Piperazine Safety Paper

Handling of Piperazine Flakes

Delamine B.V., The Netherlands
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This document describes at some length what we believe our customers should know about Piperazine and outlines the preferred methods of handling and processing the material. We hope that the following pages will help boost safety at work at your site. Every effort has been made to cover the subject comprehensively, but even so you may find that you need some additional information, clarification, or assistance. If so, please do not hesitate to contact us at Market Development & Technical Services, Delamine:

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GENERAL

Piperazine is an organic chemical in the group of ethylene amines. Piperazine can be manufactured by the EDC route or the MEA (EO) route. Delamine uses the former to produce the full range of ethylene amines. EDC (ethylene dichloride) is reacted with ammonia to yield the full range of ethylene amines linked with hydrochloride (HCl). Next, the acid components are neutralized by the addition of caustic soda, which produces NaCl and ethylene amines.

One of the products, piperazine, is purified by means of distillation. The piperazine stream is then fed to a shaping unit to turn it into our well-known piperazine anhydrous flakes. The high-purity anhydrous piperazine is used in a wide variety of products, such as pharmaceuticals, polyamides, flame retardants, and oilfield chemicals.

INFORMATION ON HEALTH EFFECTS

1. Introduction

Piperazine has been extensively tested on laboratory animals under carefully controlled conditions. From the results of these tests it is possible to estimate the effects of piperazine on human health. Data are also available from medical applications, since piperazine and its salts have been in use for a long time as anthelmintics (treatment of intestinal parasites).

Piperazine is moderately toxic on ingestion, strongly irritant or even corrosive to skin and may cause skin and/or respiratory sensitization, so great care is required in its use. The principle requirement of handling systems is that they minimize exposure.

2. Risk Assessment, Classification, and Labelling

EU
Piperazine has been subject to an EU Risk Assessment. The final report was published in 2005 (http://ecb.jrc.it/esis/). The discussion of health hazards below is based on that report.

The resultant proposals for classification and labelling, which are different from the current classification and labelling in Annex 1 of the Dangerous Substances Directive, will be tabled and presumably accepted at the 30th ATP (date as yet uncertain). The new classification and labelling rules, discussed in more detail below, will be:

Classification	**R Phrases**	**S Phrases**
Repr. Cat. 3; R62- 63 C; R34 R42/43	34 - 42/43 - 62 - 63	1/2 - 22 - 26 - 36/37/39 - 45

The corresponding labels are:

Xn

C

Note: see Annex 8 for an explanation of the classification, R- and S-phrases.

GHS: In countries already switching to the GHS system for classification and labeling, and also in Europe as of end-of-2010, the following will apply:

Repr. 2	H361F (Suspected of damaging fertility.)
Repr. 2	H361d (Suspected of damaging the unborn child.)
Skin Corr. 1B	H314 (Causes severe skin burns and eye damage)
Resp. Sens. 1	H334 (May cause allergy or asthma symptoms or breathing difficulties if inhaled)
Skin Sens 1	H317 (May cause an allergic skin reaction)

The corresponding labels are:

R.O.W.
In countries with proprietary classification systems, the same hazards have been addressed in a similar fashion. The main distinction is the environmental hazard, which in some countries (e.g. Australia, Japan) is still equal to the EU classification with R52/53, as was the case in Europe prior to the 30th ATP.

3. Occupational Exposure Limits

The European Union has established an Occupational Exposure Limit (OEL) of 0.1 mg/m^3 for 8-hour exposure and 0.3 mg/m^3 for short-term exposures. This OEL was implemented in all EU member states by December 31, 2001. It should be noted that this limit does not necessarily offer sufficient protection to people who suffer from (occupational) asthma due to an allergy to piperazine. Less strict OELs may be in place in some other countries, but we recommend adhering to the above EU standard.

