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Decision: Review of existing rules for management of laboratory waste and discharge of chemicals to drains		Document type: Rules, 10 pages	
Processed by Department/Unit: Security and Environment Unit, Facilities Office, Central Administration		Prepared with: KI's Transport Safety Advisor and representatives from Stockholm Vatten.	
Reviewed in regard to: Changed legislation for labelling and signage of chemicals; updating management of antibiotics-containing waste and discharge of chemicals to drains.			

KI rules for management of laboratory waste

The Swedish version has preferential right of interpretation.
Departments located in hospitals must comply with the hospital's corresponding regulations.

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1. Yellow and black boxes

There are two classes of waste that must be sent for incineration in yellow plastic bins at KI: Sharps/infectious waste and pharmaceuticals, including cytostatic waste. Both types are classified as dangerous goods when transported on public roads. This means that they are subject to strict regulations for safe transport to the destruction facility.



Black boxes are intended for biological waste. Hygiene requirements apply when handling this waste.

In general, the following apply when using boxes:

- If the box is to be filled with liquid waste, an absorbent pad must be placed at the bottom.
- The box must not weigh more than 12 kg. *NB!* Do not overfill the box. The lid must be easy to seal.
- The box must be sealed carefully. The outside of the box must be clean.
- The box must be labelled with a completely filled-in label.
- The box shall be placed in the designated room in the department.

1.1 Sharps/infectious waste

Sharps waste includes all sharp objects such as needles, syringes with fixed needles, scalpels, lancets, suture needles and microscope slides. This applies even if the material is not suspected to be infectious.



Smaller sharps/needlestick waste can be placed:

- in smaller hazardous waste bins (2-3 litres). When full, the smaller hazardous waste bins can be placed in a yellow box.
- directly in a yellow box.

Infectious waste includes human blood and blood products, microorganisms, cell cultures and material that has been in contact with these, such as gloves, pipettes, pipette tips, petri dishes, napkins and similar. This also applies when the waste is contaminated with small amounts of pharmaceuticals or chemicals.

Infectious solid waste must be collected and placed in a yellow box. Infectious liquid waste must be collected in sealable bottles or jerry cans and then placed in a yellow box.

Label the box with the label “SKÄRANDE/STICKANDE SMITTFÖRANDE AVFALL” and fill in the fields.

Waste management of infectious agents must always be included in the risk assessment performed prior to the start of an experiment.



1.1.1 Special rules

- Microorganisms in risk group 3/’verksamhet’ level R must always be inactivated locally in accordance with an approved method and must not be handed in as infectious waste.
- The strictest requirements for waste handling shall apply to the entire laboratory. For example, when working with *Salmonella* in a laboratory where other work is undertaken (not infectious), all waste from the laboratory must be handled as though it is contaminated with salmonella.
- Waste regulations for genetically modified microorganisms (including cell cultures) are local and are defined in the local permit/notification.

1.1.2 Exceptions

- *Solid* waste that has come into contact with *well-characterised* cell cultures that are neither genetically modified nor infectious. Liquid waste is NOT exempt from the regulation.
- Inactivated/sterilised waste, but only if it has been inactivated/sterilised using an approved method.

1.1.2.1 Approved methods of inactivation/sterilisation

- Autoclaving. This method kills all infectious waste including spores and can always be used as a sterilization method.
- Heat/chemicals/other treatment. This method is only permitted if it has been demonstrated to be effective against the infectious agent in question.

Solid waste that is exempt from the rule or which has been inactivated/sterilised must be collected together in a protective inner packaging and clearly labelled that it has been inactivated, for example using autoclave tape or text.

NB1! “Sharps/infectious waste” labels must NOT be used for inactivated/sterilised waste.

NB2! Antibiotics/cytostatics/chemicals are often used in the same experiment as infectious agents. This mixed waste can always be handled as Sharps/infectious waste; however, even though it has been inactivated/sterilised, due to its pharmaceutical/chemical content it may not be suitable for treatment as combustible waste. In these cases, the inactivated/sterilised waste is handled as either “Pharmaceuticals, including cytostatic waste” or as “Chemical waste”.

1.2 Pharmaceuticals, including cytostatic waste

Antibiotics, hormone preparations and cytostatics belong to the can pose an environmental risks if incorrectly handled. These substances are often slow to degrade and can be biologically active for a long time after use. They can also be highly toxic, induce mutations or cause hormonal disruptions. A large number of pharmaceutical substances have been detected in Swedish waterways.



Pharmaceuticals, including cytostatic waste includes:

- Pharmaceuticals such as vaccines, antibiotics, cytostatics, narcotic drugs.
- Objects associated with cytostatics and other pharmaceuticals that have persistent toxic effects.
- Packaging that contained antibiotics, cytostatics or other pharmaceuticals.

