MATERIAL SAFETY DATA SHEET

DEAHEUNG CHEMICAL CO., LTD. www.dhcbond.co.kr

Product Name	DW-42NF(A)

1. Product and Company Identification

A. Product Name: DW-42NF(A)

B. Recommended use of the chemical and restrictions on use

- Recommended use of the chemical: Bonding for the PVC sheet and film to wood and plastic, hard board, wood based materials, resin felt, etc.
- Restrictions on use of the product: Do not use for purposes other than adhesive.

C. Manufacturer/Supplier/Distributor Information

- Name: DAEHEUNG CHEMICAL CO., LTD.
- Address: 68, Sandan-ro 64beon-gil, Pyeongtaek-si, Gyeonggi-do, Korea
- Emergency phone number: 82-31-668-1424

2. Hazards identification

A. Hazard·Risk Classification

Flammable Liquid : Category 2
Acute Toxicity (Oral) : Category 4
Skin Corrosion/Irritation : Category 2
Serous Eyes Damage/Eye Irritation : Category 2
Carcinogenicity : Categories 2
Reproductive Toxicology : Category 2
Target Organ Toxicity (Single Exposure) : Category 3(Narcotic effects)
Target Organ Toxicity (Single Exposure) : Category 1
Target Organ Toxicity (Repeated Exposure) : Category 1
Acute hazards to the aquatic environment : category 2

B. Label elements including precautionary statements

- Symbol

- Signal Word: Danger
- Hazard·Risk Statement

H225 Highly flammable liquid and vapour
H302 Harmful if swallowed
H315 Causes skin irritation
H319 Causes serious eye irritation
H336 May cause drowsiness or dizziness
H351 Suspected of causing cancer
H361 Suspected of damaging fertility or the unborn child
H411 Toxic to aquatic life with long lasting effects

- Precautionary Statement

Prevention

P201 Obtain special instructions before use
P202 Do not handle until all safety precautions have been read and understood
P210 Keep away from heat/sparks/open flames/hot surfaces – No smoking
P233 Keep container tightly closed

	P240 Ground/bond container and receiving equipment
Prevention	P241 Use explosion-proof electrical/ventilating/light/equipment
	P242 Use only non-sparking tool
	P243 Take precautionary measures against static discharge
	P260 Do not breathe dust/fume/gas/mist/vapours/spray
	P264 Wash thoroughly after handling
	P270 Do not eat, drink or smoke when using this product
	P271 Use only outdoors or in a well-ventilated area
	P273 Avoid release to the environment
	P280 Wear protective gloves/protective clothing/eye protection/face protection
	P281 Use personal protective equipment as required
Response	P301+312 IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
	P302+352 IF ON SKIN : Wash with soap and water
	P303+P361+P353 IF ON SKIN (or hair) : Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
	P304+340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
	P305+351+338 IF IN EYES : Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do - continue rinsing
	P307+311 IF exposed: Call a POISON CENTER or doctor/physician
	P308+P313 IF exposed or concerned : Get medical advice/attention
	P312 Call a POISON CENTER or doctor/physician if you feel unwell
	P314 Get Medical advice/attention if you feel unwell
	P330 Rinse mouth
	P332+313 If skin irritation occurs: Get medical advice/attention
	P337+313 If eye irritation persists get medical advice/attention
	P362 Take off contaminated clothing and wash before reuse
	P391 Collect spillage
Storage	P403+233 Store in a well ventilated place. Keep container tightly closed
	P403+235 Store in a well ventilated place. Keep cool
	P405 Store locked up
Disposal	P501 Dispose of contents/container to …

C. Other Hazard·Risk which are not included in the classification criteria (e.g. dust explosion hazard)

Health	2
Fire	3
Reactivity	0

3. Composition/Information on ingredients

Chemical Name	Other name	CAS number	Content(%)
DICHLOROMETHANE	Methylene Chloride	75-09-2	40~50
ACETONE	2-propanone	67-64-1	1~10
PARA-TERTIARY-BUTYLPHENOL-FORMALDEHYDE RESIN	Phenol, P-tert-butyl-	25085-50-1	10~20
POLYURETHANE	-	9009-54-5	10~20
FLAME RETARDANT	-	-	20~30

4. First aid measures

A. Eye contact	IF IN EYES: Wash carefully with water for several minutes. Remove contact lenses, if possible. Easy to do. If eye irritation persists, Consult a physician if irritation persists.
B. Skin contact	Skin (or hair): Take off immediately all contaminated clothing or remove the Keep. Rinse skin with water / shower. If skin irritation occurs, obtain medical advice Keep. Remove and isolate contaminated clothing and shoes. In case of burns, immediately cool affected skin for as long as possible with cold water. Do not remove clothing if adhering to skin. Wash skin with soap and water.
C. Inhalation	Excessive dust or fumes when exposed to clean air removed by coughing or other symptoms and seek medical attention if you have.
D. Ingestion	Rinse mouth. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.
E. Indication of immediate medical attention and notes for physician	Medical personnel are aware of the material and to take precautions to protect.

