IV Collection and Storage of Liquid Waste

Among chemical substance waste discharged from the university, that which can be collected by the Environment Preservation Center mainly consists of liquid-state waste from experimental facilities (liquid waste) and is sorted into inorganic and organic liquid waste groups for collection. However, infectious waste and radioactive waste is not included. Since waste generators know the properties and history of liquid waste the most, they are responsible for properly collecting and classifying waste when it is generated.

In storing and accumulating liquid waste, observe applicable laws and regulations, and prevent scattering, leakage, and fire. When you request the disposal of liquid waste, the Chemical Substance Management System shall be used.

Wait a moment! Check it again before discarding it!!
Properly dispose of hazardous substances on your own responsibility.

- Do not throw liquid waste down the drain!!
- Check it again before getting rid of it!

1. Collection and storage of inorganic liquid waste

Store inorganic liquid waste according to the liquid waste group specified in Table 1. Observe the precautions below in collecting and storing inorganic liquid waste.

1) Applicable liquid waste is listed under Groups Nos. 1 through 5 in Table 1.
2) In the case of compounds, components with a higher toxicity or that are more hazardous shall be prioritized, and shall be classified accordingly.
3) Liquid waste containing chemical substances that may react with each other and cause an explosion if mixed should not be comingled.

Refer to Table 2, and confirm the combination before storage (or before moving liquid waste into specified containers).

4) When liquid waste is moved from experimental containers to specified containers, it is said that 99 to 99.9% or more per container volume is transferred when the first waste washing liquid is collected. To ensure safety, waste washing liquid shall be collected up to the third washing.
5) Organic substances shall be excluded in principle. If such substances are inseparable, their content shall be limited to 3% at a maximum.
6) Liquid waste in groups other than ‘Mercury and Mercury Compounds’ should not contain mercury and mercury compounds in principle. If the mercury contained is inseparable, convert liquid waste to inorganic mercury and decrease the concentration to 10 ppb at a maximum.
7) Since ammonia forms a complex when reacting with heavy metals and makes processing difficult, ensure that it is processed as liquid waste under the dilute organic aqueous solutions group described later (ammonia content of 10% at a maximum) if no metal is contained. If metals are present, dilute the liquid to ensure an ammonia content of 10% at a maximum, and change it to ‘alkaline liquid waste.’

Table 1 Collection and classification of **INORGANIC** liquid waste from experimental facilities

No. and ID card color	**Group**/Contents of Liquid Waste	Remarks
1	**MERCURY and MERCURY COMPOUNDS** Inorganic mercury, organic mercury, and their compounds (Acid)	Wash the emptied vessel that contained the liquid waste at least three times and store the washing liquid with the waste at pH≤2. Filter off any precipitates. →Store the precipitates as “mercury sludge” in a separate sealed vessel. Request disposal. →The center will collect it in a timely fashion. ・**Organic mercury and its compounds**: Decompose organic compounds (see note 1) in principle. If the organic compounds present are inseparable, restrict the organic compound content to 3% at a maximum. ・**Mercury metals and mercury amalgam**: Store in a separate sealed vessel. Request disposal as mercury sludge. →The center will collect it in a timely fashion.
2	**ACID, CHROMIUM and HEAVY METALS** Chromium, lead, copper, zinc, cadmium, iron, manganese, silver, cobalt, nickel, etc. and their compounds Mineral acid waste solutions such as hydrochloric acid, sulfuric acid, and nitric acid (Acid)	Wash the emptied vessel that contained the liquid waste at least three times and store the washing liquid with the waste at pH≤4. Filter off any precipitates. →Store the precipitates as “non-mercury sludge” in a separate sealed vessel. Request disposal. →The center will collect it in a timely fashion. ・Hydrochloric acid or sulfuric acid without harmful compounds and their alkali salts: If waste is not excessively concentrated (not more than 5%) or in large quantities, it could be carefully disposed of after neutralization or dilution (pH 5–9) and confirmation of safety. ・It should not contain **mercury**. If the mercury contained is inseparable, however, restrict the content to 10 ppb at a maximum. ・It should not contain hydrofluoric acid or its compounds. ・It should not contain **cyanides**. If the cyanide contained is inseparable, restrict the content of cyanide to 1 ppm at a maximum. ・For boron, refer to the Precautions Common to All the Groups.
3	**CYANIDES, CYANIDE COMPLEX COMPOUNDS and ARSENIC COMPOUNDS** Cyanides, cyanide complex compounds, arsenic compounds, selenium compounds (Alkaline)	Wash the emptied vessel that contained the liquid waste at least three times and store the washing liquid with the waste at pH≥9. Filter off any precipitates. →Store the precipitates as “non-mercury sludge” in a separate sealed vessel. Request disposal in a timely fashion ・**Cyanides**: Decompose them in principle (see note 2). (Ensure an inorganic cyanide concentration of 80 ppm at a maximum.) The compounds include ferricyanide salts and ferrocyanide salts. ・It should not contain **mercury**. If the mercury contained is inseparable, however, restrict its content to 10 ppb at a maximum. ・Cyanides and arsenic compounds should be stored in separate containers**.**
4	**ALKALINE SOLUTIONS** Sodium hydroxide, potassium hydroxide, ammonium hydroxide, alkaline solutions containing heavy metals, etc. (Alkaline)	Wash the emptied vessel that contained the liquid waste at least three times and store the washing liquid. Filter off any precipitates. →Store the precipitates as “non-mercury sludge” in a separate sealed vessel. Request disposal. →The center will collect it in a timely fashion. ・Sodium hydroxide, potassium hydroxide aqueous solution, etc. without harmful compounds: If waste is not excessively concentrated (not more than 5%) or in large quantities, it could be carefully disposed of after neutralization or dilution (pH 5–9) and confirmation of safety. ・It should not contain **mercury**. If the mercury contained is inseparable, however, restrict the content to 10 ppb at a maximum. ・It should not contain **cyanides**. If the cyanide contained is inseparable, however, restrict the content to 1 ppm at a maximum.
5	**HYDROGEN FLUORIDE and its salts** Hydrogen fluoride and solutions containing its salts (Acid)	Wash the emptied vessel that contained the liquid waste at least three times and store the washing liquid.
	Precautions Common to All the Groups	**Organic compounds (including chelating agent, etc.)**: Decompose them in principle (see note 3). If the organic compounds present are inseparable, however, restrict their content to 3% at a maximum. **Boron and its compounds**: Boron should be restricted to 200 ppm at a maximum. **Osmium, thallium and beryllium** (see Out-of-scope liquid waste section) should not be present. **Water-prohibitive substances and flammable compounds** (see Out-of-scope liquid waste section) should not be present. **Nuclear fuel materials and radioactive waste** should not be present.

