THE INTERNATIONAL SOCIAL SECURITY ASSOCIATION (ISSA)

has more than 300 members (government authorities and public institutions) in more than 120 countries, half of whom are concerned with occupational safety. The headquarters of the ISSA is at the International Labour Organization in Geneva. Its main objective is the promotion and improvement of SOCIAL SECURITY in all parts of the world.

To intensify work safety in plants in the chemical industry, including the plastics, explosives, mineral oil, and rubber industries, the

INTERNATIONAL SECTION OF THE ISSA ON THE PREVENTION OF OCCUPATIONAL RISKS AND DISEASES IN THE CHEMICAL INDUSTRY

was set up in 1970. It has its chair and secretariat at the Berufsgenossenschaft der chemischen Industrie, D-69115 Heidelberg, Germany.

EPSC - the European Process Safety Centre - is an international industry-funded organization which provides an independent technical focus for process safety in Europe. EPSC's activities are sponsored by chemical manufacturing companies and related businesses with a keen interest in chemical process safety.

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Mis-Identification of Chemicals

Causes and Precautions for Storage, Transport and Production Plant

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Preface

In 1998 the European Process Safety Centre (EPSC) initiated the formation of a Contact Group on safety issues in batch production. Among other activities, this Group compiled a report on precautions taken by the member companies to prevent the mis-identification of chemicals. This report was issued in 2000.

Due to the relevance of this topic, the Technical Steering Committee of the EPSC decided to make this information available to a broader audience. An ideal partner was found in the International Association for Social Security (ISSA) whose Chemical Section has been dealing with the safety of process plants for a considerable time and has already issued a comprehensive series of publications in this field. Good contacts between EPSC and ISSA enabled the development and distribution of this brochure as a first joint project.

In this publication, hazards resulting from the mis-identification of chemicals are presented and preventive measures are described. Selected incident reports will draw the attention of managers and employees of companies involved along the entire logistic chain to the subject and raise their awareness in order to avoid future incidents, accidents and loss of property.

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Contents

Mis-Identification of chemicals is a key problem for production plants specialising in batch processing, such as are commonly encountered in the fine-chemicals and pharmaceutical industries. But also firms in other industries which use different reactive chemicals to treat waste water for example - usually with purely organisational safeguards - run this risk as is proven by numerous accounts of accidents.

Mis-Identification of chemicals is always significant if for example:

· Sacks, barrels, containers or tank wagons for transporting chemicals are used instead of fixed pipeline connections

· Different chemicals pass through an (intermediate) storeroom

· Both acids and alkalis are maintained in order to set a specified pH value

· In multi-purpose plants, different products are made from different feedstocks (in this case there are two ways that the feedstocks may be confused – when the chemicals are being used and when the finished products are being distributed on the market)

When using chemicals as described above, appropriate measures should be taken, e. g.:

· Ensure the substance is identified correctly
· Ensure the correct amounts are added
· Ensure they are added in the correct place
· Ensure they are added at the correct time
· Ensure the correct process conditions

The main subject of this brochure is “identifying the substance correctly”. It is important to note that the chemicals used are often bought in and supplied by a third party. This is why care must be taken to avoid a mix-up throughout the entire logistics chain, from the point of manufacture, storage, transport and delivery right through to the end user.

The measures a company takes to avoid mis-identification of chemicals depend on the particular situation. The measures chosen should be reliable and appropriate for the potential scale of damage that a chemical mix-up may cause.

A recognised method for ensuring the high availability of protective measures is the single-error tolerance principle. This principle is met if, for example, a measure is performed redundantly, i. e. if it is carried out several times independently of each other. The single-error tolerance principle must be employed both for technical and organisational methods of protection.

In practice, different companies have developed and implemented very different safety strategies. The starting point of every safety strategy should be a safety evaluation e. g. using the PAAG or HAZOP procedure or another systematic method for performing risk assessment and evaluation. The cause of a chemical mix-up can also lie outside the usual areas examined by such analyses.
For example, on repeated occasions in the past, cargo or freight documents have been mixed up during transport due to unfortunate circumstances. An error such as this should therefore never be ruled out entirely, even when buying in chemicals from certified manufacturers.

Some companies use „interaction matrices“ in order to set out the effects of combining the wrong chemicals. This enables possible consequences to be categorised, e. g. „non-critical“, „harmful to quality“ or „significant from a safety perspective“, and appropriate measures to be put in place for dealing with critical combinations of substances. In cases where one chemical is mistaken for another, matrices of this type usually only take into account those substances that occur in the process under examination and not those that can enter the plant due to a mix-up outside the areas in question.

The following sections describe a number of selected incidents where one chemical is mistaken for another, followed by a description of the lessons that can be learned from this and the measures that can help prevent such incidents.
An assessment of the measures in terms of quantifying availability has been deliberately omitted.