5. Fire-Fighting measures

A. Suitable (and unsuitable) extinguishing media	Water spray, foam, dry powder When to do Fire-Fighting, use dry sand or earth.
B. hazards arising from the chemical (e.g. nature of any hazardous combustion products)	Highly flammable liquid and vapor. Vapors may form explosive mixtures with air. Those substances designated with a (P) may polymerize explosively when heated or involved in a fire. Vapors may travel to source of ignition and flash back. Fire will produce irritating, corrosive and/or toxic gases. Containers may explode when heated. HIGHLY FLAMMABLE: Will be easily ignited by heat, sparks or flames. The steam explosion hazard at Indoor, outdoor, drain. Some of these materials may burn, but most do not ignite readily.
C. Special protective equipment and precautions for fire-fighters	In case of fire: Wear self-contained breathing apparatus. Vapors from liquefied gas are initially heavier than air and spread along ground. Dike far ahead of liquid spill for later disposal. Move containers from fire area if you can do it without risk. Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. Cool containers with flooding quantities of water until well after fire is out. ALWAYS stay away from tanks engulfed in fire.

6. Accidental release measures

A. Personal precautions, protective equipment and emergency procedures	Avoid breathing dust/fume/gas/mist/vapours/spray Use water spray/stream to protect personnel and to cool endangered containers. Remove product from area of fire. Wear suitable protective clothing, gloves and eye/face protection. Stop leak if safe to do so. Remove all sources of ignition. In case of fire: Wear selfcontained breathing apparatus.

A. Personal precautions, protective equipment and emergency procedures	Evacuate unnecessary personnel. Remove all sources of ignition. Stop leak if safe to do so. Eliminate leaks immediately.
B. Environmental precautions and protective procedures	Avoid release to the environment Waterways, sewers, basements, and Prevent entry into confined spaces.
C. Methods and materials for containment and cleaning up	Stop leak if you can do it without risk. Dike far ahead of spill; use dry sand to contain the flow of material. Dike far ahead of spill to collect runoff water. Collect in closed containers for disposal. Dispose of this material and its container to hazardous or special waste collection point. Cover powder spill with plastic sheet or tarp to minimize spreading. With clean shovel place material into clean, dry container and cover loosely; move containers from spill area.

7. Handling and storage

A. Precautions for safe handling	Do not handle until all safety precautions Read and understand all safety precautions. Use only non-sparking tools. Avoid breathing dust/fume/gas/mist/vapours/spray Wash thoroughly after handling Do not eat, drink or smoke when using this product Use only outdoors or in a well-ventilated area Use explosion-proof electrical/ventilating/light/equipment. Follow all MSDS/label precautions even after container is emptied because it may retain product residues. May be ignited by heat, sparks or flames. Use in the well-ventilated areas. Keep out of low areas.
B. Conditions for safe storage (including any incompatibilities)	Keep away from heat/sparks/open flames/hot surfaces – No smoking Store in a well ventilated place. Keep container tightly closed Store in a well ventilated place. Keep cool Do not eat, drink or smoke when using this product

8. Exposure controls & personal protection

A. Control parameters (e.g. occupational exposure limit values, biological limit values)

- Occupational exposure limit values

DICHLOROMETHANE	TWA – 50ppm 175mg/m^3
ACETONE	TWA – 500ppm 1188mg/m^3 STEL – 750ppm 1782mg/m^3

- ACGIH limit values

ACETONE	TWA 500ppm
	STEL 750 ppm

B. Appropriate engineering controls	Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Provide adequate ventilation.
C. Personal protective equipment	
- Respiratory protection	The filter class must be suitable for the maximum contaminant concentration(gas/vapour/aerosol/particulates) that may arise when handling the product. If the concentration is exceeded, closed-circuit breathing apparatus must be used!. In case of fire: Wear self contained breathing apparatus.
- Eye protection	Wear eye protection/face protection.
- Hands protection	Wear proper chemical resistant gloves.
- Body protection	Wear proper Protective clothing.

9. Physical and chemical properties

A. Appearance	
Physical state	Viscous liquid
Color	Milky like
B. Odour	Solvent
C. Odour threshold	No data available
D. pH	No data available
E. Melting point/freezing point	-95℃
F. Initial boiling point and boiling range	40℃
G. Flashing point	No data available
H. Evaporation rate	No data available
I. Flammability(solid, gas)	No data available
J. Upper/lower flammability or explosive limits	13/23
K. Vapor pressure	400mmHg (at 24℃)
L. Solubility	Unsolubility in water
M. Vapor density	2.9
N. Relative density	1.2
O Partition coefficient:n-octanol/water	No data available
P. Auto-ignition temperature	No data available
Q. Decomposition temperature	No data available
R. Viscosity	7,500~8,500cps
S. Formula mass	No data available

10. Stability and reactivity

A.Chemical stability and possibility of hazardous reactions	Stable under normal conditions. Some of these materials may burn, but most do not ignite readily. Vapors may cause dizziness or asphyxiation without warning. Fire will produce irritating, corrosive and/or toxic gases. Contact may irritate or burn skin and eyes.
B. Conditions to avoid	Flammable material, irritating, toxic gases.
C. Incompatible materials	Flammable material, irritating, toxic gases.
D. Hazardous decomposition products	CO, CO_2, nitrogen compounds, hazardous gas etc. Fire will produce irritating, corrosive and/or toxic gases.

