Ruse Chemicals

SAFETY DATA SHEET
In compliance with Regulation (EC) 1907/2006/EC

MALEIC ANHYDRIDE

No: 2 / Date of issue: 1.03.2014 Revision date: 11.05.2016 Version: 02

1. IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND THE COMPANY/ENTERPRISE

1.1. Identification of the product:
1.1.1. Substance

Trade name of the substance	MALEIC ANHYDRIDE (flakes, melt)
Chemical name of substance	MALEIC ANHYDRIDE
IUPAC name	furan-2,5-dion
Index №	607-096-00-9
EC (EINECS) №	203-571-6
Registration number under REACH	01-2119472428-31-0022
Reference number under CLP	02-2119835167-36-0000
CAS №	108-31-6

1.2. Identified uses of the substance or mixture that are of importance, and uses that are not recommended
Identified uses
Manufacture of substance (flakes; low dustiness)
Use as a monomer in polymer production(flakes; low dustiness)
Industrial use as an intermediate (flakes; low dustiness)
Manufacture of substance(melting; 77°C)
Use as a monomer in polymer production (melting; 77°C)
Industrial use as an intermediate (melting 77°C)

1.3. Details of the supplier of the safety data sheet
“RUSE CHEMICALS” AD
Republic of Bulgaria
7000 Ruse
133, Bulgaria blvd.
Tel: +359 82 / 886-455
Fax: +359 82 / 886-455
E-mail address: rositsa.georgieva@orgachim.bg

1.4. Emergency Phone
Unified emergency number: 112
National Toxicology Information Center, Institute for Emergency Medical Care "Pirogov":
Emergency telephone and fax +359 2 9154 409
E-mail: poison_centre@mail.orbitel.bg
http://www.pirogov.bg

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2. HAZARDS DESCRIPTION

2.1. Classification of the substance or mixture

Classification under Regulation (EC) 1272/2008/EC (CLP)

Acute Tox. 4	H302
Skin Corr. 1B	H314
Resp. Sens. 1	H334
Skin Sens. 1	H317

For the full text of H-phrases declared above, see Section 2.2. and Section 16.

2.2. Label elements

Product identifiers	Trade name: MALEIC ANHYDRIDE Index №: 607-096-00-9

Hazard pictograms:

GHS07 (exclamation mark) GHS08 (Health hazard) GHS05 (Corrosion)



Signal word: Danger

Hazard Warnings:	
H302	Harmful if swallowed.
H314	Causes severe skin burns and eye damage.
H334	May cause allergic or asthmatic symptoms or breathing difficulties if inhaled
H317	May cause allergic skin reaction.
Safety precautions:	
P301+P312	IF SWALLOWED: Immediately contact the POISON CENTER or doctor/physicin if you feel unwell

P260	Do not breathe dust/fume/gas/mist/vapours/spray.
P280	Use protective gloves / protective clothing / goggles / protective face mask.
P305+P351+P338	EYE CONTACT: Rinse thoroughly with water for several minutes. Remove contact lenses, if any, as far as possible. Continue rinsing.
P342+P311	When symptoms of breathlessness: Contact the CENTER OF TOXICOLOGY, or a doctor.
P333+P313	In case of skin irritation or skin rash: Seek medical advice / attention.

2.3. Other hazards
Criteria for PBT or vPvB: Maleic anhydride is readily biodegradable and does not meet the criteria for PBT or vPvB**.**
Other dangers of substance that do not affect the classification:
In case of fire, can emit toxic or irritant gases that may pollute the air.

3. COMPOSITION / INFORMATION ON INGREDIENTS

3.1. Substances
3.1.1. Chemical identity of the substance: MALEIC ANHYDRIDE

Index No:	607-096-00-9
EC (EINECS) No:	203-571-6
Pre-registration number under REACH	01-2119472428-31-0022
CAS No:	108-31-6

3.1.2. Other dangerous ingredients in the composition of the substance

CAS No	EC No	Index No	% (mass)	Name	Classification (Regulation) 1272/2008/CLP)
108-31-6	203-571-6	607-096-00-9	≥ 99,3	Maleic anhydride	Acute Tox. 4 (*); H302 Skin Corr. 1B; H314 Resp. Sens. 1; H334 Skin Sens. 1; H317
85-44-9	201-607-5	607-009-00-4	≤ 0,7	Phthalic anhydride	Acute Tox. 4 (*); H302 STOT SE 3; H335 Skin Irrit. 2; H315 Eye Dam. 1; H318 Resp. Sens. 1; H334 Skin Sens. 1; H317

3.2. Mixtures
Not applicable, the product is a substance.

3.3. Additional information
For the full text of R-and H-phrases stated herein above, see Section 16.
Exposure Limits in work environment, if any, are listed in Section 8.

4. FIRST AID MEASURES

4.1. Description of first aid measures

General Information
In case of inhalation, skin burns from molten product, eye contact, seek immediately medical help.
Immediately take off contaminated clothes and shoes.
If you experience health problems or if you suspect your health could be affected, consult a physician and provide it with information from this safety data sheet.
To maintain vital functions until medical help arrives, it is necessary to check the pulse of the sufferer, to do artificial respiration, heart massage. If the person has lost consciousness or if you consider he can lose consciousness, transport him to a hospital. In the case of first-degree burns (painful red spots) and second degree burns (painful blisters), cool the affected area in a stream of cold water. In the case of third degree burns (black dots, loose pale skin, usually painless), do not cool the affected area and cover it with a clean cloth. The sufferer must not lose their body heat.

After inhalation
Solid maleic anhydride (flakes)
Remove to fresh air. In case of doubt, that there is still dust in the air from the product, the person providing first aid must wear appropriate mask or self-contained breathing apparatus. Keep the sufferer warm and at rest.
If breathing has stopped or is difficult, give artificial respiration by a trained person or put him a breathing apparatus. Breathing "mouth to mouth" may be dangerous for the first aid provider. Seek immediate medical attention.
If unconscious, place in recovery position, loosen any clothing (eg, collar, tie, belt) and seek immediate medical attention. Avoid further exposure.

Liquid maleic anhydride (melt)
Remove people from the danger zone without endangering their safety. Remove the sufferer to fresh air. If breathing is difficult, put him a breathing apparatus, make him rest and keep warm. Seek medical attention.

After skin contact
Solid maleic anhydride (flakes)
Remove clothing and footwear. Immediately wash skin thoroughly with soap and water for 10-15 minutes. If signs of irritation occur, seek medical attention. Before second use, wash the contaminated clothing.
Liquid maleic anhydride (melt)
Upon burning with liquid maleic anhydride, cool with water and bandage with a sterile bandage. Do not remove the bark of the product, which probably formed on the skin either by force or by any solvents. Seek immediate medical attention.

After eye contact
If maleic anhydride in some form contact eyes (even small amounts destruct the tissue), rinse immediately with large amounts of running water. Do not let the sufferer rub their eyes or keep them closed. Remove contact lenses. Start a

prolonged (at least 30 minutes) rinsing with clean water, pulling the eyelid with the thumb and forefinger and move eyes in all directions. Then bandage eyes and take the sufferer immediately to an ophthalmologist.

Ingestion
Rinse mouth thoroughly with water. Remove the sufferer to fresh air. Keep him warm and at rest. If the sufferer is conscious, give him drink small amounts of water. Stop if he starts vomiting. It can be dangerous.
Do not induce vomiting. If the sufferer starts to vomit, bend his head to avoid running the content in the lungs. Seek medical attention.
Never try to give anything by mouth to an unconscious person. If unconscious, place in recovery position, loosen any clothing (eg, collar, tie, belt) and seek immediate medical attention.

4.2. Most significant acute and subsequent symptoms and effects
***Inhalation*:** Irritation of mucous membranes, cough. Irritation caused by inhalation of dust can cause asthma, especially in people who are predisposed or previously had asthma symptoms. Such persons or persons who are prone to allergies should not work in places where they may experience air pollution from dust or vapors of maleic anhydride.
Skin contact: Causes severe burns to the skin.
Eye contact: Causes serious damage to the eyes.
Ingestion: Not available.
A prolonged contact of the eyes, mucous tissues and wet skin with a solid maleic anhydride, can cause surface burns. Repeated contact may lead to inflammation, chronic disturbances of vision, invasion of blood or abscess of the nasal mucosa.