Human reliability plays a major role in all strategies for preventing chemical mix-ups. This is because, on the one hand, human beings can cause incidents themselves through operator error, and on the other hand because they can make a far more wide-ranging contribution to the detection and solution of the problem than any technical device thanks to their experience and the different ways in which they perceive things. The training and know-how of employees is therefore a key starting point when drawing up measures.

However, there is no foolproof method which can guarantee the total prevention of mis-identification of chemicals.

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Incidents

The following reports describe incidents that actually occurred in different companies. To keep confidentiality, certain substance names have been modified or the case history has been simplified. The objective of this collection is to illustrate the broad variety of reasons for and consequences of the mis-identification of chemicals. These reports are thus not statistically representative with respect to causes, effects or operations involved.

Incident 1

Two operators are manually loading phenoxy acetic acid from flexible bulk containers into a stirred vessel. Inadvertently, a cloud of hydrogen sulphide is released and overcomes the operators. They suffer poisoning by the toxic gas.

In searching for the cause of this incident, the investigation revealed that the vessel did not contain potassium hydroxide as prescribed for the neutralization of the phenoxy acetic acid. Instead, sodium hydrogen sulphide was in the vessel, a substance that releases hydrogen-sulphide in contact with acids.

This deviation was due to mistakes in the management of storage and delivery of potassium hydroxide. Normally, the manufacturer of potassium hydroxide kept the bags containing this substance in a separate and specially designated storage area. Due to a lack of space, a pallet with sodium hydrogen sulphide was also brought into this special area. Both potassium hydroxide and sodium hydrogen sulphide were stored in units of 40 bags of 25kg each.

Upon request for 1000 kg potassium hydroxide, the warehouse operator took a pallet from the special area and checked for the correct number of bags. Neither the warehouse operator nor the operators in the production plant checked the substance name on the label and thus the sodium hydrogen sulphide was erroneously loaded into the vessel.

Incident 2

20 drums containing wet aceto acet toluidide are prepared for drying. While shifting the drums manually, an operator notices that two of them are slightly lighter than the others. After opening the drums, it appears that the form of crystals is also different from the material in the other drums, although all the drums look identical and are identically labelled. The operator separates the two drums and reports his findings to the foreman.

A chemical analysis shows that, instead of aceto acet toluidide, the two drums contain aceto acet anilide, which has a significantly lower melting point. If the operator had loaded this wrong material, melting of the anilide would have occurred at the drying temperature of aceto acet toluidide, resulting in tedious and costly cleaning work. In the case of products with more critical safety data (e. g. exothermic decomposition reactions), a thermal runaway could have occurred.

The investigation of the causes for this near-miss showed that the material was returned from the customer for re-drying due to a too high content of water. At the customer's warehouse, drums containing aceto acet anilide were mixed up and erroneously labelled with aceto acet toluidide.

When the dry material arrived at the supplier's plant, the usual quality testing was not carried out, since this was returned material for re-drying.

Incident 3

At the unloading station of a tank farm, different chemicals are delivered in tank wagons. One of the chemicals, epichorohydrin, comes in non-isolated tank cars with two axes and top-unloading via dip-pipe. An amine transferred at the same station is delivered in non-isolated tank cars with four axes and bottom valves. Immediately after connecting a transfer hose for the amine to the bottom valve of a tank car, a violent exothermic reaction occurs and vapours are released from the vent line of the tank car.

The cause for this incident was the connection of the transfer hose to the wrong tank car. On the day of the incident, epichlorohydrin had been delivered in a non-isolated tank car with two axes that was correctly labelled. However, in addition to the top-unloading connection, this tank car also had a bottom valve.
The epichlorohydrin had been correctly transferred via the dip-pipe. The empty tank car was left at the unloading station. Two operators of the next shift were then ordered to transfer the amine. Erroneously, they connected the transfer line to the bottom valve of the empty epichlorohydrin tanker. When they opened the valve a residual amount of about 20 kg epichlorohydrin came into contact with some amine in the hose, resulting in a violent reaction.

Incident 4

According to the manufacturing procedure, 190 kg of nitric acid has to be prepared in a stirred vessel for a nitration reaction. Using a balance for weight control, the acid is transferred in three portions from three identical plastic containers. The operators leave the working area, and shortly after that a violent thermal explosion occurs. The cover of the reactor is propelled through the roof of the building and the pressure wave destroys the windows in neighbouring buildings.

The cause of the thermal explosion was a mis-identification of chemicals. In extensive laboratory tests, it was shown that, in one of the three containers, there was 40% formaldehyde instead of nitric acid. Formaldehyde reacts violently with nitric acid, producing large amounts of NOx gases. The safety valve did open but the gas evolution was so fast that gas flow exceeded the venting capacity. The root cause for the mis-identification was not identified. While the Goods Receiving Department pretended that all containers were labelled in accordance with their contents, the plant operators said that the three containers were labelled with “nitric acid”.

Incident 5

For the production of a plant protective agent, a reaction involving 600 kg chloronitrotoluene, 1050 kg dimethylsulfoxide and 500 kg potassium carbonate is carried out. Two operators and the plant manager check the correct loading of the reactor and then leave the production room.

