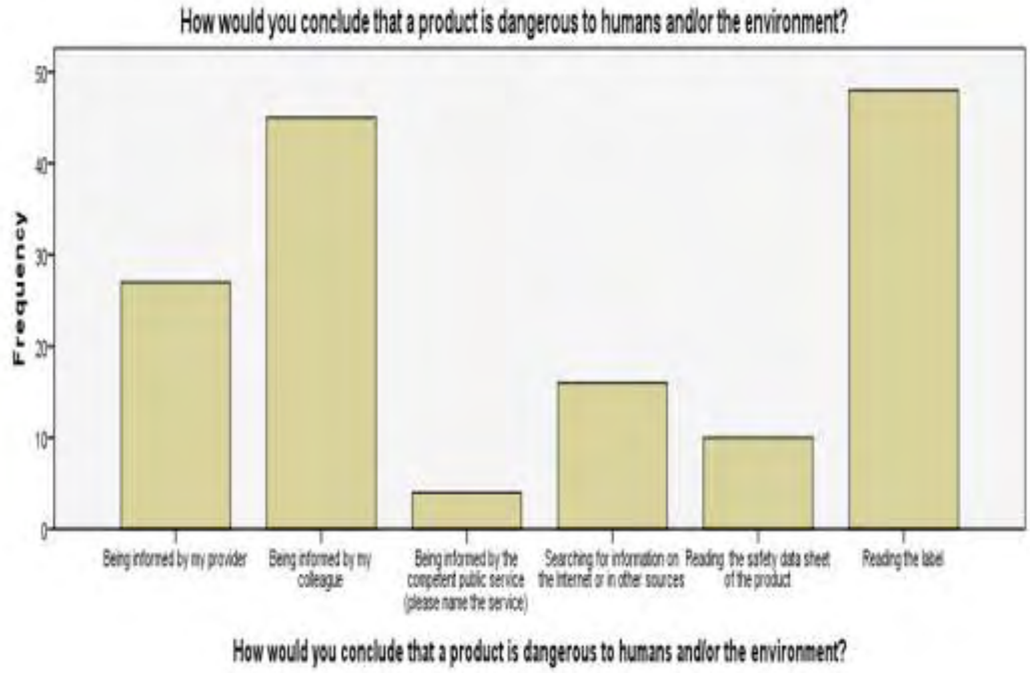
Question 4

The greater majority 46.7% (70 workers) said that they utilize products potentially dangerous for the environment in professional activity and a lower percentage of 8,7%(13 workers) answered “No” , saying they believed that they utilized products that are not potentially dangerous for the environment



Question 5

In this question, we can see that the majority of the respondents (30% - 40 workers) said ” being informed by their colleague “, and only 2,7% (4 workers “ Being informed by the competent public service”