11. Toxicological information

A. Information on the likely routes of exposure	No data available
B. Health hazards information	
- Acute toxic	
Oral	
DICHLOROMETHANE	LD50 1600 ㎎/㎏ Rat
ACETONE	LD50 5280 ㎎/㎏ Rat (EHC(1990), SIDS(1997))
Inhalation	
DICHLOROMETHANE	LC50 53 ㎎/ℓ 6 hr
ACETONE	Vapor LC50 32000 ppm Rat
Dermal	
ACETONE	LD50 12870 ㎎/㎏ Rabbit (EHC(1990), PATTY(1994), SIDS(1997))

- Skin corrosive/irritant

DICHLOROMETHANE	Skin - rabbit - Mild skin irritation
ACETONE	It was classified as out of Category from the statement of having no stimulativeness on rabbit skin (EHC 207 (1998)) and (SIDS (1999)).

- Serious eye damage/eye irritation

DICHLOROMETHANE	Eye irritation
ACETONE	Vapor stimulates public eye. However, if exposure stops, irritation will not follow (ATSDR (1994)). The result of severe is reported in the rabbit (ACGIH (2001)). Although a corneal epithelium is destroyed, substrate is not destroyed, and destruction of a corneal epithelium will be recovered in 4-6 days. Acetone is not corrosive eye irritations (SIDS (1999)).

- Respiratory sensitization — No data available

- Skin sensitization

ACETONE	Since it was indicated negative by the Mouse ear swelling test and Guinea pig maximization test(SIDS (1999)).

- Carcinogenicity

Ministry of Employment and Labor Notice

DICHLOROMETHANE	2
ACETONE	No data avaliable

IARC

DICHLOROMETHANE	Group 2B
POLYURETHANE	Group 3

OSHA	No data avaliable
ACGIH	A4

NTP

DICHLOROMETHANE	R

EU CLP

DICHLOROMETHANE	Carc. 2

- Germ Cell Mutagenicity

DICHLOROMETHANE	
ACETONE	We found the negative results for in vivo micronucleus examination (SIDS (1999), EHC 207 (1998)).

- Reproductive toxicity

ACETONE	There is a report that he has no effect on a miscarriage in an epidemiological study (ATSDR, 1994). It is reported of slight developmental toxicity (decrease of embryo weight) in rat high concentration exposure (11000 ppm (20 mg/L)) (EHC, 207 (1998)) and of the decrease of embryo weight and the increase of late embryo absortion rate in mouse high concentration exposure (6600 ppm (15.6 mg/L)) (EHC, 207 (1998)). There is a description that study is still more nearly required, for an animal with humans (EHC).

- Specific target organ toxicity (single exposure):

DICHLOROMETHANE	In humans, pneumonia accompanied by headache, chest pain, impaired attention, fatigue and lethargy, memory loss, loss of sense of time, neurobehavioral effects, edema accompanied by bleeding from the lungs, inflammation of the skin, Cerebral edema accompanied by one-way hernia. Bronchial, necrosis of epidermal cells of bronchioles, clathal cell expansion and vacuolation were observed in experimental animals

ACETONE	Based on the descriptions that irritation in the human throat is caused by 1200ppm exposure (ACGIH (2001)), that irritation is caused in the nasal cavity, throat and trachea by 1190 and 2400mg/m3/6h exposure to humans (ECH 207 (1998)), and that irritation was caused in the throat by 1000ppm/4h exposure (ECH 207 (1998)). So it was set as Category 3 (airway irritation). And the discriptions that a male who drank 200ml fell coma (recovering his conciousness in 12 hours), and that a worker exposed to 12000ppm experienced headache, dizziness, leg weakness and fainting (ACGIH (2001)). So it was also set as Category 3 (anesthetic actions) based on the descriptions that a male who drank 200 ml fell coma, recovering his conciousness in 12 hours, and that a worker exposed to 12000 ppm experienced headache, dizziness, leg weakness and dead faint(ACGIH (2001)).

- Specific target organ toxicity (repeated exposure)

DICHLOROMETHANE	In humans, intermittent headache, vomiting, transient memory impairment, right brain impairment with right brain impairment, encephalopathy accompanied by hallucinations and hallucinations, intelligence disturbance, memory impairment and equilibrium sensation loss, bilateral transient temporal lobe degeneration, In hepatocellular carcinoma, hepatocellular vacuolation, hepatocyte mutation
ACETONE	It was classified into Category 2, since by the examination using volunteers, the significant increase in white corpuscles and an eosinophil and the significant reduction of a phagocytosis of a neutrophil were observed in the exposure group with 500 ppm, 6 hours/day for 6 days (ACGIH (2001)). In the examination using the rat and the mouse, although it was a dose greatly beyond guidance limits, the similar haematological changes like in humans was admitted (SIDS (1999)). Since in other examination using a rat and a mouse , each is over the guidance limits (ACGIH (2001)),(SIDS (1999)) and there is also no example of a report in humans, they were not adopted as a classification basis.

- Aspiration hazard

ACETONE	The calculated dynamic viscosity is 0.426mm^2/sec and there was not the animal data of chemical pneumonia, however, it was the ketone of under C13.