Waste that has been contaminated with cytostatics and other pharmaceuticals must first be placed in a sealed inner packaging (sealed plastic bag or similar) before being placed in a yellow box with other pharmaceutical waste.

Liquid medicinal waste must be collected in leak-proof, sealable bottles/containers and placed in a yellow box.

Narcotic drug waste must be de-identified before placed with other pharmaceutical waste. Disposal must be documented in the hospital drug consumption register. Documentation must be witnessed by two authorised persons.

Label the box with “CYTOSTATIKA OCH LÄKEMEDELSFÖRORENAT AVFALL” and fill in all fields. *NB!* Pharmaceuticals, including cytostatic waste must always be labelled with the hazard symbol for “Highly toxic” together with the hazard symbol for “Environmentally toxic”, see the example on the right.

1.2.1 Exceptions:

- Needles must be handled as “Sharps/infectious waste”.
- Special routines apply to waste from clinical trials. Agreements must be made between the sponsor and any involved pharmacy.
- Radiopharmaceuticals must be dealt with as radioactive waste.
- Packaging that has contained merbromin and chromic acid must be handled as chemical waste.
- Pharmaceuticals that contain toxic metals such as antimony, arsenic, lead, chrome and mercury are dealt with in accordance with the routines for chemical waste. This applies to acetarsol, arsenic powder, lead acetate, potassium antimony tartrate, chromic acid (chromium trioxide), merbromin solution, silver nitrate solution and thimerosal solution.
- Dental products and anaesthetic gasses: anaesthetic gasses such as Enfluran, Isoflouran, Halothan and Sevoflouran are dealt with in accordance with the routines for chemical waste.

1.2.2 Antibiotics used in cell cultures

Release of antibiotics promotes development of antibiotic resistance which can persist long after exposure to the antibiotic.



Swedish sewage facilities are not equipped to handle pharmaceutical residues. Several common antibiotics are classified as non-biologically degradable¹ which means that release to the drains entails a risk to the environment. Autoclaving does not result in complete degradation of the majority of antibiotics, and the degradation products that are formed can in turn have negative impacts on the environment. Discharge of antibiotic waste to the drains is therefore not permitted at KI.

Provided that there is no contamination with live microorganisms that are infectious and/or genetically modified, antibiotic waste shall be handled as "Chemical waste". Choose a suitable container and label it "Antibiotic-containing solution" (see 2.1 General rules for chemical waste). The container does not have to be UN-labelled. No hazard symbols are required unless the waste contains additional chemicals that require such labelling. Liquid antibiotic waste will be processed using a method that evaporates and purifies the liquid, and any solid residue is sent for incineration.

Cell culture medium that contains antibiotics where the live material has not been killed or which might contain infectious material must be handled as "Sharps/infectious waste".

1.3 Biological waste

Biological waste includes body parts, tissues and organs from people and animals as well as anatomical preparations and similar - but only if they do not contain sharp objects. Teeth, with or without composite fillings, are also considered to be biological waste.

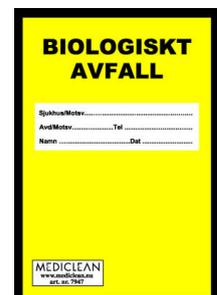


NB! Cultures with cells or microorganisms, human blood and blood products, as well as material contaminated by these, shall be handled as "Sharps/infectious waste".

For ethical reasons, biological waste must be handled separately. Biological waste must always be stored frozen.

Biological waste must be placed in black boxes:

- The material must be bagged in plastic bags before placing in the box.
- The black box must be labelled with a fully completed "BIOLOGISKT AVFALL" label. Regardless of whether the animal has been exposed to GMM/microorganisms at Level 2 or a pharmaceutical, *only* the label "BIOLOGISKT AVFALL" is to be used.
- Leave the boxes in the designated place in the department where they are kept frozen.



¹ Stockholm's County Council database for medicinal information intended for doctors and healthcare personnel, www.janusinfo.se

Particularly bulky biological waste must be bagged in double plastic sacks, each individually sealed using a sack tie or similar, and then placed in a sufficiently large cardboard box. Label and store as described above.

NB! The black boxes are not intended to tolerate autoclaving. Autoclaving can result in the boxes losing their capacity to be permanently sealed.