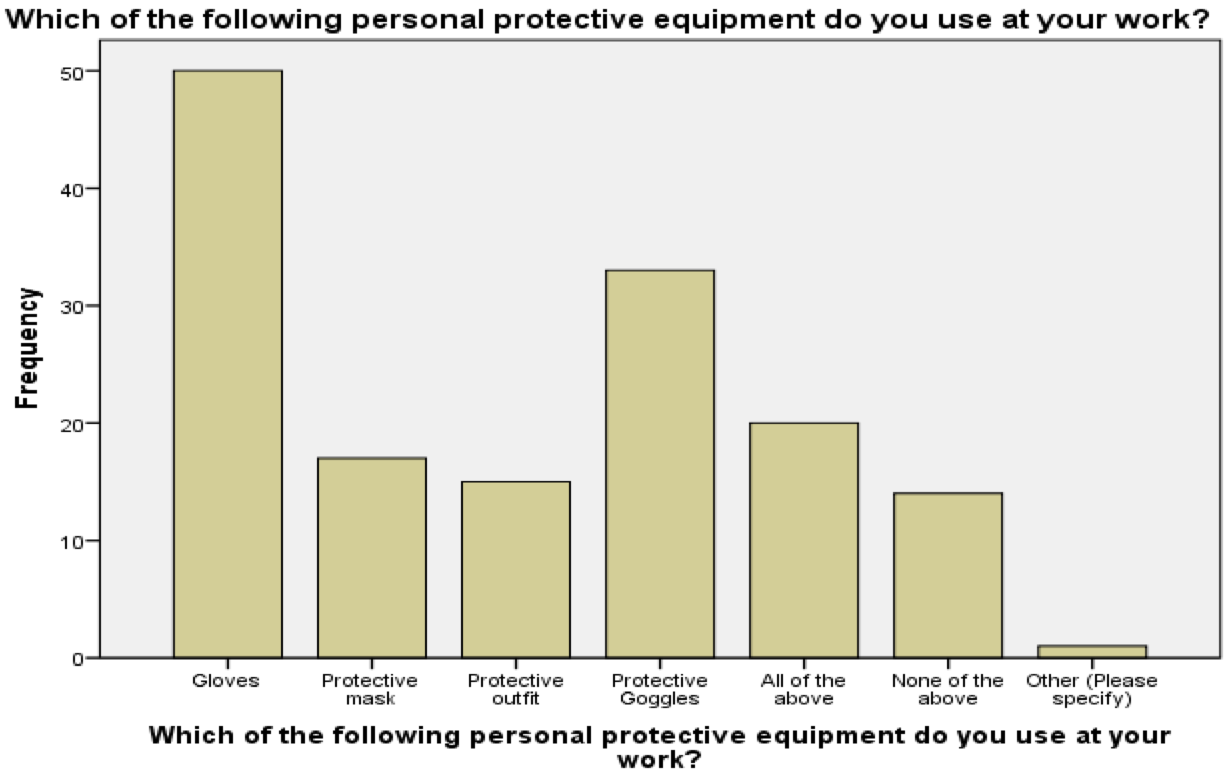


Question 6

The majority of workers (57 people - 38%) answered that” Superficially, focusing only on aspects causinge me concern for potential risks that may arise from the use of the product”. The lowest percentage 6%- 9 workers don’t read the instructions printed on the label when they use a product for the first time

Question 7

the majority of workers -50(33,3%) uses gloves and 1 worker(0,7%)answered “other”(the worker was wearing boots gasoline station)



Question 8

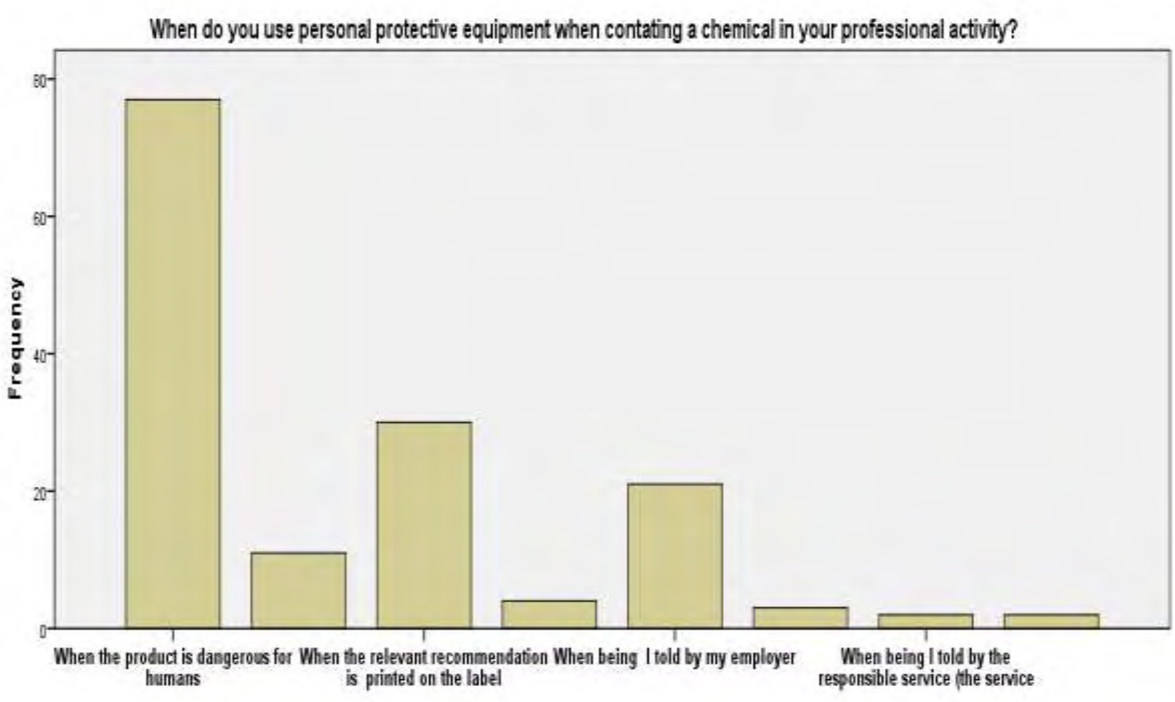
The largest percentage of workers (62 people-41,2%) often used personal protective equipment ,and the lowest percentage (7 people - 4,7%) answered “when being informed

Question 9

The majority of staff (80 people - 53,3%) replied that they commonly use gloves as personal protection. The lowest percentage (4 people-2,7%) use a protective mask.