12. Ecological information

A. Aquatic and terrestrial ecotoxicity

- Fish

DICHLOROMETHANE	LC50 5.2 ㎎/ℓ 72 hr
ACETONE	LC50 > 100 ㎎/ℓ 96 hr

- Shellfish

DICHLOROMETHANE	EC50 1682 ㎎/ℓ 48 hr

B. Persistence and degradability	No data available
C. Bioaccumulative potential	

- Concentrated Castle

DICHLOROMETHANE	BCF 40

- Biodegradable

DICHLOROMETHANE	13 (%)
D. Mobility in soil	No data available
E. Other adverse effects	No data available

13. Disposal considerations

A. Disposal method	Destroy the product by incineration
B. Disposal precaution	Destroy the product by incineration

14. Transport information

A. UN number	2810
B. UN proper shipping name	Toxic liquids and organic substances are not separately indicated with the product name
C. Transport hazard class:	6.1
D. Packing group (if applicable)	III
E. Marin pollution (yes/no)	Yes

F. Special precaution which a user to be aware of or needs to comply with in connection with transport or conveyance either within or outside their premises:

- Emergency procedure at fire	F-A
- Emergency procedure at leakages	S-A

15. Regulatory information

A. Industrial Safety and Health Act	Management harmful agents
	Working environment measurement target material (measurement period: 6 months)
	Special medical examination the substance (diagnostic period: 12 months)
	Exposure limits set material
B. Toxic Chemical Control Act	Not Applicable.
C. Dangerous Material Safety Control Act	The 4th type, the 3st petroleum type
D. Wastes Management Act	Designated Wastes

E. Other requirements in domestic and other countries

- Domestic	Not Applicable.
- Other countries	
CERCLA	
DICHLOROMETHANE	453.599 kg 1000 lb
ACETONE	2267.995 kg 5000 lb
EPCRA 313	Applicable.
EU (Classification)	
DICHLOROMETHANE	Carc. Cat. 3; R40
ACETONE	F; R11Xi; R36R66R67
EU (Risk Phrases)	
DICHLOROMETHANE	R40
ACETONE	R11, R36, R66, R67
EU (Safety Phrases)	
DICHLOROMETHANE	S2, S23, S24/25, S36/37
ACETONE	S2, S9, S16, S26, S46

16. Other information

A. Information source and references

Source of data : Korea Occupational Safety and Health Agency (KOSHA)>

B. Issuing date	November 24, 2017
C. Revision number and date	3
D. others	

MATERIAL SAFETY DATA SHEET

DEAHEUNG CHEMICAL CO., LTD. www.dhcbond.co.kr

Product Name	DW-40NF(B)

1. Product and Company Identification

A. Product Name: DW-40NF(B)

B. Recommended use of the chemical and restrictions on use

- Recommended use of the chemical: polyurethane component; industrial chemicals
- Restrictions on use of the product: Do not use for purposes other than adhesive.

C. Manufacturer/Supplier/Distributor Information

- Name: DAEHEUNG CHEMICAL CO., LTD.
- Address: 68, Sandan-ro 64beon-gil, Pyeongtaek-si, Gyeonggi-do, Korea
- Emergency phone number: 82-31-668-1424

2. Hazards identification

A. Hazard·Risk Classification

Acute toxicity : Category 4(Inhalation-mist)
Serious eye damage / Irritation : Category 2A
Skin corrosion / Irritation : Category 2
Skin Sensitization : Category 1
Respiratory sensitization : category 1
Carcinogenic : Category 2
Target Organ Toxicity (Single Exposure) : Category 3(Respiratory tract irritation)
Target Organ Toxicity (Repeated Exposure) : Category 2(Inhalation-vapor)

B. Label elements including precautionary statements

- Symbol

- Signal Word: Danger
- Hazard·Risk Statement

H302 Harmful if swallowed
H315 Causes skin irritation
H317 May cause an allergic skin reaction
H319 Causes serious eye irritation
H330 Fatal if inhaled
H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled
H336 May cause drowsiness or dizziness
H351 Suspected of causing cancer
H411 Toxic to aquatic life with long lasting effects

- Precautionary Statement

Prevention

P201 Obtain special instructions before use
P202 Do not handle until all safety precautions have been read and understood
P260 Do not breathe dust/fume/gas/mist/vapours/spray
P261 Avoid breathing dust/fume/gas/mist/vapours/spray
P264 Wash Nthoroughly after handling

	P271 Use only outdoors or in a well-ventilated area
	P272 Contaminated work clothing should not be allowed out of the workplace
Prevention	P280 Wear protective gloves/protective clothing/eye protection/face protection
	P281 Use personal protective equipment as required
	P285 In case of inadequate ventilation wear respiratory protection
Response	P302+352 IF ON SKIN : Wash with soap and water
	P304+340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
	P304+341 IF INHALED: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing
	P305+351+338 IF IN EYES : Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do - continue rinsing
	P308+P313 IF exposed or concerned : Get medical advice/attention
	P312 Call a POISON CENTER or doctor/physician if you feel unwell
	P314 Get Medical advice/attention if you feel unwell
	P321 Specific treatment
	P332+313 If skin irritation occurs: Get medical advice/attention
	P333+313 If skin irritation or a rash occurs: Get medical advice/attention
	P337+313 If eye irritation persists get medical advice/attention
	P342+311 If experiencing respiratory symptoms: Call a POISON CENTER or doctor/physician
	P362 Take off contaminated clothing and wash before reuse
	P363 Wash contaminated clothing before reuse
Storage	P403+233 Store in a well ventilated place. Keep container tightly closed
	P405 Store locked up
Disposal	P501 Dispose of contents/container to in accordance with local/regional/national/international regulation.