Collection and classification of **INORGANIC** liquid waste from experimental facilities

No and Class color	**Group**/Contents	Container Color Volume	Remarks
1	**MERCURY and MERCURY COMPOUNDS** Inorganic mercury compounds Organic mercury compounds (Acidification)	Gray or White 20L or 10L	**Wash the emptied vessel which contained the liquid wastes at least thrice, store the washing with the wastes at pH< 2.** Filter off any precipitate →Store the precipitate as "mercury sludge" in other sealed vessel. ・**Organic mercury compounds** ; Decompose organic compounds (see note 1). (>3% organic compounds) ・**Mercury metals and mercury amalgam** ; Add water and store in other sealed vessel.
2	**ACID, CHROMIUM and HEAVY METALS** Bismuth, copper, cobalt, chromium, cadmium, iron, lead, manganese, nickel, silver, tin, zinc, etc. and their salts Mineral acid waste solutions, such as hydrochloric acid, sulfuric acid, nitric acid, etc. (Acidification)	Red 20L	**Wash the emptied vessel which contained the liquid wastes at least thrice, store the washing with the wastes at pH< 4.** Filter off any precipitate →Store the precipitate as "non-mercury sludge" in other sealed vessel. ・Liquid wastes of less than 5% sulphuric acid or hydrochloric acid without harmful compounds could be carefully disposed off after neutralization (pH 5-9). ・**Inorganic fluoride** ; Do not store in container. ・**Mercury compounds** ; Store the liquid wastes after ensuring the concentration below 10ppb of mercury. ・**Cyanide and their compounds** ; Store the liquid wastes after ensuring the concentration below 1 ppm of cyanide.
3	**CYANIDE and ARSENIC COMPOUNDS** Cyanide compounds, cyanide complex compounds, arsenic, selenium compounds (Alkaline condition)	Orange 20L	**Wash the emptied vessel which contained the liquid wastes at least thrice, store the washing with the wastes at pH>9.** Filter off any precipitate →Store the precipitate as "non-mercury sludge" in other sealed vessel. ・**Cyanide and their compounds** ; Store the liquid wastes after ensuring the concentration below 80 ppm of cyanide. (see note 2) Cyanide and their compounds and arsenic compounds should be stored in separate containers**.**
4	**ALKALINE SOLUTIONS** Potassium hydroxide, sodium hydroxide, sodium carbonate, potassium carbonate, ammonium compound, alkaline solutions containing heavy metals, etc.	Blue 20L	**Wash the emptied vessel which contained the liquid wastes at least thrice, store the washing with the wastes.** Filter off any precipitate →Store the precipitate as "non-mercury sludge" in other sealed vessel. ・Liquid wastes of less than 5 % sodium hydroxide, potassium hydroxide or their salts without harmful compounds could be carefully disposed off, after neutralization (pH 5-9). ・**Mercury compounds** ; Store the liquid wastes after ensuring the concentration below 10 ppb of mercury. ・**Cyanide and their compounds** ; Store the liquid wastes after ensuring the concentration below 1 ppm of cyanide.
5	**HYDROGEN FLUORIDE and INORGANIC FLUORIDE** Hydrogen fluoride, etc	White or Red with black line 20L	**Wash the emptied vessel which contained the liquid wastes at least thrice, store the washing with the wastes.**
	Do not store in container 		Over 3 % **organic compounds** (contained cheating reagent); Decompose organic compounds. (see note 3) **Waterless compounds** (alkali metals, carbide, etc.) and **ignitable compounds** (organic lithium, organic aluminum, etc.) Over200 ppm of **Boron** **Osmium, thallium and beryllium** and their compounds ; they should be carefully stored at the user's laboratory. **Radioactive wastes**

Notes for Table 1: List of decomposition methods

Note 1: Organic mercury and its compounds, and inorganic mercury containing organic mercury and its compounds

Add sulfuric acid to liquid waste to acidify it, further add potassium permanganate solution, and heat at 70℃ for 2 to 3 hours to decompose the organic compounds. (The purple color of the potassium permanganate will remain.) After the processing, reduce excess potassium permanganate with a reducing agent, resulting in liquid waste containing mercury and its compounds. Since mercury vapor may be generated during heating, an activated carbon absorbing device shall be installed to remove it.

Other methods to decompose organic substances include using sodium hypochlorite in an alkaline state from sodium hydrochloride (pH 11 or higher) or by adding sodium/potassium dichromate in an acidic state from sulfuric acid, leaving the mixture for a month or more to completely decompose the organic substances, and reducing excess amounts of hexavalent chromium.

Note 2: Cyanides

Dilute the liquid waste to decrease the concentration of cyanide to approx. 500 ppm at a maximum, adjust the pH to 10.5 or more with sodium hydroxide, add 6% sodium hypochlorite, and shake well. Allow to stand for one hour or more, add sulfuric acid while agitating to attain a pH of 8 to 9, further add 6% sodium hypochlorite, and allow to stand for several hours. Reduce residual chlorine by using sodium sulfite, and store the mixture at a pH of 9 or more as cyanide and arsenic liquid waste. (If the mixture is acidified, highly poisonous hydrogen cyanide gas will be released.) Make sure to conduct all operations in a draft chamber.

As for liquid waste that contains persistent cyanide complexes [($RAg(CN)_2$, $R_2Ni(CN)_4$, $R_3Cu(CN)_4$, $RAu(CN)_2$, $R_3Fe(CN)_6$, $R_4Fe(CN)_6$, $R_3Co(CN)_6$, etc.; R:K or Na), add approx. 25-fold volume of iron (II) sulphate heptahydrate for cyanide, adjust to a pH of 5 to 6, allow to stand, and store at a pH of 9.0 to 9.5. If precipitation occurs, filter it off. Request separate disposal of the filtered precipitates as ‘sludge (non-mercury sludge).’

Note 3: Heavy metals containing chelating agents (complexing agent) or organic substances

Decompose organic substances with potassium permanganate (see note 1), and handle it as liquid waste containing ‘Acid, chromium and heavy metals.’

Or, add sodium carbonate or sodium hydroxide so the mixture becomes alkaline (by selecting a pH optimal for precipitation), allow to stand for a full day and night, and filter off the precipitates. Use the metal content or the like to generate precipitates at an optimum pH (around a pH of 8, for example, for coagulation sedimentation by using copper bearing iron (II)). Care must be taken to avoid influence from ligands if complexes form. Request disposal of the filtered precipitates separately as ‘sludge (non-mercury sludge).’ Confirm that the total quantity of heavy metals is 100 mg or less, and classify the filtrate as a ‘dilute organic aqueous solution.’ It is also preferable to use PAC (poly-aluminum chloride), ferric chloride (III), iron sulfate, or polymer coagulant to facilitate the generation of precipitates.

2. Collection and storage of organic liquid waste

Applicable organic liquid waste includes all organic substances discharged from university laboratories, including not only flammable liquid waste but also organic flame-retardant liquid waste. Applicable liquid waste is listed under Group Nos. 1 through 5 in Tables 3 and 4.