4. Acute Toxicity

Oral:
Piperazine has an oral LD_{50} of 1,900-4,500 mg/kg bodyweight in rats. This means that 50% of the test animals died when orally given the dose indicated. Piperazine is therefore moderately toxic when ingested. However, piperazine has been used in the treatment of worm infestations in humans. Doses of up to 75 mg/kg usually do not cause any adverse effects although transient effects such as nausea, vomiting, diarrhoea and lethargy may occur as well as allergic reactions in previously sensitized individuals.

Dermal
Piperazine has a dermal LD_{50} of 4,000 mg/kg bodyweight in rabbits. This means that 50% of the test animals died at the indicated dosage when applied in a solution to the skin. The results show that piperazine is moderately toxic in skin absorption. The solution may cause local burns, however. If the skin is exposed to piperazine flakes there will be no burns, unless the skin is moist.

Inhalation:
No data are available with respect to inhalation of piperazine. In view of the high pH in water, it is most likely that inhalation of high concentrations of piperazine vapour or dust will lead to strong irritation of the upper airways.

5. Irritation and Sensitization

Piperazine in water is strongly basic and will cause severe local irritation and even burns. Piperazine may cause skin sensitization, and may therefore give rise to allergic reactions such as eczema or rashes upon repeated exposure. People already sensitized to ethylene diamine – a common ingredient in cosmetics– may also respond to piperazine. Based on studies in factory workers, it is recognised that after repeated inhalation or after previous skin sensitization, piperazine may produce respiratory sensitization causing asthma. Piperazine will be classified in Europe as corrosive and as a sensitizer
(C; R34 R42/43).

6. Repeated Dose Studies

Piperazine was shown to be well tolerated in some animal studies when given for a prolonged period of time. A No-Observed–Adverse-Effect Level (NOAEL) of 25 mg/kg/day has been established in beagle dogs. Higher concentrations may lead to kidney and liver damage. In other animal species, especially felines, prolonged dosing with higher amounts of piperazine may lead to serious effects on the nervous system; this may also apply to humans, especially children, but a NOAEL has not been established for this endpoint.

7. Mutagenicity and Carcinogenicity

Piperazine does not cause changes in DNA structure when tested in bacteria, cell cultures, or live animals. Piperazine does not cause cancer when tested in animals. However, when given together with nitrites, DNA damage and tumours have been observed.

8. Reproductive Toxicity

Piperazine does cause malformations or stillbirths, but only if given to pregnant test animals at doses higher than those known to have other major adverse health effects. Therefore, piperazine will be classified in the EU as toxic to reproduction Cat 3, with R phrases R62–63. Piperazine will **not** be eligible for authorization under REACH.

INFORMATION ON ENVIRONMENTAL EFFECTS

1. Biotic and Abiotic Degradation

Piperazine is stable in water and is not "readily biodegradable". It is inherently biodegradable, i.e. it will be slowly eliminated from the environment.

2. Environmental Distribution

Piperazine is soluble in water and the Log K_{ow} is – 1.24. Therefore, piperazine is not expected to bioaccumulate. Based on the calculated $K_{air\text{-}water}$ of 9.3 * 10^{-6}, piperazine is expected to evaporate only moderately into the air from aquatic surfaces.

3. Acute Aquatic Toxicity

Piperazine has a No-Effect Concentration (NOEC) for inhibition of activated sludge of 540 mg/l. The NOEC for toxicity to algae is higher than 1,000 mg/l. The 48-hr EC50 to Daphnia Magna is 21 mg/l. The LC50 for fish is higher than 1,800 mg/l.

4. Chronic Aquatic Toxicity

The most sensitive species, Daphnia Magna, was tested for chronic toxicity. The 21-day NOEC is 12.5 mg/l.

Based on the above ecotoxicity data, piperazine will no longer be classified in the EU for ecotoxicology or absence of biodegradability. Updating the classification in other countries may take a considerable amount of time, though.

HANDLING OF PIPERAZINE FLAKES

1. Introduction

Ideally, all chemicals should be handled in closed systems, i.e. systems in which the chemicals remain securely contained in normal operating conditions. Piperazine is no exception to this rule.