4.3. Indications for the need of any urgent medical care and special treatment
Information for healthcare professionals
There is no specific antidote. Treatment of overexposure should be directed to control the symptoms and patient clinical treatment.
Medical monitoring is necessary for 24 hours at least.

The following protection means should be available at the workplace:
Eye bath, sterile bandages.
Protective face masks, self-contained breathing apparatus and protective gloves.
Fire suits with with hoods for head and back glass for the hood.
Extinguishing blankets.
Stretcher.

5. ANTI-FIRE MEASURES

5.1. Extinguishing Media
Suitable extinguishing media
Small fires: Extinguish with a finely dispersed water, water mist, carbon dioxide, dry chemical powder or alcohol resistant film forming foam.
Large fires: Alcohol resistant film forming foam, water mist or water jet spray, inert gases (nitrogen, carbon dioxide). Fight fire from a safe distance.
Cool containers with abundant amounts of water to extinguish the fire. Beware of falling water inside containers.
Unsuitable extinguishing media
Thick water.

5.2. Specific hazards arising from the substance or mixture
Maleic acid and maleic anhydride may form, mostly with iron, pyrophoric products, which at increased temperature may self-ignite. Therefore, on leaking of the product onto iron apparatus and hot piplines (heating), the place must be thoroughly cleaned with water. When entering a maleic anhydride in the insulating material of the apparatus, there is danger of spontaneous combustion.
During the fire, irritating and highly toxic gases from thermal decomposition or combustion may release.
Carbon dioxide - a drug. Irritating to respiratory system, violates the activities of the central nervous and cardiovascular system. At high concentrations, hardens breathing.
Carbon monoxide - poison. Displaces oxygen from the blood oxyhaemoglobin forming carboxyhaemoglobin, which leads to oxygen deficiency.
Dust can be explosive when exposed to heat or flame.

5.3. Advises for firefighters
Wear self-contained breathing apparatus and protective fireman's clothing including boots, overalls, gloves.
Upon ignition of clothing, the sufferer should be covered with a blanket for fire choking the fire.

Additional information
Quickly isolate the area of the accident. Bring people away.
Remove all sources of fire: eg open fire, lit cigarettes, sparks from tools and equipment.
The product burns after ignition. Vapor from maleic anhydride form with air explosive mixtures. By using an inert gas the danger of spontaneous combustion may be removed. Use an inert gas also in extinguishing fires in tanks containing molten maleic anhydride.
Dispose contaminated extinguishing water in accordance with the statutory requirements. Do not empty into drains.

6. ACCIDENTAL RELEASE MEASURES

6.1. Personal precautions, protective equipment and emergency procedures
Isolate the place of accident.
Do not allow entry to unnecessary or unprotected personnel.
Do not eat, drink or smoke while cleaning up.

For non-emergency staff
- Wear appropriate personal protective equipment (including personal protective equipment specified in Section 8 of MSDS) to prevent contamination of skin, eyes and personal clothing. Avoid contact with skin and eyes.
- Remove sources of ignition, provide adequate ventilation.
- Avoid dust formation. Provide access to fresh air indoors.
- In case that an emergency evacuation is needed from danger area or consultation with an expert.

For emergency staff
Wear chemical resistant protective suit, chemical resistant gloves.

6.2. Environment protection
Do not allow any product to drain in plumbing and water sewage, surface water and groundwater and soil.

Take precautions for the safe collection, transportation and disposal.

6.3. Methods and materials to containment and cleaning up
In the event of an accident and/or product spillage take measures to locate and limitate it. At temperature under 50°C, maleic anhydride turns into solid state. Collect spilled maleic anhydride so as not to powder in the air. Do not return spilled material back into the original packaging. Provide ventilation. Scrape with non-sparking tools. Scrape up collected amount and temporarily store in special sealable and labeled containers, and then inform the competent persons / authorities.
Contaminated materials should be considered as waste as described in Section 13 of this safety data sheet.

6.4. Reference to other sections
See Section 1 for information about Emergency phone number.
See Section 8 for Personal protective equipment.
See Section 13 for information about waste disposal.

7. HANDLING AND STORAGE

7.1. Precautions for safe handling
7.1.1. Recommendations

- Observe the usual precautions for handling chemicals. Ensure adequate ventilation. Do not exceed the concentration limits set forth in Section 8.
- When working in places where there may be both dust and vapor of maleic anhydride wear self contained breathing apparatus.
- People with skin problems that are prone to allergies, and persons with recurrent respiratory diseases and asthma symptoms should not work in places where they may experience air pollution from dust or vapors of maleic anhydride.
- Keep away from open flames, sparks and heat. Use only non-sparking tools and equipment. Ensure safe discharge of static electricity. This product can easily ignite from electrostatic discharge. Observe the fire prevention measures.
- Do not allow any release of the substance during loading and unloading. Prevent any eventual spills or contamination in drains.

7.1.2. Tips for general work hygiene

- Do not smoke and eat and drink in the workplace.
- Remove contaminated clothing and protective equipment before entering the dining places.
- Wash hands and face before eating, drinking and smoking.
- Avoid direct contact with maleic anhydride! Wash full after working therewith. Contaminated clothing or shoes should be immediately changed to avoid corrosion caused by maleic acid.

7.2. Conditions for safe storage, including incompatibility

- Protection from humidity. Store in a covered and dry warehouses, away from direct sunlight.
- Take precautions for safe storage in tightly closed original containers, out of reach of children and other unauthorized persons.

- Melted maleic anhydride must be stored in tanks made of stainless steel, that could be heated, under nitrogen blanket at temperatures between 65 and 75 °C.
- Packages should be marked with original manufacturer's label.
- Store only in sealed containers. Packages that have been opened must be carefully closed and kept upright to avoid leakage / spillage of product.
- Warehouses should be well ventilated. Wear appropriate respirator when ventilation is inadequate.
- Do not store with food, drink or feed.

Solid maleic anhydride (flakes)

- Protect from moisture.

Liquid maleic anhydride (melt)

- Store between the following temperatures: (53 ÷ 77)ºC.

7.3. Specific end use(s)

Manufacture of substance (flakes; low dustiness)
Use as a monomer in polymer production(flakes; low dustiness)
Industrial use as an intermediate (flakes; low dustiness)
Manufacture of substance(melting; 77°C)
Use as a monomer in polymer production (melting; 77°C)
Industrial use as an intermediate (melting 77°C)

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1. Control parameters

Data on the limits of occupational exposure, according to Directive 98/24/EC, Directive 2006/15/EC and Directive 2004/37/EC have been introduced in the Republic of Bulgaria with Regulation No13 of the Ministry of Labour and Social Policy (MLSP) and the Ministry of Health (MoH).

8.1.1. Limits of chemical agents in air at the workplace, according to Regulation No 13 of MLSP, MH

Agent's Name	EC №	CAS №	Limit values to professional exposure		Specific Effects
			For 8 hours	For 15 minutes	
Maleic anhydride	203-571-6	108-31-6	1,0 mg/m^3	-	
Phthalic anhydride	201-607-5	85-44-9	6,0 mg/m^3	-	

8.1.2. PNEC & DNEL values: In Water, maleic anhydride hydrolyzes to maleic acid.

DNEL values

	DNEL for the workers				DNEL for the population			
Exposures	Acute local effects	Acute system effects	Chronic local effects	Chronic system effects	Acute local effects	Acute system effects	Chronic local effects	Chronic system effects

Oral					There is no consumer exposure to maleic anhydride. Reaction of maleic anhydride in polymers is complete. Beyond this if there were any residual monomeric maleic anhydride it would hydrolyse to form to maleic acid.
Inhalation	0,8 mg/m^3	0,8 mg/m^3	0,4 mg/m^3	0,4 mg/m^3	There is no consumer exposure to maleic anhydride. Reaction of maleic anhydride in polymers is complete. Beyond this if there were any residual monomeric maleic anhydride it would hydrolyse to form to maleic acid.
Dermal	0,8 mg/m^3	0,8 mg/m^3	0,4 mg/m^3	0,4 mg/m^3	There is no consumer exposure to maleic anhydride. Reaction of maleic anhydride in polymers is complete. Beyond this if there were any residual monomeric maleic anhydride it would hydrolyse to form to maleic acid.