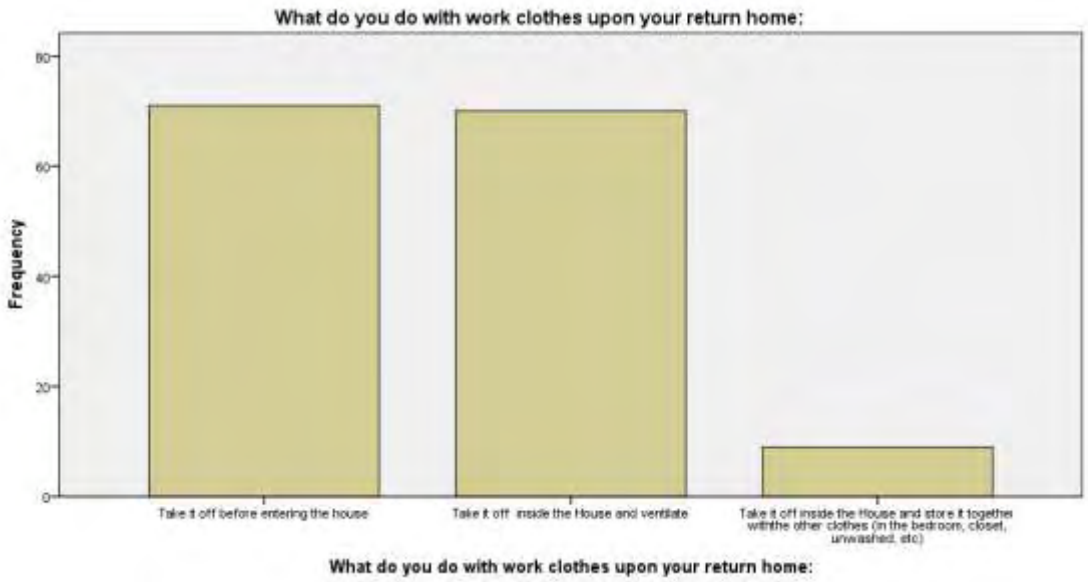
Question 10

The largest percentage of workers (77 people-51,3%) often used the personal protective equipment ,and the lowest percentage has an equal distribution of 2 people 1,3%- in the following answers: “When being told by the responsible service “ and “When being told by my supplier”



Question 11.

The majority of workers answered that they “Take it off before entering the house” 47,3% (71 people)and the smallest percentage 6% (9 people) responded that they “ Take it off inside the House and store it together with the other clothes (in the bedroom, closet, unwashed items, etc)”



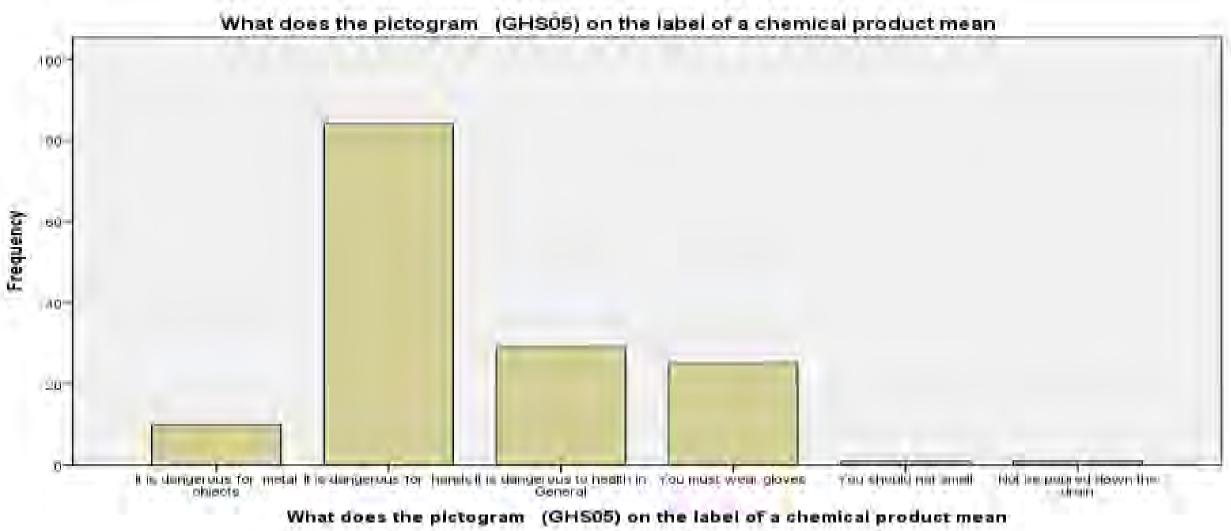
Question 12

The majority of workers 101 (67,3%) responded that they “Wash their work clothes separately from other clothing”.