2. Discharging Packed Piperazine

Piperazine is packed in 210-liter steel drums and 115-liter cardboard boxes. The 210-liter steel drums have PE-PA-PE inner liners. The 115-liter cardboard boxes have double MDPE inner liners. These package forms have to be discharged safely without exposing operators to unacceptable levels of piperazine dust and vapour.

2.1 Containment Level

As stated in the introduction, piperazine is a product that has to be handled carefully. The OEL value is 0.1 mg/m^3 air for 8 hours' exposure and 0.3 mg/m^3 for 15 minutes' exposure. Hence, the handling of piperazine is in the 0.1 – 0.5 mg/m^3 class. This means that discharging has to take place without operators coming into contact with piperazine. Discharging must be effected in closed discharging systems or in more open equipment placed in laminar flow booths.

2.2 Discharging 210-liter steel drums

2.2.1 **Complete discharging**

For this application, tipping equipment can be used. The tipping equipment must be totally closed or otherwise the tipping unit has to be placed in a laminar flow booth so that the operator cannot come into contact with piperazine. If tipping units are equipped with an exhaust and an air filtration unit that is provided with an absolute filter, no laminar flow booth is necessary.

Inner liners can be safely and dust-free processed to waste material in purpose-built equipment.

- Tipping units are available as hand-operated, semi-automated, and fully automated equipment. There are fixed and mobile types. Prices (2007 level) for basic equipment are 20 – 25 kEuro (SS 316L).

Before discharging, special attention must be paid to the inner liner(s) so that they do not come out during the discharging process. Methods used are:

- Empty the total drum/box in a machine in which the piperazine and the liner are separated and where the liner is safely processed to contained waste.
- Fold the liner round the drum/box and fasten it with a clamping strip. Then a hopper can be placed upside down on the drum/box. Subsequently, the whole device can be turned over.

For safe and dust-free piperazine handling, the first method is preferred because all process steps are combined in one machine. No flow booth is necessary. The second method does require a laminar flow booth.

Annexes 3, 4, and 5 show examples of tipping equipment, inner liner processing equipment, and a list of suppliers.

2.2.2 **Partial discharging**

Partial discharging – if only part of the content is to be used – can be done in different ways:

- *Complete discharging* into piperazine user's dosing system (See 2.2.1). There are fixed and mobile types. Prices (2007 level) for basic equipment: 20-25 kEuro.
- Partial discharging with a dosing system into piperazine user's system with a *tipping system* (this dosing is not accurate). Prices (2007 level) for basic systems are 15 kEuro. The system has to be placed upside down in a laminar flow booth that is provided with an air filtration system.
- *Exhaust/vacuum system* from piperazine boxes. There are closed and open systems. Because the system is under pressure, it is (relatively) safe for operators. The air used has to be filtered afterwards. There are fixed and mobile types. Prices (2007 level) for basic open systems: 6-7 kEuro.
- *Scooping by hand*. The box has to be placed in a laminar flow booth provided with an air filtration system.

For complete discharging and partial tipping systems the following applies. Before discharging, special attention must be paid to the inner liner(s), ensuring that they not come out during the discharging process. Methods used are:

- *Complete discharging in dosing system*: empty the total drum/box in a machine in which the piperazine and the liner are separated and where the liner is safely processed to contained waste. For safe and dust-free piperazine handling this method is preferred because all process steps are combined in one machine.
- *Partial tipping*: fold the liner round the drum/box and fasten it with a clamping strip. Then a hopper can be placed upside down on the drum/box. Subsequently, the whole device can be turned over. For this method a laminar flow booth is necessary.

Annexes 6 and 7 show examples of partial discharging equipment and a list of suppliers.

2.3 Discharging 115-liter cardboard boxes

2.3.1 **Complete discharging**

For this application, tipping equipment can be used. The tipping equipment must be totally closed or otherwise the tipping unit has to be placed in a laminar flow booth so that the operator cannot come into contact with piperazine. If tipping units are equipped with an exhaust and an air filtration unit provided with an absolute filter, no laminar flow booth is necessary.