PNEC values

Environmental Protection, purpose	**PNEC**
Fresh water	0,04281 mg/l
Sediment fresh water	0,0334 mg/kg
Sea water	0,004281 mg/l
Sediment sea water	0,0334 mg/kg
Food chain	
Microorganisms in wastewater treatment plant	44,6 mg/l
Periodical release	0,4281 mg/l
Soil	0,0415 mg/kg
Air	

8.2. Exposure Control
Observe the usual precautions for handling chemicals.
Avoid generation and inhalation of dust.
Avoid contact with skin, eyes and clothing.
Wash hands before breaks and after work.
Consult doctor in case of malaise.

8.2.1. Appropriate engineering controls
Use only in closed systems.

Provide such an adequate ventilation in work areas that the concentration of vapors does not exceed the permissible limit of concentration.
Storage and use locations to be equipped with devices for washing / eye rinsing.
Scrubbers, filters or technical improvements of the working equipment are required in order to reduce emissions to acceptable levels.

8.2.2. Individual protection measures, such as personal protective equipment

- **Eye / face protection**

Avoid contact with eyes. Wear tightly fitting safety glasses (EN 166) and face shield.

- **Skin Protection**

Avoid contact with skin. Use clean antistatic protective clothing (EN 14605) neoprene coated and with hood.

Hand Protection

Use chemical resistant, impervious gloves (EN 374). Recommended gloves of butyl rubber with a thickness exceeding 0,7 mm, protective index 6 that corresponds to a period of endurance > 480 minutes.
Upon contamination, protective gloves should be replaced immediately.

Other

Consider the information from the manufacturer on the permeability and duration of endurance as well as on the specific work conditions (mechanical load and duration of contact).

- **Respiratory protection**

In poorly ventilated workplaces if the limit of exposure is exceeded, it is recommended a protective mask filter, combined for gasses/vapor and solid particles(eg EN 14387, ABEK- P3).
In the case of hypersensitivity of the respiratory tract (asthma, chronic bronchitis) it is recommended to avoid using the product.

- **Thermal hazards**

If you use a fused product (melt), use additional protection gloves, resistant when working with melted masses (EN 407) , for example made of cloth or leather.

8.2.3. Environment exposure controls

Do not allow any release to the environment.
Emissions from ventilation or work equipment must be checked for compliance with the legal provisions for environmental protection.

Standards for permissible concentrations (threshold limit values - TLV) of harmful substances in atmosphere of settlements, according to Regulation No 14 of the Ministry of Health (MOH) and Ministry of Environment and Water (MEW):

TLV average per twenty-four hour period of maleic anhydride: 0,05 mg/m^3
TLV maximum single of maleic anhydride: 0,2 mg/m^3 (30-minute short-term exposure)

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1. Information on the basic physical and chemical properties

INDEXES	VALUES
Physical state at 20ºC and 1013 hPa	Flakes

Physical state over 53ºC	Melt
Colour	Colorless
Odour	Sharp, irritating
Limit of Odour	No data
pH value	No data
Melting / freezing point	53 - 58°C
Boiling point / boiling range	200 °C at 1013.25 hPa
Flash-point	Not applicable, the substance is in solid state at 20°C. The flash point of the melt is (100-110)°C
Evaporation Rate	Not applicable
Flammability (solid, gas)	Flammability test: substance melts at 53-58°C. In contact with water, the substance is non-combustible and has not pyrophoric properties. Therefore, maleic anhydride can be classified as non-combustible solid.
Lower / upper limit of flammability and explosion	Not applicable
Vapor pressure	0.33 hPa at 25°C
Vapour density	No data
Relative Density	1.48 g/cm³ at 20°C
Solubility (s)	In water: 400 g/l at 20°C
Coefficient of distribution : n-octanol/water	In water hydrolyses to maleic acid. log Pow (maleic acid) = -0,48 at 25°C
Self-Ignition temperature	Not applicable. The substance is solid with boiling point <160°C
Decomposition temperature	No data
Viscosity	No data – the substance is solid at 20°C
Explosive properties	Substance does not contain substances with explosive properties.
Oxidizing properties	Substance does not contain substances with oxidising properties.

9.2. Other information
Stated physical and chemical properties should not be construed as a guarantee of product quality.

10. STABILITY AND REACTIVITY

10.1. Reactivity
No data.

10.2. Chemical stability
The product is stable under normal conditions of handling and storage.

10.3. Possibility of hazardous reactions
Reacts with water.

10.4. Conditions to Avoid
Accumulation of fine dust may entail the risk of dust explosion in the presence of air.

10.5. Incompatible materials
Water, alkalines, alcohols, amines, amine compounds, alkaline and alkaline earth metals.

10.6. Hazardous decomposition products
Maleic anhydride decomposes at temperatures above 150ºC in the presence of small quantities of alkaline or alkaline-earth compounds, as well as ammonia and organic nitrogen compounds. At about 200°C this decomposition may occur very quickly. Therefore, the contact of maleic anhydride with alkaline substances must be strictly avoided! Do not, under any circumstances, clean the containers with alkaline substances!
Carbon oxides are released during burning.
In case of contact with water it hydrolyses to maleic acid.

11. TOXICOLOGICAL INFORMATION

11.1. Information on toxicological effects

Toxicokinetics, metabolism, distribution
Maleic anhydride undergoes rapid hydrolysis to maleic acid in contact with water and a similar reaction is possibly to occur in biological systems. For this reason, more likely is the maleic acid to be more important for classification product.

***In vitro* test:** Amest test – negative
***In vivo* test:** Amest test – negative.

After contact with water, maleic anhydride rapidly hydrolyses to maleic acid. Maleic acid can be found in the urine of people who were exposed to maleic anhydride by inhalation and proved absorption in the entire organism. Toxicokinetic researches show that the elimination speed is higher than the absorption speed. Genotoxicinetic tests (Amest test) are negative. Accumulation of maleic anhydride in the human organism is considered to be unlikely.

Acute toxicity

Test	Exposure	Species	Result
LD 50	Oral	Rat	1090 mg/kg bw
LC 50	Inhalation	Rat	> 4.35 mg/l/air
LD 50	Dermal	Rabbit	> 2620 mg/kg bw

Corrosivity / skin irritation
Rabbit, 20 hours: corrosive
Rabbit, 4 hours: corrosive
Human: Corrosive (skin burns after occupational exposure)

Serious eye damage / eye irritation
Irreversible damage to the eye.
Rabbit, 48 hours (without washing): irreversible eye damage/corrosive.
Rabbit: irreversible eye damage/corrosive.

Sensitization of respiratory tract or skin
Skin: sensitising
Respiratory tract: sensitising

Germ cell mutagenicity
Genetic toxicity: negative result.

Carcinogenicity
Rat, oral feeding, 2 years:
NOAEL (carcinogenicity): >100 mg / kg bw
NOAEL (toxicity): 10 mg/kg bw inhalation
From the available data, there is no indication given for a carcinogenic potential of maleic anhydride.

Toxicity for reproduction
Due to the lack of toxicity on fertility and development in definite studies with maleic anhydride, there is no need for classification according to reproductive toxicity.

Oral, rat, 2 generations:

NOAEL (fertility)	55 mg/kg
LOAEL (system/local) parental animals:	20 mg/kg bw

Developmental toxicity ,oral:
Oral, rat, gestation: 6-15 day:

NOAEL (maternal/developmental toxicity):	140 mg/l

NOAEL: 650 mg/kg/day

STOT (specific target organ toxicity) - single exposure
The substance is not classified.

STOT (specific target organ toxicity) - repeated exposure
The substance is not classified.

Repeated exposure toxicity
Repeated or prolonged exposure may lead to general inflammation of respiratory tract, nasal inflammation and bleeding, atrophy of mucous tissues (reversible), loss of sense of smell, hoarseness, bronchitis, fever, headache, dizziness, lowered pulse, lowered blood pressure, insomnia and symptoms of allergic hyperaesthesia.

Information on the likely routes of exposure
Inhalation

Vapors of maleic anhydride irritate the mucous tissues and upper respiratory tract. First it causes coughing, sneezing, burning feeling in the nose and throat and increased mucous secretions.
Possible occurrence of bronchial asthma.