C. Other Hazard·Risk which are not included in the classification criteria (e.g. dust explosion hazard)

No data available

3. Composition/Information on ingredients

Chemical Name	Other name	CAS number	Content(%)
Diphenylmethanediisocyanate, isomeres and homologues	-	9016-87-9	≥50%~≤60%
Diphenylmethane-4,4'-diisocyanate	MDI	101-68-8	≥25%~≤45%

4. First aid measures

A. General advice	Remove contaminated clothing.
B. If inhaled	Remove the affected individual into fresh air and keep the person calm. Assist in breathing if necessary. Immediate medical attention required.
C. If on skin	Wash affected areas thoroughly with soap and water. If irritation develops, seek medical attention.
D. If in eyes	In case of contact with the eyes, rinse immediately for at least 15 minutes with plenty of water. Immediate medical attention required.
E. If swallowed	Rinse mouth and then drink plenty of water. Do not induce vomiting. Never induce vomiting or give anything by mouth if the victim is unconscious or having convulsions. Immediate medical attention required.

F. Most important symptoms and effects, both acute and delayed

Symptoms: The most important known symptoms and effects are described in the labelling (see section 2) and/or in section 11., Eye irritation, skin irritation, allergic symptoms
Hazards: Symptoms can appear later.
Information on: Diphenylmethane-4,4'-diisocyanate (MDI)
Hazards: Respiratory sensitization may result in allergic (asthma-like) signs in the lower respiratory tract including wheezing, shortness of breath and difficulty breathing, the onset of which may be delayed. Repeated inhalation of high concentrations may cause lung damage, including reduced lung function, which may be permanent. Substances eliciting lower respiratory tract irritation may worsen the asthma-like reactions that may be produced by product exposures.

5. Fire-Fighting measures

A. Suitable extinguishing media	water spray, dry powder, carbon dioxide, foam
B. Hazards during fire-fighting	nitrous gases, fumes/smoke, isocyanate, vapour
C. Advice for fire-fighters	Protective equipment for fire-fighting: Firefighters should be equipped with self-contained breathing apparatus and turn-out gear.
D. Further information	Keep containers cool by spraying with water if exposed to fire. Dispose of fire debris and contaminated extinguishing water in accordance with official regulations.

6. Accidental release measures

A. Personal precautions, protective equipment and emergency procedures	Clear area. Ensure adequate ventilation. Wear suitable personal protective clothing and equipment.
B. Environmental precautions and protective procedures	Do not discharge into drains/surface waters/groundwater.
C. Methods and materials for containment and cleaning up	
- For small amounts	Absorb isocyanate with suitable absorbent material (see § 40 CFR, sections 260, 264 and 265 for further information). Shovel into open container. Do not make container pressure tight. Move container to a well-ventilated area (outside). Spill area can be decontaminated with the following recommended decontamination solution: Mixture of 90 % water, 8 % concentrated ammonia, 2 % detergent. Add at a 10 to 1 ratio. Allow to stand for at least 48 hours to allow escape of evolved carbon dioxide.
- For large amounts	If temporary control of isocyanate vapor is required, a blanket of protein foam or other suitable foam (available from most fire departments) may be placed over the spill. Transfer as much liquid as possible via pump or vacuum device into closed but not sealed containers for disposal.
- For residues	The following measures should be taken for final cleanup: Wash down spill area with decontamination solution. Allow solution to stand for at least 10 minutes. Dike spillage.

7. Handling and storage

A. Precautions for safe handling	Provide suitable exhaust ventilation at the processing machines. Ensure thorough ventilation of stores and work areas. Avoid aerosol formation. When handling heated product, vapours of the product should be ventilated, and respiratory protection used. Wear respiratory protection when spraying. Danger of bursting when sealed gastight. Protect against moisture. If bulging of drum occurs, transfer to well ventilated area, puncture to relieve pressure, open vent and let stand for 48 hours before resealing.
- Protection against fire and explosion	No explosion proofing necessary.
B. Conditions for safe storage (including any incompatibilities)	Keep away from water. Segregate from foods and animal feeds. Segregate from acids and bases. Segregate from bases.
- Suitable materials for containers	Carbon steel (Iron), High density polyethylene (HDPE), Low density polyethylene (LDPE), Stainless steel 1.4301 (V2)

– Further information on storage conditions	Formation of CO2 and build up of pressure possible. Keep container tightly closed and in a well-ventilated place. Outage of containers should be filled with dry inert gas at atmospheric pressure to avoid reaction with moisture.
– Storage temperature	32 – 110 °F Protect against moisture.

8. Exposure controls & personal protection

A. Control parameters (e.g. occupational exposure limit values, biological limit values)

– Diphenylmethane-4,4'-diisocyanate (MDI)	
	OSHA PEL CLV 0.02 ppm 0.2 mg/m3 ; CLV 0.02 ppm 0.2 mg/m3 ;
	ACGIH TLV TWA value 0.005 ppm ;
– P-MDI	OSHA PEL CLV 0.02 ppm 0.2 mg/m3 ; CLV 0.02 ppm 0.2 mg/m3 ;
	ACGIH TLV TWA value 0.005 ppm ;
– Isocyanic acid, polymethylenepolyphenylene ester(P-MDI)	OSHA PEL CLV 0.02 ppm 0.2 mg/m3 ; CLV 0.02 ppm 0.2 mg/m3 ;
	ACGIH TLV TWA value 0.005 ppm ;

