

Nitric Acid**1. IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING****1.1 Product Identifier**

Chemical name: Nitric acid
EC number: 231-714-2
CAS number (EC inventory): 7697-37-2
Annex VI index number: 007-004-00-1
Registration number: 01-2119487297-23-0038
Chemical characterization: Nitric acid is an inorganic substance

1.2 Relevant identified uses of the substance or mixture and uses advised against

Nitric Acid is used in the manufacture of bulk, large scale chemicals (including petroleum products), manufacture of fine chemicals, as intermediate, formulation of preparations and/or re-packaging (excluding alloys), manufacture of food products, industrial use of processing aids in processes and products, not becoming part of articles, industrial use of reactive processing aids, industrial use of process regulators for polymerization processes in production of resins, rubbers, polymers, use in fertilizers, washing and cleaning products (including solvent based products), metal and non-metal surface treatment products, including galvanic and electroplating products, use in products such as ph-regulators, flocculants, precipitants, neutralization agents and use as laboratory reagent.

Relevant identified Uses (see corresponding Exposure Scenarios (ES) in annex) Manufacturing and industrial uses of HNO₃ (C<75%), ES1 (Annex 1)
Professional Use of Nitric acid (C< 75%), ES2 (Annex 2)

Uses advised against None

1.3 Details of the supplier of the safety data sheet

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2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

Classification (REGULATION (EC) No 1272/2008)

<u>Classification</u>	<u>Hazard statements:</u>
Oxid. Liquid 3	H272: May intensify fire; oxidizer
Met. Corr. 1	H290: May be corrosive to metals
Skin Corr. 1A	H314: Causes severe skin burns and eye damage

Classification (67/548/EEC, 1999/45/EC)

<u>Classification</u>	<u>Risk phrases:</u>
O - Oxidising	R8: Contact with combustible material may cause fire.
C - Corrosive	R35: Causes severe burns.

2.2 Label Elements

Labelling (REGULATION (EC) No 1272/2008)

Symbol(s):



GHS03: flame over circle



GHS05: corrosion

Signal word:

Danger

Hazard statements:

H314: Causes severe skin burns and eye damage.
H272: May intensify fire; oxidizer.
H290: May be corrosive to metals.

CLP supplemental hazard statement:

EUH071: Corrosive to the respiratory tract.

Precautionary statements

P210: Keep away from heat/sparks/open flames/hot surfaces.... No smoking.
P221: Take any precaution to avoid mixing with combustibles...
P260: Do not breathe dust/fume/gas/mist/vapours/spray.
P264: Wash... thoroughly after handling.
P280: Wear protective gloves/protective clothing/eye protection/face protection.
P310: Immediately call a POISON CENTER or doctor/physician.
P390: Absorb spillage to prevent material damage.
P304+P340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P301+P330+P331: IF SWALLOWED: rinse mouth. Do NOT induce vomiting.

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P303+P361+P353: IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.

P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Specific concentration limits:

Concentration (%)	Classification
$C \geq 65$	Oxid. Liquid 3 Skin Corr. 1A Met. Corr. 1
$20 \leq C \leq 65$	Skin Corr. 1A Met. Corr. 1
$5 \leq C < 20$	Skin Corr. 1B

Labelling in Annex I of Directive 67/548/EEC

Symbol(s):



O - OXIDISING



C – CORROSIVE

Risk phrases:

R8 - contact with combustible material may cause fire
R35 - causes severe burns

Safety phrases:

S1/2 - keep locked up and out of reach of children
S23 - do not breathe gas/fumes/vapour/spray (appropriate wording to be specified by the manufacturer)
S26 - in case of contact with eyes, rinse immediately with plenty of water and seek medical advice
S36 - wear suitable protective clothing
S45 - in case of accident or if you feel unwell, seek medical advice immediately (show the label where possible)

Specific concentration limits:

Concentration (%)	Classification
$5 \leq C < 20$	C; R34 Corrosive; Causes burns.
$C \geq 20$	C; R35 Corrosive; Causes severe burns.
$C \geq 70$	O; R8 Oxidising; Contact with combustible material may cause fire. C; R35 Corrosive; Causes severe burns.

2.3 Other Hazard

n.a.