Ingestion

May cause mouth, throat, gullet burning and gastrointestinal disturbance.

Skin contact

Causes burns.

Eye contact

Occupational exposure to vapours causes severe irritation, acute conjunctivitis, running eyes, corneal inflammation, necrosis.

12. ECOLOGICAL INFORMATION

12.1. Toxicity

Aquatic toxicity

	Test	Exposure	Species	Result
Short-term	LC 50	96 h	*Fish:* Oncorhynchus mykiss	75 mg/l
Short-term	LC 50	96 h	*Fish:* Lepomis macrochirus	75 mg/l
	EC 50	48 h	Crustacea*:* Daphnia magna	42,81 mg/l
	NOEC	21 d	Crustacea*:* Daphnia magna	10 mg/l
	EC 50 / LC 50	72 h	*Algae and acuatic plants:* Pseudokirchnerella subcapitata (algae)	74,32 mg/l
	EC 10 / LC 10 NOEC	72 h	*Algae and acuatic plants:* Pseudokirchnerella subcapitata (algae)	11,8 mg/l
	EC 10/LC 10/ NOEC	18 h	*Water microorganisms:* Pseudomonas putida	44,6 mg/l

12.2. Persistence and degradability

***Biodegradability*:** Easily biodegradable
***Hydrolysis in water*:** Fast hydrolysis
Maleic anhydride readily hydrolyses forming maleic acid. The substance and the product of hydrolysis are both readily biodegradable.

12.3. Bioaccumulative ability

Based on the value of distribution coefficient n-octanol/water (log Kow = -2.61), maleic anhydride is not likely to be bioaccumulative.

12.4. Mobility in soil

Koc of maleic anhydride (Koc = 1) indicates that absorption of maleic anhydride in soil is unlikely. Maleic anhydride readily hydrolyses in the presence of water forming maleic acid. Considering **Koc** of maleic acid (log Koc = 0,8) the absorption of suspended particles in soil is unlikely .

Adsorption to soil and mobility is not of vital importance for environment due to the process of fast hydrolysis in water.

12.5. Results of the assessment of PBT and vPvB
Considering the available data for abiotic and biotic degradability, bioaccumulation and toxicity, it is determined that the substance does not fulfill the criteria for **PBT and vPvB**.

12.6. Other adverse effects
Prevent spillage into soil, groundwater and drainage systems.

13. WASTES DISPOSAL

13.1. Methods of waste treatment
Any residues of the substance, waste from its application and the packaging in which it was stored, to be collected in special sealable and labeled containers for temporary storage and then to be transferred to persons holding an authorization under Art. 37 from Waste Management Act.
Transport and treatment of wastes in accordance with Directive 91/689/EEC on hazardous waste.
Do not dispose the substance together with household waste.
Do not allow to enter the environment, water sources and / or drainage waters. Take care that the spills and cleansing water not to reach the city sewers and open waters.
Packaging
After emptying, submit the packaging to a station for waste collection.

Recommended classification of waste of substance and packaging in accordance with the Ordinance on waste classification (NCA) (SG, Issue 44 of 25.05.2004)

Waste of substance, code and name
07 01 99 - wastes not otherwise specified.
16 05 08* - Waste organic chemicals with high degree of purity, consisting of or containing dangerous substances.
Packaging code and name of the waste
15 01 10* - Packages containing residues of hazardous substances or contaminated with hazardous substances.

14. TRANSPORTATION INFORMATION

	ADR/RID	AND/AD NR	IMDG	IATA
14.1 UN No.	2215	2215	2215	2215
14.2 Exact name of the goods under UN list	Maleic anhydride	Maleic anhydride	Maleic anhydride	Maleic anhydride
14.3 Hazardness Class (es) in view of Transportation	8	8	8	8

14.4 Packaging group	III	III	III	III
14.5 Environment hazards	No	No	It is not marine pollutant	No
Additional information	Identificational hazard number: 80		EmS: F-A S-B	

Restrictive code for passing through tunnels: (E) (ADR).

14.4. Special precautions for users
Not to be transported together with food for people and animals.

Maleic anhydride in liquid state (melt)
Flash temperature**:** (100 – 110)ºC.
Hot melt; risk of skin burns
Acute odour.
Keep separate from food products.
Limited quantity LQ0

14.5. Transport in bulk in accordance with Annex II of MARPOL 73/78 and the IBC Code
No data.

15. REGULATORY INFORMATION

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture
The substance does not affect the ozone layer, according to Regulation (EC) 2037/2000.
The substance is not persistent organic pollutant under Regulation (EC) 850/2004.
The substance is not hazardous chemicals under Regulation (EC) 689/2008.
The substance is not included in the categories of danger according to Directive Seveso II (96/82/EC).

15.2. Evaluation of safety of chemical substance or mixture
Chemical safety assessment has been carried out.

16. OTHER INFORMATION

16.1. Full text of all H-phrases referred to in Sections 2 and 3
H302 - Harmful if swallowed.
H314 - Causes severe skin burns and serious eye damage.
N315 - Causes skin irritation.
H335 - May cause respiratory irritation.
H317 - Can cause allergic skin reaction.
H318 - Causes serious eye damage.
H334 - Can cause allergic or asthmatic symptoms or breathing difficulties if inhaled.

16.2. Altered data, compared to the previous version:
Sections 2 and 3 of Material Safety Data Sheet are revised. This updated edition supersedes all previous versions of this Safety Data Sheet.

16.3. Abbreviations and acronyms used in the SDS:
SDS – Safety Data Sheet
CAS - Register of chemicals
EC - European Inventory of Existing Commercial Chemical Substances
LD 50 - Lethal dose 50%
LC 50 - Lethal concentration 50%
EC 50 – Average effective concentration
ECx – Concentration at which x% growth decrease or decrease of speed of growth is observed
NOEC - No Observable Effect Concentration
OEL – Occupational exposure limit
NOAEL – No observable adverse effect level
NOAEC – No observable adverse effect concentration
DNEL – derived no effect level
PNEC - Predicted No Effect Concentration
in vivo - Tests for mutagenicity on germ cells
in vitro - Tests for mutagenic effects in somatic cells
PBT - Persistent, bioaccumulative and toxic substance as defined in Annex XIII
vPvB - very persistent and very bioaccumulative substances as specified in Annex XIII
BCF - bioconcentration factor
IUPAC - International Union of Pure and Applied Chemistry

16.4. Material Safety Data Sheet has been prepared in accordance with Regulation 453/2010 (EU), the international rules for transport and the following documents introduced in European legislation:
Regulation (EC) 1907/2006/ES (REACH) on the Registration, Evaluation, Authorisation and Restriction of Chemicals
Regulation (EC) 1272/2008/ES (CLP) on classification, labeling and packaging of substances and mixtures
Directive 98/24/EC on the protection of health and safety of workers from risks related to chemical agents at work
Directive 2006/15/EC establishing a second list of indicative limit values for exposure of workers in the implementation of Directive 98/24/EC on the protection of health and safety of workers from risks related to chemical agents at work
Directive 2004/37/EC on the protection of workers from risks related to exposure to carcinogens or mutagens at work
Regulation (EC) 2037/2000 on substances that deplete the ozone layer
Regulation (EC) No 850/2004 on persistent organic pollutants
Directive 91/689/EEC on hazardous waste
Regulation (EC) 689/2008 concerning the export and import of dangerous chemicals
Directive Seveso II (96/82/EC) for the control of major accidents involving hazardous chemicals
MARPOL 73/78 - International Convention for the Prevention of Pollution from Ships
Code IBC - International Code of chemicals in bulk
ADR - European Agreement concerning the International Carriage of Dangerous Goods by Road
RID - Regulations concerning the International Carriage of Dangerous Goods
ADN - European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways
IMDG - International Code for the transport of dangerous goods by sea

ICAO - International Civil Aviation Organization

The information in this MSDS is intended to provide guidance for professional users to take necessary measures to protect human health and the environment, and ensure the health and safety in the workplace. It should not be construed as a warranty for technical characteristics, specific contractual quality of the product or proper specific application. All protective rights as well as existing laws and rules are to be kept by the buyer on their own responsibility.

