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RULES FOR THE ENVIRONMENTALLY COMPATIBLE HANDLING OF CHEMICALS

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Summary
Contains chemicals handling rules adapted to activities at the University of Gothenburg, including laboratory and artistic activities and the cleaning services. These rules are based on the requirements contained in legislation (European chemicals legislation – REACH, the Environmental Code and their underlying ordinances and regulations).

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1. Purchases of chemical products

The University has concluded framework agreements with a number of suppliers that are to be used for the purchase of chemical products; you will find these suppliers in the University of Gothenburg's [Purchasing System](#). If a chemical product is not available from any of the suppliers with framework agreements, use suppliers with direct purchasing agreements; these can also be found in the Purchasing System. All purchases of chemical products should be coordinated to one person, who must be appointed by the head of department.

A party who has imported a chemical product from a non-EU country is responsible for drawing up a safety data sheet or acquiring the necessary written risk and protection information for the imported products (Article 31 of Regulation (EC) No 1907/2006). A safety data sheet shall be attached if the product has been imported from the European Union. Notice is to be given to the Products Register (Ordinance 2008:245) when more than 100 kg of an individual chemical product is being imported annually and if the products imported have a certain tariff heading. Notices are made to [the Swedish Chemicals Agency](#).

When chemical products are purchased, the supplier is always liable to enclose a safety data sheet for each individual chemical product. The safety data sheet shall be translated into an appropriate language (EC 1907/2006, Article 31). Safety data sheets shall be available in Swedish and, when required, English. The departments are responsible for ensuring that everyone handling chemical products at the department has access to safety data sheets; this is usually done by compiling these electronically in the [chemical handling system \(KLARA\)](#) or in a folder in close proximity to the storage site. The University normally only mixes chemicals for their own use, e.g. dilutions and reagents for labs, or alternatively compounds made directly in connection with use. Safety data sheets shall be drawn up to the extent that there are compounds that do not satisfy the above-mentioned requirements.

Some departments register chemicals on an ongoing basis at the time of each delivery. In this way they always have an updated chemicals register. Further information about the chemicals register is available below.

2. Registration and inventories in KLARA

According to the Ordinance on Self-monitoring by Operators (1998:901), the University must keep a register of the chemical products handled within its activities that may entail risks from the perspective of health and the environment. The University of Gothenburg has chosen to use the web-based system **KLARA** to register and make an inventory of chemical products used in the activity.

Each department that handles chemical products in its activity is responsible for registering and making an annual inventory of these products in KLARA. **Please note** that inventories in KLARA must be completed by **no later than 31 January annually**. Each faculty that handles chemical products in its activity must appoint a KLARA administrator who, among other things, can administer authorisations in KLARA for the entire faculty. The heads of some departments have appointed persons responsible for each lab/workshop. These persons may, for example, be responsible for KLARA inventories and any lab folders with safety data sheets.

3. Risk assessments

A risk assessment shall be conducted before starting any work involving the handling of chemical products in order to identify and assess the components in the handling of the chemical products that may pose a risk of personal injury or

causing damage. The purpose of a risk assessment is to establish how to prevent occupational disease and accidents caused by chemical products by identifying and assessing those components that may be hazardous.

Risk assessments shall be conducted *before* starting work that involves one or more chemical products. Such a risk assessment shall always be conducted when the activity is temporarily or permanently changed or if it may be expected that the result of the risk assessment will be affected due to new information (Swedish Work Environment Authority Regulations – AFS 2014:43, Section 5). Nor may work start before necessary measures are taken to prevent occupational disease and accidents.

The risk assessment is only valid if signed by a responsible manager. The risk assessment must also indicate who conducted the assessment. The risk assessment must be stored at the premises to which the risk assessment relates (AFS 2014:43, Section 10).

The documentation shall be available to the employees concerned and written in Swedish or another language used by the entire personnel (AFS 2014:43, Section 13). For example, the risk assessment may need to be written in both Swedish and English.