C. Personal protective equipment

– Respiratory protection	When workers are facing concentrations above the occupational exposure limits they must use appropriate certified respirators. When atmospheric levels may exceed the occupational exposure limit (PEL or TLV) NIOSH-certified air-purifying respirators equipped with an organic vapor sorbent and particulate filter can be used as long as appropriate precautions and change out schedules are in place. For emergency or non-routine, high exposure situations, including confined space entry, use a NIOSH-certified full facepiece pressure demand self-contained breathing apparatus (SCBA) or a full facepiece pressure demand supplied-air respirator (SAR) with escape provisions.
– Hand protection	Chemical resistant protective gloves should be worn to prevent all skin contact., Suitable materials may include, chloroprene rubber (Neoprene), nitrile rubber (Buna N), chlorinated polyethylene, polyvinylchloride (Pylox), butyl rubber, depending upon conditions of use.
– Eye protection	Tightly fitting safety goggles (chemical goggles). Wear face shield if splashing hazard exists.
– Body protection	Cover as much of the exposed skin as possible to prevent all skin contact., Suitable materials may include, saran-coated material, depending upon conditions of use.
– General safety and hygiene measures	Wear protective clothing as necessary to prevent contact. Eye wash fountains and safety showers must be easily accessible. Observe the appropriate PEL or TLV value. Wash soiled clothing immediately. Contaminated equipment or clothing should be cleaned after each use or disposed of.

9. Physical and chemical properties

A. Appearance

Physical state	Liquid
Color	dark amber
B. Odour	faint odour, aromatic
C. Odour threshold	Not Applicable
D. pH	Not Applicable
E. Freezing point	<10 °C (1 ATM)
F. Boiling point	330 °C (1,013 mmbar)
G. Sublimation point	No applicable information available.
H. Flash point	220 °C (open cup)
I. Flammability(solid, gas)	Not flammable
J. Lower explosive limits	For liquids not relevant for classification and labelling. The lower explosion point may be 5 – 15 °C below the flash point.
K. Upper explosive limits	For liquids not relevant for classification and labelling.

L. Vapor pressure	<0.01 Pa (25 °C)
M. Density	1.24 g/cm3 (20 °C)
N. Relative density	1.22 (25 °C)
O Bulk density	10.17 lb/USg (25 °C)
P. Vapor density	8.5 (20 °C)
Q. Partitioning coefficient n-octanol/water (log Pow)	Not Applicable
R. Self-ignition temperature	>600 ℃
S. Thermal decomposition	No decomposition if stored and handled as prescribed/indicated.
T. Viscosity, dynamic:	100~2,000 mPa.s (25 °C)
U. Solubility in water	Reacts with water.
V. Molar mass	Not Applicable
W. Evaporation rate	Value can be approximated from Henry's Law Constant or vapor pressure.
X. Other Information	If necessary, information on other physical and chemical parameters is indicated

10. Stability and reactivity

A. Reactions	Corrosion to metals: No corrosive effect on metal. Oxidizing properties: not fire-propagating
B. Chemical stability	The product is stable if stored and handled as prescribed/indicated.
C. Possibility of hazardous reactions	Reacts with water, with formation of carbon dioxide. Risk of bursting. Reacts with alcohols. Reacts with acids. Reacts with alkalies. Reacts with amines. Risk of exothermic reaction. Risk of polymerization. Contact with certain rubbers and plastics can cause brittleness of the substance/product with subsequent loss in strength.
D. Conditions to avoid	Avoid moisture.
E. Incompatible materials	acids, amines, alcohols, water, Alkalines, strong bases, Substances/products that react with isocyanates.
F. Hazardous decomposition products	
- Decomposition products	Hazardous decomposition products: carbon monoxide, carbon dioxide, nitrogen oxide, hydrogen cyanide, nitrogen oxides, aromatic isocyanates, gases/vapours
- Thermal decomposition	No decomposition if stored and handled as prescribed/indicated.

11. Toxicological information

A. Primary routes of exposure	Routes of entry for solids and liquids are ingestion and inhalation, but may include eye or skin contact. Routes of entry for gases include inhalation and eye contact. Skin contact may be a route of entry for liquefied gases.
B. Acute Toxicity/Effects	
- Acute toxic	Assessment of acute toxicity: Inhalation of vapours may cause irritation of the mucous membranes of the nose, throat or trachea, breathlessness, chest discomfort, difficult breathing and reduced pulmonary function. Inhalation exposure well above the PEL may result additionally in eye irritation, headache, chemical bronchitis, asthma-like findings or pulmonary edema. Isocyanates have also been reported to cause hypersensitivity pneumonitis, which is characterized by flu-like symptoms, the onset of which may be delayed.
Oral	Information on: Diphenylmethane-4,4'-diisocyanate (MDI) Type of value: LD50 Species: rat (male/female) Value: > 2,000 mg/kg (Directive 84/449/EEC, B.1)
Inhalation	Type of value: LC50 Species: rat (male/female) Value: 2.0 mg/l (OECD Guideline 403) An aerosol was tested.
Dermal	Information on: Diphenylmethane-4,4'-diisocyanate (MDI) Type of value: LD50 Species: rabbit (male/female) Value: > 9,400 mg/kg