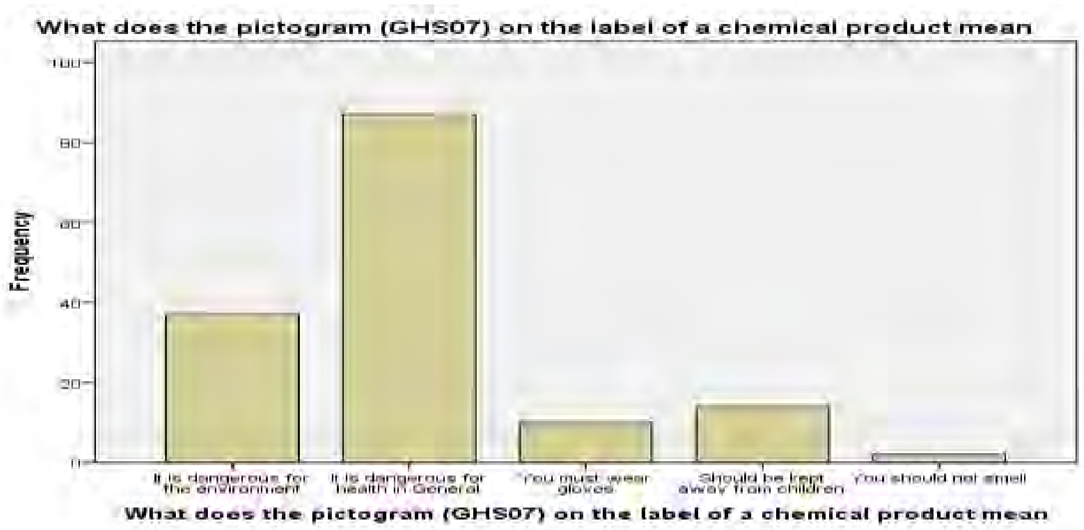
2 workers (1,3%) , the lowest percentage, responded that they clean it in the laundry.

Question 13

84 workers (56%) answered that" the pictogram GHS05  is dangerous for hands". It is the largest percentage of answers.
The lowest percentage has an equal distribution of 1 people 0,7 %- in 2 answers :" You should not smell it " and "Not to be poured down the drain"



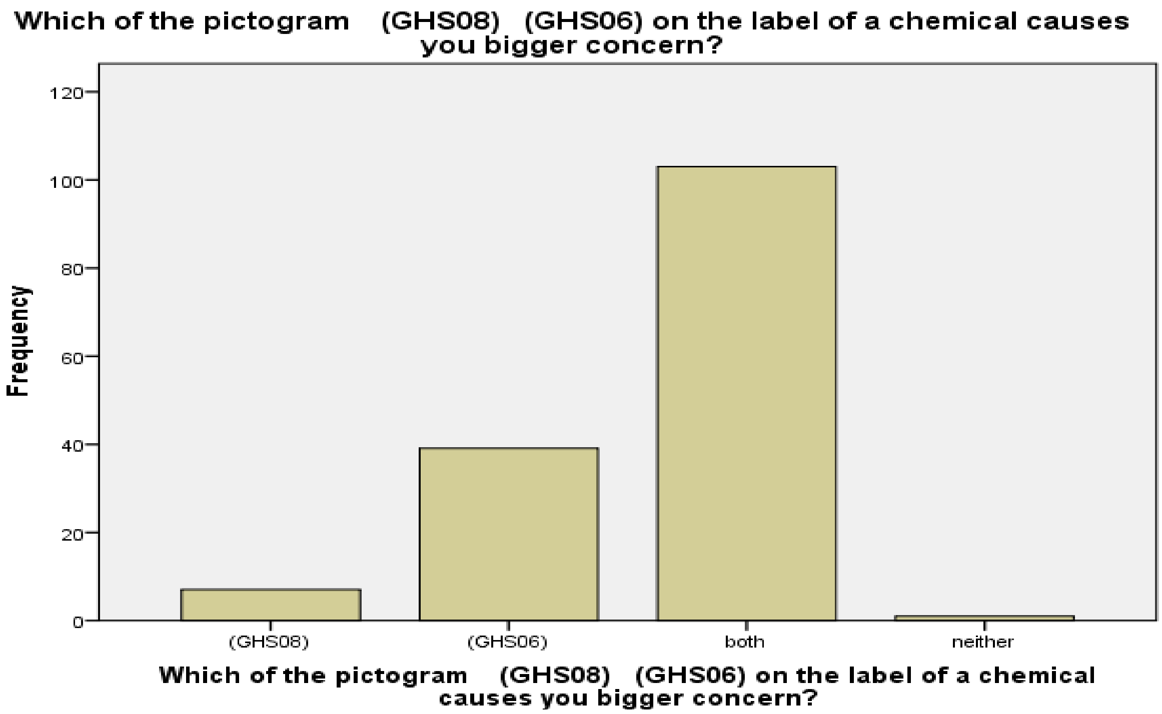
Question 14
87 workers (58,0%) is the majority of respondents that answered that the pictogram  GHS07 " is dangerous for health in General"2 workers(1,3%) is the lowest percentage who answered that "you should not smell it"