Shortly afterwards, the reactor explodes. The pressure wave destroys part of the light roof and combustible chemicals, which were released cause a fire in the production room. It takes several hours to put out the fire. Eleven employees are injured, two of them suffering perforated eardrums. In total, 102 persons, most of them from the neighbouring residential area, require ambulant treatment.

The cause for this violent exothermic reaction was the mis-identification of raw materials. Instead of potassium carbonate, labelled with “Potash”, potassium hydroxide (“caustic potash”), which is supplied in similar bags labelled with “Potassium Hydroxide” was filled into the reactor. Potassium hydroxide undergoes a violent exothermic reaction with chloronitrotoluene.

Incident 6

In the storage area of a water treatment plant there are two tanks, one for caustic soda, the other for hydrogen chloride. During the routine filling of the acid tank from containers supplied by the traditional and approved supplier, a violent release of chlorine gas occurs. The gas cloud spreads over the site into a neighbouring residential area and causes a large-scale emergency operation by the police and the fire brigade.

Initially the investigation team cannot explain this incident, as the delivery notes for the acid are correct and the two tanks have different (non-compatible) couplings. Nevertheless, a mis-identification has obviously occurred.

A more detailed investigation of the **causes** revealed that, in the marshalling area of the supplier, containers with sodium hypochlorite (supplementary description on the label "12% active chlorine" were loaded on the truck instead of those containing hydrogen chloride, although the delivery notes were correct. In the water treatment plant, only the delivery notes were checked and no analytical test was made, since the supplier had the appropriate quality certification. The "problem" with the incompatible couplings between container and tank was "solved" by using an "emergency-adapter".

Incident 7

During filling of a liquid nitrogen tank on a customer's site, the driver of the tanker notifies an unusual difference between the expected weight and the volume of the gas.

A short analysis shows, that the nitrogen in the tank contains about 25% oxygen. The customer is immediately informed. The tank and the distribution net for inert gas are emptied and flushed with pure nitrogen. The risk of an explosion can thus be eliminated "just in time".

The cause for the mix-up of nitrogen and oxygen was identified at the supplier's site. Tank wagons are used for the transport of the liquefied gas from the production plant to the distribution centre. From there to the customer, tank trucks are used. Both vehicles are designed to carry both liquid nitrogen and liquid oxygen. On both sides, flip-plates display the content of the tank:

Flipped up: "Oxygen"
Flipped down: "Nitrogen"

Depending on the content, the tanks are equipped with different, non-compatible couplings.

At the supplier's site, an employee was given the oral instruction to fill nitrogen into an empty tank wagon. The plate on his side was erroneously in the "up" position, i. e. it displayed "Oxygen". The reason for this error could not be identified.
The plate on the other side was in the correct position, but the employee did not see this and he filled the tank with oxygen. As the coupling of the hose did not match, he replaced it with a nitrogen coupling.

Incident 8

During filling of a tank for diphenylmethan diisocyanate (MDI) with a liquid delivered in a tank truck, an unattended reaction in the tank occurs, resulting in the release of aggressive vapours. Two employees have to seek medical treatment.

The cause for this accident was a mix-up of transport documents during the international transport. The drivers of two tank trucks containing MDI and a water-based plant protective agent from the same source submitted the freight to the Customs control. There, the transport documents were mixed up and returned to two new drivers, that were in charge of delivering the chemicals to the customer. Therefore nobody noticed that the wrong documents were handed out and the water-based plant protective agent was brought to the unloading station for MDI. A chemical analysis was not made before the transfer to the tank took place, as the supplier was certified according to ISO 9000.

Incident 9

In the drum oven of a smelting work, an explosion occurs with severe impact: the pressure wave and the flames destroy the melting facility. Six people are killed, twelve are injured, some seriously. The cost of the damage to property totals more than one million Euros.

The investigation of the causes for this accident revealed that, due to the mis-identification of raw materials, 100 kg of sodium **nitrate** was added to the melting of aluminium instead of sodium **chloride**. Sodium nitrate reacts violently with aluminium, releasing large quantities of nitrous gases and a tremendous amount of energy.

Incident 10

In a multi-purpose reactor, various silicon-organic compounds are produced in batch mode. Only a few minutes after filling the raw materials into the vessel and adding the catalyst, the two operators notice a strong fizzling and swoosh, and they immediately leave the production room. The plant manager tries to approach the source of the noise and, as he does so, he is hit by the pressure wave of a tremendous explosion. The three men suffer severe burns; the plant manager dies the next day.