- Tipping units are available as hand-operated, semi-automated, and fully automated equipment. There are fixed and mobile types. Prices (2007 level) for basic equipment are 20 – 25 kEuro (SS 316L).

Before discharging, special attention must be paid to the inner liner(s) so that they do not come out during the discharging process. Methods used are:

- Empty the total drum/box in a machine in which the piperazine and the liner are separated and where the liner is safely processed to contained waste.
- Fold the liner round the drum/box and fasten it with a clamping strip. Then a hopper can be placed on the drum/box. Subsequently, the whole device can be turned over.

For safe and dust-free piperazine handling, the first method is preferred because all process steps are combined in one machine. No flow booth is necessary. The second method does require a laminar flow booth.

Annexes 3, 4, and 5 show examples of tipping equipment, inner liner processing equipment, and a list of suppliers.

2.3.2 **Partial discharging**

Partial discharging – if only part of the content is to be used – can be done in different ways:

- *Complete discharging* into piperazine user's dosing system (See 2.3.1). There are fixed and mobile types. Prices (2007 level) for basic equipment are 20-25 kEuro.
- Partial discharging as a dosing system into piperazine user's system with a *tipping system* (this dosing is not accurate). Prices (2007 level) for basic systems are 15 kEuro. The system has to be placed upside down in a laminar flow booth provided with an air filtration system.
- *Exhaust/vacuum system* of piperazine boxes. There are closed and open systems. As the system is under pressure, it is (relatively) safe for operators. The air used has to be filtered afterwards. There are fixed and mobile types. Prices (2007 level) for basic open systems are 6-7 kEuro.
- *Scooping by hand*. The box has to be placed in a laminar flow booth provided with an air filtration system.

For complete discharging and partial tipping systems the following applies: before discharging, special attention must be paid to the inner liner(s), ensuring that they do not come out during the discharging process. Methods used are:

- *Complete discharging in dosing system*: empty the total drum/box in a machine in which the piperazine and the liner are separated and where the liner is safely processed to contained waste. For safe and dust-free piperazine handling, this method is preferred because all process steps are combined in one machine.
- *Partial tipping*: fold the liner round the drum/box and fasten it with a clamping strip. Then a hopper can be placed upside down on the drum/box. Subsequently, the whole device can be turned over. For this method a laminar flow booth is necessary.

Annexes 6 and 7 show examples of partial discharging equipment and a list of suppliers.

2.4 Equipment supplier selection criteria

The suppliers listed in Appendices 3 - 7 have experience in handling hazardous and pharmaceutical chemicals. Selection criteria when choosing a supplier are:

1) Point out to the supplier that solid piperazine has high vapour pressure and sublimating properties. Sublimation is solidification of vaporous piperazine (preferably on cold spots).
2) Choose supplier(s) that can show references for products from the same hazard class as piperazine.
3) Choose supplier(s) that offer you tests at their test facilities.

Delamine would be pleased to provide further information and share their supplier experiences with you, to the best of their knowledge.

3. Airborne Piperazine

Various countries around the world set exposure limits for chemicals. These are concentrations in air which are believed to cause no harm to human health. As noted above, there is an EU-wide OEL of 0.1 mg/m^3 and a short-term exposure limit of 0.3 mg/m^3. This means that the authorities believe that over an eight-hour shift, the average concentration of piperazine in the air should not exceed 0.1 mg/ m^3 whereas the 0.3 limit applies to an average exposure for 15 minutes.

Delamine would be pleased to provide further information on suitable procedures for measurement of piperazine concentrations in air, to the best of their knowledge.

Piperazine easily evaporates, so if flakes are spilt they will produce vapours in the air. For this reason, spillage should be cleaned up immediately. Good ventilation and local exhaust systems must be present wherever Piperazine flakes are handled.

Ask Delamine in case you need more information on this topic.