Question 15

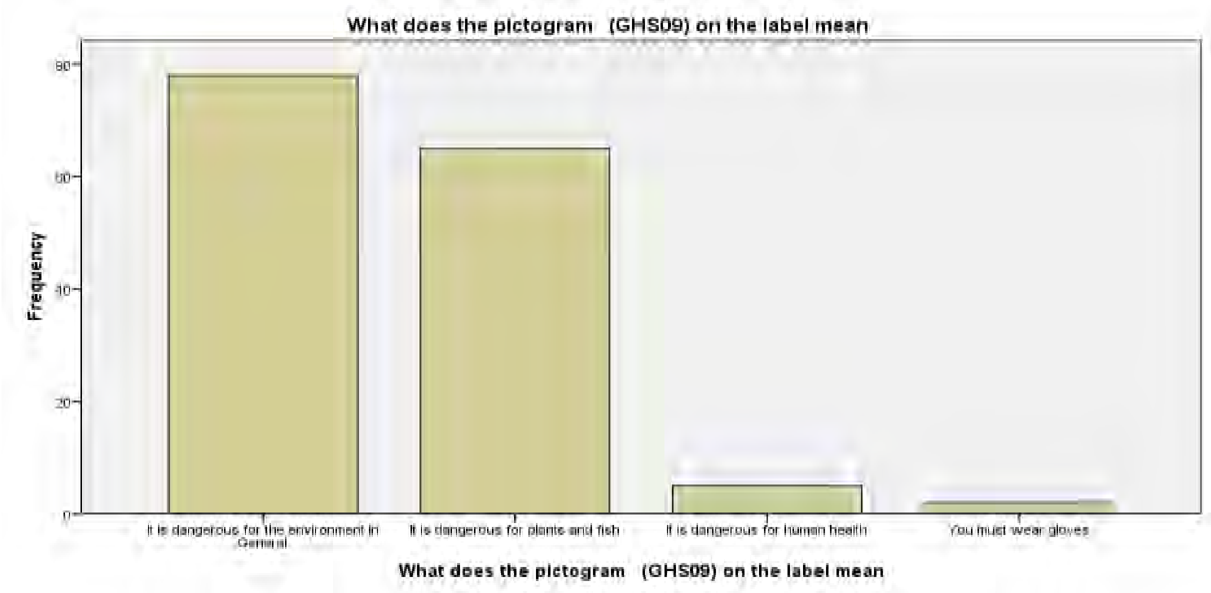
103 workers (68,7%) is the majority of respondents who answered that both pictograms GHS08  and GHS 06  cause them bigger concern

Only one respondent 0,7% answered “neither” to this question



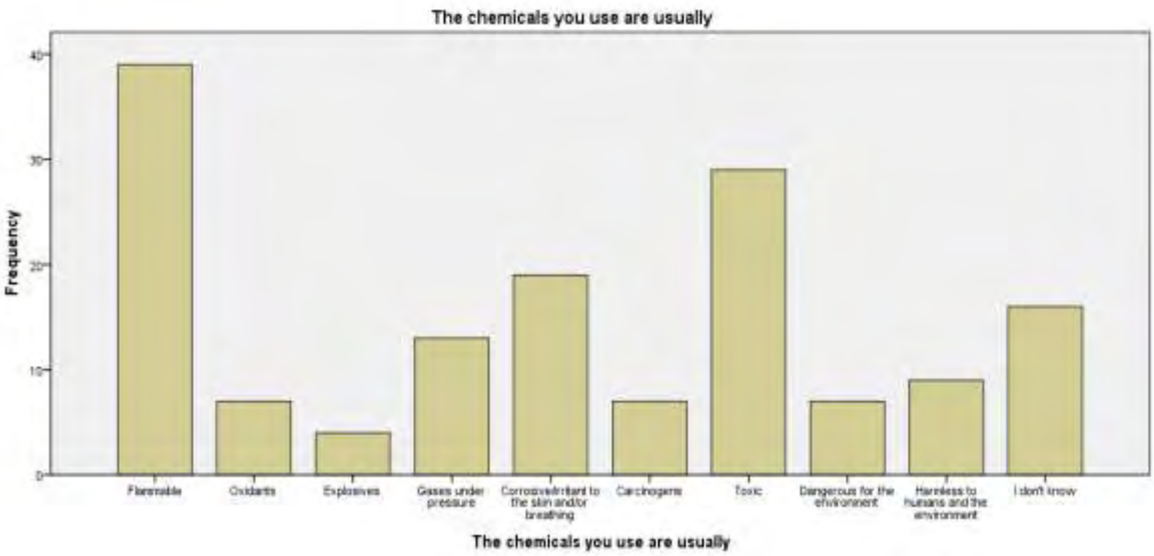
Question 16

The largest percentage 78 workers (52%) answered that the pictogram GHS09  means that ”It is dangerous for the environment in General” . The lowest percentage of 2 workers (1,3%) answered “you must wear gloves”