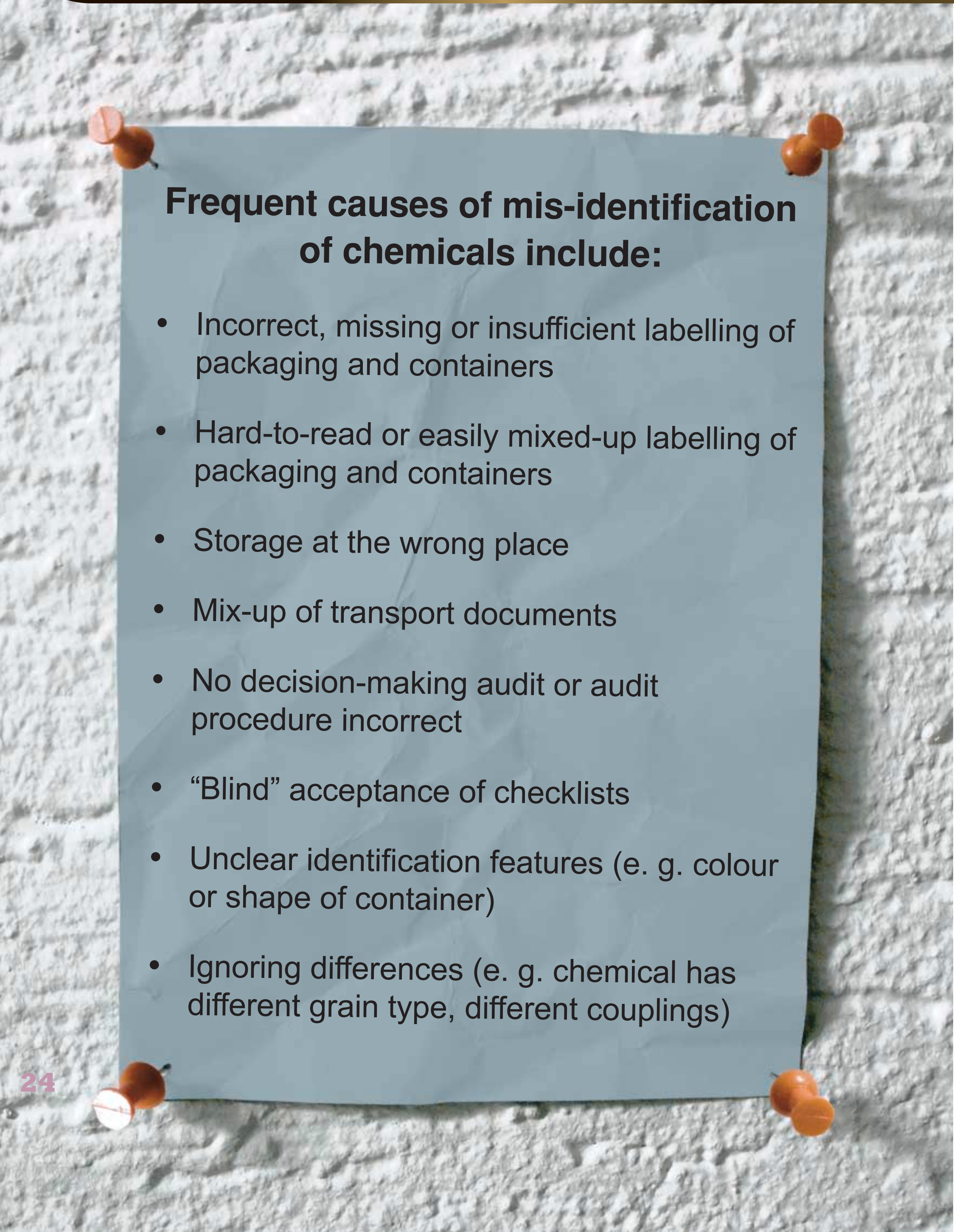
The cause for this explosion was the mis-identification of raw materials: instead of Allyl-glycidyl-ether Hydrogen-siloxane was filled into the reactor. This material was used in another process in the plant and was delivered to the plant in similar drums. After the addition of the catalyst, a decomposition reaction occurred, which produced hydrogen gas and other decomposition products so fast, that the gases could not be vented via the pressure relief system of the vessel. Thus the pressure inside exceeded the design pressure of the reactor.

Incident 11

Mis-identifications of chemicals may occur not only in production but also in laboratories, as the news report below illustrates. In such situations, it is almost impossible to take technical counter measures, which are reasonably practicable: safety relies on the awareness and the conscientiousness of the lab personnel. This incident points out that, in an analytical laboratory, samples submitted for analytical control might be mixed-up, resulting in wrong information being sent to the production plant.

Nitro-Glycerol-Alarm in a Laboratory in Bonn

By mistake, an employee in a test laboratory of a research institute in Bonn has prepared a highly explosive cocktail: instead of sulphuric acid, she added nitric acid to some samples containing fat and glycerol. Thereby, she unintentionally produced about 30 g of nitro-glycerol. After the mistake was noticed, the management of the institute called the fire brigade. An explosives expert from the Criminal Investigation Department in Düsseldorf carried the explosive mixture outside the building, where it was destroyed in a closely-supervised controlled explosion. (soj)



The list shows that the cause of a mis-identification of chemicals can be found at different places in the logistics chain - during manufacture, during storage/ transport and at the processing plant itself.
The incident reports and the list also show that in some cases the failure of individual “barriers” can also be the cause of an incident. The protection strategy chosen must take this into account.