3.1 What should be risk assessed?

An entire method may be risk assessed, or just a specific hazardous component.

KLARA, the chemical handling system, has a risk assessment module with associated instructions that provide all of the necessary information required to perform a complete risk assessment.

3.2 CMR substances

‘CMR substances’ stands for substances that are Carcinogenic, Mutagenic and Toxic for Reproduction. Specific requirements have been drawn up in the Work Environment Legislation, including Sections 38 to 44 of AFS 2014:43 issued by the Swedish Work Environment Authority, owing to the nature of CMR substances and the risks that are currently considered to be linked to their use.

CMR-classified chemical products are products specified with the following hazard statements and/or risk phrases (R-phrases):

H350: May cause cancer

H340: May cause genetic defects

H360: May cause harm to fertility or the unborn child

Investigation regarding the possibility of replacing a product:

According to Section 39, work that involves a CMR substance may not be started before an investigation has been conducted into whether it is possible to replace the CMR substance with a less hazardous substance.

If the results of the investigation indicate that the CMR-classified product cannot be replaced, local procedures and rules for how the work will be conducted must be drawn up together with written risk assessments before work starts.

Register in the event of exposure:

The Employer (head of department or equivalent) shall keep a register if people have been exposed to a CMR substance that may entail a risk of ill-health. The register must include the following information:

- the name of the employee,
- work tasks,

- the substance to which the person has been exposed,
- measured or estimated level of exposure.

This register must be saved for 40 years.

The substances encompassed by register in the case of exposure are:

Carcinogenic substances – Categories 1A and 1B: substances with R-phrases H350.

Mutagenic substances – Categories 1A and 1B: substances with R-phrase H340.

No substances that are toxic for reproduction (H360) are encompassed by the requirement for a register.

3.3 Emergencies, accidents and stoppages

There should be procedures for how to act in the event of emergencies, e.g. spillage, risk of explosion or fire. These procedures must be documented and accessible if they are extensive and complicated. Regular emergency preparedness exercises should be held. The head of department is responsible for the safety work functioning, regardless of who performs the practical work. All employees should be aware of what to do in the event of an emergency.

The public authorities (either the emergency services (tel. 112), emergency services for Greater Gothenburg (031 335 26 00) or the Environment and Public Health Offices in Gothenburg (tel. 031-365 00 00),

<http://www.goteborg.se/wps/portal/miljo>) must be immediately notified of any accidents, stoppages or similar events that may be detrimental to human health or the environment, e.g. discharges or emissions of chemicals into the sewerage network or atmosphere.

4. Substitution of chemical products that are hazardous to the environment and health

Everyone operating at GU, who handles and purchases chemical products, shall endeavour to substitute such chemical products with products that are less hazardous to the environment and health in accordance with the product choice rule contained in Chapter 2, Section 4 of the Environmental Code. Purchasers of chemicals have an important responsibility to keep themselves informed of better alternatives, if available. Two substitutions have been specified in legislation and shall be made subject to the precondition that the quality of the activity can be maintained, and also that it is financially reasonable and practicable to do so.

- (1) Halogenated solvents are to be replaced with non-halogenated solvents, and
- (2) Lead, cadmium, mercury and other heavy metals are to be replaced with other compounds.

The Swedish Chemicals Agency's database, PRIO (www.kemi.se) lists a number of substances that should be phased out. Those making inventories in KLARA can obtain a list of those chemicals among the products in the department's inventory that are also included in the PRIO database.

A simple way of reducing the use of chemical products hazardous to the environment and health is to conduct laboratory experiments or other elements on a smaller scale. For example, the volumes of chemical products used in laboratory experiments could be reduced by using smaller reaction vessels, such as small Eppendorf tubes and microtiter plates. Those carrying out laboratory work should choose a method whenever possible that minimises the use of chemical products that are hazardous to the environment and health.

5. Handling of chemical products

5.1 Environmental introduction at laboratories and in workshops

All employees and students who are to handle chemical products must receive an environmental introduction before they are permitted to work in activities where chemical products are handled. This introduction should include basic rules for working safely with chemical products and information about emergencies, waste management and risk assessments.