Notes for Tables 3 and 4: List of decomposition methods

Note 11: Carbon disulphide

Add potassium hydroxide to ethanol, dissolve the solution while heating (taking care not to ignite the ethanol), cool the solution with ice, and add liquid waste containing carbon disulphide to generate precipitates (potassium xanthate). Filter off the generated precipitates, and dissolve potassium xanthate in water to prepare a dilute organic aqueous solution. The filtrate shall be classified as waste solvent or a dilute organic aqueous solution according to water content. In addition, there are methods that generate ammonium xanthate salt and dithiocarbamic acid derivatives, followed by dissolving them in water.

Note 12: Organic aqueous solution containing heavy metals

Decompose organic substances with potassium permanganate (see note 1), and handle it as liquid waste containing ‘Acid, chromium and heavy metal.’

Or, add sodium carbonate or sodium hydroxide to induce alkaline conditions (by selecting the optimum pH for precipitation), allow to stand for a full day and night, and filter off the precipitates. Use the metal content or the like to generate precipitates at the optimum pH (around a pH of 8, for example, for coagulation sedimentation by using copper bearing iron (II)). Care must be taken to avoid influence from ligands if complexes form. Request disposal of the filtered precipitation separately as ‘sludge (non-mercury sludge).’ Confirm that the total quantity of heavy metals is 100 mg or less and classify the filtrate as a ‘dilute organic aqueous solution.’ It is also preferable to use PAC (poly-aluminum chloride), ferric chloride (III), iron sulfate, or polymer coagulant to facilitate the generation of precipitates.

Note 13: Photographic processing liquid waste

This refers to photographic developers and fixing solutions for monochrome photographs used for electron micrography and medical X-ray photography in the education, research, and medical care fields. Photographic developers and fixing solutions shall be stored separately.

Fixing solution (the major component of which is sodium thiosulfate, and which contains a small quantity of sodium sulfite and acetic acid and a large quantity of silver): Outsource treatment of fixing solution to external contractors.

Photographic developers (the major components of which are hydroquinone, p-methyl aminophenol sulfate, and phenidone, and which also contains sodium sulfite, ascorbic acid, borax, and sodium hydroxide): If the solution contains no metal, classify it as a dilute organic aqueous solution. If the solution contains a large quantity (100 mg or more) of silver, classify it as a fixing solution (with a clear description that it contains a photographic developer).

Notes

1. Liquid waste containing **organic mercury compounds**

Add excess potassium permanganate solution to liquid wastes and heat at 70℃ for 2-3 hours to decompose organic compounds, reduce excess potassium permanganate with sodium oxalate and treat as inorganic mercury compounds.

2. Liquid waste containing **cyanide and their compounds**

Add sodium hypochlorite solution at pH >11, allow to stand for 1 hour and store the waste after ensure to achieve a concentration below 80 ppm of total cyanide.

(If liquid waste was made acidic, toxic cyanogen gas would be released.)

To liquid wastes containing non decomposable cyanide complexes, such as $KAg(CN)_2$, etc., add about 25 folds amounts of iron(II) sulphate heptahydrate for cyanide, adjust to pH 5-6 and allow to stand, store at pH 9.0-9.5 after ensure to achieve a concentration below 80 ppm of total cyanide. If precipitation occurs, filter off the precipitate.

3. Liquid waste containing **heavy metals containing chelating agents**

- Decompose organic compounds with potassium permanganate. (see note 1)
- Add sodium carbonate or sodium hydroxide to optimum pH, allow to stand and filter off, treat the precipitate as inorganic sludge, and treat the filtrate as dilute organic aqueous solutions group.

Table 2 Chemicals at risk of causing explosions when combined (A + B)

Chemical A	Chemical B	Chemical A	Chemical B
Alkali metals, powdered aluminum or magnesium and other substances	Carbon tetrachloride and other carbon chlorides, carbon disulphide and halogens	Inflammable liquid	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide and halogen
Chromic acid	Acetic acid, naphthalene, camphor, glycerin, turpentine oil, alcohols, oxidizable substances	Ammonia (anhydrous)	Mercury (e.g. mercury in manometer) chlorine, calcium hypochlorite, iodine, bromine, anhydrous hydrofluoric acid, silver compounds
Copper	Acetylene, hydrogen peroxide	Anhydrous hydrofluoric acid	ammonia (aqueous or anhydrous)
Silver	Acetylene, oxalic acid, tartaric acid, fulminic acid, ammonium compounds	Potassium or sodium	Carbon tetrachloride, carbon dioxide, water
Chlorine	Ammonia, acetylene, butadiene, butane, methane, propane, other petroleum gases, hydrogen, sodium, carbide, turpentine oil, benzene, finely ground metals	Potassium permanganate	Ethanol or methanol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulphide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural
Bromine	Same as with chlorine	Nitric acid (concentrated)	Acetic acid, aniline, chromic acid, cyanic acid, hydrogen sulphide, inflammable liquid, inflammable gas
Iodine	Acetylene, ammonia (aqueous or anhydrous), hydrogen	Hydrocarbon (butane, propane, benzene, gasoline, turpentine oil and others)	Fluorine, bromine, chromic acid, sodium peroxide
Fluorine	Reaction rate is high for all types of compounds	Acetylene	Chlorine, bromine, copper, fluorine, silver, mercury
Chlorine dioxide	Ammonia, methane, phosphine, hydrogen sulphide	Cumene hydroperoxide	Various types of acids (organic or inorganic)
Chlorate	Ammonium salts, various types of acids, powdered metals, sulfur, finely ground organic substances or combustible materials	Perchlorate	Acetic anhydride, bismuth and its alloys, alcohol, paper, wood
Aniline	Nitric acid, hydrogen peroxide	Oxalic acid	Silver, mercury
Hydrogen peroxide	Copper, chromium, iron, many other metals or their salts, alcohol, acetone, organic substances, aniline, combustible materials, inflammable liquids, nitromethane	Sulfuric acid	Potassium chlorate, potassium perchlorate, potassium/sodium permanganate, permanganate of light metals such as lithium
Mercury	Acetylene, oxalic acid, ammonia, fulminic acid	Sodium azide	Acid, heavy metals (lead, copper, mercury, silver)

Chemicals in danger of exploding in combination (A + B)

