UiO : Department of Chemistry
University of Oslo

Chemical and Hazardous Waste Guide

Version .02 - 17.01.2023

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1. Purpose

Purpose of the hazardous waste guide is to provide common rules and general guidelines for the Department of Chemistry with respect to collection and handling of hazardous laboratory waste. Additionally, each lab laboratory has to establish tailored procedures in cooperation with the HSE coordinator for the laboratory waste produced in that particular laboratory.

2. Regulations

Regulation regarding recycling and handling of waste ("avfallsforskiften")

- Forskrift om gjenvinning og behandling av avfall (avfallsforskriften)
  - Kapittel 11. Farlig avfall («Hazardous waste»)

Avfallsforskriften has many references to European regulations, including CLP[1] (Classification, Labelling and Packaging) and REACH[2] (Registration, Evaluation, Authorization and Restriction of Chemicals).

3. Hazardous waste

Definition: Hazardous waste is waste that cannot be handled together with ordinary waste if it can cause serious pollution or risk of harm to humans or animals.

"**a. Heavy metals**: any compound of antimony, arsenic, cadmium, chrome (VI), copper, lead, mercury, nickel, selenium, tellurium, thallium and tin, as well as these substances in metal form are to be classified as hazardous waste
b. Transition metals: any compound of scandium, vanadium, manganese, cobalt, copper, yttrium, niobium, hafnium, wolfram, titan, chrome, iron, nickel, sink, zirconium, molybdenum and tantalum, as well as these substances in metal form are to be classified as hazardous waste". [3]

[1] CLP: Understanding CLP - ECHA (europa.eu)
[2] REACH: Understanding REACH - ECHA (europa.eu)
[3]Translated from Avfallsforskiften: Kapittel 11. Farlig avfall («Hazardous waste»)
Transition metals mentioned above, as well as palladium and silver are to be treated as heavy metals.

4. Waste categories (waste numbers)

Hazardous waste needs to be collected and separated based on waste categories that are defined by so-called waste numbers. It is important that hazardous waste is collected and separated according to these waste categories (see table 1).

Table 1: Avfallstoffnummer farlig avfall/ Waste numbers for hazardous waste

Avfallstoffnummer/ waste number	**Beskrivelse/Description**
7012	Spillolje, ikke refusjonsberettiget/ *Oil (e.g. used engine or pumpoil)*
7021	Olje- og fettvfall / *Oil and fat (e.g. silicon bath oil)*
7022	Oljeforurenset masse/ *Oil-contaminated mass (e.g. oil-contaminated paper towels, tubing, empty oil canisters)*
7041	Organiske løsemidler med halogen/ *halogenated organic solvents*
7042	Organiske løsemidler uten halogen/ *non-halogenated organic solvents*
7051	Maling, lim og lakk / *painting, glues and laquer*
7055	Spraybokser /*spray boxes*
7081	Kvikksølvholdig avfall / *mercury containing waste*
7082	Kvikksølvholdige batterier / *mercury batteries*
7083	Kadmiumholdig avfall / *cadmium containing waste*
7084	Kadmiumholdige batterier / *cadmium battteries*
7091	Uorganiske salter og annet fast stoff / *inorganic salts and other solids*
7092	Blyakkumulatorer / *lead-accumulator*
7094	Litiumbatterier / *litium batteries*
7096	Katalysatorer, slagg, støv, flygeaske, blåsesand/ *catalysts, dust, flyash*
7097	Uorganiske løsninger og bad / *inorganic solutions and bath* (5<pH<9)
7100	Cyanidholdig avfall / *cyanide containing waste*
7122	Sterkt reaktivt stoff / *strong reactive substances*
7123	Herdere, organiske peroxide / *organic peroxides*
7131	Syrer, uorganiske / *inorganic acids*
7132	Baser, uorganiske / *inorganic bases*
7134	Surt organisk avfall / *acidic organic waste*
7135	Basisk organisk avfall / *alkaline organic waste*
7151	Organisk avfall med halogen / *halogenated organic waste*
7152	Organisk avfall uten halogen / *non-halogenated organic waste*
7240	KFK / *CFC*
7261	Gasser i trykkbeholdere / *gasses in pressure vessels*

5. Chemical waste

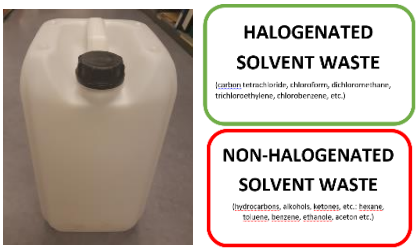
Chemical waste and residue chemicals should be handled according to section 13 in the Material Safety Data Sheet (MSDS). Section 13 in the MSDS describes disposal considerations, often waste treatment methods for unused/residue chemicals. In most cases, it will state that surplus and non-recyclable solutions must be offered to a licensed disposal company. For UiO, this company is Norsk Gjenvinning.