5.2 Storage requirements

It is difficult to provide comprehensive information about the storage of chemical products owing to the large number of chemicals and their wide variation in properties. It is therefore important for those handling chemicals to have sufficient knowledge about potential risks and for an up-to-date safety data sheet to be made available for each chemical product handled and stored within the activity. The head of department is responsible for those handling chemicals having the right competence to perform the work. People handling chemicals should also attend lab-safety courses arranged by the University of Gothenburg.

A revised list of storage requirements from the Swedish Chemical Agency:

- Chemical products that are hazardous to health or the environment must be stored to prevent health and environmental risks.
- Chemical products that are hazardous to health must be stored so that they are hard for children to access and are kept separate from products intended for consumption.
- Acids and bases may not be stored together.
- Strong acids and organic compounds may not be stored together.
- Strong oxidisers may not be stored together with oxidisable substances.
- Ethers and other peroxide-forming substances must be stored in a cool, dark place in occlusive containers.
- Chemical substances must be stored with lids when not in use. This is partly due to the risk of leakage and partly due to volatile chemicals being emitted into the air. This particularly applies to substances being handled in a fume cupboard.
- Chemicals must normally be stored in their original packaging. If a small amount of a substance is needed, the new packaging must be appropriate for purpose. Marking must be in accordance with the original packaging. It must always be possible to know what substance the packaging contains and the risks applicable.
- Packaging shall be intended for storing the chemical product in question, e.g. corrosive chemicals must be packaged in containers that can withstand such corrosion; see also Section 19 of Ordinance 2008:245.
- Refrigerators and freezers for the storage of chemicals must be specially designed for this purpose (e.g. the refrigerator/freezer must be lockable if poisons are being stored and spark-proofed when storing flammable chemicals). Chemicals and the like may not be stored in refrigerators or freezers intended for the storage of food.
- Flammable liquid must not be stored together with flammable gases or highly flammable materials.
- Combustible materials must be stored in fireproof cabinets or spaces.
- The fire classification of storage cupboards and storerooms must correspond to the types and quantities of chemicals stored there.
- Bunding must be available for flammable chemicals. Bunding must accommodate the volume of the largest container and also accommodate at least ten per cent of the total volume of chemicals.
- There may not be any open floor drains in storerooms for chemical products (or in laboratories). If there is a floor drain, this must be fitted with protection to prevent leakage. This means, for example, tight-fitting lids, a manual opening and closing function for the drain or other comparable device.
- Chemical products must not be stored in a fume cupboard with an open drain (requirement from the Environment and Public Health Offices for the City of Gothenburg). However, limited storage may take place if the drain has been plugged up or a collection tank is used. Please note that bottles, etc., affect the air circulation in a fume cupboard and it is recommended that no chemicals at all are stored in the fume cupboard.
- Equipment for cleaning up spillages must be made ready and adapted to the chemical products in question.

- Tanks and bunding may well be used to avoid spillages into drains and the like.
- The sash of the fume cupboard must be pulled down completely when not in use. An open fume cupboard has a significant impact on energy consumption.

5.3 Storage requirements for particularly hazardous chemical products

Particularly hazardous chemical products (chemical products for which a permit requirement applies in accordance with Ordinance 2008:245) must be stored in such a way that unauthorised persons cannot gain access to them (KIFS 2008:2, Chapter 2, Section 9).

Products with the following classification are deemed to be 'particularly hazardous chemical products' (KIFS 2008:2, Chapter 4, Section 1):

- Hazard class '**Acute Toxicity**' in hazard categories 1, 2 and 3 (marked with hazard pictogram 'Skull with crossbones' (GHS06) and the signal word 'Danger')
- Hazard classes '**Carcinogenicity**', '**Germ Cell Mutagenicity**' or '**Reproductive Toxicity**' in hazard categories 1A or 1B (marked with hazard pictogram 'Health Hazard' (GHS08) and the signal word 'Danger') (see specific requirements for CMR-classed substances under Risk assessments)
- Hazard class '**Skin corrosion**' in hazard category 1A (marked with hazard pictogram 'Corrosive' (GHS05) and the signal word 'Danger')
- Hazard classes '**Specific target organ toxicity – single exposure**' and '**Specific target organ toxicity – repeated exposure**' in hazard category 1 (marked with hazard pictogram 'Health Hazard' (GHS08) and the signal word 'Danger').