Chemical A	Chemical B	Chemical A	Chemical B
Alkali metals, powdered aluminum or magnesium and other substances	Carbon tetrachloride and other carbon chlorides, carbon disulphide and halogen	Hydrogen peroxide	Copper, chromium, iron, many other metals or their salts, alcohol, acetone, organic substances, aniline, combustible materials, inflammable liquid, nitromethane
Metal potassium or sodium	Carbon tetrachloride, carbon dioxide, water	Ammonia (anhydrous)	Mercury(e.g. mercury in manometer) chlorine, calcium hypochloride, iodine, bromine, anhydrous hydrofluoric acid, silver compounds
Copper	Acetylene, hydrogen peroxide	Chromic acid	Acetic acid, naphthalene, camphor, glycerin, turpentine oil, alcohols, oxidizable substances
Silver	Acetylene, oxalic acid, tartaric acid, fulminic acid, ammonium compounds	Anhydrous hydrofluoric acid	ammonia (aqueous or anhydrous)
Mercury	Acetylene, oxalic acid, fulminic acid, ammonia	Nitric acid (concentrated)	Acetic acid, aniline, chromic acid, cyanic acid, hydrogen sulphide, inflammable liquid, inflammable gas
Chlorine	Ammonia, acetylene, butadiene, butane, methane, propane, other kerosene gases, hydrogen, sodium, carbide, turpentine oil, benzene, finely ground metal	Sulphuric acid	Potassium chlorate, potassium perchlorate, potassium permanganate (or permanganate of light metals such as sodium and lithium)
Bromine	Same as the case of chlorine	Hydrocarbon (butane, propane, benzene, gasoline, turpentine oil and others)	Fluorine, bromine, chromic acid, sodium peroxide
Iodine	Acetylene, ammonia (aqueous or anhydrous), hydrogen	Acetylene	Chlorine, bromine, copper, fluorine, silver, mercury
Fluorine	Reaction rate is high for all kinds of compounds	Aniline	Nitric acid, hydrogen peroxide
Chlorine dioxide	ammonia, methane, phosphine, hydrogen sulphide	Oxalic acid	Silver, mercury
Chlorate	Ammonium salts, various kinds of acids, powdered metal, sulphur, finely ground organic substances or combustible materials	Cumene hydroperoxide	Various kinds of acids (organic or inorganic)
Perchlorate	Acetic anhydride, bismuth and its alloys, alcohol, paper, wood	Inflammable liquid	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide and halogen
Potassium permanganate	Ethanol or methanol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulphide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural	Sodium azide	Acid, lead, copper, mercury, silver

Table 3 Collection and classification of **ORGANIC** liquid waste **A** from experimental facilities

No and ID card color	Group/Contents of Liquid Waste	Remarks
1	**Waste solvents** Hydrocarbons, alcohols, ketones, aldehydes, esters, weak acids (such as acetic acid), weak bases (such as pyridine), volatile oils, kerosene, light oil, etc.	Waste solvents with a flash point of 70°C or less Set the water content to 50% or less.
4	**Dilute organic aqueous solution** Aqueous organic acid solution, other dilute aqueous waste solvents (such as alcohol or amine) Ethers (such as diethyl ether, tetrahydrofuran, dioxane, or dimethoxyethane) Collodion Carbon disulfide Organic aqueous solutions containing heavy metals Photographic developer (for monochrome photos)	Set the water content to 50% or more. Dilute formaldehyde or paraformaldehyde to 4% or less. Make sure to dilute it with at least a 20-fold quantity of water. Do not mix with other waste solvents (to prevent electrostatic charge, superoxide production, or explosion due to decomposition). Decrease collodion content to 1% or less. Decompose it in principle (see note 11). Decompose them in principle (see note 12). Store developers and fixers separately (see note 13).
Precautions Common to All the Groups		**Heavy metals** should not be present. If the heavy metals present are inseparable, restrict the total quantity to 250 mg at a maximum in a 20-liter container. **Mercury should never be present.** **Flame-retardant substances, non-combustible solvents** and **waste oils** should not be present. However, if they are present but inseparable, restrict the content to 10% at a maximum. The same applies to organic halogen compounds. **Inorganic substances should not be present.** If they are present but inseparable, however, restrict the content to 10% at a maximum. Dilute fluorine compounds (including organic fluorine compounds) to 1% fluorine at a maximum. Follow the precautions common to all the groups in Table 1 for boron compounds. **Solid substances** (including gelatinous substances) should not be present. Liquid waste that may solidify during storage or when mixed with liquid waste containing similar groups shall be properly treated. **Self-decomposition explosive substances** (see Out-of-scope liquid waste section) should not be present. **Hazardous reactants** (see Out-of-scope liquid waste section) should not be present. **PCBs** (see Out-of-scope liquid waste section) should not be present. **Nuclear fuel materials and radioactive waste** should not be present.

Collection and classification of **ORGANIC** liquid waste A from experimental facilities

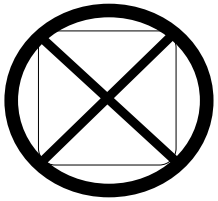
No and Class color	**Group** /Contents	Container Color Volume	Remarks
1	**WASTE ORGANIC SOLVENTS** Hydrocarbons, alcohols, ketones, aldehydes, esters, weak acids, amines, gas oil, kerosene, etc.	White 20L	**Waste solvent with flash point lower than 70℃**. Water content should be below 50 %.
4	**DILUTE AQUEOUS ORGANIC SOLUTIONS** Aqueous organic acid solutions Dilute aqueous organic solvents (alcohols, formalin, amines, etc.) Ethers(diethyl ether, tetrahydrofuran, dioxane, dimethoxyethane, etc.) Collodion Carbon disulphide Aqueous organic solutions containing metals Photographic developer	White 20L	Water content should be greater than 50 % Content of compounds having formaldehyde or praformaldehyde should be less than 4%. Ethers should be diluted with over 20-folds of water and mixed with no other waste solvents. Collodion content should be less than 1 %. Convert carbon disulphide to xanthate or dithiocarbamate and dissolve in water. Add sodium carbonate or sodium hydroxide to the optimum pH, allow to stand and filter off, treat precipitate as inorganic sludge, treat filtrate as dilute organic aqueous solutions group. (see note 5) Fixer and developer should be stored in separate containers.
	Do not store in container 		More than 250 mg of **total heavy metals.** Especially **mercury** and mercury compounds. More than 10% of other **inorganic compounds**. Waste organic solvents should be free from slightly and **non combustible organic solvents** and **waste oil** groups. Especially more than 1% of **fluoride** and their inorganic and organic compounds.. **Precipitate and sludge**. **Polychlorinated biphenyls** (PCB), Polychlorinated naphthalene (chlorine number more than 3) and Hexachlorobenzene ; they should be carefully stored at the user's laboratory. Explosive substances by self-decomposition, such as polynitrocompounds peroxides, etc. **Highly reactive and dangerous substances,** such as styrene monomer, etc.