→ **Nothing should be poured down the drain.**

It is required to attach a chemical list for the following types of waste:

7091	Uorganiske salter og annet fast stoff / *inorganic salts and other solids*
7097	Uorganiske løsninger og bad / *inorganic solutions and bath* (5<pH<9)
7122	Sterkt reaktivt stoff / *strong reactive substances*
7131	Syrer, uorganiske / *inorganic acids*
7135	Basisk organisk avfall / *alkaline organic waste*
7151	Organisk avfall med halogen / *halogenated organic waste*
7152	Organisk avfall uten halogen / *non-halogenated organic waste*
7122	Sterkt reaktivt stoff fast / *strong reactive substances* solid
7122	Sterkt reaktivt stoff flyttende/ *strong reactive substances* liquid

5.1 Organic solvent waste

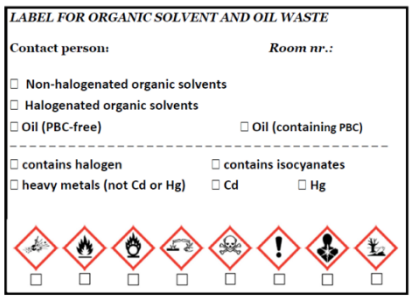


All organic solvent waste should be separated into:

- Halogenated solvent waste
- Non-halogenated solvent waste

In the lab, mark waste canisters clearly, immediately upon use. Big waste stream labels can be found at the end of this documents and on the HSE webpages.

Packaging:
for solvent waste special plastic canisters are available in the central storage. The canisters come in 5, 10 and 20 L and are marked with an UN-code such as 3H1/**X1.9**/250/10/D/BAM 11872. The **X** represents a packaging code. Containers must have either X or Y as packaging code to be used for solvent waste. No other plastic cans should be used. Smaller plastic solvent bottles can be used given they have a UN code with X or Y. If solvent bottles are used, original labels need to be removed or cross out and a liquid waste label with the appropriate information needs to be attached.



Labels for disposal:
use the "**Label for organic solvents and oil**" and cross off the appropriate information.

Rules for handling of solvent waste:

→ The water content in solvent waste needs to be below 10%. If you have solvent waste with water content > 10%, please collect it separately and contact the HSE coordinator for disposal.
→ Maximum filling of the plastic can is 90% of total capacity.
→ The solvent waste should not contain strong acids or bases.
→ The solvent waste cans must be kept in a ventilated area with a tray underneath that can collect the whole volume of the container.
→ Avoid mixing reactive chemicals in the waste solvent containers.
→ Oil, PCB, cyanides, isocyanides, phthalates, cadmium, mercury and any waste containing one of them should always be collected separately. Cyanides in solution should be made unreactive (quenched).
→ Do not add any substances that can cause polymerization or gel-formation to the solvent waste.

5.2 Organic waste (not solvents)

Organic waste should be separated into following categories

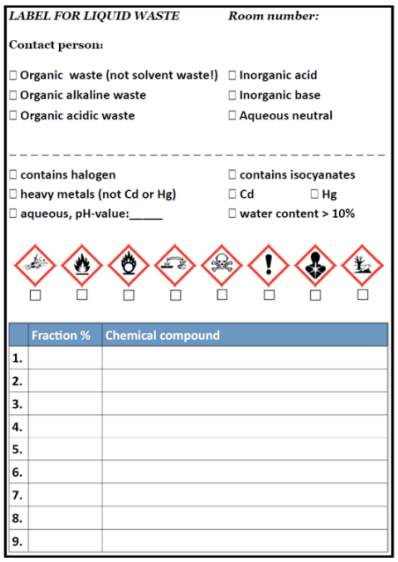
- Acidic organic waste
- Basic organic waste
- Other organic waste

Solids and liquids must be collected separately. Additionally, you need to keep track on the waste content!