Precautions

Mis-identification of chemicals is a deviation from normal operation, which should be considered in any systematic risk assessment in the process industry.
Where such a deviation could have dangerous effects, technical or organisational measures should be taken to avoid a mis-identification or at least to mitigate possible effects.

Incidents related to mis-identification of chemicals are often caused by human failure. Well educated and trained staff having a clear understanding for the processes in the plant and the associated hazards are therefore a crucial element in the prevention of such incidents. All employees should be trained to recognize indicators for wrong or mixed-up chemicals, e. g.

- Unusual colour of a substance
- Changed particle size or viscosity
- Missing or illegible labels
- A different container or package than usual
- A different weight of the package
- Non-matching couplings of hoses and pipes
- Unusual name or description of the substance on the label
- Discrepancies between transport documents and labels

The employees should know what actions are to be taken in case of such observations. Even for well-educated employees there are limitations of making own decisions, beyond which superiors are to be involved. Everybody should clearly know where these limits are.

A comprehensive and systematic verification of documents such as shipping papers, delivery notes and data sheets is another basic requirement to prevent mis-identification of chemicals.

On the next pages methods are presented that proved to be effective in practice in various companies. This compilation is not to be understood as a list of requirements, which have to be implemented in all cases. For the selection of appropriate measures various aspects are relevant, which depend on local circumstances and conditions. As a rule, redundant checks of the identity of substances using organisational measures are applied in chemical multi-purpose plants.

Packages, bags, drums and containers are labeled such that the identity of the content can clearly and easily be identified. Essential elements of a good labelling system are:

- Easily visible labels
- Labelling of all packaging units of a consignment (e. g. of all bags on a pallet)
- Resistant labels (sticking well, weather resistant)
- Substance name in large, easily readable characters
- Avoidance of similar substance names, in particular of similar abbreviations and acronyms

A proper and clear labelling of chemicals during storage and transport, as well as in the plant where they are processed is a basic requirement to avoid misidentification of chemicals. The implementation of this measure is straightforward in most cases.

The number of labels per package is necessarily limited by space, and as a result it is sometimes unavoidable that labels are "hidden" on the rear side or on the top of a package, where access may require a special effort.

Re-labelling is sometimes required in the logistic chain, resulting in a compromise being required between reliable adhesion and the easy replacement of the label.

The similarity of chemical names can be a significant problem when trying to avoid the mis-identification of chemicals. Shortened names or abbreviations have been introduced to allow easier communication and better distinction between chemicals with similar scientific names. But with increase in the number of these abbreviations, more of them will inevitably become similar to each other. Moreover, cases have been reported where the abbreviation has inadvertently been identical to a molecular formula of a completely different chemical.

In view of the dynamic changes in the process industries, characterized by mergers and take-overs, the use of different systems of abbreviations in the plants of different parent companies bears the risk of mis-identification of chemicals, e. g. after process transfers.

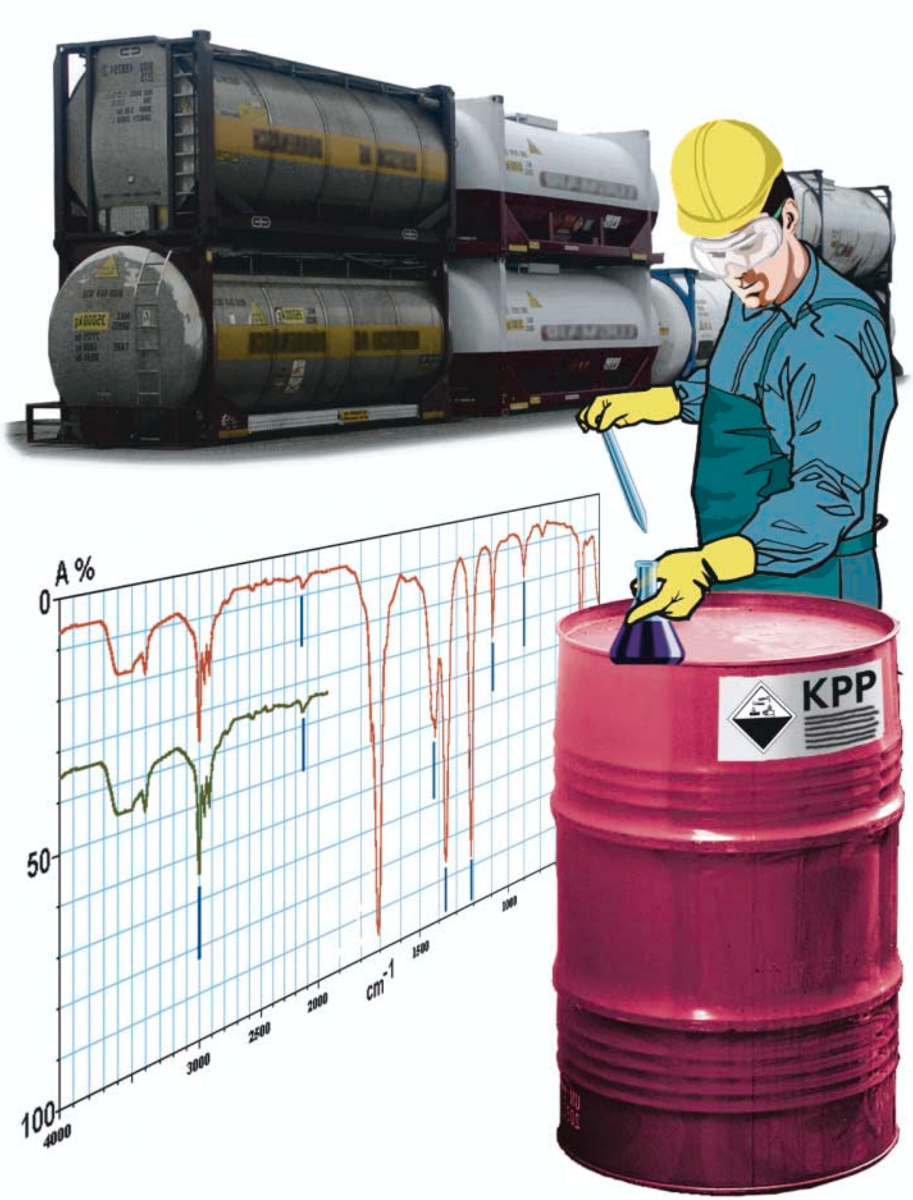
Analytical methods allow clear identification of substances based on selected chemical and physical properties. Numerous analytical methods and the respective sampling techniques are available. With modern microelectronic systems, like infrared spectroscopy, it is even possible to identify substances without taking samples, i. e. by direct measurements in the package or container.