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3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Hazardous substance

Chemical Name	CAS-No.	EC-No.	REACH No.	Concentration [%]
Nitric acid	7697-37-2	231-714-2	01-2119487297-23-0038	≥ 68 (w/w)

3.2 Mixtures

n.a.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice:	Give first aid and obtain medical attention immediately. First aiders should be protected adequately (see section "Handling and storage"). Remove affected person from further exposure. Ensure that eyewash facility and safety showers are provided close to the work place. Speed is essential.
If inhaled:	Move the injured person to fresh air at once. Keep the patient warm and at rest in a half upright position. Apply artificial respiration, if breathing has stopped or shows sign of failing. Mouth to mouth resuscitation may be dangerous. Administer oxygen if competent person is available.
In case of skin contact:	Drench with water, remove contaminated clothing and wash or shower the affected skin with plenty of water for at least 15 minutes. Chemical burns must be treated promptly by a physician.
In case of eye contact:	Immediately irrigate the eyes with eyewash solution or clean water for at least 15 minutes. Hold eyelids open during flushing. Do not allow victim to rub eyes.
If swallowed:	Do not induce vomiting. If the person is conscious, wash out mouth with water and give water or milk to drink. Obtain immediately medical attention.

4.2 Most important symptoms and effects, both acute and delayed:

n.a.

4.3 Indication of immediate medical attention and special treatment needed:

Following exposure to acid/NO_x fumes the patient should be kept under medical review for at least 48 hours as delayed pulmonary oedema may develop.

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5. FIRE-FIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media: Nitric acid is not combustible but if involved in a fire use the best means available to extinguish the fire (e.g water, or CO2)

Unsuitable extinguishing media: Do not use chemical extinguishers or foams or attempt to smother the fire with steam or sand.

5.2 Special hazards arising from the substance or mixture

Specific hazards during fire fighting / Specific hazards arising from the chemical: Nitric acid is not combustible, but has oxidizing properties and therefore may react with many combustible materials causing fires and releasing toxic fumes (nitrogen oxides).
May explode on contact with a powerful reducing agent.
Reacts with most common metals to liberate hydrogen which can form explosive mixtures with air

5.3 Advice for firefighters

Special protective equipment for fire-fighters: Wear self-contained breathing apparatus and full acid-resistant protective clothing.

Special fire fighting procedures: Use water sprays to cool fire-exposed containers and structures, to disperse vapours and to protect personnel.
Avoid disposal of contaminated fire fighting water to the environment.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Those dealing with major releases should wear full protective clothing including respiratory protection.
Avoid skin and eye contact and inhalation vapours.
Evacuate unnecessary personnel.

6.2 Environmental precautions

Contain spillage where possible and safe to do so. Take care to avoid the contamination of watercourses.
Inform appropriate authority in case of accidental contamination of watercourses or drains.
Dilute with water and neutralise the acid with, for example soda or sodium carbonate, before discharging contaminated material into treatment plants or water courses.

6.3 Methods and materials for containment and cleaning up

For small spillage dilute with water and neutralise cautiously with soda ash and/or lime and recover for disposal.
Contain/absorb large spillage with sand or earth as necessary. Do not use organic compounds, sawdust etc. Use a tool to scoop up solid or absorbed material and place into an appropriately labelled water container.
Pump large amounts of the spilled liquid into containers suitably labelled for disposal.
Isolate source of leak as quickly as possible.
Ventilate area of spill or leak to disperse vapours if necessary

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6.4 Reference to other sections

See section 8.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid skin and eye contact and inhalation of vapours.
Provide adequate ventilation.
Wear eye and hand protection when handling small quantities.
Wear full protective equipment where there is a risk of leaks or splashes.
When diluting, add acid to water and not water to acid.

7.2 Conditions for safe storage, including any incompatibilities

Store in cool, well ventilated area away from heat, ignition source and direct sunlight.
Do not permit smoking in the storage area.
Keep away from incompatible substances. (See Section 10 - Stability and reactivity).
Protect containers from corrosion and physical damage.
Follow appropriate Industry or National codes for bulk and container storage.
Containers should be of stainless steel and preferably of low carbon, content such as 304L or plastic (e.g. PVC).