The following marking exists for these products:



GHS06



GHS08



GHS05

5.4 Marking of packaging

All packaging must (KIFS 2008:245, Section 18) be marked with product name, hazard pictograms, R-phrase, etc. If there is no such marking owing to racking or outer packaging, this should be marked up. However, marking is not required in some exceptional cases, e.g. if there is **minimal risk** of staff or visitors being injured by the unmarked product.

5.5 Transportation of chemical products

Chemicals regarded as hazardous goods (Act 2006:263) must be transported by an authorised transporter. Own transportation of hazardous goods is prohibited on public roads such as, for example, Medicinaregatan. The University of Gothenburg purchases the 'Safety Advisor' service from its waste contractor which takes care of all handling, marking and transportation of hazardous goods.

5.6 Genetically modified organisms (GMOs)

The relevant public authority must be notified of all GMO handling. Different public authorities deal with different kinds of GMO. The University has drawn up procedures for how to notify and handle GMOs. This is regulated in the University's procedure *Att hantera GMO* [Handling GMOs] which is to be found in the Environmental Manual. Further information about notifications is also available at www.genteknik.nu where all of the supervisory authorities cooperate to provide comprehensive information about handling and notifying GMOs.

6. Waste, wastewater and ventilation

Everyone handling chemical products must ensure that chemical products that are hazardous to the environment and health do not escape into the environment.

6.1 Hazardous waste

If a chemical product constitutes hazardous waste after use, it should be handled in accordance with the University of Gothenburg's [procedures for hazardous waste](#).

ALL chemical residues that may not be poured into a wastewater drain (see below) are 'hazardous waste'. Different kinds of chemical waste may not be mixed together, i.e. separate containers are required for chlorinated and non-chlorinated solvents, acids, bases and oxidisers, etc. Hazardous waste must be packaged in approved containers and cartons and marked with a completed 'Hazardous waste' label, which can be ordered from the waste contractor, to enable collection and transportation by waste contractors. Glass and plastic goods contaminated with hazardous chemical products are to be handled as hazardous waste.

'Hazardous waste' is a term that includes sharps, radioactive waste, contagious waste, biological waste, biological waste agar plates, cytostatic waste, human waste, blood waste and pharmaceutical waste. These types must be packaged and marked in specific ways. Find out more about these rules at:

<http://medarbetarportalen.gu.se/arbetsmiljohandboken/arbetsmiljo-a-till-o/Riskavfall/>

6.2 Wastewater drainage and chemical products

The University has a fundamental rule for the disposal of chemicals:

“All chemical solutions that differ from normal household waste owing to their chemical content shall be collected in waste containers and sent for destruction as hazardous waste.”

However, the University has agreed to some exemptions from above-mentioned rule. The 'Rules for wastewater drainage from laboratory research and teaching at the University of Gothenburg and Chalmers University of Technology' are reported in Appendix 1. Appendix 1 also includes handling rules for antibiotics that, in certain cases, have been deactivated during autoclaving/boiling. All laboratory personnel must comply with these Rules. The faculty's environmental coordinator or the University's Environmental Unit must be informed before any deviations are made from these Rules. The supervisory authorities also require the University, when necessary, to undertake analyses of wastewater.

6.3 Ventilation and chemical products

Evaporation may not be used as a way of getting rid of a chemical residue. All chemicals must be handled/stored in such a way that emissions to the air are kept to a minimum. Evaporation may be used in certain cases as a way of reducing the water content of a solution, e.g. inorganic substances in an aqueous solution. In the case of evaporation of water from organic solutions, it should be entirely certain that nothing hazardous is being evaporated together with the water.