End of SDS

ANNEX: Scenarios of exposure (CE)

Brief description of exposure scenarios

Identified uses in the industrial sector	Category of the process (PROC)	Category of the chemical product (PC)	Sectors of use (SU)	Product Category (AC)	Category release into the environment (ERC)
CE 1 Production of the substance (flakes, low dustiness)	PROC 1, PROC2, PROC 3, PROC 4, PROC 8b, PROC 15	n/a	SU 8	n/a	ERC 1
CE 2 Use as monomer for production of polimer (flakes, low dustiness)	PROC 1, PROC2, PROC 3, PROC 4, PROC 8b, PROC 15	PC 19 PC 32	SU 11 SU 12	n/a	ERC 1 ERC 6c
CE 3 Industrial use as medial product (flakes, low dustiness)	PROC1, PROC2, PROC 3, PROC 8b, PROC15	PC 19 PC 21	SU 8	n/a	ERC 6a ERC 1
CE 4 Production of the substance (melt; 77°C)	PROC 1, PROC2, PROC 3, PROC 4, PROC 8b, PROC 15	n/a	SU 8	n/a	ERC 1
CE 5 Use as monomer (melt; 77°C)	PROC 1, PROC2, PROC 3, PROC 4, PROC 8b, PROC 15	PC19 PC32	SU 11 SU 12	n/a	ERC 1 ERC 6c
CE 6 Industrial use as medial product (melt; 77°C)	PROC1, PROC2, PROC 3, PROC 8b, PROC15	PC19 PC21	SU 8	n/a	ERC 1 ERC 6a

CE 1: PRODUCTION OF MALEIC ANHYDRIDE (FLAKES, LOW DUSTINESS)

1. Short title of exposure scenario	Production of substance (flakes, low dustiness) Production of substance. Includes transferring of material, storage, maintenance, loading, loading/offloading and taking of samples.
2.Processes and activities covered by the exposure scenario	PROC 1: Use in closed process, no likelihood of exposure (industrial environment) PROC 2: Use in closed, continuous process with occasional controlled exposure (industrial environment) PROC 3: Use in closed batch process (synthesis or formulation), (industrial environment) PROC 4: Use in batch and other process (synthesis) where opportunity for exposure arises (industrial environment) PROC 8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large (industrial and non-industrial environment) containers at dedicated facilities PROC 15: Use as laboratory reagent (non-industrial environment) SU 8: Manufacture of bulk, large scale chemicals (including petroleum products) ERC 1: Manufacture of substances
Working conditions of use	
3. Duration and frequency of use	**Workers (occupational)** 8 hours a day, 5 working days in week. 220 days a year - a standard number of working days per year **Consumers** Product is not intended for consumer usage . **Environment** – to 365 days in the year
4.1 Physical form of substance	
Physical state in 20 C and 1013 hPa	Flakes
4.2 Concentration of substance in the product	100 %
Dust	Low

4.3 Amount used per time or per activity	Not applicable
5. Other working conditions related to exposition	**Workers (occupational)** Exposure of workers to the impact of solid maleic anhydride is considered to be negligible, as the substance is used in a closed system.
Measures for risk management	
6.1 Measures of risk management related to human health (workers and consumers)	Production and handling of maleic anhydride is carried out at high temperature in a system with little or no exposure potential. Piping and containerss are hermetically closed and isolated. Workers involved in production, work in the control room without direct contact with any equipment and material. Workers who take samples and those who cut the finished product are trained in safe handling and use of personal protective equipment, to minimize exposure and risk.
6.2 Measures of risk management, related to environment	Avoid release into the air, soil and water before harmful emissions are minimized. To reduce environmental emissions to legally established standards , scrubbing and incineration are used . Maleic anhydride is easyly biodegradable in the atmosphere, water and soil and does not bioaccumulate. Removal in wastewater treatment plants is efficient and emissions to air are controlled by scrubbers and incinerators. Therefore, it is considered unlikely that people will be exposed to direct or indirect contact with air, water, soil or drinking water or exposure in the food chain.
7. Measures for waste management	Any residues of Maleic anhydride, waste from its application and the packaging in which it has been stored, must be collected in separate, sealable and labeled containers for temporary storage. Waste to be transported and treated in accordance with Directive 91/689/EEC on hazardous waste. Do not allow product falling into the environment, water sources and / or drainage, urban drainage and open waters.
Information on the estimated exposure and guidance for downstream users	
According to Regulation № 13 of MLSP, MH, the limit occupational exposure to maleic anhydride for the Republic of Bulgaria for exposure of 8 hours is 1 mg/m^3.	

8.Calculation of exposure

Workers (PROC 1)

Exposure route	concentration	unit
Long-term exposure, systemic, inhalation	0.01	mg/m^3
Long-term exposure, local, dermal	10.0	µg/cm^2
Short exposure, systemic, inhalation	0.02	mg/m^3
Short exposure, local, dermal	10.0	µg/cm^2

Workers (PROC 2)

Exposure route	concentration	unit
Long-term exposure, systemic, inhalation	0.01	mg/m^3
Long-term exposure, local, dermal	20.0	µg/cm^2
Short exposure, systemic, inhalation	0.02	mg/m^3
Short exposure, local, dermal	20.0	µg/cm^2

Workers (PROC 3)

Exposure route	concentration	unit
Long-term exposure, systemic, inhalation	0.10	mg/m^3
Long-term exposure, local, dermal	10.0	µg/cm^2
Short exposure, systemic, inhalation	0.20	mg/m^3
Short exposure, local, dermal	10.0	µg/cm^2

Workers (PROC 4)

Exposure route	concentration	unit
Long-term exposure, systemic, inhalation	0.05	mg/m^3
Long-term exposure, local, dermal	20.0	µg/cm^2

Short exposure, systemic, inhalation	0.10	mg/m^3
Short exposure, local, dermal	20.0	µg/cm^2

Workers (PROC 8b)

Exposure route	concentration	unit
Long-term exposure, systemic, inhalation	0.025	mg/m^3
Long-term exposure, local, dermal	20.0	µg/cm^2
Short exposure, systemic, inhalation	0.05	mg/m^3
Short exposure, local, dermal	20.0	µg/cm^2

Workers (PROC 15)

Exposure route	concentration	unit
Long-term exposure, systemic, inhalation	0.10	mg/m^3
Long-term exposure, local, dermal	10.0	µg/cm^2
Short exposure, systemic, inhalation	0.20	mg/m^3
Short exposure, local, dermal	10.0	µg/cm^2

9. Guidance for downstream users	Downstream users are not exposed to the impact of Maleic anhydride during the manufacturing process, according to CE 1.

CE 2: USE OF MALEIC ANHYDRIDE AS MONOMER IN THE PRODUCTION OF POLYMER (Flakes, low dustiness)

1. Short title of exposure scenario	Use as a monomer for the production of polymer products (flakes, low dustiness) .Processing of formulated polymers including material transfers, additives handling, casting, curing and molding, materials processing, storage and maintenance associated with this.
2.Processes and activities covered by the exposure scenario	PROC 1: Use in closed process, no likelihood of exposure (industrial environment) PROC 2: Use in closed, continuous process with

	occasional controlled exposure (eg taking samples), (industrial environment) PROC 3: Use in closed batch process (synthesis or formulation), (industrial environment) PROC 4: Use in batch and other process (synthesis) where opportunity for exposure arises (industrial environment) PROC 8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities, (industrial and non-industrial environment) PROC 15: Use as laboratory reagent (non-industrial environment) PC 19: Intermediate PC 32: Polymer preparations and compounds SU 11: Manufacture of rubber products SU 12: Manufacture of plastics products, including compounding and conversion ERC 1: Manufacture of substances ERC 6в: Industrial use of monomers for manufacture of thermoplastics
Working conditions of use	
3. Duration and frequency of use	**Workers (occupational)** 8 hours a day, 5 working days in week 220 days a year - a standard number of working days per year Продуктът не е предназначен за потребителска употреба. **Consumers** Product is not intended for consumer useg days per year. **Environment** – to 365 days in the year
4.1 Physical form of substance	
Physical state in 20 C and 1013 hPa	Flakes
4.2 Concentration of substance in the product	100 %
Dust	Low
4.3 Amount used per time or per activity	Not applicable
5. Other working conditions related to exposition	Exposure of workers to the impact of solid Maleic anhydride is considered to be negligible, as the substance is used in a closed system