4. Personal Protection

Neoprene gloves and boots and safety goggles should be worn when handling piperazine. If leather articles (shoes, belts, watch straps, etc.) are contaminated, they must be taken off and destroyed, since piperazine will be absorbed by the leather and cannot be removed. If contaminated items continue to be worn there is a real risk of skin burns.

Approved respirators should be worn when piperazine is present in the air at more than 1 part per million. These should have organic vapour or ammonia/amines-approved cartridges. Self-contained or supplied air respiratory equipment may also be worn.

5. First Aid

NOTE TO DOCTORS:

Most times you will not be the first to arrive on the scene of accidents or spills. Someone else will give first aid, and you will then be consulted if the patient was exposed to high quantities and/or when symptoms persist.

There is no specific antidote for ethylene amines. Treatment of overexposure depends on the symptoms and on the patient's clinical condition.

Due to the corrosive nature of ethylene amines, swallowing may lead to ulceration and inflammation of the upper alimentary tract, with haemorrhaging and fluid loss. Perforation of the oesophagus or stomach may also occur. This may lead to mediastinitis or peritonitis. The products aspirated during vomiting may cause lung injury, so that emesis should not be induced mechanically or pharmacologically. If it is necessary to evacuate the stomach, do so by means least likely to cause aspiration, such as gastric lavage after endotracheal intubation.

Exposure to vapours may cause a minor transient oedema of the corneal epithelium. This condition, known as glaucopsia (blue or blue-grey haze), produces a blurring of vision against a general bluish haze and the appearance of haloes around bright objects. This effect disappears spontaneously within a few hours after the end of the exposure and leaves no sequela. Although not detrimental to the eyes per se, glaucopsia predisposes an affected individual to physical accidents and reduces the ability to undertake skilled tasks.

5.1 First Aid after Swallowing

If the patient is fully conscious, give two glasses of water at once after having rinsed the mouth. DO NOT induce vomiting. Seek medical advice without delay.

5.2 First Aid after Inhalation

Take the person to fresh air. Let him rest in a sitting position. Give artificial respiration if not breathing. When breathing is laboured, oxygen may be given. Always seek medical advice after significant exposure.

5.3 First Aid after Skin Contact

Remove all contaminated clothing and shoes immediately. Rinse with plenty of water for at least 15 minutes. Always seek medical advice. Wash contaminated clothes with **plenty** of water. Discard contaminated shoes.

5.4 First Aid after Eye Contact

Rinse eyes immediately and as long as possible with plenty of water. Eyelids should be held away from the eyeball to ensure thorough rinsing.
Contact lenses: Depending on locale, conflicting advice may be given with respect to removal of contact lenses. Please check out and folow the prevailing medical opinion in your country. However, whatever the national preference, do not waste time in trying to remove contact lenses if the eye closure reflexes are so strong that the eye cannot be opened sufficiently for lens removal (as is often the case with caustic substances). In such cases, rinsing should be initiated as quickly as possible DO NOT remove contact lenses.
Always seek medical advice without delay (if possible consult an eye specialist).

5.5 First Aid (General)

Due to the corrosive nature of ethylene amines it is essential that adequate first aid measures should be taken immediately after contact with the product. It is important that personnel has been trained well to give the right first aid within seconds after the exposure. Persons administering first aid should be mindful of their own safety. Always consult a doctor when the exposure is significant or symptoms persist.

Give the company doctor a copy of this chapter and of the "Hazards Identification" and "Human Health and Animal Toxicity" chapters in our Product Stewardship Manual.

Note that contaminated clothes must be washed with plenty of water. It is our experience that when the clothes are cleaned with little water or through dry cleaning, some ethylene amine may remain in the textile and cause skin irritation when the clothes are worn again. So when in doubt check as follows. Leave the cleaned garment in a small amount of water for 15 to 30 minutes, then determine the pH of the water. There is no residual contamination if the pH is unchanged.

6. Accidental Release Measures

6.1 Personal Protection

Wear suitable personal protection, as specified in the chapter on Handling of Piperazine Flakes, page 9.