– Assessment other acute effects	Assessment of STOT single: Causes temporary irritation of the respiratory tract.
– Irritation / corrosion	Assessment of irritating effects: Irritating to eyes, respiratory system and skin. Skin contact may result in dermatitis, either irritative or allergic.
– Skin	Information on: Diphenylmethane-4,4'-diisocyanate (MDI) Species: rabbit Result: Irritating. Method: Draize test
– Eye	Information on: Diphenylmethane-4,4'-diisocyanate (MDI) Species: rabbit Result: Irritating. Method: Draize test
– Sensitization	Assessment of sensitization: Sensitization after skin contact possible. The substance may cause sensitization of the respiratory tract. As a result of previous repeated overexposures or a single large dose, certain individuals will develop isocyanate sensitization (chemical asthma) which will cause them to react to a later exposure to isocyanate at levels well below the PEL/TLV. These symptoms, which include chest tightness, wheezing, cough, shortness of breath, or asthmatic attack, could be immediate or delayed up to several hours after exposure. Similar to many non-specific asthmatic responses, there are reports that once sensitized an individual can experience these symptoms upon exposure to dust, cold air, or other irritants. This increased lung sensitivity can persist for weeks and in severe cases for several years. Chronic overexposure to isocyanates has also been reported to cause lung damage, including a decrease in lung function, which may be permanent. Prolonged contact can cause reddening, swelling, rash, scaling, or blistering. In those who have developed a skin sensitization, these symptoms can develop as a result of contact with very small amounts of liquid material, or even as a result of vapour-only exposure. Animal tests indicate that skin contact may play a role in causing respiratory sensitization.
	Information on: Diphenylmethane-4,4'-diisocyanate (MDI) Buehler test Species: guinea pig Result: sensitizing
	Mouse Local Lymph Node Assay (LLNA) Species: mouse Result: sensitizing Can cause skin sensitization
	other Species: guinea pig Result: sensitizing Studies in animals suggest that dermal exposure may lead to pulmonary sensitization. However, the relevance of this result for humans is unclear.
– Aspiration Hazard	No aspiration hazard expected.

C. Chronic Toxicity/Effects

– Repeated dose toxicity	Assessment of repeated dose toxicity: The substance may cause damage to the olfactory epithelium after repeated inhalation. The substance may cause damage to the lung after repeated inhalation. These effects are not relevant to humans at occupational levels of exposure.
	Information on: Diphenylmethane-4,4'-diisocyanate (MDI) Experimental/calculated data: rat (Wistar) (male/female) Inhalation 2 yrs, 6 hr/day 0, 0.2, 1, 6 mg/m3 , olfactory epithelium NOAEL: 0.2 mg/m3 LOAEL: 1 mg/m3
	The substance may cause damage to the olfactory epithelium after repeated inhalation. These effects are not relevant to humans at occupational levels of exposure. Repeated inhalative uptake of the substance did not cause damage to the reproductive organs.
– Genetic toxicity	Assessment of mutagenicity: The substance was mutagenic in various bacterial test systems; however, these results could not be confirmed in tests with mammals.

	Information on: Diphenylmethane-4,4'-diisocyanate (MDI) Genetic toxicity in vitro: OECD Guideline 471 Ames-test Salmonella typhimurium:with and without metabolic activation ambiguous
	Information on: Diphenylmethane-4,4'-diisocyanate (MDI) Genetic toxicity in vivo: OECD Guideline 474 Micronucleus assay rat (male) Inhalation negative No clastogenic effect reported.
- Carcinogenicity	Assessment of carcinogenicity: A carcinogenic potential cannot be excluded after prolonged exposure to severely irritating concentrations. These effects are not relevant to humans at occupational levels of exposure. IARC Group 3 (not classifiable as to human carcinogenicity).
	Information on: Diphenylmethane-4,4'-diisocyanate (MDI) Assessment of carcinogenicity: A carcinogenic potential cannot be excluded after prolonged exposure to severely irritating concentrations. These effects are not relevant to humans at occupational levels of exposure. IARC Group 3 (not classifiable as to human carcinogenicity).
	Information on: P-MDI
	Assessment of carcinogenicity: A carcinogenic potential cannot be excluded after prolonged exposure to severely irritating concentrations. These effects are not relevant to humans at occupational levels of exposure. IARC Group 3 (not classifiable as to human carcinogenicity).
	Information on: Methylenediphenyl diisocyanate Assessment of carcinogenicity: A carcinogenic potential cannot be excluded after prolonged exposure to severely irritating concentrations. These effects are not relevant to humans at occupational levels of exposure. IARC Group 3 (not classifiable as to human carcinogenicity).
	Information on: 1,3-Diazetidine-2,4-dione, 1,3-bis[4-[(4-isocyanatophenyl)methyl]phenyl]- Assessment of carcinogenicity: The product has not been tested. The statement has been derived from substances/products of a similar structure or composition. A carcinogenic potential cannot be excluded after prolonged exposure to severely irritating concentrations. These effects are not relevant to humans at occupational levels of exposure.
	Information on: Isocyanic acid, polymethylenepolyphenylene ester, polymer with.alpha.-hydro-.omega.-hydroxypoly(oxy-1,2-ethanediyl) Assessment of carcinogenicity: The product has not been tested. The statement has been derived from substances/products of a similar structure or composition. A carcinogenic potential cannot be excluded after prolonged exposure to severely irritating concentrations. These effects are not relevant to humans at occupational levels of exposure.
	Experimental/calculated data: OECD Guideline 453 rat Inhalation 0, 0.2, 1, 6 mg/m3 Result: Lung tumors
- Reproductive toxicity	Assessment of reproduction toxicity: Repeated inhalative uptake of the substance did not cause damage to the reproductive organs.
- Teratogenicity	Assessment of teratogenicity: The substance did not cause malformations in animal studies; however, toxicity to development was observed at high doses that were toxic to the parental animals.
- Development	OECD Guideline 414 rat Inhalation 0, 1, 4, 12 mg/m3 NOAEL Mat.: 4 mg/m3 NOAEL Teratog.: 4 mg/m3 The substance did not cause malformations in animal studies; however, toxicity to development was observed at high doses that were toxic to the parental animals.
D. Symptoms of Exposure	The most important known symptoms and effects are described in the labelling (see section 2) and/or in section 11., Eye irritation, skin irritation, allergic symptoms