In the lab, mark waste canisters clearly, immediately upon use. Big waste stream labels can be found at the end of this documents. If the correct label is not available, make your own one!

Packaging:
Liquids - same as for solvent waste.
Solid waste: 500 ml and 1 l screw lock containers available in the central storage.


Labels for disposal:
Use "Liquid laboratory waste label"/"Solid laboratory waste label". You need to keep track of the waste content.



LABEL FOR LIQUID WASTE *Room number:*

Contact person:

☐ Organic waste (not solvent waste!) ☐ Inorganic acid
☐ Organic alkaline waste ☐ Inorganic base
☐ Organic acidic waste ☐ Aqueous neutral

☐ contains halogen ☐ contains isocyanates
☐ heavy metals (not Cd or Hg) ☐ Cd ☐ Hg
☐ aqueous, pH-value:_____ ☐ water content > 10%

	Fraction %	Chemical compound
1.		
2.		
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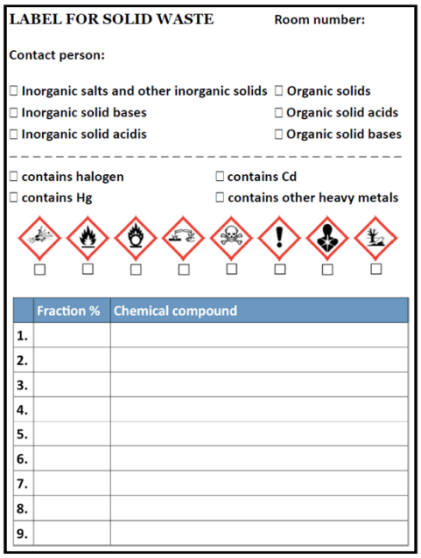


LABEL FOR SOLID WASTE Room number:

Contact person:

☐ Inorganic salts and other inorganic solids ☐ Organic solids
☐ Inorganic solid bases ☐ Organic solid acids
☐ Inorganic solid acidis ☐ Organic solid bases

☐ contains halogen ☐ contains Cd
☐ contains Hg ☐ contains other heavy metals

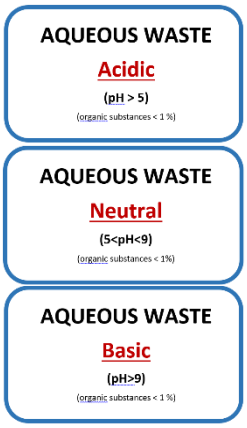
	Fraction %	Chemical compound
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		

Rules for handling of organic waste:

→ The water content in waste needs to be below 10%. If you have organic waste with water content > 10%, please collect it separately and contact the HSE coordinator for disposal.
→ Maximum filling of the plastic can is 90% of total capacity.
→ Organic liquid waste cans must be kept in a ventilated area with a tray underneath that can collect the whole volume of the container.
→ Avoid mixing reactive chemicals in the waste containers.
→ Oil, PCB, cyanides, isocyanides, phthalates, cadmium, mercury and any waste containing one of them should always be collected separately. Cyanides in solution should be made unreactive (quenched).
→ Do not add any substances that can cause polymerization or gel-formation to the liquid waste.
→ Waste containers need to give information about the waste content

5.3 Aqueous solutions

Aqueous solutions (inorganic solutions) should not be contaminated with organic substances. If they are contaminated with more than 1% organic substances, then aqueous solutions must be declared as organic waste. This includes organic color indicators such as phenolphthalein. In this case, please collect this waste separately.



Type of aqueous waste (each of them has their own waste number):

- Acidic, pH < 5
- Neutral, 5 < pH <9
- Basic, pH > 9

In the lab, mark waste canisters clearly, immediately upon use. Big waste stream labels can be found at the end of this documents and on the HSE webpages.

Packaging: Use the same plastic canisters for aqueous waste as for solvent and organic liquid waste.

Labels: Use the "Liquid laboratory waste labels" and cross off the appropriate information. You need to keep track of the waste content!