2. Chemical waste

Chemical waste includes:

- Chemicals marked with hazard symbols, including reagent solutions, solvents, oils, paints, adhesives, disinfectants, etc.
- Unidentified chemicals (must be denoted with “Unknown chemical” under “Contents”).
- Materials such as gloves, paper towels and test tubes, that are contaminated with chemicals labelled with the hazard symbol for “Highly toxic”, “Carcinogenic/Mutagenic” and/or “Environmentally toxic”.
- Bottles and cans labelled with the symbol for “Highly toxic”, “Carcinogenic/Mutagenic” and/or “Environmentally toxic”. This also applies to empty containers.
- Photochemical waste; developers, fixing solutions and films.
- Certain objects containing environmentally hazardous metals such as mercury thermometers and lead aprons from radiography.
- Teeth with amalgam or gold fillings.

NB! Diluting chemicals to negligible concentrations or removing chemicals via evaporation in a fume cupboard is not permitted.

2.1 General rules for handling chemical waste

- The can, bottle, jerry can must not be affected by the contents. For liquid chemical waste, use the original packaging or an appropriate UN-labelled container that is approved for transport of dangerous goods.
- The container must be properly sealed. The lid must be intact.
- Material contaminated with chemicals labelled with the symbol for “Highly toxic”, “Carcinogenic/Mutagenic” and/or “Environmentally toxic” must be bagged in double, robust plastic bags that are each sealed individually using a sack tie or similar, labelled and placed in the chemical waste room.



- The container must be marked with the content, hazard symbol, date, dispatcher, phone number and department affiliation. If the container has the original markings indicating the correct content, only the dispatcher's name, department and phone number need to be filled in. Otherwise, the label "Farligt avfall" can be used for containers with chemical waste. Adhesive stickers can be ordered from Medicarrier. All fields must be completed.
- Containers that contain chemicals for which a permit is required (A/B classified) must be labelled with the chemical name and that it is a regulated chemical.



FARLIGT AVFALL

DATUM:

INNEHÅLL:

ANSVARIG PERSON:

AVDELNING: TFN:

INSTITUTID/MOTSV:

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2.1.1 Exceptions

- Small quantities of material (not packaging) that have been contaminated with chemicals labelled with the symbol for "Highly toxic", "Carcinogenic/Mutagenic" and/or "Environmentally toxic" can be dealt with as "Sharps/infectious waste".
- Contaminated material, such as pipette tips, plastic tubes or similar, that have been in contact with chemicals that are NOT labelled with the hazard symbol for "Highly toxic", "Carcinogenic/Mutagenic" or "Environmentally toxic" shall be placed in a sealed inner bag and then handled as normal waste, that is, sorted according to content, e.g. "Plastic waste", "Glass waste", "Combustible waste" et c.

2.1.2 Storage of chemical waste

Storage of chemical waste is governed by the same regulations as chemicals in general which means that:

- Ventilation must be sufficient to avoid accumulation of vapour.
- Liquid chemical waste must not pass to the sewers via floor drains or similar.
- Containers with liquid chemical waste must be stored encapsulated or in trays that contain the entire volume of the largest container + 10% of the remaining total volume of the chemicals that are stored in the tray. Substances that can react with each other must not be placed in the same drip tray; for example:
 - ◆ acids must not be stored together with bases,
 - ◆ ammonia must not be stored together with hydroxides and hypochlorites,
 - ◆ oxidizing substances must not be stored together with oxidisable substances.
- Chemical waste must be stored so that it is inaccessible by unauthorised persons.
- If the room for chemical waste is situated separately, emergency routines should be posted and decontamination systems and appropriate protective equipment must be available in the premises.

2.2 Paraformaldehyde

Paraformaldehyde (PFA) is generally used for fixation or for perfusion of animals to fix brain tissue in adult mice, for example before dissection. PFA can be degraded to formaldehyde (FA) in solution or by heating. All concentrations of formaldehyde are CMR classified chemicals.

Because labelling of PFA and FA is mandatory, all contaminated waste must be collected together and dealt with as chemical waste. In perfusion experiments a collection tray must be placed under the perfused slice on the ventilated bench where the perfusion is taking place. A powder that neutralises PFA/FA and any vapour within a few minutes is added to the collection tray. The gel that is formed is biologically degradable and can be handled as combustible waste.

Examples of products that can be used to neutralise PFA/FA:

- NF powder from Histolab
- D-formalizer powder or pads from Leica

2.3 Ethidium bromide

Ethidium bromide is a compound that is used primarily in DNA analyses. It binds to DNA and fluoresces under UV light. The DNA-binding capacity makes it a potential mutagen since it may also bind to DNA in the human body. Alternatives to ethidium bromide can be assumed to have similar health risks.

Handling waste that contains or is contaminated with ethidium bromide or other substances with similar properties:

- Solutions with high concentrations (>1mg/L) or stock solutions must be labelled and handled as chemical waste.
- Gels that contain ethidium bromide must be sorted together with contaminated pipette tips, gloves, and bench paper as chemical waste.
- Buffers and rinse baths must either be handled as chemical waste or by using a “tea bag” to reduce the concentration of ethidium bromide. The tea bag is handled as chemical waste. When it can be demonstrated that the solution no longer contains ethidium bromide it can be emptied into the drains – provided that it does not contain other substances that are classified as hazardous.