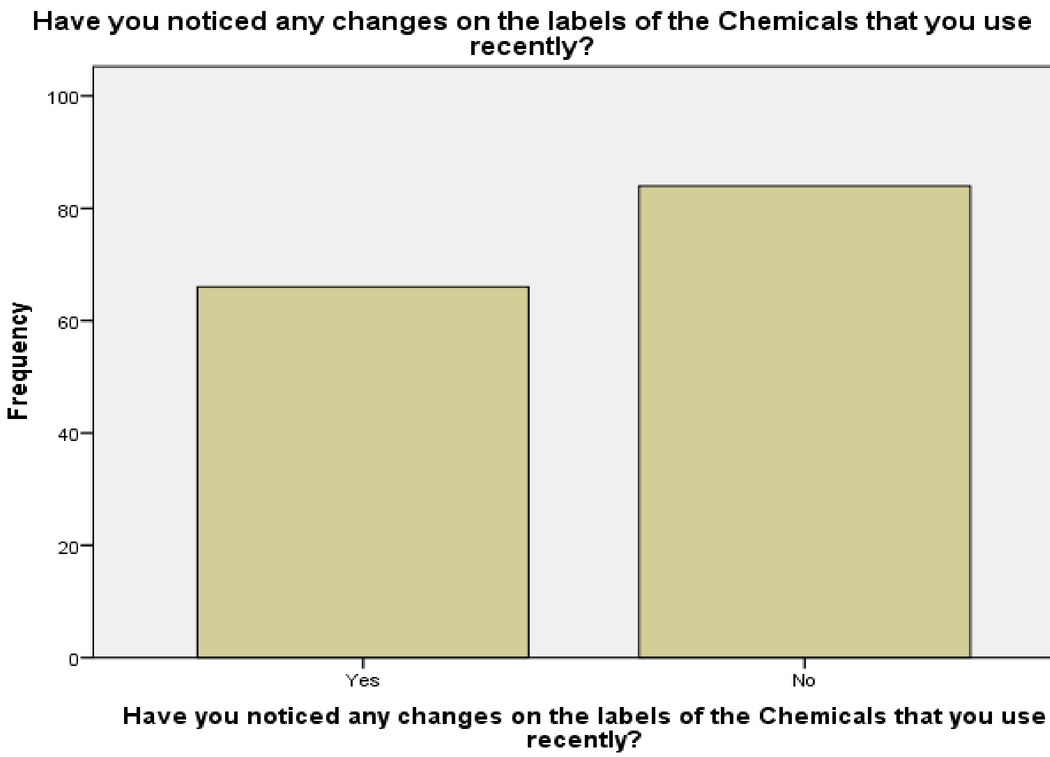
Question 17

The majority of workers (39 people - 26%) answered that they usually use “flammable” chemicals. The lowest percentage has an equal distribution of 7 people- 4,7 % in 2 answers : “Carcinogens” and “Dangerous for the environment”.



Question 18

In this question the majority said “No” (84 people - 56%) and the 44% (66 people) said “Yes”.

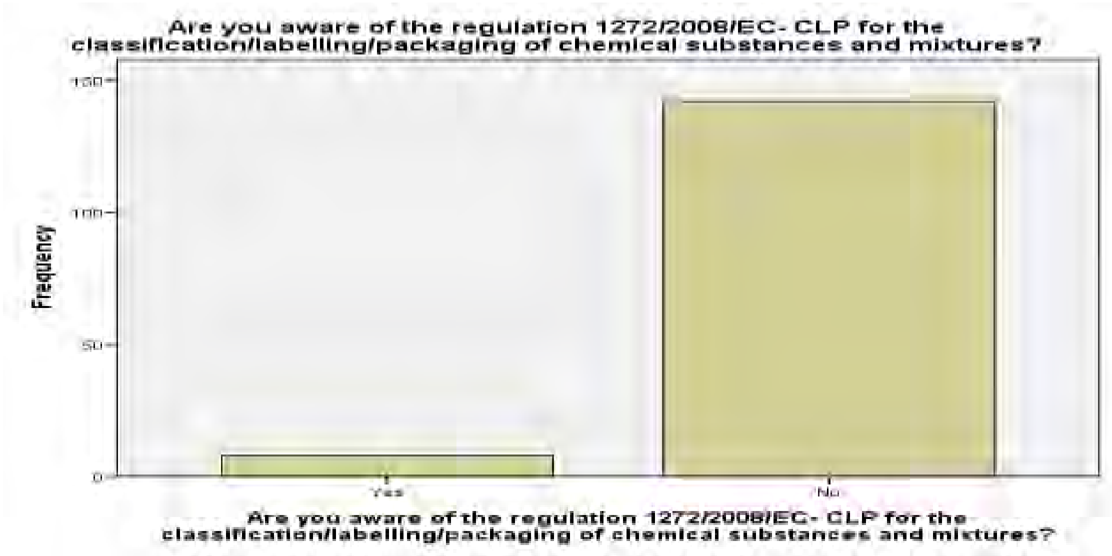


Question 19

The majority of respondents (72 people-48%) says that they more often use the chemical products with the GHS labeling. The lowest percentage (21 respondents -14%) use the chemical products with the DSD labeling.

Question 20

The vast majority of respondents 142(94,7%) are not aware of the regulation 1272/2008/EC- CLP. Only 8(5,3%) of respondents are aware of the regulation CLP for the classification/labeling/packaging of chemical substances and mixtures.



PART 3

BELOW IS THE ANALYSIS OF THE STATISTICAL SIGNIFICANCE *RESULTS* OF ALL THE QUESTIONS IN RELATION TO DEMOGRAPHIC DATA, USING THE CHI-SQUARE TEST METHOD

SEX

In question number 5, there is a p value of 0.03 which makes the test significant και in question number 17 , there is a statistical significance of 0.02. In the majority of questions , it is clear there is no important connection between sex and the answers.