Some rules for handling of aqueous waste:

→ Aqueous waste containing Hg or Cd must be each collected separately; all other heavy metals can be collected together.
→ Do not mix acids and/or bases that are highly reactive.
→ Small amounts of non-toxic and environmentally non-hazardous acids and bases such as NaOH and HCl can be neutralized and poured down the drain. Flush with plenty of water. Larger amounts – deliver to the HSE coordinator.
→ Aqueous waste that contains more than 1% organic compounds need to be delivered as (acidic/alkaline) organic waste
→ Waste containers need to give information about the waste content (type of acids, metal ions,…)

5.4 Inorganic salts and other solids

Inorganic salts and other solids cover all inorganic salts and other inorganic solids (except for solid inorganic acid and bases and solids containing Cd and Hg), including pure metals. In the lab, mark waste canisters clearly, immediately upon use.

Packaging: Inorganic solid waste can be collected in 500 ml and 1 L screw lock containers available in the Central Storage.

Label for disposal: Use the label "solid laboratory waste" and cross off the appropriate information. You need to keep track of the waste content!

Rules for handling of inorganic solid waste:

→ Solids containing Hg or Cd must be each collected separately.
→ Make sure not to mix solids that may react with each other.
→ Solid inorganic acids and bases are collected each separately; they have their own waste number.
→ Pure metals might need to be collected as 7122 – strong reactive substances. Check MSDS for that. Examples: lithium, sodium, zinc-powder, barium…
→ Used silica gel: For now you can deliver used silica-gel to the HSE coordinator. In the future, a 200L barrel will be made available for collection of used silica gel.
→ Inorganic acidic and alkaline solids must be collected each separately. Modify the "Solid inorganic waste labels" as needed.

5.5 Residue chemicals

- All residue chemicals should be delivered in its original packaging to the HSE coordinator.
- For delivery to the HSE coordinator, residue chemicals should be pre-sorted according to the waste numbers. For more information, see "Hazardous waste disposal form". If you need help, contact the HSE coordinator.
- Oils (such as silicon oil, pump oil or motor oil) are to be collected in leak tight contains (original packaging or same waste canisters as for solvent waste including correct waste label).
- Pay special attention to strongly reactive chemicals and contact HSE coordinator before disposal.
- **OBS!** Be especially careful with explosive and self-igniting chemicals. Those need usually special handing. Contact HSE-coordinator for details.
- **If in doubt, contact the HSE coordinator!**

5.6 Products and chemicals that count as chemical waste

Materials that **are contaminated** with chemicals are to be disposed along with infectious waste (yellow risk waste bins, see section 5.7). Once infectious waste bins are full, close thoroughly and place them into the "Miljøsafe" in the back yard. New bins are available from the central storage.

- Needles, syringes, razor blades → small sharps box. Once full, it is placed into the infectious waste bin. **Obs! Do NOT recap needles due to risk of stab wounds.**

- Broken contaminated laboratory glass (small items; lager items → deliver to HSE coordinator.
- Gloves, pipette tips, disposable paper tissue that have been contaminated with chemicals. **OBS! NO flammable or highly reactive substance!**
- Packaging that has been contaminated with chemicals.
- Contaminated paper (filter paper). If contaminated with reactive chemicals, it first needs be made unreactive (e.g. sodium on filter paper can cause fire!).

If you have lager contaminated equipment that you would like to dispose, please contact the HSE coordinator for appropriate packaging.

5.7 Risk waste

Risk waste includes waste from working with biological substances, infectious substances, genetically modified organisms (GMO), and genetically modified microorganisms (GMM, including GMM2). Risk waste is placed into the yellow risk waste bins.

Other items that can be placed into risk waste: see section 5.6

5.8 General rules for handling of chemical waste

- For liquid laboratory waste use 5, 10 and 20 L plastic canisters available from the central storage. If smaller canisters are needed, 2.5 L plastic solvent bottles can be used if they have an UN code (X or Y). If solvent bottles are used, original labels have to be removed or cross out and a liquid waste label with the appropriate information needs to be attached. If solvent bottles are used for aqueous waste, the bottle needs to be clean and free for solvents before use.
- Waste containers and lids must be free of rust or breakage.
- Waste containers must be labelled (see labels attached; use both, small and big labels).
- Waste containers should be stored closed. Funnels should not remain permanently in waste containers.
- Stock virgin chemicals must be stored separately from waste chemicals.
- Only fill one container of the same type of waste at one time (No duplicate waste streams).
- Containers for liquid waste should have secondary containment (Containment bin or a spill pallet). Incompatible waste needs to be stored segregated.
- Use plastic bottles and not glass for collection of hazardous waste. The HSE coordinator does not accept waste collected in glass bottles.
- The water content in solvent and other organic waste needs to be below 10%. If the water content is > 10%, mark it clearly on the waste label and contact the HSE coordinator for disposal.
- Oil, PCB, cyanides, isocyanides, and phthalates, cadmium, mercury and any waste containing one of them should always be collected separately. Cyanides in solution should be made unreactive (quenched).
- Solvent or organic waste containing more than 5% inorganic or organic acids: waste needs to be collected as organic acidic waste.
- Solvent or organic waste containing more than 5% inorganic or organic bases: waste needs to be collected as organic basic waste.