Appendix 1

Guidelines for wastewater drainage from laboratory research and teaching at the University of Gothenburg and Chalmers University of Technology

Purpose

The purpose is to provide guidelines and support for how liquid waste from laboratories is to be handled, including what discharges can be made to the municipal sewerage (i.e. wastewater) system.

Scope

These Guidelines apply to research and training laboratories whose principal is either the University of Gothenburg or Chalmers University of Technology and are linked to the municipal treatment plant GRYAAB (*Göteborgsregionens Ryaverksaktiebolag*) via the municipal sewerage network. These Guidelines are an exception from applicable rules and legislation and have been approved following communication with the appropriate public authorities and treatment plants. This exception is based on the conditions prevailing at the above-mentioned laboratories and the part of the pipeline network in question, the treatment plant and the Göta Älv river. Consequently, this procedure may NOT be used by other activities, outside GU and Chalmers, without prior communication with the relevant public authorities.

Responsibility

The head of department is responsible for the handling of chemicals and wastewater drainage at the department.

Questions

Questions are answered in the first instance by the departments' laboratory officers, in the second instance by the faculty's environmental coordinator or the central environmental coordinator at the University. The GRYAAB wastewater treatment plant will also assist with questions or doubts about chemicals in the municipal wastewater; see www.gryaab.se.

Discharges and emissions

Discharges and emissions of substances/chemicals that do not meet the requirements contained in these Guidelines shall be immediately notified to the emergency service tel. 112, the emergency service for Greater Gothenburg, tel. 031 335 26 00 or the Environment and Public Health Offices in Gothenburg, tel. 031- 365 00 00, <http://www.goteborg.se/wps/portal/miljo>, in accordance with the legislation.

Background

It is extremely important for everyone to help to reduce discharges of chemicals to the sewerage network as far as possible in order to reduce our combined environmental impact and the risk of releasing hazardous substances from our activities. GRYAAB is the primary destination of wastewater from the University of Gothenburg and Chalmers' activities, and this wastewater can only be received subject to the precondition that it can be treated at Ryaverket. This treatment plant has been built to treat the pollution that normally arises in wastewater from households. Environmentally dangerous

and hazardous substances, such as heavy metals and some organic compounds that are persistent, toxic, bioaccumulative (stored in living organisms) or nitrification/denitrification inhibiting (major nitrogen removal), must absolutely not be poured into the sewerage network.

Fundamental principle

All chemical solutions that differ from normal household waste owing to their chemical content shall be collected in waste containers and sent for destruction as hazardous waste.

Exception from the fundamental principle

All of these points must be satisfied if a chemical is to be discharged into the sewer:

1. Small quantities of, for example, residues from experiments or solvents are involved, which are difficult to collect when, for example, washing up.
It is prohibited to pour pure chemicals directly out from a can or similar. Thus this list should not be applied to disposal of residues from chemical roguing, etc. Carefully check that the solution does not contain any hazardous secondary chemicals.
2. The pH value should be at least 5 and no more than 11.5.
Strongly acidic or basic solutions may damage the pipework system. The pH value should therefore be checked.
3. The substance is one of the following:
- Inorganic chemicals: Inorganic substances must be left as hazardous waste. However, small quantities of the following ions in an aqueous solution can be poured into the wastewater drain:

Cations:	Na ⁺ , Mg ²⁺ , K ⁺ , Ca ²⁺ , Ti(IV), Mn(IV) (NB not Mn(VII)), Fe ²⁺ , Fe ³⁺ , Al ³⁺
Anions:	Cl ⁻ , Br ⁻ , I ⁻ , CO ₃ ²⁻ , NO ₃ ⁻ , PO ₄ ³⁻ , SO ₃ ²⁻ , SO ₄ ²⁻ , silicates, borates

GRYAAB has requested that we do not pour Li⁺ into the wastewater drain, as they use this substance to trace certain things in the pipeline network.