Table 4 Collection and classification of **ORGANIC** liquid waste B from experimental facilities

No and ID card color	Group/Contents of Liquid Waste	Remarks
2	**Flame-retardant substances and non-combustible solvents** Halides such as chloroform, dichloromethane, and carbon tetrachloride	CN compounds such as acetonitrile should not be present.
3	**Waste oils** Lubricant, gear oil, cylinder oil, turbine oil, animal and vegetable oils, etc.	Waste oil with a flash point of 70°C or more CN compounds such as acetonitrile, flame-retardant substances, and non-combustible solvents should not be present.
5	**Photographic fixer** Photographic fixer (for monochrome photos)	Store developers and fixers separately (see note 13).
Precautions Common to All the Groups		**Heavy metals** should not be present. **Mercury should never be present.** **Inorganic substances should not be present.** If they are present but inseparable, however, restrict the content to 10% at a maximum. Dilute fluorine compounds (including organic fluorine compounds) to 1% fluorine at a maximum. Follow the precautions common to all the groups in Table 1 for boron compounds. **Solid substances** (including gelatinous substances) should not be present. Liquid waste that may solidify during storage or when mixed with liquid waste containing similar groups shall be properly treated. **Self-decomposition explosive substances** (see Out-of-scope Liquid Waste section) should not be present. **Hazardous reactants** (see Out-of-scope Liquid Waste section) should not be present. **PCBs** (see Out-of-scope Liquid Waste section) should not be present. **Nuclear fuel materials and radioactive waste** should not be present.

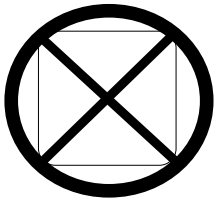
3. Out-of-scope liquid waste (waste that cannot be disposed of)

1) Nuclear fuel materials and radioactive waste (including substances that were converted to radioactive waste in the course of conducting experiments)
2) Infectious waste and possibly infectious waste
3) PCB (polychlorinated biphenyl), polychlorinated naphthalene (with 3 chlorines or more), hexachlorobenzene (necessary to store under strict control at the site of generation; refer to reference 9), and dioxins
4) Self-decomposition explosive substances (such as explosives, poly-nitro compounds, acetylenic compounds, or peroxides)
5) Hazardous reactants (such as substances that will burn or explode due to decomposition when mixed with other substances such as an organic substance with concentrated acid, or an organic substance with benzoyl peroxide, or monomers that can easily polymerize such as styrene monomers)
6) Water-prohibitive substances (such as alkali metals, organic metal compounds like organic lithium compounds, metal hydrides, or carbides) and combustible substances (such as organic lithium, organic aluminum, yellow phosphorus, reduced nickel, reduced platinum, or reduced palladium)
7) Chemical substances that may cause health problems or accidents during work at treatment facilities
8) Osmium tetroxide and thallium (for which a treatment method has not been established; necessary to store under strict control at the site of generation)

   In addition, beryllium treatment is difficult and is recommended to be carried out at the site of generation wherever possible. Since beryllium carbonates or phosphates are insoluble in water, their salts can be separated and then disposed of.

The above-mentioned substances and liquid waste that contain these substances even in small quantities shall be stored under strict control at the site of generation. If a treatment method for some substances has been established, it shall be followed.

Collection and classification of **ORGANIC** liquid waste B from experimental facilities

No and Class color	**Group** /Contents	Container Color Volume	Remarks
2	**SLIGHTLY and NON COMBUSTIBLE ORGANIC SOLVENTS** Chloroform, carbon tetrachloride, dichloromethane, etc.	White 8L	Slightly and non combustible organic solvents should be free from CN compounds such as acetonitrile, etc.
3	**WASTE OILS** Machine oils, etc.	White 8L	**Waste oil with flash point higher than 70℃** Waste oils should be free from CN compounds such as acetonitrile, etc. Waste oils should be free from slightly and non combustible organic solvents group.
5	**Photographic fixer**	White 8L	Fixer and developer should be stored in separate containers.
	Do not store in container 		**Total heavy metals and mercury**, mercury compounds. More than 10% of other **inorganic compounds**. Especially more than 1% of **fluoride** and their inorganic and organic compounds.. **Precipitate and sludge**. **Polychlorinated biphenyls** (PCB), Polychlorinated naphthalene (chlorine number more than 3) and Hexachlorobenzene ; they should be carefully stored at the user's laboratory. Explosive substances by self-decomposition, such as polynitrocompounds peroxides, etc. **Highly reactive and dangerous substances,** such as styrene monomer, etc.

4. Designated containers and collection system

1） Designated containers

(1) Size and materials

Organic A (waste solvents and dilute organic aqueous solution): 20-liter plastic container designated by contractors; to be loaned

Organic B (flame-retardant or non-combustible solvents, waste oils, fixers, etc.): 10-liter polyethylene containers (160 x 260 mm; height: 340 mm; thickness: 1.0 mm or more)

Inorganic (excluding mercury and mercury compounds): 20-liter polyethylene container (160 x 350 mm; height: 410 mm; thickness: 1.3 mm or more)

Inorganic (mercury and mercury compounds): Either the above-mentioned 10- or 20-liter polyethylene container can be used (will not be returned).

Note that polyethylene is easily corroded by organic solvents (such as chloroform and ether, in particular). Periodically renew the designated containers.

(2) Color: See Table 5.

Table 5 Designated colors and colors of ID cards

	Classification of liquid waste	Storage capacity	Container color or band color	Colors of ID cards
Inorganic liquid waste	Mercury and mercury compounds	10/20 L	Gray/white (gray band)	Gray
	Acid, chromium and heavy metals	20 L	Red	Red
	Cyanides, cyanide complex compounds and arsenic compounds	20 L	Orange	Orange
	Alkaline	20 L	Blue	Blue
	Hydrogen fluoride and its salts	20 L	White/red (black band)	Violet
Organic liquid waste	Waste solvents	20 L	White	Yellow
	Dilute organic aqueous solutions	20 L	White	White
	Flame-retardant/non-combustible solvents	8 L	White	Olive
	Waste oils	8 L	White	Ivory
	Photographic fixer	8 L	White	Pink

（3） Returning after treatment

Among the above classifications, containers other than ‘Mercury and mercury compounds’ shall be returned after treatment, and can be used for the next storage requirement. However, it can take several months until being returned since treatment is outsourced to external contractors.

Sometimes containers from other groups may be returned. To ensure the return of containers to their own group, attach a group name label at a readily-identifiable location on the container or take other measures to prevent mix-ups.

Containers for 'Mercury and mercury compounds' will not be returned. Therefore, either 10- or 20-liter plastic white containers can be used (with a gray tape band).

2） ID card

(1) Colored section-specific cards: Shown on the next page and Table 5.

(2) Card case and section-specific colors

Use a size-A5 soft non-vinyl chloride case (222 x 155 mm) as the card case. Attach plastic section -specific colored tape (see Table 6) near the opening on the front and back sides of the case. Make a hole on one side of the opening to allow a cord to pass through.