Measures for risk management	
6.1 Measures of risk management related to human health (workers and consumers)	Maleic anhydride is used as a monomer in the manufacture of alkyd resins, polyester polyols. Transport to the place of use, using local transport. Piping and containers are hermetically closed and isolated. It is used in system with none or little potential for exposure. Workers involved in production, work in the control room without direct contact with any equipment and material. Workers who take samples and those who cut the finished product are trained in safe handling and use of personal protective equipment, to minimize exposure and risk. Bags containing maleic anhydride flakes must be emptied in closed systems to prevent the dust emissions. If the dust can not be completely avoided, it is necessary to use effective masks with filters for face / eyes / skin protection.
6.2 Measures of risk management, related to environment	Avoid release into the air, soil and water before harmful emissions are minimized. To reduce environmental emissions to legally established standards, scrubbing and incineration are used . Maleic anhydride is easyly biodegradable in the atmosphere, water and soil and does not bioaccumulate. Removal in wastewater treatment plants is efficient and emissions to air are controlled by scrubbers and incinerators. Therefore, it is considered unlikely that people will be exposed to direct or indirect contact with air, water, soil or drinking water or exposure in the food chain.
7. Measures for waste management	Any residues of Maleic anhydride, waste from its application and the packaging in which it has been stored, must be collected in separate, sealable and labeled containers for temporary storage. Waste to be transported and treated in accordance with Directive 91/689/EEC on hazardous waste. Do not allow product falling into the environment, water sources and / or drainage, urban drainage and open waters.
Information on the estimated exposure and guidance for downstream users	

According to Regulation № 13 of MLSP, MH, the limit occupational exposure to maleic anhydride for the Republic of Bulgaria for exposure of 8 hours is 1 mg/m^3.

8. Calculation of exposure

Workers (PROC 1)

Exposure route	concentration	unit
Long-term exposure, systemic, inhalation	0.01	mg/m^3
long-term exposure, local, dermal	10.0	µg/cm^2
Short exposure, systemic, inhalation	0.02	mg/m^3
Short exposure, local, dermal	10.0	µg/cm^2

Workers (PROC 2)

Exposure route	concentration	unit
Long-term exposure, systemic, inhalation	0.01	mg/m^3
Long-term exposure, local, dermal	20.0	µg/cm^2
Short exposure, systemic, inhalation	0.02	mg/m^3
Short exposure, local, dermal	20.0	µg/cm^2

Workers (PROC 3)

Exposure route	concentration	unit
Long-term exposure, systemic, inhalation	0.10	mg/m^3
Long-term exposure, local, dermal	10.0	µg/cm^2
Short exposure, systemic, inhalation	0.20	mg/m^3
Short exposure, local, dermal	10.0	µg/cm^2

Workers (PROC 4)

Exposure route	concentration	unit
Long-term exposure, systemic, inhalation	0.05	mg/m^3

Long-term exposure, local, dermal	20.0	µg/cm^2
Short exposure, systemic, inhalation	0.10	mg/m^3
Short exposure, local, dermal	20.0	µg/cm^2

Workers (PROC 8b)

Exposure route	concentration	unit
Long-term exposure, systemic, inhalation	0.025	mg/m^3
Long-term exposure, local, dermal	20.0	µg/cm^2
Short exposure, systemic, inhalation	0.05	mg/m^3
Short exposure, local, dermal	20.0	µg/cm^2

Workers (PROC 15)

Exposure route	concentration	unit
Long-term exposure, systemic, inhalation	0.10	mg/m^3
Long-term exposure, local, dermal	10.0	µg/cm^2
Short exposure, systemic, inhalation	0.20	mg/m^3
Short exposure, local, dermal	10.0	µg/cm^2

9. Guidance for downstream users	Downstream users are not exposed to the impact of Maleic anhydride during the manufacturing process, according to CE 2.

CE3: INDUSTRIAL USE AS INTERMEDIATE PRODUCT / FLAKES, LOW DUSTINESS/

1. Short title of exposure scenario	Industrial use as an intermediate (flakes, low dust). Industrial use resulting in manufacture of another substance.
2.Processes and activities covered by the exposure scenario	PROC 1: Use in closed process, no likelihood of exposure (industrial environment) PROC 2: Use in closed, continuous process with occasional controlled exposure (eg taking of samples),

	(industrial environment) PROC 3: Use in closed batch process (synthesis or formulation), (industrial environment) PROC 8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities (industrial and non-industrial environment) PROC 15: Use as laboratory reagent (non-industrial environment) PC 19: Intermediate PC 21: Laboratory chemicals SU 8: Manufacture of bulk, large scale chemicals (including petroleum products) ERC 1: Manufacture of substances ERC 6a : Industrial use on intermediate products
Working conditions of use	
3. Duration and frequency of use	**Workers (occupational)** 8 hours a day , 5 working days per week 220 days a year - a standard number of working days per year **Consumers** Product is not intended for consumer usage. **Environment** – to 365 days in the year
4.1 Physical form of substance	
Physical state in 20 C and 1013 hPa	Flakes
4.2 Concentration of substance in the product	100 %
Dust	Low
4.3 Amount used per time or per activity	Not applicable
5. Other working conditions related to exposition	**Workers (occupational)** Exposure of workers to the impact of solid maleic anhydride is considered to be small, as the substance is in a closed system. Processes are controlled by operators via the computer.
Measures for risk management	
6.1 Measures of risk management related to human health (workers and consumers)	The mane use of maleic anhydride is as an intermediate product. Use in closed systems and exposure to emissions from use is the same as in production.

	Piping and containers are sealed and isolated. It is used in system with none or little potential for exposure. Workers involved in production, work in the control room without direct contact with any equipment and material. Workers who take samples and those who cut the finished product are trained in safe handling and use of personal protective equipment, to minimize exposure and risk. Bags containing maleic anhydride flakes must be emptied in closed systems to prevent the dust emissions. If the dust can not be completely avoided, it is necessary to use effective masks with filters for face / eyes / skin protection.
6.2 Measures of risk management, related to environment	Avoid release into the air, soil and water before harmful emissions are minimized. To reduce environmental emissions to legally established standards, scrubbing and incineration are used . Maleic anhydride is easyly biodegradable in the atmosphere, water and soil and does not bioaccumulate. Removal in wastewater treatment plants is efficient and emissions to air are controlled by scrubbers and incinerators. Therefore, it is considered unlikely that people will be exposed to direct or indirect contact with air, water, soil or drinking water or exposure in the food chain.
7. Measures for waste management	Any residues of Maleic anhydride, waste from its application and the packaging in which it has been stored, must be collected in separate, sealable and labeled containers for temporary storage. Waste to be transported and treated in accordance with Directive 91/689/EEC on hazardous waste. Do not allow product falling into the environment, water sources and / or drainage, urban drainage and open waters.
Information on the estimated exposure and guidance for downstream users	
According to Regulation № 13 of MLSP, MH, the limit occupational exposure to maleic anhydride for the Republic of Bulgaria for exposure of 8 hours is 1 mg/m^3.	

8. Calculation of exposure

Workers (PROC 1)

Exposure route	concentration	unit
Long-term exposure, systemic, inhalation	0.01	mg/m^3
Long-term exposure, local, dermal	10.0	µg/cm^2
Short exposure, systemic, inhalation	0.02	mg/m^3
Short exposure, local, dermal	10.0	µg/cm^2

Workers (PROC 2)

Exposure route	concentration	unit
Long-term exposure, systemic, inhalation	0.01	mg/m^3
Long-term exposure, local, dermal	20.0	µg/cm^2
Short exposure, systemic, inhalation	0.02	mg/m^3
Short exposure, local, dermal	20.0	µg/cm^2

Workers (PROC 3)

Exposure route	concentration	unit
Long-term exposure, systemic, inhalation	0.10	mg/m^3
Long-term exposure, local, dermal	10.0	µg/cm^2
Short exposure, systemic, inhalation	0.20	mg/m^3
Short exposure, local, dermal	10.0	µg/cm^2

Workers (PROC 8b)

Exposure route	concentration	unit
Long-term exposure, systemic, inhalation	0.025	mg/m^3
Long-term exposure, local, dermal	20.0	µg/cm^2
Short exposure, systemic, inhalation	0.05	mg/m^3

Short exposure, local, dermal	20.0	µg/cm^2

Workers (PROC 15)

Exposure route	concentration	unit
Long-term exposure, systemic, inhalation	0.10	mg/m^3
Long-term exposure, local, dermal	10.0	µg/cm^2
Short exposure, systemic, inhalation	0.20	mg/m^3
Short exposure, local, dermal	10.0	µg/cm^2

9. Guidance for downstream users	Downstream users are not exposed to the impact of Maleic anhydride during the manufacturing process, according to CE 3.