In principle, the analytical identification of substances is applicable in all cases. As chemical and physical analysis is often the only truly comprehensive and definitive method to determine the identity and the quality of a substance it is broadly applied along the entire logistic chain from storage via transport to the final use.

In certain situations sampling can be associated with new hazards as it often involves open handling: destabilizing impurities may get into the package, which could have hazardous effects in the downstream processing. Employees who are not adequately protected could be exposed to hazardous substances. Such hazards are to be assessed and compared to the risks of a possible mis-identification of chemical in case no analytical identification is made.

If chemicals are delivered in small packages (e. g. a pallet with 40 bags), the analytical identification of the content of all packages becomes impractical. In such cases, analysis is limited to spot-checks and samples should be taken such that the optimum reliability results from a given number of tests.

It should be noticed that samples are also subject to the risk of mis-identification on the transfer to the laboratory and the handling there. Some companies apply the "just-in-time" principle for delivery of raw materials. This system has the advantage of keeping inventories in warehouses and the associated hazard potentials low. On the other hand, it imposes considerable time pressure on the analytical laboratories responsible for identification and quality control. The respective procedures must be in place to minimize the risk associated with the needs for fast response.



BARCODES

Barcodes are labels that can be read by computers. Individual packages can be identified and traced along the entire logistic chain. This can help to avoid mis-identification. A standardization of barcodes for important bulk chemicals is currently being discussed in international groups. Such a harmonization would considerably facilitate the application of barcode systems, as the same codes could be used by different parties along the logistic chain.

Barcode systems are particularly useful in the fine chemicals and specialty chemical industry where batch- and semi-batch processes involving many different packaging units (bags, drums etc) are prevailing. Where balances, analytical instruments etc. are also connected, barcode systems may be used as integrated control and planning instruments for production. This allows a comprehensive documentation of each individual operation, including quantities, checks and quality approvals, which can be used to fulfill GMP requirements, applicable in particular in the pharmaceutical industry.

In practice, scanners which allow barcodes to be read from a certain distance are preferable to reading pens, which have to be swept directly over the label with the code, in particular where the code label is fixed on a curved surface, like a drum.

A barcode system can never be more reliable than the person or the organisation responsible for labelling the packages with the code. Therefore barcode identification is never fully equivalent to identification by chemical or physical analysis.

Where a barcode system is used as a safety relevant protective system, elevated requirements apply for its functional safety and reliability. Maintenance is an important organisational element to fulfil these requirements. The costs for a barcode system may be so high that the introduction of such a system exclusively as a precaution against mis-identification of chemicals may not be justified.