6.2 Environmental Precautions

Avoid discharge to sewers and surface water. Prevent contamination of ground water.

6.3 Methods of Cleaning Up

- *Large spills*:
  Contain with a dike and pump into suitable, properly labelled containers for reuse or disposal.
- *Moderate spills*:
  Absorb with sand and put into a suitable and properly labelled container for disposal. Flush the remainder with plenty of water.
- *Small spills*:
  Flush with large amounts of water.

7. General Comments

Do not eat, drink, or smoke whilst handling piperazine. High standards of skin care and personal hygiene should be maintained at all times.

Maintenance
Great care should be taken to ensure that all equipment is decontaminated before maintenance work is undertaken.

Conclusion
Although piperazine has the potential of having serious effects on human health, no ill effects will occur if suitable precautions are taken.

DETECTION METHODS

This section briefly outlines the piperazine detection method to ascertain piperazine exposure values in the workplace. More information is available from Delamine.

Method	:	Piperazine dust levels
Code	:	DEL 160
Remark	:	Handling of solid piperazine often involves the generation of fine dust in the ambient air.
Description	:	An air sampling pump feeds its intake of ambient air through a sulphuric acid solution. Any piperazine in the air is readily absorbed by the solution, which is subsequently titrated with m-Toluyl chloride. The derivative products formed in the process are extracted and analyzed by HPLC.
Equipment	:	Air sampling pump (e.g. SIPIN SP-103) Reversed-phase HPLC unit

STORAGE AND SHELF LIFE

Delamine ships its piperazine from Delfzijl in two different containers:

- 210-liter steel drums (net wt. 100 kg)
- 115-liter square cardboard boxes (net wt. 50 kg)

Store in a dry, well-ventilated place away from direct sunlight and other sources of heat. The minimum product shelf life is 12 months. However, tests have shown that much longer storage need cause no degradation.

EMERGENCY RESPONSE SYSTEM

Delamine products are distributed the world over by all means of transport. Despite our and your prevention efforts, accidents during transport, storage, and use of these products may happen.

Delamine accepts its responsibility as a manufacturer of these products and will render emergency support through Akzo Nobel Chemicals' Emergency Response System, operated from Deventer, the Netherlands.

CEFIC, The European Federation of Chemical Industries, has issued a guideline on distribution emergency response under the Responsible Care initiative. In Europe, the emergency response is coordinated by CEFIC's International Chemical Environment (ICE) system. The CEFIC guideline recognizes the following three response levels:

Level 1	:	Availability of information on safety data sheets (SDS)
Level 2	:	Availability of specialized product knowledge and emergency experience
Level 3	:	Availability of an intervention team equipped for on-the-spot control of chemical emergencies

The HSE department of Akzo Nobel Chemicals Deventer provides desk support for all company products (including Delamine products). It can be reached 24 hours a day at:

+ 31 570 67 9211

In the United States, call Chemtrec at **1 800 424 9300** for assistance in traffic accidents, spills, or other emergencies.

ANNEX 1 : Bibliography

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PIP: **Environmental Properties**

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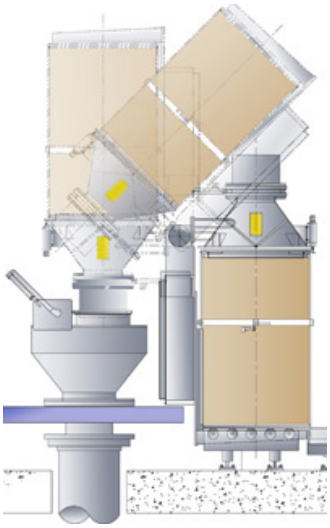
ANNEX 2 : Piperazine SDS