7.3 Specific end use(s)

See exposure scenarios in annex to this SDS.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components	CAS-No.	Value	Control parameters	Legal Basis	Form of exposure
Nitric acid (HNO ₃)	7697-37-2	2.6 mg/m ³ (1ppm)	STEL	(2006/15/EC)	Vapours
Nitrogen dioxide		0,95mg/m ³ (0,5ppm)	TWA	German MAK commission	Gas

TWA: time weight average

STEL: Short term exposure limit based

DNEL value(s)

Acute – local effects inhalation 2.6 mg/m³
Long-term -local effects inhalation 1.3 mg/m³

PENEC value(s)

No data

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8.2 Exposure controls

8.2.1 Appropriate Engineering Controls

Local exhaust ventilation where appropriate.

Provide safety showers and eye washing facility at any location where skin or eye contact can occur.

8.2.2 Individual Protection Measures, Suchs as Personal Protective Equipment

Respiratory protection: Wear suitable breathing apparatus if exposure levels exceed or may exceed the recommended exposure limits e.g. masks equipped with filter type E (EN 14387) and B, self contained breathing apparatus.

Hand protection: Chemical resistant gloves complying with EN 374 should be worn at all times when handling nitric acid e.g. > 8 hrs. (Breakthrough time) butyl rubber, PVC, PTFE fluoro elastomer.

Eye protection: Use chemical safety goggles e.g. EN 166 or full face mask EN 402.

Skin and body protection: Wear chemical resistant, protective suit (EN 14605) and boots.

Hygiene measures: When handling the product do not eat, drink or smoke. Wash hands after handling and before eating, smoking and using the lavatory and at the end of the working period.

8.2.3 Environmental exposure controls

n.a.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

Appearance

Form: Nitric acid is liquid at the standard temperature (20 °C) and pressure (1013 hPa).

Colour: Colorless liquid

Safety data

pH 2
Boiling point/boiling range: 356 K at 1013 hPa
Melting point: 232 K at 1013 hPa
Flammability (solid, gas): non flammable
Vapour pressure: 6.1E+03 Pa at 293 K
Relative density: 1.513 at 20°C
Water solubility: 5.0E+05 mg/L at 20 °C
Viscosity, dynamic: 0.75 mPa s at 25 deg C.
Explosive properties: non explosive

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Oxidizing properties: Nitric acid is a (strong) oxidizing substance.

9.2 Other information

Dissociation constant: $pK_a = -1$

10. STABILITY AND REACTIVITY

10.1 Reactivity

Thermally stable in reaction terms at normal storage conditions.

10.2 Chemical stability

Can react violently with reducing agents, strong bases, organic materials, chlorides and finally divided metals.
Is corrosive to concrete.

10.3 Possibility of hazardous reactions

Can react violently with reducing agents, strong bases, organic materials, chlorides and finally divided metals.

10.4 Conditions to avoid

Avoid direct heat and high temperature to prevent nitric acid fumes release and damage of container.
Avoid reaction with most common metals because it may liberate hydrogen.
Reaction with water is exothermic.

10.5 Incompatible materials

Avoid combustible materials, organic matter, reducing agents, alkalies, metallic powders, hydrogen sulphide, alcohols, chlorates and carbides, carbon steel, monel, copper, several other metals and alloys, flammable liquids and chromic acid.
Can react violently with reducing agents, strong bases, organic materials, chlorides and finally divided metals.
Is corrosive to concrete.

10.6 Hazardous decomposition products

When heated, nitric acid and NO_x vapours may be evolved.

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Nitric acid is a corrosive substance to skin and eye. It is not considered to have bioaccumulative potential as nitrate is highly soluble in water and rapidly excreted via the urine. From the results obtained on nitric acid, sodium and potassium nitrates and due to their structural similarities with nitric acid, it is possible to conclude that nitric acid is not expected to cause genetic toxicity. From the study of Dockery & al, 1996, gaseous acids (HNO₂ and HNO₃) were associated with a significantly higher risk of asthma and showed a positive association with higher reporting of attacks of wheezing, persistent wheeze, and any asthmatic symptoms. Nitric acid is not expected to be systemically available

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in the body under normal handling and use conditions and therefore systemic effects of nitric acid after repeated exposure are not expected to occur.