For instance:

5.How would you conclude that a product is dangerous to humans and/or the environment?

Question 5 has a p-value of 0,03

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11,829[a]	5	,037
Likelihood Ratio	13,143	5	,022
Linear-by-Linear Association	,932	1	,334
N of Valid Cases	150		

a. 3 cells (25,0%) have expected count less than 5.
The minimum expected count is 1,60.

AGE

In question number 20, there is a p value of 0.03 which makes the test significant. In the rest of the questions there is no statistically significant difference therefore there is no connection between age and general risk communication regarding chemicals.

For instance:

20.Are you aware of the regulation 1272/2008/EC- CLP for the classification/labeling/packaging of chemical substances and mixtures?

Question 20 has a p-value 0.03

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	44,256[a]	29	,035
Likelihood Ratio	28,183	29	,508
Linear-by-Linear Association	7,574	1	,006
N of Valid Cases	150		

a. 48 cells (80,0%) have expected count less than 5.
The minimum expected count is ,05.

OCCUPATION

In questions number 1 ,3 ,5 ,6, 7, 9, 10,17,18,19,20 there is a p value of 0.01, and in questions 8, 11, 12 και 13 the p value varies from 0.03 to 0.05. These question categories are related to the classification of the product as "dangerous" (from 1 to 6), question categories which refer to means of personal protection (from 7 to 12) and understanding the pictograms (from 13 to 19) and knowledge of the CLP regulations (question 20). This shows us a strong relationship between the occupation and the risk communication of chemicals.

For instance:
1.OCCUPATIONAL and* Classification “dangerous for humans” on a product means that it:

Question 1
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	139,032[a]	76	,000
Likelihood Ratio	136,867	76	,000
N of Valid Cases	150		

a. 94 cells (94,0%) have expected count less than 5. The minimum expected count is ,05.

3.OCCUPATIONAL * Do you utilize products potentially dangerous for humans in your professional activity

Question 3

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	106,097[a]	57	,000
Likelihood Ratio	103,949	57	,000
N of Valid Cases	150		

a. 70 cells (87,5%) have expected count less than 5. The minimum expected count is ,05.

WORK EXPERIENCE

As it can be seen in the five first questions, in 3 of them we have p value results fluctuating from 0.01 to 0.05 which means there is strong evidence that the tests are statistically significant (there is a significant relationship between work experience and product hazards to people and the environment).In questions 13,14,15 and 16 which refer to understanding pictograms ,there are statistical significant from 0.01 to 0.05 which confirm the strong connection between work experience and pictogram comprehension. In questions 17 and 20 , the p values are 0.03 και 0.01 therefore the tests are statistically significant**.**

For instance:

1.Work experience * Classification "dangerous for humans" on a product means that it:

Question 1 has a statistical significance of 0,01

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	156,288[a]	120	,015
Likelihood Ratio	143,793	120	,069
Linear-by-Linear Association	2,394	1	,122
N of Valid Cases	150		

a. 153 cells (98,7%) have expected count less than 5. The minimum expected count is ,05.

Question 3 and work experience have a statistical significance of 0,02

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	119,117[a]	90	,022
Likelihood Ratio	95,816	90	,318
Linear-by-Linear Association	1,037	1	,309
N of Valid Cases	150		

a. 117 cells (94,4%) have expected count less than 5. The minimum expected count is ,05.

Question 5 has a statistical significance of 0,05
There is strong evidence that there is a significant relationship between work experience and product hazards for man and environment

Chi-Square Tests

	Value	*df*	*Asymp. Sig. (2-sided)*
Pearson Chi-Square	*178,729[a]*	*150*	*,055*
Likelihood Ratio	*153,869*	*150*	*,397*
Linear-by-Linear Association	*18,350*	*1*	*,000*
N of Valid Cases	*150*		

a. 184 cells (98,9%) have expected count less than 5. The minimum expected count is ,03.

EDUCATION

Here, the results of the chi square test can show us very strong statistically significant results and it is clear that there is an important relationship between the educational level and the realization of what "dangerous" to health and the environment is (questions 1, 3, 5 with statistical significance varying from 0.01 - 0.04). There is also a connection between the educational level and the understanding of labels and means of protection (p-value 0.01 in questions 6 & 7), the comprehension of GHS signs (questions 13, 17, 18, 19 with a p value of 0.01) and the awareness of CLP regulations (question 20 with a p value 0.01))

For instance::

1.EDUCATION and Classification “dangerous for humans” on a product means that it:

Question1

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	156,288[a]	120	,015
Likelihood Ratio	143,793	120	,069
Linear-by-Linear Association	2,394	1	,122
N of Valid Cases	150		

a. 153 cells (98,7%) have expected count less than 5. The minimum expected count is ,05.