ANNEX 3 : Complete discharging of 210-liter drums and 115-liter boxes

Examples of equipment

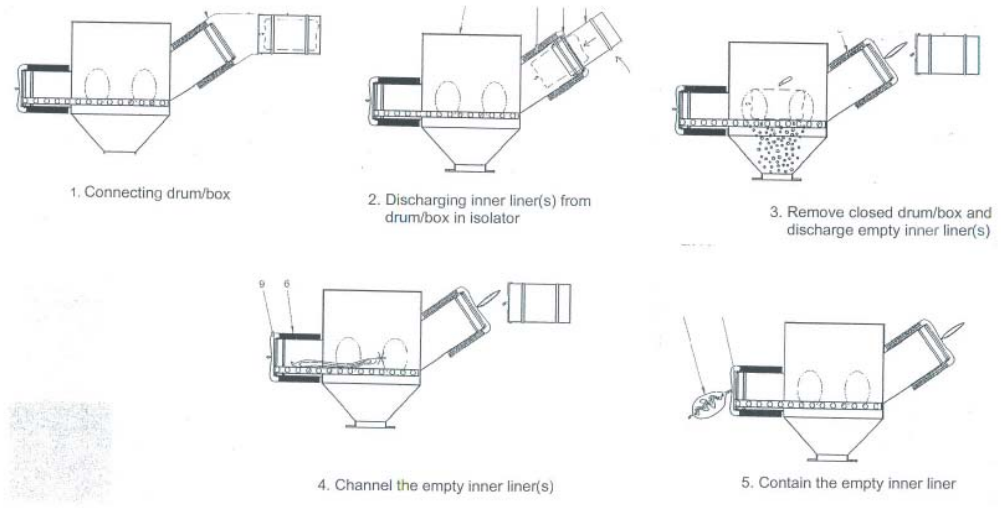
Note that all equipment must be placed in a laminar flow booth.



Tipping equipment

Laminar flow booth (example)

ANNEX 4 : Dust-free PE inner liner processing



Scheme of processing drum/box and PE inner liner

Densifier for empty PE inner liners, can be connected to drum/box discharging unit

ANNEX 5 : List of suppliers of discharging equipment

List of suppliers of dust-free liner processing equipment:

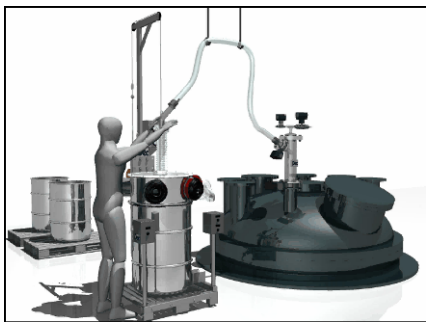
- Dinnissen, Sevenum, Netherlands, www.dinnissen.nl
- Hecht, Pfaffenhofen, Germany, www.hecht-anlagenbau.de

There are more suppliers of liner processing equipment, but these two offer the facility as an integrated part in their drum/box discharging equipment.

List of suppliers of discharging equipment:

- Dinnissen, Sevenum, Netherlands, www.dinnissen.nl Costs simple system RVS 316L 20 - 25 kEuro
- Flexicon Europe, Herne Bay, Kent, UK, www.flexicon.co.uk Costs simple system RVS 316L 20 - 25 kEuro
- Hecht, Pfaffenhofen, Germany, www.hecht-anlagenbau.de Costs simple system RVS 316L 20 - 25 kEuro
- PalPharma, Chesterfield, UK, www.palpharma.com Costs simple system RVS 316L 20 kEuro
- J-Tec, Kapellen, Belgium, www.j-tec.com
- Hosokawa, Ellend, West Yorkshire, UK, www.hosakawa.co.uk
- Morse Inc.,East Syracuse, US, www.morsemfgco.com
- Pharmatech, Coleshill, Warwickshire, UK, www.pharmatech.co.uk

ANNEX 6 : Partial discharging of 210-liter drums and 115-liter boxes



Contained vacuum system

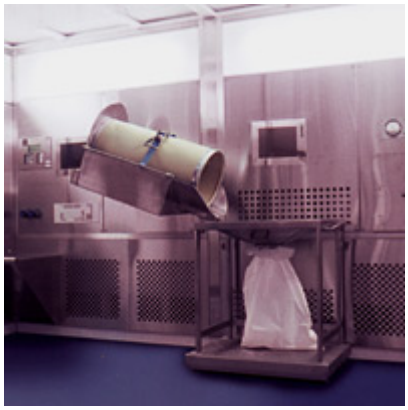
Open vacuum system

Note that this equipment has to be placed in a laminar flow booth.