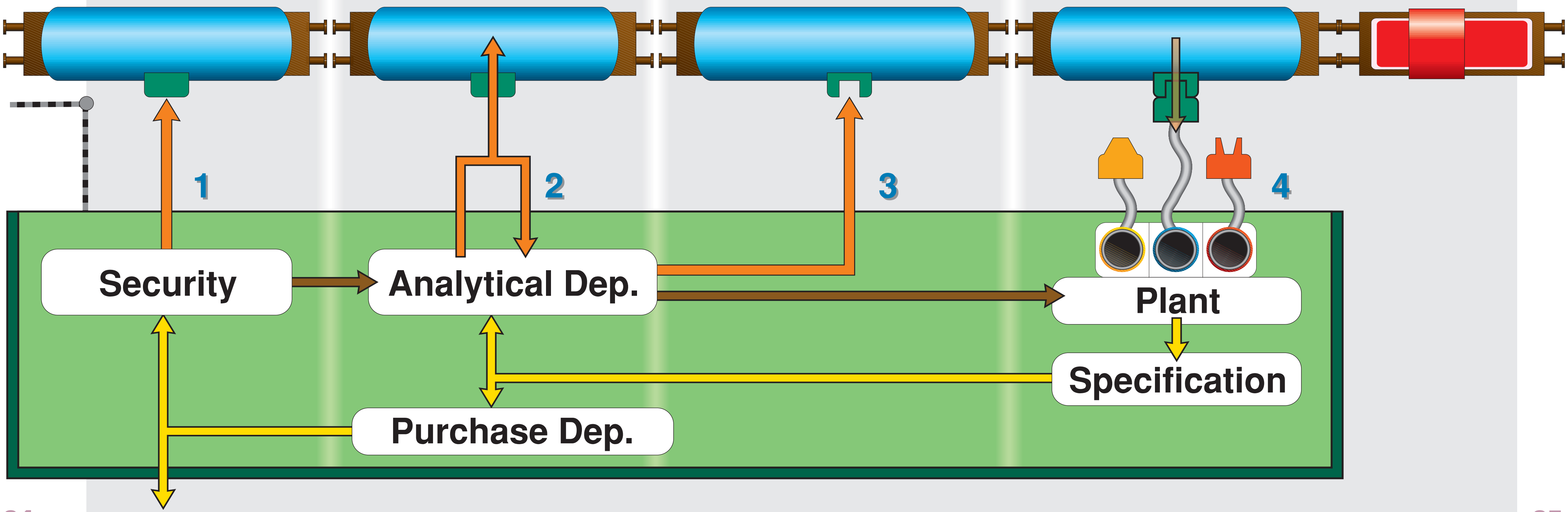
Key-Lock systems are used to block mechanically the further transfer of chemicals from one container to another, unless this is authorized by a competent person.

There are numerous types of such systems; the figure shows an example: At the gate of the factory site the unloading valve of a rail tank car is locked (1) and the analytical department authorized for formal acceptance of the content is informed. A sample is taken and the content is clearly identified by analytical methods (2). Then a lock specific for this particular liquid is fixed on the unloading valve (3) and the receiving plant unit is informed. Using the matching key (specific for the liquid) the liquid can be transferred only to the correct storage tank (4).

This process is accomplished by the exchange of the relevant documents between the organisational units involved (brown arrows). For a new order of the chemical the information is forwarded accordingly (yellow arrows).

Key-Lock systems are particularly suitable for the control of chemicals, which are delivered periodically in standardized bulk containers and which are unloaded using standardized equipment (e. g. couplings, valves). Especially "just-in-time" deliveries can be controlled effectively and efficiently in this way.

Key-Lock systems are less useful to control piece goods (e. g. chemicals in bags), where packages cannot be secured against unauthorized emptying. Key-Lock systems require an analytical infrastructure in the site as the transfer of samples to a remote service lab would cost a lot of time and increase the risk of mis-identification of the samples.



The Four-Eyes-Principle involves an independent confirmation of the correct identity of a substance by two operators with their signatures on the batch sheet.

The Four-Eyes-Principle with second signatories is most applicable when the operations being undertaken have the potential for producing hazardous situations if the procedure is incorrectly followed or the wrong chemical(s) is added. The procedure is particularly useful where technical measures would cause excessive costs related to the frequency of the respective operation or where it may be difficult to provide technical means of ensuring correct operation.

To work most effectively the Four-Eyes-Principle should be used sparingly and only when double-checks are needed to reduce significant risks, because the double-checks often increase the workload for operators and if the method is used too frequently on low hazard situations there is the possibility that the method will be devalued and operators may begin to sign without performing the required checks.

If the Four-Eyes-Principle is applied to control the labels of packages, it cannot prevent the use of wrong substances which are incorrectly labelled. This must be compensated by the ability and awareness of operators to recognize deviations of other characteristics (e. g. colour, particle size).

A weakness is the dissipation of responsibility among the involved operators. The first operator might assume that the second operator would check the consignment and the second operator could assume the first has conducted the tests. This may lead to a situation, where in effect these double checks mean that neither operator conducts the inspections. Therefore the Four-Eyes-Principle requires that operators are fully trained in the method and be informed on the reasons behind it.

Segregated Storage

Some companies apply the method of segregated storage to prevent the mix-up of chemicals. Segregated storage can be achieved by organisational measures, e. g. by directives where to put which substances. In addition the storage areas dedicated to specific products could be marked. Sometimes barriers, walls, aisles or areas for non-critical substances are used to separate two or more incompatible materials.