Hazard class	Dose descriptor	Method/reference
Acute oral toxicity:	Acute toxicity test does not generally need to be conducted if the substance is classified as corrosive to the skin (column 2 adaptation, Annex VIII, section 8.5).	
Acute dermal toxicity:	Acute toxicity test does not generally need to be conducted if the substance is classified as corrosive to the skin (column 2 adaptation, Annex VIII, section 8.5).	
Acute inhalation toxicity:	LC ₅₀ (1h): 1562.5mg/m ³ air (rat male/female) test mat. Nitric acid;	Equivalent or similar to OECD Guideline 403 (Acute Inhalation Toxicity)
Skin irritation:	Nitric acid is a skin corrosive substance, therefore, <i>in vitro</i> testing for skin irritation or corrosion with this substance is not useful. <i>In vivo</i> testing can be waived according to the REACH Regulation as nitric acid is a strong acid (pH < 2) (column 2 adaptation, Annex VIII, section 8.1.1).	
Skin corrosion:	Nitric acid is classified as a skin corrosive substance category 1A (concentration > or = 20%) and category 1B (5% < or = concentration and 20%) according to the CLP Regulation Annex VI, table 3.1 (EC Regulation 1272/2008 on classification, labeling and packaging of substances and mixtures).	
Eye irritation/corrosion:	Nitric acid is a skin corrosive substance, therefore, <i>in vitro</i> testing for eye irritation or corrosion with this substance is not useful. <i>In vivo</i> testing can be waived according to the REACH Regulation as nitric acid is a strong acid (pH < 2) (column 2 adaptation, Annex VIII, section 8.1.1).	
Skin Sensitisation:	According to the REACH Regulation, testing for skin sensitization does not need to be conducted if the substance is a strong acid (pH < 2,0) (column 2 adaptation, Annex VII, section 8.3).	

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Hazard class	Dose descriptor	Method/reference
Germ cell mutagenicity Genotoxicity <i>in vivo</i> :	Negative (no translocations in P1 males) (mouse male); Test material (CAS number): 7631-99-4 (read-across from supporting substance)	OECD 485 is not followed, not GLP, no positive control, less animals used; heritable translocation test (heritable translocation test)
Carcinogenicity:	Inconclusive, unreliable information;	
Reproductive toxicity Fertility:	NOAEL (P):1500 mg/kg bw/day (rat (wistar) male/female) (test mat. CAS no: 7757-79-1) (no effects at the highest dose tested);	OECD Guideline 422 (Combined Repeated Dose Toxicity Study with the Reproduction / Developmental Toxicity Screening Test)
Teratogenicity/development:	NOAEL: 1500 mg/kg/day (general toxicity) rat(Sprague-Dawley);	OECD Guideline 422 (Combined Repeated Dose Toxicity Study with the Reproduction / Developmental Toxicity Screening Test)
STOT - SE	No data.	
STOT- RE	No data.	
Aspiration hazard	No data.	

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Information on environmental effects

The studies show that a pH caused by adding nitric acid roughly between pH at 3 (or lower) and 4 is critical for fish. Long-term toxicity test on fish does not need to be conducted as nitric acid will dissociate into H⁺ ions (resulting in a pH decrease) and nitrate ions, and the endpoint can consequently be covered with a study done on sodium nitrate, which also dissociates into nitrate ions. Finally, long-term effects to fish at environmentally relevant pH values are not expected to occur, similarly as in aquatic invertebrates.

Hazard class	Dose descriptor	Method/reference
Toxicity to fish:	Median lethal pH (96h) 3-3.5 for <i>Lepomis macrochirus</i> Median lethal pH (96h) ca. 3.7 for <i>Oncorhynchus mykiss</i> Additional study with sodium nitrate: LC ₅₀ (96h) 8226 mg/L for rainbow trout (no guideline followed) NOEC <i>Amphiprion ocellaris</i> (anemone fish) (3 mo): 97.8 mg/L;	Ellgaard EG and Gilmore JY III (1984) (no guideline followed). Swift MC and Morgan RP (1983) (no guideline followed). Frakes, T. and Hoff, Jr., F.H. (1982)
Toxicity to daphnia and other aquatic invertebrates:	LC ₅₀ (pH range tested: 3.4-8.1) (48 h): 4.4 pH (<i>Ceriodaphnia dubia</i>) standard units based on: mortality; LC ₅₀ (pH range tested: 3.2-8.0) (48 h): 4.7 (<i>Ceriodaphnia dubia</i>) pH standard units based on: mortality	Methods of measuring the acute toxicity of effluents to freshwater and marine organisms.- W. H. Peltier and C. I. Weber, eds. USEPA/ 600/4-85/013. Cincinnati, Ohio. USEPA. 1985.