2.4 Packages labelled “Highly toxic”, “Carcinogenic/Mutagenic” or Environmentally toxic”

Bottles and cans that contain residues or are contaminated with chemicals that entail risks for health or environment shall be handled as “Chemical waste”. Bottles and cans labelled with the hazard symbols “Highly toxic”, “Carcinogenic/Mutagenic” and/or “Environmentally toxic” must always be handled as “Chemical waste” also when empty. Normal recycling centres will not accept packaging with such labels, instead, it is recycled by companies with special expertise.

Bottles, cans and similar that are labelled with the following hazard symbols must be handled as chemical waste regardless of the residual quantities in the packaging. This packaging shall be collected together in robust, transparent plastic sacks.



Clean packaging that do not have the above hazard symbols shall be handled as normal waste, *i.e.* sorted as glass, hard plastics, etc. – *but only if it does not contain dust or droplets!* Sealed packaging that has contained flammable goods must be opened and rinsed carefully with water to prevent the contents giving off flammable vapour after the packaging is placed in the source sorting bins. The packaging shall be discarded without a lid to further minimise the risk of fire.

NB! In cases of doubt, the packaging shall be handled as chemical waste.

2.5 Discharge to drains

Drain water from Karolinska Institutet goes directly to Käppalaverket (Campus Solna) and Henriksdal's sewage treatment plants (Campus Flemingsberg). The drain water can only be processed under condition that it does not vary significantly from normal household waste water.

Only solutions that are known, without any doubt, to be harmless to the treatment plants' various processes as well as to the Baltic Sea and to its organisms, both in the short and long term, can be discharged to the drains.

All pure chemicals and preparations whose chemical content distinguishes them from normal household drain water must be collected in containers and sent as chemical waste for destruction. It is not permitted to pour live microorganisms/cell cultures into the drains!

Nutrient solutions that only contain vitamins, electrolytes, amino acids, peptides, proteins, carbohydrates and lipids are not considered to result in any significant effects on the environment. Residues from such nutrient solutions can be poured into the drains.

Note that a product in a concentrated form may need to be handled as hazardous waste even though the product in solution can be rinsed to the drains during use. For example, unused dishwasher tablets/powder must be handled as hazardous waste while the discharge from the dishwasher passes into the drains. Disinfectants can also contain substances that are harmful for aquatic organisms, for example Gigasept, Chemgene, and Virkon, and discharge of these solutions to the drains must be limited.

Note that personnel, traps, pipe systems and plumbers can be affected by banned discharge to the drains. In the event of major spills or discharge of chemicals to the drains, the sewage treatment plants and municipality must be contacted promptly. Read "Emergency procedure for larger spills of hazardous chemicals" for more information and relevant phone numbers.

If a chemical product with mandatory labelling is to be discharged into the drains, **all** three of the points below must be met:

- **Only small amounts (<10 ml)**, for example experiment residues or solvents that are difficult to collect when dishwashing glass ware.
- **The pH must be no lower than 5 and no higher than 11.5** - highly acidic or basic solutions can damage the pipe systems. ***Substances with the Corrosive hazard symbol*** can be poured into the drains if they have no other hazardous properties and if the pH has been adjusted.
- **The chemical is neither an environmental hazard nor harmful i.e. it cannot be marked with hazard codes H400-H413**, such as heavy metals and certain organic substances that are difficult to degrade, toxic, bioaccumulative (stored in living organisms) or affect nitrogen separation in the treatment plant.

If uncertain, apply the safety principle!

3. Radioactive waste

KI's permit for activities using ionising radiation stipulates requirements on how radioactive waste must be managed. Requirements related to handling radioactive waste can also be found in SSMFS 2010:2.

Radioactive waste must be dealt with separately and must not be disposed of with normal waste. Detailed instructions for handling various types of radioactive waste can be found in KI's Local Radiation Safety Instructions and in the laboratory's local licence.

All radioactive waste (solid and liquid) that leaves the premises must be documented. In the waste rooms for radioactive waste located in the hospital grounds in Solna and Flemingsberg, documentation takes place using a web-based program.

Equipment marked with the symbol for radioactivity must be declassified before decommissioning. Empty lead containers used as external packaging for radioactive substances must be declassified before disposal. KI has an agreement with V/O Medical Physics at Karolinska University Hospital for declassification of equipment, premises and lead containers.

KI's Local Radiation Safety Instructions include, in addition to instructions for handling radioactive waste, contact details for V/O Medical Physics.