CE 4: PRODUCTION OF MALEIC ANHYDRIDE / melting; 77°C /

1. Short title of exposure scenario	Production of substance (melting77**°C**). Production of the substance. Includes material transfer, storage, handling, loading / unloading and taking of samples.
2.Processes and activities covered by the exposure scenario	PROC 1: Use in closed process, no likelihood of exposure (industrial environement) PROC 2: Use in closed, continuous process with occasional controlled exposure (eg taking of samples), (industrial environement) PROC 3: Use in closed batch process (synthesis or formulation), (industrial environement) PROC 4: Use in batch and other process (synthesis) where opportunity for exposure arises, (industrial environement) PROC 8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities (industrial and non-industrial environement) PROC 15: Use as laboratory reagent (non-industrial environment) SU 8: Manufacture of bulk, large scale chemicals (including petroleum products)

	ERC 1: Manufacture of substances
Working conditions of use	
3. Duration and frequency of use	**Workers (occupational use)** 8 hours a day , 5 working days per week 220 days a year - a standard number of working days per year **Consumers** Product is not intended for consumer usage. **Environment** – to 365 days in the year
4.1 Physical form of substance	
Physical state , 77°C	Melting
4.2 Concentration of substance in the product	100 %
Vapor pressure	12.04 hPa
Volatility	Medium
4.3 Amount used per time or per activity	Not applicable
5. Other working conditions related to exposition	**Workers (occupational)** Exposure for workers in the use of Maleic anhydride is considered negligible for the liquid form as it is in a hermetically sealed apparatus.
Measures for risk management	
6.1 Measures of risk management related to human health (workers and consumers)	Production and work with melted maleic anhydride is done at high temperature in a system with none or little potential for exposure. Piping and containers are hermetically closed and isolated. Workers involved in production, work in the control room without direct contact with any equipment and material. Workers who take samples and those who load the finished product are trained in safe handling and use of personal protective equipment, to minimize exposure and risk.
6.2 Measures of risk management, related to environment	Avoid release into the air, soil and water before harmful emissions are minimized. To reduce environmental emissions to legally established standards, scrubbing and incineration are used . Maleic anhydride is easyly biodegradable in the atmosphere, water and soil and does not bioaccumulate.

	Removal in wastewater treatment plants is efficient and emissions to air are controlled by scrubbers and incinerators. Therefore, it is considered unlikely that people will be exposed to direct or indirect contact with air, water, soil or drinking water or exposure in the food chain.
7. Measures for waste management	Any residues of Maleic anhydride, waste from its application must be collected in separate, sealable and labeled containers for temporary storage. Waste to be transported and treated in accordance with Directive 91/689/EEC on hazardous waste. Do not allow product falling into the environment, water sources and / or drainage, urban drainage and open waters.
Information on the estimated exposure and guidance for downstream users	

According to Regulation № 13 of MLSP, MH, the limit occupational exposure to maleic anhydride for the Republic of Bulgaria for exposure of 8 hours is 1 mg/m^3.

8. Calculation of exposure	
Workers (PROC 1)	

Exposure route	concentration	unit
Long-term exposure, systemic, inhalation	0.04	mg/m^3
Long-term exposure, local, dermal	20.0	µg/cm^2
Short exposure, systemic, inhalation	0.08	mg/m^3
Short exposure, local, dermal	20.0	µg/cm^2

Workers (PROC 2)	

Exposure route	Concentration	unit
Long-term exposure, systemic, inhalation	0.20	mg/m^3
Long-term exposure, local, dermal	20.0	µg/cm^2
Short exposure, systemic, inhalation	0.41	mg/m^3
Short exposure, local, dermal	20.0	µg/cm^2

Workers (PROC 3)	

Exposure route	Concentration	unit
Long-term exposure, systemic, inhalation	0.26	mg/m^3
Long-term exposure, local, dermal	20.0	µg/cm^2
Short exposure, systemic, inhalation	0.51	mg/m^3
Short exposure, local, dermal	20.0	µg/cm^2

Workers (PROC 4)

Exposure route	concentration	unit
Long-term exposure, systemic, inhalation	0.41	mg/m^3
Long-term exposure, local, dermal	20.0	µg/cm^2
Short exposure, systemic, inhalation	0.82	mg/m^3
Short exposure, local, dermal	20.0	µg/cm^2

Workers (PROC 8b)

Exposure route	concentration	unit
Long-term exposure, systemic, inhalation	0.31	mg/m^3
Long-term exposure, local, dermal	20.0	µg/cm^2
Short exposure, systemic, inhalation	0.61	mg/m^3
Short exposure, local, dermal	20.0	µg/cm^2

Workers (PROC 15)

Exposure route	concentration	unit
Long-term exposure, systemic, inhalation	0.10	mg/m^3
Long-term exposure, local, dermal	20.0	µg/cm^2
Short exposure, systemic, inhalation	0.20	mg/m^3
Short exposure, local, dermal	20.0	µg/cm^2

9. Guidance for downstream users	Downstream users are not exposed to the impact of Maleic anhydride

	during the manufacturing process, according to CE 4.

CE 5: USE AS A MONOMER IN PRODUCTION OF POLYMER / MELTING 77 °C /

1. Short title of exposure scenario	Use as a monomer in production of polymer /melting 77 °C/. Processing of formulated polymers including material transfers, additives handling, casting, curing and molding, materials processing, storage and maintenance associated with this.
2.Processes and activities covered by the exposure scenario	PROC 1: Use in closed process, no likelihood of exposure (industrial environment) PROC 2: Use in closed, continuous process with occasional controlled exposure (eg taking of samples), (industrial environment) PROC 3: Use in closed batch process (synthesis or formulation), (industrial environment) PROC 4: Use in batch and other process (synthesis) where opportunity for exposure arises, (industrial environment) PROC 8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities (industrial and non-industrial environment) PROC 15: Use as laboratory reagent (non-industrial environment) PC 19: Intermediate PC 32: Polymer preparations and compounds SU 11: Manufacture of rubber products SU 12: Manufacture of plastics products, including compounding and conversion ERC 1: Manufacture of substances ERC 6b: Industrial use of monomers for manufacture of thermoplastics
Working conditions for use	
3. Duration and frequency of use	**Workers (occupational use)** 8 hours a day , 5 working days per week 220 days a year - a standard number of working days per year

	Consumers Product is not intended for consumer usage. **Environment** – to 365 days in the year
4.1 Physical form of substance	
Physical state at 77 °C	Melting
4.2 Concentration of substance in the product	100 %
Vapor pressure	12.04 hPa
Volatility	Medium
4.3 Amount used per time or per activity	Not applicable
5. Other working conditions related to exposition	**Workers (occupational)** Exposure for workers in the use of maleic anhydride is considered negligible for the liquid form as it is in a hermetically sealed apparatus. Processes are controlled by operators via the computer.
Measures for risk management	
6.1 Measures of risk management related to human health (workers and consumers)	Maleic anhydride is used as monomer in the production of alkyd resins, polyester polyols. It is transported to the places of use via tanks made of stainless steel, which could be heated under nitrogen blanket. Piping and containers are hermetically closed and isolated. Use take palce in a system with non or little potential for exposure. Workers involved in production, work in the control room without direct contact with any equipment and material. Workers who take samples and those who load the finished product are trained in safe handling and use of personal protective equipment, to minimize exposure and risks. If vapors could not be completely avoided, effective protective equipment for face/eyes/protection of skin should be used.
6.2 Measures of risk management, related to environment	Avoid release into the air, soil and water before harmful emissions are minimized. To reduce environmental emissions to legally established standards, scrubbing and incineration are used. Maleic anhydride is easyly biodegradable in the atmosphere, water and soil and does not bioaccumulate. Removal in wastewater treatment plants is efficient and emissions in the air are controlled by scrubbers and incinerators. Therefore, it is considered unlikely that

	people will be exposed to direct or indirect contact with air, water, soil or drinking water or exposure in the food chain.
7. Measures for waste management	Any residues of Maleic anhydride, waste from its application must be collected in separate, sealable and labeled containers for temporary storage. Waste to be transported and treated in accordance with Directive 91/689/EEC on hazardous waste. Do not allow product falling into the environment, water sources and / or drainage, urban drainage and open waters.