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12.2 Persistence and degradability

n.a.

12.3 Bioaccumulative potential

As nitric acid is extremely soluble in water, it will not accumulate in fatty tissues. Therefore bioaccumulation studies are deemed not relevant.

12.4 Mobility in soil

No data.

12.5 Results of PBT/vPvB assessment

The criteria for the identification of PBT/vPvB properties, as laid down in REACH Annex XIII do not apply to inorganic substances. This implies that inorganic substances like nitric acid will not be identified as PBT or vPvB substances.

12.6 Other adverse effects

n.a.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Small quantities: Neutralize carefully with lime or carbonates.
Empty remaining contents.

14. TRANSPORT INFORMATION

ADR	UN number:	2031-NITRIC ACID (other than red fuming, with nitric acid>70%) 2031-NITRIC ACID (other than red fuming, with nitric acid 65-70%) 2031-NITRIC ACID (other than red fuming, with nitric acid <65%)
	UN proper shipping name:	Nitric Acid
	Transport hazard class(es):	8
	Packing group:	I (nitric acid >70%) II (nitric acid <70%)
	Classification Code:	CO1 (nitric acid > 65%) C1 (nitric acid <65%)
	Hazard identification No:	85 (nitric acid >65%) 80 (nitric acid <65%)
	Labels:	8 + 5.1 (nitric acid>65%) 8 (nitric acid <65%)
	Tunnel restriction code:	(E)
	Environmentally hazardous :	
IATA	UN number:	2031-NITRIC ACID (other than red fuming, with nitric acid>70%)

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UN proper shipping name: Transport hazard class(es): Packing group: Labels: Packing instruction (cargo aircraft): Packing instruction (passenger aircraft): Packing instruction (LQ): Environmentally hazardous:	2031-NITRIC ACID (other than red fuming, with nitric acid 65-70%) 2031-NITRIC ACID (other than red fuming, with nitric acid <65%) Nitric Acid 8 I (nitric acid >70%) II (nitric acid <70%) 8 + 5.1 (nitric acid >65%) 8 (nitric acid <65%)
IMDG UN number: UN proper shipping name: Transport hazard class(es): Packing group: Hazard identification No: Labels: EmS Number 1: Marine pollutant:	2031-NITRIC ACID (other than red fuming, with nitric acid >70%) 2031-NITRIC ACID (other than red fuming, with nitric acid 65-70%) 2031-NITRIC ACID (other than red fuming, with nitric acid <65%) Nitric Acid 8 I (nitric acid >70%) II (nitric acid <70%) 85 (nitric acid >65%) 80 (nitric acid <65%) 8 + 5.1 (nitric acid >65%) 8 (nitric acid <65%) F-A, S-Q (nitric acid > 65%) F-A, S-B (nitric acid < 65%)
RID UN number: UN proper shipping name: Transport hazard class(es): Packing group: Classification Code: Hazard identification No: Labels: Environmentally hazardous:	2031-NITRIC ACID (other than red fuming, with nitric acid >70%) 2031-NITRIC ACID (other than red fuming, with nitric acid 65-70%) 2031-NITRIC ACID (other than red fuming, with nitric acid <65%) Nitric Acid 8 I (nitric acid >70%) II (nitric acid <70%) CO1 (nitric acid > 65%) C1 (nitric acid <65%) 85 (nitric acid >65%) 80 (nitric acid <65%) 8 + 5.1 (nitric acid >65%) 8 (nitric acid <65%)

15. REGULATORY INFORMATION

The elaboration of this safety data sheet was based on the criteria of Dir 67/548/EEC of 27 July (DSD), transposed into national law by Decree 98/2010 of 11 August, the EC Reg. No 1272 / 2008 of 16 December (CLP) and the EC Reg. No 1907/2006 of 18 December (REACH).

16. OTHER INFORMATION

This information only concerns the above mentioned product and does not need to be valid if used with other product(s) or in any process. The information is to our best present knowledge correct and complete and is given in good faith but without warranty. It remains the user's own responsibility to make sure that the information is appropriate and complete for his special use of this product.