- Avoid mixing reactive chemicals in the waste canisters → heat development, gas development and pressure build-up. Check "Chemicals compatibility chart".[4]

6. Other

Deliver to/contact HSE coordinator:

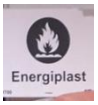
- Any hazardous/chemicals waste that is not covered in the sections above.
- NMR tubes, LC and GC vials containing solvents
- Workshop chemicals, e.g. glue, paint residues, oils, oil contaminated material (tubing, paper, plastic,…).
- Sprays bottles empty or with residues.
- Darkroom / photo chemicals, e.g. developer solutions, stop bath, fixer etc. are also treated as chemical waste.
- **Batteries –** batteries are collected in battery bins in the Central Storage. Li-batteries, Cd-batteries and Pb-containing batteries need each to be collected separately. Do not place them into the red bins but next to them. **Lithium batteries need to be taped before disposal to avoid shortening.** **Damaged batteries** are to be delivered to the HSE coordinator..

7. Empty chemical containers

Clean empty chemical containers if possible. **Containers that cannot be cleaned (e.g. of strong reactive or highly toxic substance) → deliver to HSE coordinator.**

→ **Glass bottles:** clean and dry glass bottles can be disposed into the laboratory glass waste. Small amounts (a few ml) solvents can be evaporated under the fume hood. There is a container for white and brown glas each.

→ **Plastic containers:** clean and dry plastic containers can be disposed into plastic waste marked with "Energiplast".



→ **Metal/ aluminum bottles:** clean and try metal container and aluminum bottles can be disposed as metal waste into the big metal container (not the mixed metal- and glass waste).

8. Radioactive waste

Collection of radioactive waste is coordinated by the radiation protection coordinator at Nuclear Chemistry, VU77. All radioactive substance and waste should only be located in special approved laboratories in the west wing of the chemistry building. If you find any radioactive substances in other laboratories, do not touch it, but contact the radiation protection coordinator immediately.

[4] Chemical compatibility chart.
https://www.ehs.harvard.edu/sites/ehs.harvard.edu/files/chemical_waste_chemical_compatibility_chart.pdf

9. How to set-up a laboratory waste system

a.) Identify the different waste streams in your laboratory. You can use the laboratory waste flow chart and this hazardous waste guide for it. If you have any waste that is not specified in this document, contact the Department's HSE coordinator.
b.) If space allows, dedicate one fume-hood to waste collection. You should only have one container per waste stream.
c.) Liquid waste containers should be standing within a secondary containment. Make sure that only compatible waste is stored in the same secondary containment.
d.) All waste containers need to be labelled properly. Examples for labels are attached at the end of this document. Use these labels or make your own appropriate ones.
e.) Use the solid and liquid waste labels in addition to ensure that you have all the necessary information. Labels on page 12 to 14 are mandatory for waste disposal.

This is what your waste system in the laboratory ideally looks like!

End of "Hazardous waste guide":

If in doubt or any questions? Contact the HSE coordinator.

Every laboratory should have Laboratory Instructions including a risk assessment, SOPs for standard procedures and instrumentation, as well as management of chemicals and chemical waste.

LABEL FOR SOLID WASTE

Room number:

Contact person:

☐ Inorganic salts and other inorganic solids ☐ Organic solids
☐ Inorganic solid bases ☐ Organic solid acids
☐ Inorganic solid acidis ☐ Organic solid bases

☐ contains halogen ☐ contains Cd
☐ contains Hg ☐ contains other heavy metals

	Fraction %	Chemical compound
1.		
2.		
3.		
4.		
5.		
6.		
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9.		