DIAGNOSED HEALTH PROBLEMS

Regarding diagnosed health problems, there are statistically significant results to questions 1, 4, 5 (with the p value varying from 0.01 to 0.05) which means there is a relationship with the question category which examines what danger to health and danger to the environment mean , in question 9 (p value 0.04) with the usual protective means and question 18 (p value 0.01) about the change of pictograms from DSD to GHS.

For instance:

1. DIAGNOSED HEALTH PROBLEMS and Classification "dangerous for humans" on a product means that it:

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	40,826[a]	28	,056
Likelihood Ratio	45,471	28	,020
Linear-by-Linear Association	7,290	1	,007
N of Valid Cases	150		

a. 29 cells (72,5%) have expected count less than 5.
The minimum expected count is ,11.

2.2. Conclusions

Out of 150 professional users of chemical substances in different areas that have participated in this study, we can draw the following conclusions.

The perception level of the existing danger for workers and their working environment depends on the nature of their job, their educational level and their work experience. This is based on statistically significant results.

With regard to protective measures, only a 26% uses Personal Protective Equipment (PPE) on a daily basis. This also depends on the type of job they perform, as shown through statistical significance. The usage of PPE is not really related to the remaining demographics. As for the pictogram perception level, it does not depend on age, sex etc but on the specific type of the job the employees work in, as shown by the majority of results being statistically significant and fluctuating from 0.01 to 0.04.

In some pictograms, the educational level played an important role in their level of understanding. Diagnosed health problems do not affect at all the hazard perception level. Finally, concerning the knowledge of the European legislation and the CLP regulation, only a 5.3% of workers know about them, who are people of academic and technological education. Pictograms are not the universal communication system as we formerly thought. Depending on the profession and the educational level, there might be influence on determining the meaning of pictograms and enhancing the usage of protective measures.

Specific training programs should be designed to draw attention to safety pictograms and instill their meaning into the employees at risk.

3. DISCUSSION

Apart from implementing the questionnaire, through the personal interviews I has with the participants in this study, I tried to understand if the employees realize the necessity of protective measures, in relation to comprehending the various pictograms on the chemical product they use. Statistical analysis has revealed interesting correlations between protection level, comprehension of hazards, usage frequency and several demographic characteristics. Generally, I have become aware of the employees' great disappointment regarding the absence of clear instructions and lack of knowledge regarding the existing legislation concerning the specific protective measures. But even those employees who understand the danger and the absence of professional protection, unfortunately, do not act accordingly due to insecurity and fear of losing their job, given the Greek economic crisis. This particularly concerns gas station employees who specifically mentioned that they will scare the customers if they put on masks and since the law cannot protect them, they cannot do it. In addition, the employees believe that the same the lack of information and lack of training provided by the competent authorities is also valid for the business owners, whose business is involved in the usage of hazardous substances or mixtures. The owners of small family businesses themselves have no idea about the CLP regulation and the protective measures. Most of the time, they don't even know if the materials they use are hazardous or not. In addition, they have no idea what the Material Safety Data Sheets are and to whom they can turn to for further information.
A great number of workers dealing with chemicals tend to develop various health problems during their working life.

Several studies that have been conducted to determine biomarkers to evaluate exposure. Medical professionals, such as occupational medical

doctors, should help in this field. Unfortunately they are not properly trained. Usual hematological and biochemical biomarkers are not appropriate. This is an obstacle to a better understanding of how serious exposure to chemicals is at the workplace. I ought to mention once more that the insufficiency of the current legislation which, ideally, should cover the necessity of such a control at their workplace, regarding skin and inhalation exposure. What is of MAJOR IMPORTANCE here is how detrimental to health THE EMPLOYEES 'EXPOSURE to chemicals is and how they can be protected.

***Some suggestions could be*:**

1. To establish toxicological control at the working environment

2. Tests on the workers to determine the levels of toxic substances in their organism

3. Control for the suitability of substances which are used mostly in small companies, to ensure they are legal and approved by ECHA

4. Staff training in recognizing hazard pictograms on labels for improved risk communication

5. Follow-up testing through exams to make sure all employees have understood the pictograms in use

6. Abidance of using occupational protective means ,for instance, a protective uniform.

7. Control and inspection by public health services to ensure correct use of protective measures
8. Proper legislation should be enacted for all of the above

It is necessary to implement all these measures for financial reasons, too, as Greece is financially unstable at present. A lot of people suffer from known pathologies, due to conditions at their workplaces. Not always there is official recognition of the “guilty” substance, so prevention cannot apply. A good example is the cholangiocarcinoma epidemically developed among workers of a printing company in Japan. Each heavily sick patient produces a high cost to the government. There is poor life quality for patients and their families. Moreover, the nation loses a valuable part of the workforce. In all aspects, if there is no change, in the near future, in this miserably controlled situation in the professional field of toxicological substance users, there will be a considerable damage at the expense of the government and, overall, the state. It needs to be emphasized that the pharmaceutical industry is evolving rapidly in various countries and the technological advances bring forward new substances whose toxic properties haven't been studied thoroughly enough yet, such as nanomaterials. The legislative weakness in proper control implementation is going to be destructive for us all.

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