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Annex 1

Manufacturing and industrial uses of HNO₃ (C<75%) - Exposure Scenario ES1

1. Short title of exposure scenario 1	
Manufacturing and industrial use of nitric acid – Concentration <75%	
2. Description of activities and processes covered in the exposure scenario	
Sector of use (SU)	SU 3, SU4, SU 8, SU 9, SU 10, SU12, SU14, SU 15, SU 16
Product category (PC)	PC0, PC7, PC12, PC14, PC15, PC19, PC20, PC33, PC35, PC37
Process category (PROC)	PROC 1: Use in closed process, no likelihood of exposure. PROC 2: Use in closed, continuous process with occasional controlled exposure. PROC 3: Use in closed batch process (synthesis or formulation). PROC 4: Use in batch and other process (synthesis) where opportunity for exposure arises. PROC 5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact). PROC 7: Industrial spraying. PROC 8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities. PROC 8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities. PROC 9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing). PROC 10: Roller application or brushing. PROC 13: Treatment of articles by dipping and pouring. PROC 14: Production of preparations or articles by tableting, compression, extrusion, pelletisation. PROC 15: Use as laboratory reagent.
Article category (AC)	Not applicable
Environmental release category (ERC)	ERC 1 Manufacture of substances ERC 2 Formulation of preparations ERC 4: Industrial use of processing aids in processes and products, not becoming part of articles. ERC 6a: Industrial use resulting in manufacture of another substance (use of intermediates). ERC 6b Industrial use of reactive processing aid ERC 6d: Industrial use of process regulators for polymerisation processes in production of resins, rubbers, polymers. ERC 7 Industrial use of substances in closed systems
3. Operational conditions	
3. 1 Operational conditions related with frequency and quantities of use	
Duration of exposure at workplace:	8 hours/day
Frequency of exposure at workplace:	220 days/year for each worker

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Annual amount used per site:	The daily and annual amount/emission per site is not considered to be the main determinant for environmental exposure.
3.2 Operational conditions related with substance/ product	
Physical state	Liquid
Concentration of substance in mixture	Aqueous solutions contain more than 25% nitric acid up to a maximum of 75% nitric acid.
3.3 Other relevant operational conditions	
Based on the information retrieved, the maximum duration considered for this exposure scenario is a working shift of above 4h/day. Concentration of nitric acid in industrial application range from 25 to 75% and worst case will be taken into account.	
4. Risk Management Measures	
4.1 RMMs related to workers	
Organisational measures	Workers in the identified risky process/areas should be trained a) to avoid to work without protection and b) to understand the corrosive properties and, especially, the respiratory inhalation effects of nitric acid and c) to follow the safer procedures instructed by the employer The employer has also to ascertain that the required PPE is available and used according to instructions.
Technical measures	<ul style="list-style-type: none">• Use closed/ automated systems or covering of open containers (e.g. screens) to avoid irritating mists, sprayings and potential splashes. (Good practice)• Transport over pipes, technical barrel filling/emptying of barrel with automatic systems (suction pumps etc.) (Good practice)• Use of pliers, grip arms with long handles with manual use "to avoid direct contact and exposure by splashes (no working over one's head)" (Good practice)• Store in cool, dry, clean, well ventilate areas away from alkaline products and metals. Do not store under direct sun light. Do not pile up the containers. Do not store at temperatures close to freezing point. (Good practice).• Compatible materials: stainless steel 316-L; high density polyethylene; glass• Local exhaust / general ventilation is not required but good practice
Respiratory protection	Respiratory protection: respiratory protection is not required to usual works. In foggy-vapororous situations like spraying, use of a spreading over all facemask with a suitable inorganic acid filler. In case of spraying a mask with an Assigned Protection Factor (APF) = 20 as given in BS EN 529:2005 are recommended. For short time exposure masks , EN149 type FF P3, EN 14387 type B or Type E model P3, EN 1827 class FMP3 are recommended (Non exhaustive list). For longer time of exposure full masks or masks with an apparatus providing fresh air are recommended – Full mask EN 143, EN 14387, EN 12083 class P3 or class XP3, EN12941 class TH3, EN 12942 TM3, EN14593 or EN138. (Non exhaustive list)
Hand protection	Hand protection is required: use impervious chemical resistant protective gloves complying with EN 374 (required): material: butyl rubber, PVC, PTFE fluoro elastomer.
Eye protection	Wearing of eye/face protection is required. Chemical goggles EN166 or face protection shield EN 402 or equivalent are required.
Skin and body protection	Wearing of suitable acid resistant protective clothing and rubber boots is required.
Hygiene measures	Keep away from foodstuffs, drinks and tobacco. Wash hands before breaks and at

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end of work. Keep work clothes separate.