- Organic chemicals: The substances' concentration may not exceed ten per cent by volume when poured out (damages pipes/water traps). No more than three litres of a ten-per cent solution per day and laboratory and no more than 30 litres of a ten-per cent solution per day and building, provided that there is no risk of ignition or inhalation.

Methanol, ethanol, propanol, isopropanol, butanol Propanon (Acetone), Acetonitrile
Glucose – sucrose, etc., sugars Urea
Formic acid, acetic acid, propionic acid, citric acid

Radioactive isotopes: For Chalmers, alpha-emitting isotopes may not be discharged. Other isotopes that exceed background radiation levels may be discharged following authorisation from Chalmers' Radiation Protection Officer. In this connection, compliance with SSMFS 2010:2 is required. Account should also be taken of the risk of radioactivity accumulating in pipes, treatment plants and sludge. For the University of Gothenburg, certain isotopes may be poured into the wastewater the drain in accordance with Regulation SSMFS 2010:2 issued by the [sic] Swedish Radiation Safety Authority; see also www.sis.se.

Antibiotics handling rules

Some antibiotics are deactivated during autoclaving/boiling and can then be poured into the wastewater drain (see following table). Antibiotics that are not deactivated by autoclaving/boiling or where the effect of autoclaving/boiling is unknown are left as hazardous waste. When pouring away, for example, culture mediums where antibiotics have been deactivated, there is obviously a requirement that the medium does not contain any hazardous secondary chemicals. Antibiotics prepared in the form of pharmaceuticals (tablets or solutions) are always left as hazardous waste. These recommendations apply to the disposal of, for example, residues from experiments or culture media that arise in the University's laboratory. In other words, these recommendations shall not apply to disposal in the event of roguing, etc.

Handling instructions

The following handling shall be implemented without exception.

Antibiotics	Recommendation
Beta-lactams	
Ampicillin	To be autoclaved/boiled and poured into the wastewater drain.
Carbenicillin	<i>(Destroyed during autoclaving/boiling)</i>
Penicillin	
Aminoglycosides	
Geneticin (G418)	To be autoclaved/boiled and poured into the wastewater drain.
Gentamycin	<i>(Destroyed during autoclaving/boiling)</i>
Neomycin	
Streptomycin	
Kanamycin	Not destroyed during normal autoclaving/boiling. May be autoclaved in strongly acidic pH before being poured into the wastewater drain; otherwise left as chemical waste.
Other	
Chloramphenicol	NOT destroyed during autoclaving/boiling, but quickly broken down in the open. May be poured into the wastewater drain.
Amphotericin = Fungizone	To be autoclaved/boiled and poured into the wastewater drain.
Erythromycin	To be autoclaved/boiled and poured into the wastewater drain.
Puromycin	To be autoclaved/boiled and poured into the wastewater drain.
Sulfadoxine	To be autoclaved/boiled and poured into the wastewater drain.
Tetracycline	To be autoclaved/boiled and poured into the wastewater drain.
Blasticidin	To be left as hazardous waste <i>(unknown properties)</i> .

Ciprofloxacin	To be left as hazardous waste (<i>NOT destroyed during autoclaving</i>).
Enrofloxacin	To be left as hazardous waste (<i>unknown properties</i>).
Nalidixic acid	To be left as hazardous waste.
Vancomycin	To be left as hazardous waste and preferably be swapped completely. (<i>Very stable, last antibiotic to function against multi-resistant staphylococcus</i>).
Zeomycin	To be left as hazardous waste (<i>unknown properties</i>).
Zeocin	To be left as hazardous waste (<i>unknown properties</i>).

Antibiotics are to be left as hazardous waste if there is any uncertainty at all.

Sources: *Antibiotika-Fibel*, Georg Thieme Verlag, Stuttgart, 1975 and

“Rekommendationer för behandling av antibiotikaavfall vid Karolinska Institutet” [Recommendations for the handling of antibiotic waste at the Karolinska Institute], *Christina Hallgren et al.*