(3) Attachment position

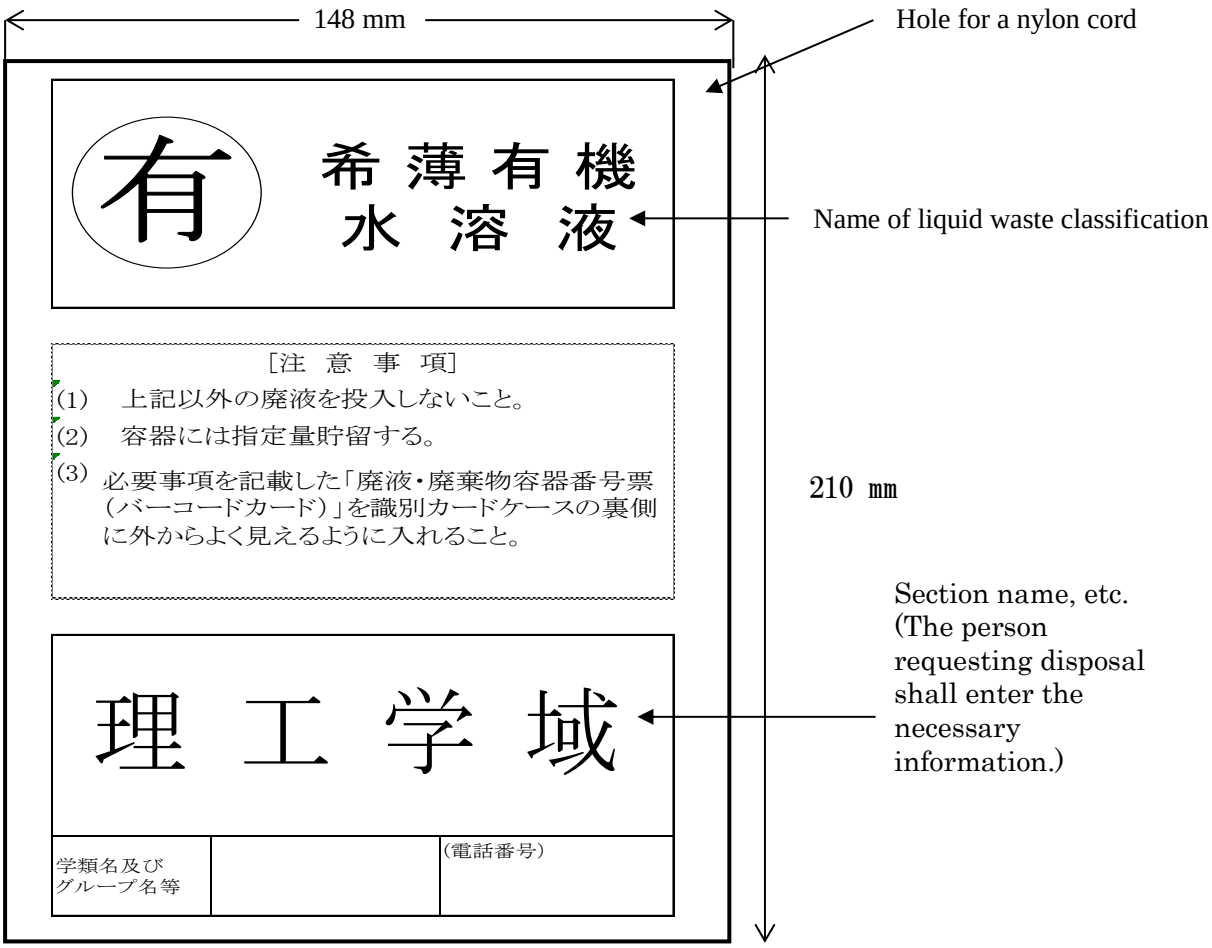
Attach the ID card case with a polyethylene (or nylon) cord (with a diameter of 3 mm) tied to the handle of the designated container.

Be sure to use liquid waste classification ID cards and section identification tape as designated.

Table 6 Identification colors of sections and collection sites

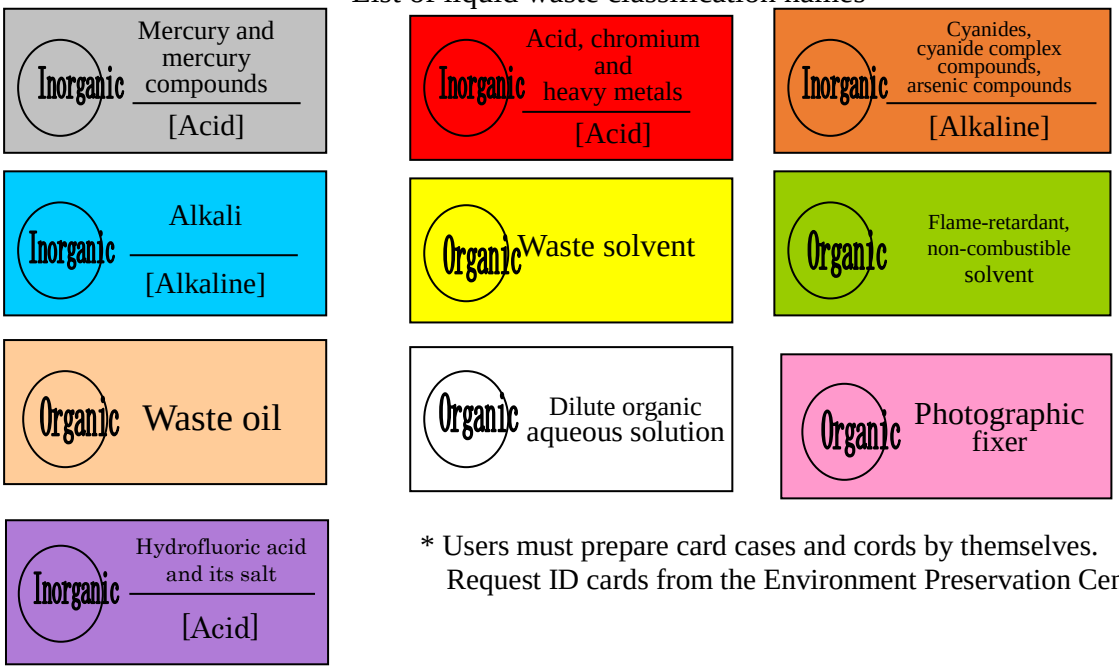
Section (collection site) name	Color	Section (collection site) name	Color
Institute of Science and Technology, Institute of Nature and Environment Technology (Natural Science & Technology Building)	Orange	Graduate School of Medical Sciences, Takara-machi Campus, Advanced Science Research Center, Cancer Research Institute (Medical Building D, Building AB (Blue tape on the handle), Building C (Pink tape on the handle))	Blue
Institute of Science and Technology, No.5 Building Advanced Science Research Center (Natural Science No.5 Building)	Sky blue	Graduate School of Medical Sciences, Kakuma Campus, Advanced Science Research Center (Natural Science & Technology Building)	Brown
Graduate School of Human and Social Sciences (Human Science (formerly the College of Education) Building/Senior High School)	Green	Graduate School of Medical Sciences, Tsuruma Campus (Health Science Building)	Gray
Cancer Research Institute (Cancer Research Institute Building)	White	Kanazawa University Hospital (University Hospital Building)	Red
Institute of Liberal Arts and Science (General Education Building)	Yellow	Others (Administrative Office Building, etc.)	Black

NanoLSI : Pink



ID card (size A5)

List of liquid waste classification names



* Users must prepare card cases and cords by themselves.
Request ID cards from the Environment Preservation Center.