– Medical conditions aggravated by overexposure	The isocyanate component is a respiratory sensitizer. It may cause allergic reaction leading to asthma-like spasms of the bronchial tubes and difficulty in breathing. Medical supervision of all employees who handle or come into contact with isocyanates is recommended. Contact may aggravate pulmonary disorders. Persons with history of respiratory disease or hypersensitivity should not be exposed to this product. Preemployment and periodic medical examinations with respiratory function tests (FEV, FVC as a minimum) are suggested. Persons with asthmatic conditions, chronic bronchitis, other chronic respiratory diseases, recurrent eczema or pulmonary sensitization should be excluded from working with isocyanates. Once a person is diagnosed as having pulmonary sensitization (allergic asthma) to isocyanates, further exposure is not recommended.

12. Ecological information

A. Aquatic and terrestrial ecotoxicity	
– Assessment of aquatic toxicity	There is a high probability that the product is not acutely harmful to aquatic organisms. The inhibition of the degradation activity of activated sludge is not anticipated when introduced to biological treatment plants in appropriate low concentrations. Based on long-term (chronic) toxicity study data, the product is very likely not harmful to aquatic organisms. The product may hydrolyse. The test result maybe partially due to degradation products. The product has not been tested. The statement has been derived from substances/products of a similar structure or composition. Toxicity to fish LC0 (96 h) > 1,000 mg/l, Brachydanio rerio (OECD Guideline 203, static) Aquatic invertebrates EC50 (24 h) > 1,000 mg/l, Daphnia magna (OECD Guideline 202, part 1, static) Aquatic plants EC0 (72 h) 1,640 mg/l (growth rate), Scenedesmus subspicatus (OECD Guideline 201, static)
B. Microorganisms/Effect on activated sludge	Toxicity to microorganisms OECD Guideline 209 aquatic aerobic bacteria from a domestic water treatment plant/EC50 (3 h): > 100 mg/l
C. Persistence and degradability	Assessment biodegradation and elimination (H2O) Poorly biodegradable. The product is unstable in water. The elimination data also refer to products of hydrolysis. Elimination information 0 % BOD of the ThOD (28 d) (OECD Guideline 302 C) (aerobic, activated sludge) Poorly biodegradable. Assessment of stability in water In contact with water the substance will hydrolyse slowly. Information on Stability in Water (Hydrolysis) t1/2 20 h (25 °C)
D. Bioaccumulative potential	Assessment bioaccumulation potential Significant accumulation in organisms is not to be expected. Bioaccumulation potential Bioconcentration factor: 200 (28 d), Cyprinus carpio (OECD Guideline 305 E)
E. Mobility in soil	Assessment transport between environmental compartments The substance will not evaporate into the atmosphere from the water surface. Adsorption to solid soil phase is not expected.

13. Disposal considerations

A. Waste disposal of substance	Incinerate or dispose of in a licensed facility. Do not discharge substance/product into sewer system.
B. Disposal precaution	DRUMS: Steel drums must be emptied and can be sent to a licensed drum reconditioner for reuse, a scrap metal dealer or an approved landfill. Do not attempt to refill or clean containers since residue is difficult to remove. Under no circumstances should empty drums be burned or cut open with gas or electric torch as toxic decomposition products may be liberated. Do not reuse empty containers.

14. Transport information

Land transport USDOT	Not classified as a dangerous good under transport regulations
Sea transport IMDG	Not classified as a dangerous good under transport regulations
Air transport IATA/ICAO	Not classified as a dangerous good under transport regulations
Further information	No data available

15. Regulatory information

A. Federal Regulations

Registration status: Chemical TSCA, US released / listed

EPCRA 311/312 (Hazard categories): Acute; Chronic

EPCRA 313:

CAS Nimber	Chemical name
101-68-8	Diphenylmethane-4,4'-diisocyanate (MDI)
9016-87-9	P-MDI

CERCLA RQ	CAS Number	Chemical name
5000 LBS	101-68-8; 9016-87-9	Diphenylmethane-4,4'-diisocyanate (MDI); P-MDI

Reportable Quantity for release: 13,157.9 lb

State regulations

State RTK	CAS Number	Chemical name
NJ	101-68-8	Diphenylmethane-4,4'-diisocyanate (MDI)
	9016-87-9	P-MDI
	26447-40-5	Methylenediphenyl diisocyanate
PA	101-68-8	Diphenylmethane-4,4'-diisocyanate (MDI)
	9016-87-9	P-MDI

NFPA Hazard codes: Health : 2 Fire: 1 Reactivity: 1 Special

HMIS III rating Health: 2 Flammability: 1 Physical hazard: 1

16. Other information

A. Information source and references

BASF NA Product Regulations, SDS Prepared on

B. Issuing date	November 24, 2017
C. Revision number and date	3
D. others	