Information on the estimated exposure and guidance for downstream users

According to Regulation № 13 of MLSP, MH, the limit occupational exposure to maleic anhydride for the Republic of Bulgaria for exposure of 8 hours is 1 mg/m^3.

8. Calculation of exposure

Workers (PROC 1)

Exposure route	concentration	unit
Long-term exposure, systemic, inhalation	0.04	mg/m^3
Long-term exposure, local, dermal	20.0	µg/cm^2
Short exposure, systemic, inhalation	0.08	mg/m^3
Short exposure, local, dermal	20.0	µg/cm^2

Workers (PROC 2)

Exposure route	concentration	unit
Long-term exposure, systemic, inhalation	0.20	mg/m^3
Long-term exposure, local, dermal	20.0	µg/cm^2
Short exposure, systemic, inhalation	0.41	mg/m^3
Short exposure, local, dermal	20.0	µg/cm^2

Workers (PROC 3)

Exposure route	concentration	unit

Long-term exposure, systemic, inhalation	0.26	mg/m^3
Long-term exposure, local, dermal	20.0	µg/cm^2
Short exposure, systemic, inhalation	0.51	mg/m^3
Short exposure, local, dermal	20.0	µg/cm^2

Workers (PROC 4)

Exposure route	concentration	unit
Long-term exposure, systemic, inhalation	0.41	mg/m^3
Long-term exposure, local, dermal	20.0	µg/cm^2
Short exposure, systemic, inhalation	0.82	mg/m^3
Short exposure, local, dermal	20.0	µg/cm^2

Workers (PROC 8b)

Exposure route	concentration	unit
Long-term exposure, systemic, inhalation	0.31	mg/m^3
Long-term exposure, local, dermal	20.0	µg/cm^2
Short exposure, systemic, inhalation	0.61	mg/m^3
Short exposure, local, dermal	20.0	µg/cm^2

Workers (PROC 15)

Exposure route	concentration	unit
Long-term exposure, systemic, inhalation	0.10	Mg/m^3
Long-term exposure, local, dermal	20.0	µg/cm^2
Short exposure, systemic, inhalation	0.20	Mg/m^3
Short exposure, local, dermal	20.0	µg/cm^2

9. Guidance for downstream users	Downstream users are not exposed to the impact of Maleic anhydride during the manufacturing process, according to CE 5.

CE 6: INDUSTRIAL USE AS AN INTERMEDIATE / MELTING 77°C/

1. Short title of exposure scenario	Industrial use as an intermediate (melting, 77°C) Industrial use resulting in manufacture of another substance.
2.Processes and activities covered by the exposure scenario	PROC 1: Use in closed process, no likelihood of exposure (industrial environment) PROC 2: Use in closed, continuous process with occasional controlled exposure (eg taking of samples), (industrial environment) PROC 3: Use in closed batch process (synthesis or formulation), (industrial environment) PROC 4: Use in batch and other process (synthesis) where opportunity for exposure arises, (industrial environment) PROC 8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities, (industrial and non-industrial environment) PROC 15: Use as laboratory reagent (non-industrial environment) PC 19: Intermediate PC 21: Laboratory chemicals SU 8: Manufacture of bulk, large scale chemicals (including petroleum products) ERC 1: Manufacture of substances ERC 6a: Industrial use resulting in manufacture of another substance (use of intermediates)
Working conditions of use	
3. Duration and frequency of use	**Workers (occupational)** 8 hours a day , 5 working days per week 220 days a year - a standard number of working days per year **Consumers** Product is not intended for consumer usage. **Environment** – to 365 days in the year
4.1 Physical form of substance	
Physical state 77 °C	Melting

4.2 Concentration of substance in the product	100 %
Vapor pressure	12.04 hPa
Volatility	Medium
4.3 Amount used per time or per activity	Not applicable
5. Other working conditions related to exposition	**Workers (occupational)** Exposure for workers in the use of Maleic anhydride is considered negligible for the liquid form as it is in a hermetically sealed apparatus. Processes are controlled by operators via the computer
Measures for risk management	
6.1 Measures of risk management related to human health (workers and consumers)	The domain use of maleic anhydride is as an intermediate. Used in closed systems and exposure to emissions from use is the same as in production. Pipelines and containers are hermetically closed and insolated. Use takes place in a system with little or no potential for exposure Workers involved in production, work in the control room without direct contact with any equipment and material. Workers who take samples and those who load the finished product are trained in safe handling and use of personal protective equipment, to minimize exposure and risk. It is transported to the places of use via tanks made of stainless steel, which could be heated under nitrogen blanket. If vapors could not be completely avoided, effective protective equipment for face/eyes/protection of skin should be used.
6.2 Measures of risk management, related to environment	Avoid release into the air, soil and water before harmful emissions are minimized. To reduce environmental emissions to legally established standards , scrubbing and incineration are used . Maleic anhydride is easyly biodegradable in the atmosphere, water and soil and does not bioaccumulate. Removal in wastewater treatment plants is efficient and emissions in the air are controlled by scrubbers and incinerators. Therefore, it is considered unlikely that people will be exposed to direct or indirect contact with air, water, soil or drinking water or exposure in the food chain.
7. Measures for waste management	Any residues of Maleic anhydride, waste from its application must be collected in separate, sealable and

	labeled containers for temporary storage. Waste to be transported and treated in accordance with Directive 91/689/EEC on hazardous waste. Do not allow product falling into the environment, water sources and / or drainage, urban drainage and open waters.

Information on the estimated exposure and guidance for downstream users

According to Regulation № 13 of MLSP, MH, the limit occupational exposure to maleic anhydride for the Republic of Bulgaria for exposure of 8 hours is 1 mg/m^3.

8. Calculation of exposure

Workers (PROC 1)

Exposure route	Concentration	Unit
Long-term exposure, systemic, inhalation	0.04	mg/m^3
Long-term exposure, local, dermal	20.0	µg/cm^2
Short exposure, systemic, inhalation	0.08	mg/m^3
Short exposure, local, dermal	20.0	µg/cm^2

Workers (PROC 2)

Exposure route	concentration	unit
Long-term exposure, systemic, inhalation	0.20	mg/m^3
Long-term exposure, local, dermal	20.0	µg/cm^2
Short exposure, systemic, inhalation	0.41	mg/m^3
Short exposure, local, dermal	20.0	µg/cm^2

Workers (PROC 3)

Exposure route	concentration	unit
Long-term exposure, systemic, inhalation	0.26	mg/m^3
Long-term exposure, local, dermal	20.0	µg/cm^2
Short exposure, systemic, inhalation	0.51	mg/m^3

Short exposure, local, dermal	20.0	µg/cm^2

Workers (PROC 8b)

Exposure route	concentration	unit
Long-term exposure, systemic, inhalation	0.31	mg/m^3
Long-term exposure, local, dermal	20.0	µg/cm^2
Short exposure, systemic, inhalation	0.61	mg/m^3
Short exposure, local, dermal	20.0	µg/cm^2

Workers (PROC 15)

Exposure route	concentration	Unit
Long-term exposure, systemic, inhalation	0.10	mg/m^3
Long-term exposure, local, dermal	20.0	µg/cm^2
Short exposure, systemic, inhalation	0.20	mg/m^3
Short exposure, local, dermal	20.0	µg/cm^2

9. Guidance for downstream users	Downstream users are not exposed to the impact of Maleic anhydride during the manufacturing process, according to CE 6.