Segregated storage can be applied after production, in consignment stocks, warehouses and, in particular, in the raw material storage areas of production units. In order for this method to work, all the personnel involved must be given clear instructions and each individual must understand exactly which items are to be stored in which area. Segregated storage must be regularly controlled.

Segregated storage requires often larger storage areas than mixed storage. Often space for storage is rather limited, in particular if elevated fire protection (e. g. sprinkler protection) must be provided for the area.

The designation of certain areas for certain chemicals bears the risk that operators assume the chemical is correct because of its location, rather than inspecting the chemical individually. This can lead to dangerous mix-up, e. g. if due to lack of space a different substance is "temporarily" stored in an area, which is not designated for it. Segregated storage alone is therefore not sufficient to prevent mis-identification of chemicals. Incorrect labelling and problems with respect to the similarity of chemical names cannot be avoided.

Collaboration between Supplier, Carrier and Recipient for Bulk Chemicals

Chemicals that are shipped and delivered in bulk quantities, i. e. in tanks or silos, require particular attention regarding prevention of mis-identification, as the possible impact of a mix-up could be very severe due to the large amounts.
On the other hand, sampling and analytical identification is much easier than with small packages like drums, pallets or flexible bulk containers (FIBC).

Basically all measures described in the previous chapters may be applied to bulk quantities as well. However, close collaboration between the supplier, the recipient and logistic service providers on the transport chain is of particular importance in any preventive concept involving bulk chemical.

Essential items are:

For each delivery documents must be supplied describing quantities, identity and quality of the chemicals, as well as any hazardous properties. These documents have to be handed over to the actual responsible person along the entire logistic chain, e. g. when changing the carrier.

Whenever the container is moved into new “possession” within the supply chain, a check of the container number against the documentation should be made.

Suppliers and carriers should announce the arrival of bulk containers to the recipient. By such a redundant document transfer mistakes can be identified and corrected in due time.

Before each step in the journey, the container placards should be checked against transport documents to ensure they are correct for the product(s) being carried.

Supplier and recipient may agree on the use of unique couplings for a specific chemical. However this should not hinder the offloading of a tanker’s contents if an emergency occurs during transit.

Suppliers may fit unique single-use seals to the container, inscribed with the product name, which would have to be broken at offloading.

Consideration should be made during the selection of suppliers and carriers that they are capable of meeting any requirements or procedures deemed necessary for the safe transfer of materials. Logistic service providers should audit their own processes and systems, to ensure that they are all operating correctly.

EPSC Vision Statement

OUR VISION:

To be the prime European focus for objective and sound reference on process safety matters, and to encourage the development and use of best practice to prevent process incidents associated with processing and storing hazardous materials and to mitigate the consequences of any such event.

OUR OBJECTIVES:

EPSC has four objectives:

Information

- To provide advice on how to access safety information and whom to consult, what process safety databases exist and what information on current acceptable practices is available.

Research and Development

- To collect European research and development (R&D) needs and activities in the process safety and loss prevention field and related topics, to inform members accordingly, to act as a catalyst in stimulating the required R&D and to provide independent advice to funding agencies on priorities.

Legislation and Regulations

- To provide technical and scientific background information and advice in connection with European safety legislation and regulations e. g. to legislative bodies and competent authorities.

Education and Training

- To provide a single source of information on training materials for:
  a) the teaching of safety and loss prevention at undergraduate level; and
  b) courses and materials for training and continuing education at all levels of the work force

THE ISSA AND THE PREVENTION OF OCCUPATIONAL RISKS AND DISEASES

The ISSA Standing Committee on the Prevention of Occupational Risks and Diseases brings together occupational safety specialists from all over the world. It promotes international cooperation in this field, and undertakes special studies on topics such as the role of the press, radio, and television in occupational safety, and integral strategies for the workplace, road traffic, and domestic household. It also coordinates the activities of the seven international sections for the prevention of occupational risks and diseases, which are active in various industries and in agriculture, and which have their secretariats in various different countries. Two further sections are concerned with information technology in the field of occupational safety, and with relevant research.

The activities of the international sections of the ISSA comprise:

- the international exchange of information between bodies concerned with the prevention of occupational risks
- the organization of conferences of committees and working parties, round-table discussions, and colloquia at the international level
- the performance of surveys and investigations
- the promotion of research
- the publication of corresponding information

Further information relating to these activities and the general work of the ISSA in the field of occupational safety can be found in the leaflet “Safety Worldwide”. It is available in English, German, French, and Spanish from the secretariat of the Section.

MEMBERSHIP OF THE INTERNATIONAL SECTIONS

Each international section of the ISSA has three categories of membership:

- Full Member — Full members and associate members of the ISSA, Geneva, and other non-profit organizations can apply for membership as a Full Member.
- Associate Member — Other organizations and companies can become Associate Members of a section if they have knowledge of the area for which the section is responsible.
- Correspondent — Individual experts can become Corresponding Members of a section.

Further information and application forms are available directly from the secretariats of the individual sections.