4.2 RMMs related to the environment

Organisational measures	Procedural and/or control technologies are required to minimize emissions and the resulting exposure during cleaning and maintenance procedures.
Abatement measures related with wastewater	Nitric acid wastewater should be reused or discharged to the industrial wastewater and further neutralized if needed
Abatement measures waste air and solid waste	Nitric acid is not expected to be found in the solid waste nor to reach the air compartment, due to its low vapour pressure and degradation in NOx.

4.3 Waste related measures

Type of waste	Liquid waste. Packaging material
Disposal technique	The neutralised liquid can be spilled in accordance to regulatory normative .The residue of the containers or the used container itself should be disposed in accordance with local requirements.
Fraction released to environment during waste treatment	The pH of wastewater released from manufacturing sites should be between pH 6-9.

5. Prediction of exposure resulting from the conditions described above and the substance properties.

5.1. Human exposure

Workers (oral)	No significant oral exposure due to good hygiene practice.	
Workers (inhalation) <i>DNEL = 1.3 mg/m3</i>	Liquid - Calculated with MEASE	RCR
PROC 1	0.001 mg/m ³	0.0008
PROC 2	0.001 mg/m ³	0.0008
PROC3	0.01 mg/m ³	0.0077
PROC 4	0.05 mg/m ³	0.0385
PROC 5	0.05 mg/m ³	0.0385
PROC 8a	0.05 mg/m ³	0.0385
PROC 8b	0.01 mg/m ³	0.0077
PROC 9	0.01 mg/m ³	0.0077
PROC 10	0.05 mg/m ³	0.0385
PROC 13	0.01 mg/m ³	0.0077
PROC 14	0.01 mg/m ³	0.0077
PROC15	0.01 mg/m ³	0.0077
PROC 7 – With mask APF 20	0.05 mg/m ³	0.0385
Workers (dermal)	As reported in the CLP Regulation No 1272/2008 Annex VI Table 3.1, nitric acid is corrosive above the 20% concentration limit. Therefore effective control measures are	

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in place to prevent dermal exposure. Furthermore protective clothing and gloves are considered to be used consistently when handling corrosive substances. Production companies report the use of protective gloves and thus repeated daily dermal exposure to commercial product is considered negligible.

5.2. Environmental exposure (qualitative assessment)

Environmental release	The production of nitric acid can potentially result in aquatic emissions and locally increase the nitrate concentration while decreasing the pH in the aquatic environment. However, the pH of industrial effluents is normally measured frequently and can be neutralized easily.
Waste water treatment plants (WWTP)	Not relevant. Nitric acid dissociates in H^+ and NO_3^- and will be neutralized before reaching WWTP.
Aquatic pelagic compartment	Due to its high water solubility, nitric acid is mainly found in soil (migrating towards the groundwater table) and water compartments: there, nitric acid progressively dissociates affecting the pH of the receiving compartment. The higher the buffer capacity of the water is, the lower the effect on pH will be.
Sediments	Not relevant. There will be no absorption on particulate matter or surfaces.
Soil and groundwater	Not relevant. Infiltration, partial neutralization, dispersion, dilution.
Atmospheric compartment	Nitric acid is highly soluble and in air will react into NO_x . These NO_x emissions in the troposphere are small compared to releases from combustion processes
Secondary poisoning	Bioaccumulation in organisms is not relevant for nitric acid.