ANNEX 7 : Partial discharging of 210-liter drums and 115-liter boxes

Pouring systems

Note that this equipment has to be placed in a laminar flow booth.



Pouring system in laminar flow booth. Remote-controlled.

List of suppliers of partial discharging units

Exhaust/vacuum system:

- Dietrich Engineering Consultants, Ecublens, Switzerland, www.dec-sa.com
- Helios, Rosenheim, Germany, www.helios-systems.de
  Costs approx 6 kEuro
- Flexicon Europe, Herne Bay, Kent, UK, www.flexicon.co.uk
  Refers to Helios, but is mentioned here because of better process knowledge

Tipping/pouring system

- Hecht, Pfaffenhofen, Germany, www.hecht-anlagenbau.de
- PalPharma, Chesterfield, UK, www.palpharma.com
  Costs simple system SS 316L 15 kEuro
- Flexicon Europe, Herne Bay, Kent, UK, www.flexicon.co.uk
- Hosokawa, Ellend, West Yorkshire, UK, www.hosakawa.co.uk
- Morse Inc.,East Syracuse, US, www.morsemfgco.com
- Pharmatech, Coleshill, Warwickshire, UK, www.pharmatech.co.uk

ANNEX 8 : Classification and Labeling: explanation of codes

Classification	**R Phrases**	**S Phrases**
Repr. Cat. 3; R62-63 C; R34 R42/43	34 - 42/43 - 62 - 63	1/2 - 22 - 26 - 36/37/39 - 45

Repr. Cat 3: Substances which cause concern for human fertility, generally on the basis of:
- results in appropriate animal studies which provide sufficient evidence to cause a strong suspicion of impaired fertility in the absence of toxic effects, or evidence of impaired fertility occuring at around the same dose levels as other toxic effects, but which is not a secondary non-specific consequence of the other toxic effects, but where the evidence is insufficient to place the substance in category 2,
- other relevant information.
Or
Substances which cause concern for humans owing to possible developmental toxic effects, generally on the basis of:
- results in appropriate animal studies which provide sufficient evidence to cause a strong suspicion of developmental toxicity in the absence of signs of marked maternal toxicity, or at around the same dose levels as other toxic effects but which are not a secondary non-specific consequence of the other toxic effects, but where the evidence is insufficient to place the substance in category 2,
. other relevant information.

R62 Possible risk of impaired fertility. To be applied if Cat. 3 toxic to reproduction is applicable.

R63 Possible risk of harm to the unborn child.. To be applied if Cat 3 toxic to development is applicable.

C: Corrosive : a substance or a preparation is considered to be corrosive if, when it is applied to healthy intact animal skin, it produces full thickness destruction of skin tissue on at least one animal during the test for skin irritation cited in Annex V or during an equivalent method,

R34 Causes burns:
if, when applied to healthy intact animal skin, full thickness destruction of skin tissue occurs as a result of up to four hours exposure, or if this result can be predicted,

R42/43: May cause sensitisation by inhalation/ May cause sensitisation by skin contact
To be applied
. if there is evidence that the substance or preparation can induce specific respiratory hypersensitivity,
. where there are positive results from appropriate animal tests/
- if practical experience shows the substance or preparation to be capable of inducing a sensitisation by skin contact in a substantial number of persons, or
. where there are positive results from an appropriate animal test.

S-phrases:
S1/2: Keep locked up / keep out of the reach of children
S22: Do not breathe dust
S26: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice
S36/37/39: Wear suitable protective clothing / Wear suitable gloves / In case of insufficient ventilation, wear suitable respiratory equipment
S45: In case of accident or if you feel unwell seek medical advice immediately (show the label where possible