5. Collection and storage of the sludge

Precipitates or sludge (such as hydroxides of heavy metals or calcium fluoride) generated from pre-treatment of liquid waste are disposed of as sludge. Therefore, designate them as waste 'sludge' in the Chemical Substance Management System and request disposal. If the contents of the sludge are not registered at the time of the request for discharge, enter the name of the contents in the remarks field, as well as the total weight and water content (with a pH of 7), and store the sludge in a thick, transparent plastic bag for each group. Filter paper used to filter the precipitates shall be stored with the sludge.

Among non-mercury waste (sludge), 'glass' and 'plastics' contaminated with hazardous substances shall be sufficiently washed with acid, organic solvent, or water wherever possible. Confirm that no hazardous substances are soluble, and dispose of them as general industrial waste. When disposing of washing solutions used for these substances, separately request from the Environment Preservation Center disposal as liquid waste categorized as washing solvents and hazardous substances.

The table below indicates the classification of liquid waste (sludge) to be collected by the Environment Preservation Center. If you directly outsource disposal to an external disposal waste contractor, observe the description of 'V-1 Sorting of waste.'

As for mercury waste, you must always request disposal from the Environment Preservation Center.

Table 7 Classification of waste at the Environment Preservation Center

Classification		Remarks
Mercury	**Hg sludge** Mercury-contaminated sludge	Sludge containing mercury (such as precipitates and sludge), metal mercury, amalgam, etc.; including paper used for filtering
	Hg glass Mercury-contaminated glass (including ceramics)	Glassware contaminated with mercury, mercury thermometers, etc.
	Hg plastics Mercury-contaminated rubber/plastic	Rubber products or plastic products, etc. contaminated with mercury
	Hg metal products Mercury-contaminated metal containers	Iron or other metal containers, etc. contaminated with mercury. Metal mercury is classified as 'Hg sludge.'
Non-mercury	**Sludge** Sludge (inorganic sludge)	Sludge contaminated with inorganic hazardous substances such as heavy metals (such as precipitates and sludge), heavy metals used in experiments; including paper used for filtering
	Glass Glass contaminated with hazardous substances (including ceramics)	Glassware contaminated with hazardous substances such as heavy metals, silica gel, etc.
	Plastics Rubbers/plastics contaminated with hazardous substances	Rubber products or plastic products contaminated with hazardous substances such as heavy metals
	Organic sludge Sludge (organic sludge)	Sludge contaminated with organic hazardous substances (such as precipitates and sludge); including paper used for filtering Waste activated carbon (Do not mix with other substances.)

The paragraphs below describe examples of the disposal of used plastic containers and waste silica.

1） Used plastic containers

If plastic containers borrowed from contractors (20-liter white container with the contractor's name on it) are no longer necessary, return them to the Environment Preservation Center. (The center records the number of containers loaned out to each section.)

If plastic containers other than the above become unnecessary due to dirt or damage, wash them as described below, and securely tie the same group of five containers at a maximum with a strap. Classify them as the waste 'plastics' according to the Chemical Substance Management System (or 'Hg plastics' in the case of gray or mercury-contaminated containers), enter '(Group name) Plastic container: Number of containers.' Also enter the total weight and water content (with a pH of 7) with no content, and request discharge. The Environment Preservation Center will collect used containers and outsource disposal. Never discharge them as ordinary landfill waste.

If you have any questions, consult with the Environment Preservation Center.

（1）**10-liter white plastic containers** (limited to organic liquid waste containers (flame-retardant/non-combustible, waste oil, or fixer)):

① Thoroughly wash with water and air dry. (Removal of solids: Separately request the disposal of solids as 'sludge' or 'organic sludge.')

② Designate the washing solution as 'dilute organic aqueous solution' liquid waste. (In a request for discharge via the Chemical Substance Management System, enter the plastic container washing solution as the group name in the remarks field, the presumed mixed component names and maximum quantity of the respective components.)

（2）**Red plastic containers** (excluding contamination with mercury):

① Thoroughly wash with acid (such as several moles of hydrochloric acid) to remove heavy metals completely, wash with water and air dry.

② Designate the washing solution as 'acid, chromium and heavy metal' liquid waste. (As with white containers, enter in the Chemical Substance Management System.)

（3）**Orange/blue plastic containers** (excluding contamination with mercury):

① Thoroughly wash with water and air dry.

② Designate the washing solution as 'cyanides, cyanide complex compound and arsenal compound' liquid waste. (As with white containers, enter in the Chemical Substance Management System.)

（4）**Gray plastic containers:**

① Gray plastic containers are collected as 'Hg plastics' without washing. However, designate liquid in the container as 'mercury and mercury compounds' liquid waste and separately request disposal.

Note 1: Handle 10-liter white plastic containers contaminated with heavy metals as red containers as described above.

Note 2: Handle white plastic containers contaminated with cyanides or arsenal compounds as orange/blue containers as described above.

Note 3: Handle other plastic containers contaminated with mercury as gray containers as described above.

Clearly write or label mercury-contaminated containers as [Mercury-contaminated] or the like at a readily visible location.

2） Waste silica

As for the method to request disposal in the Chemical Substance Management System, please refer to the section on ‘Used plastic containers’ on the previous page.

（1） Request disposal as ordinary sludge.

（2） Store waste silica in a thick, transparent plastic bag, and prevent the contents from leaking. The weight shall be limited to below 10 kg.

（3） Enter XX-adhered (absorbed) silica (gel) in the remarks field with the names of the adhered (absorbed) substances and their presumed quantity. Enter the gross weight. Classify it as glass, and enter the presumed water content.

（4） Separately store silica mounted on plates for thin-layer chromatography. (It is preferable to separate silica from plates wherever possible, and divide the materials into silica, glass plates, and aluminum plates for classified storage.) If silica remains on a plate, enter XX-adhered (absorbed) silica gel with glass (or aluminum) plate for thin-layer chromatography in the remarks field, and handle it as described above.

Optimum disposal methods shall be outsourced to and conducted by external contractors.

Follow similar disposal request procedures and collection methods for sludge. The date of collection will separately be notified by taking the requested disposal quantity into consideration. (The frequency of sludge collection and disposal is usually once in several years.)