LABEL FOR SOLID WASTE

Room number:

Contact person:

☐ Inorganic salts and other inorganic solids ☐ Organic solids
☐ Inorganic solid bases ☐ Organic solid acids
☐ Inorganic solid acidis ☐ Organic solid bases

☐ contains halogen ☐ contains Cd
☐ contains Hg ☐ contains other heavy metals

	Fraction %	Chemical compound
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		

LABEL FOR ORGANIC SOLVENT AND OIL WASTE

Contact person: ***Room nr.:***

☐ Non-halogenated organic solvents

☐ Halogenated organic solvents

☐ Oil (PBC-free) ☐ Oil (containing PBC)

☐ contains halogen ☐ contains isocyanates

☐ heavy metals (not Cd or Hg) ☐ Cd ☐ Hg

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

LABEL FOR ORGANIC SOLVENT AND OIL WASTE

Contact person: ***Room nr.:***

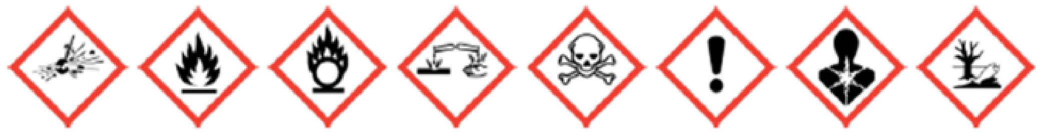
☐ Non-halogenated organic solvents

☐ Halogenated organic solvents

☐ Oil (PBC-free) ☐ Oil (containing PBC)

☐ contains halogen ☐ contains isocyanates

☐ heavy metals (not Cd or Hg) ☐ Cd ☐ Hg



☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

LABEL FOR ORGANIC SOLVENT AND OIL WASTE

Contact person: ***Room nr.:***

☐ Non-halogenated organic solvents

☐ Halogenated organic solvents

☐ Oil (PBC-free) ☐ Oil (containing PBC)

☐ contains halogen ☐ contains isocyanates

☐ heavy metals (not Cd or Hg) ☐ Cd ☐ Hg

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

LABEL FOR ORGANIC SOLVENT AND OIL WASTE

Contact person: ***Room nr.:***

☐ Non-halogenated organic solvents

☐ Halogenated organic solvents

☐ Oil (PBC-free) ☐ Oil (containing PBC)

☐ contains halogen ☐ contains isocyanates

☐ heavy metals (not Cd or Hg) ☐ Cd ☐ Hg

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

LABEL FOR LIQUID WASTE ***Room number:***

Contact person:

☐ Organic waste (not solvent waste!) ☐ Inorganic acid
☐ Organic alkaline waste ☐ Inorganic base
☐ Organic acidic waste ☐ Aqueous neutral

☐ contains halogen ☐ contains isocyanates
☐ heavy metals (not Cd or Hg) ☐ Cd ☐ Hg
☐ aqueous, pH-value:_____ ☐ water content > 10%

	Fraction %	Chemical compound
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		

LABEL FOR LIQUID WASTE ***Room number:***

Contact person:

☐ Organic waste (not solvent waste!) ☐ Inorganic acid
☐ Organic alkaline waste ☐ Inorganic base
☐ Organic acidic waste ☐ Aqueous neutral

☐ contains halogen ☐ contains isocyanates
☐ heavy metals (not Cd or Hg) ☐ Cd ☐ Hg
☐ aqueous, pH-value:_____ ☐ water content > 10%

	Fraction %	Chemical compound
1.		
2.		
3.		
4.		
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HALOGENATED SOLVENT WASTE

(carbon tetrachloride, chloroform, dichloromethane, trichloroethylene, chlorobenzene, etc.)

NON-HALOGENATED SOLVENT WASTE

(hydrocarbons, alkohols, ketones, etc.: hexane, toluene, benzene, ethanole, aceton etc.)

AQUEOUS WASTE

Acidic

(pH < 5)

(organic substances < 1 %)

AQUEOUS WASTE

Basic

(pH>9)

(organic substances < 1 %)

AQUEOUS WASTE

Neutral

(5<pH<9)

(organic substances < 1%)

SOLID INORGANIC WASTE

Inorganic salts and solids

(no inorganic acids or bases)

SOLID ORGANIC WASTE

Acidic, neutral, alkaline

(modify label as needed!!! Neutral waste must be separated into halogenated and non-halogenated)

LIQUID ORGANIC WASTE (not solvent)

Acidic, neutral, alkaline

(modify label as needed!!! Neutral waste must be separated into halogenated and non-halogenated)