For other sludge, also enter the names of adhered (absorbed) or possibly adhered (absorbed) hazardous substances and their presumed quantities in the remarks field. Be sure to enter the gross weight.

6. Disposal of liquid waste of unknown content

If there is a reagent, liquid waste, or solid waste of unknown content, outsource its disposal to external disposal waste contractors.

7. Other precautions

1) Waste

（1） Observe V-2 ‘Disposal of industrial waste.’

（2） When outsourcing the collection, transportation, or disposal of waste, in particular, follow the description from ‘outsourcing of disposal’ in the previous section. Registration in the manifest management of the Chemical Substance Management System is necessary.

（3） Polymerized acrylamide and media used in experiments shall be disposed of as industrial waste. (Never discard as general refuse.)

2) Laboratory safety

（1） Observance of 5S: Always maintain the laboratories and chemical substances in an organized state

① Conduct the 5S activity (Sort, Set in order, Scrub, Standardize, and Sustain).

② ‘Sort’ means ‘to distinguish necessary items from unnecessary ones and dispose of (discard) the latter.’

③ ‘Set in order’ means ‘to place necessary items in easy-to-understand and safe manner so that they can be taken out in required quantities at the required time.’

④ ‘Scrub’ means ‘to remove dirt and dust and suppress their occurrence, and to inspect the condition of facilities and fixtures.’

⑤ ‘Standardize’ means ‘to maintain the sorted, organized, and clean state mentioned above.’

⑥ ‘Sustain’ means ‘to promote a habit of carrying out the above activities (Sort, Set in order, Scrub, and Standardize).

（2） Local ventilators

① In principle, handle designated chemical substances in the draft chamber.

② Conduct necessary periodic and start-up inspections to ensure maximum performance of the draft chamber. Store the inspection record for the specified period.

③ Close the door of the draft chamber during experiments. If the door must be opened, open it only half way. Do not put your face in the chamber while conducting experiments.

④ Install exhaust gas treatment equipment in the draft chamber wherever possible.

（3） Assurance of evacuation routes

① Ensure a width of 80 cm or more for passageways in laboratories.

② Ensure that there are at least two entrances/exits for each room.

③ Do not leave items in the hallways and passageways.

④ Clearly indicate the evacuation routes.

（4） Emergency response

① Install shower units and eye washing devices for emergency, and confirm their locations.

② Always make gas masks (of the appropriate type), gloves, and safety goggles available.

（5） High-pressure gas cylinders

① Ensure that the total capacity of high-pressure gas cylinders does not exceed the level specified by applicable laws and regulations. Do not put in place unnecessary gas cylinders.

② Take fall prevention measures for gas cylinders. Make sure to stand them upright; do not

lay them down. When storing them upright, fix them at two locations using chains.

（6） Education on safety, use of procedure manuals, and storage of records

① Prepare work instructions and operation manuals, and always make them available. Emergency responses shall be described in the manuals. Store records for the specified time periods.

② Provide education on safety. Hazardous points shall be easily recognizable.

（7） Other precautions for laboratories

① Separate laboratories from living spaces. Eating and drinking in laboratories is strictly prohibited.

② Avoid connecting many devices to a single outlet via a power strip.

③ Prevent the risk of falls from high places.

3） Others

（1） Experiments require careful preparation. Always assume that experiments carry risk (burns, explosions, fires, etc.), and check for appropriate measures in the case of accidents (such as checking for evacuation routes) before starting any experiment. Also be prepared to take action against possible accidents.

（2） Wear gloves and safety goggles in the laboratory since foreign matter such as reaction solution spattering due to bumping may enter the eye. Exercise due caution since alkaline solutions or substances (such as ethylenediamine or sodium hydroxide) in particular may cause loss of vision. Safety goggles shall preferably be made of plastic. Wear a designated protective mask or gas mask as required.

（3） Wear a lab coat made of natural fibers such as cotton in the laboratory. Always wear clothes that are properly buttoned-up or suitable for experiments. Minimize skin exposure and be careful not to allow chemicals to adhere to the skin. Wear sneakers or other shoes that firmly catch the laboratory floor and are easy to move around in.

（4） Check glassware for any cracks before using it. Since glassware is easy to break, closely pay attention to handling to prevent cuts or other injuries. Since glass pipettes break quite easily, avoid handling them roughly.

（5） Place plastic trays below glassware or filtration equipment to prevent reaction liquids or filtrates from flowing into the sink even when they inadvertently fall.

（6） Glassware does not turn color even when heated. Be careful not to burn yourself on any hot glassware.

（7） Sufficiently check reagent names. Mix or add reagents in small quantities while observing the condition of the solution. Cool it if necessary.

（8） When heating a water bath (cold or hot) with a blowtorch, ensure that inflammable organic solvent (such as alcohol or acetone) is not placed in the surrounding area. Be careful not to allow any instrument such as a beaker to fall down into the water bath. If it falls down, be careful not to allow reaction liquid or hot water to spatter onto you. In principle, do not use heating equipment that generates a flame in the same room where organic solvents are used.

（9） Prepare designated liquid waste containers. Check them for any cracks or damage before commencing storage. Do not use excessively dirty containers. Remove dirt wherever possible. Check that containers are provided with ID cards and liquid waste container

number labels (barcode labels).

（10） Liquid waste containers deteriorate through long-time use. Deterioration accelerates if containers are subject to direct sunlight exposure and deterioration rate may vary depending on the chemicals stored. If you notice that a container has become hard or wall thickness has become thinner, do not use it.

（11） Properly treat liquid waste containing chemicals, place them in specified liquid waste containers and store them. Do not casually discard liquid waste into sewers. When the quantity reaches the specified level, take necessary measures. Do not store liquid waste over the specified quantity.

（12） Note that some types of liquid waste may cause explosions, intense reactions, or generation of toxic gas and may be very dangerous when mixed. Precipitates may form when some types of waste are mixed. Before mixing liquid waste, first mix them in small quantities and confirm there is no abnormal generation of heat. If possible, distinguish liquid waste containers for each experiment, and color-code them with stickers to prevent mix-ups. Dilute highly-concentrated liquids before storage to prevent accidents.

（13） Place a tray below liquid waste containers just in case liquid waste spills occur.

（14） Store filled liquid waste containers at specified places. (Some waste groups or contents may be designated as hazardous substances according to the Fire Service Act.)

（15） Since 20-liter plastic containers designated by contractors are borrowed items, handle them with care, and never use them for purposes other than the storage of liquid waste outsourced to the contractors for disposal.

（16） If a chemical enters the eye, thoroughly wash the eye and seek medical care from an ophthalmologist. If an alkali enters the eye, immediately wash the eye under running water for at least 10 minutes and seek medical care from an ophthalmologist.

（17） If a chemical adheres to the skin or you are burned, thoroughly wash the skin with water and seek medical care.

（18） Learn general first-aid skills for chemical poisoning, injury due to broken glass, and electric shock.