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Annex 2

Professional Use of Nitric acid (C< 75%) - Exposure Scenario ES2

1. Short title of exposure scenario 2	
Professional use of nitric acid – Concentration < 75%	
2. Description of activities and processes covered in the exposure scenario	
Sector of use (SU)	SU 1, SU 22
Product category (PC)	PC12, PC14, PC15, PC20, PC21, PC35
Process category (PROC)	PROC 5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact). PROC 8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities. PROC 8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities. PROC 9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing). PROC 10: Roller application or brushing. PROC 11: Non industrial spraying. PROC 13: Treatment of articles by dipping and pouring. PROC 15: Use as laboratory reagent PROC 19: Hand-mixing with intimate contact and only PPE available.
Article category (AC)	Not applicable
Environmental release category (ERC)	ERC 8a (Wide dispersive indoor use of processing aids in open systems) ERC 8b (Wide dispersive indoor use of reactive substances in open systems) ERC 8e (Wide dispersive outdoor use of reactive substances in open systems)
3. Operational conditions	
3.1 Operational conditions related with frequency and quantities of use	
Duration of exposure at workplace:	8 hours/day
Frequency of exposure at workplace:	220 days/year for each worker
Annual amount used per site:	The daily and annual amount/emission per site is not considered to be the main determinant for environmental exposure.
3.2 Operational conditions related with substance/ product	
Physical state	Liquid
Concentration of substance in mixture	Nitric acid is used during the production phase of various cleaning products, although often the amount in the end products is limited due to its reactivity. Nevertheless in case of this scenario worst case scenario was considered with products containing more than 25% nitric acid but always less than 75%.
3.3 Other relevant operational conditions	
The amount used per professional workers varies from activity to activity. The maximum duration >4 h/day was considered	

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as worst case assumption.

4. Risk Management Measures

4.1 RMMs related to workers

Organisational measures	Because nitric acid is corrosive, the risk management measures for human health should focus on the prevention of direct contact with the substance. Since automated, closed systems and local exhaust ventilation may be less feasible to implement for professional settings, product related design measures should be taken (low concentration for example) as well as good practices that prevent direct eye/skin contact with nitric acid and prevent formation of aerosols and splashes are more important along with the personal protective equipment measures.
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	<i>HNO3 concentration in product > 20%:</i>	<i>HNO3 concentration in product between 5% and 20%:</i>	<i>HNO3 concentration in product < 5%</i>
Respiratory protection	Compulsory	Recommended	Good practice
Hand protection	Compulsory	Recommended	Good practice
Eye protection	Compulsory	Recommended	Good practice
Skin and body protection	Compulsory	Recommended	Good practice

Hygiene measures	Keep away from foodstuffs, drinks and tobacco. Wash hands before breaks and at end of work. Keep work clothes separate..
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4.2 RMMs related to the environment

Organisational measures	Procedural and/or control technologies are required to minimise emissions and the resulting exposure during cleaning and maintenance procedures.
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Abatement measures related to wastewater	Different rules apply to professional users regarding control of their effluents. It is required that the flow of release to municipal wastewater or to surface water do not cause significant in pH changes. It is then dependant whether or not discharging is done to municipal wastewater equipped with sewage treatment plant or not.
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Abatement measures related to waste air	Nitric acid is not expected to be found in the solid waste nor to reach the air compartment, due to its low vapour pressure and degradation in NOx. Therefore, no specific risk management measures for air emissions are provided..
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Abatement measures related to soil	For release to soil for fertilizer uses, the pH will be naturally neutralized by the medium before reaching the groundwater.
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4.3 Waste related measures

Type of waste	Liquid waste – packaging material
Disposal technique	The neutralised liquid can be spilled in accordance to applicable normative. The residue of the containers or the used container itself should be disposed in accordance with local requirements.

5. Prediction of exposure resulting from the conditions described above and the substance properties.

5.1. Human exposure

Professionals (oral)	No significant oral exposure due to good hygiene practice.
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Professionals (dermal)	As reported in the CLP Regulation No 1272/2008 Annex VI Table 3.1, nitric acid is corrosive above the 20% concentration limit. Therefore effective control measures are in place to prevent dermal exposure. Furthermore protective clothing and gloves are
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considered to be used consistently when handling corrosive substances. Production companies report the use of protective gloves and thus repeated daily dermal exposure to commercial product is considered negligible.

Professional (inhalation)	Calculated with MEASE	RCR
<i>DNEL = 1.3 mg/m³</i>		
PROC 5	0.1 mg/m ³	0.08
PROC8a	0.05 mg/m ³	0.04
PROC8b	0.05 mg/m ³	0.04
PROC9	0.05 mg/m ³	0.04
PROC10	0.05 mg/m ³	0.04
PROC 13	0.05 mg/m ³	0.04
PROC14	0.1 mg/m ³	0.08
PROC15	0.01 mg/m ³	0.01
PROC19	0.05 mg/m ³	0.04
PROC 11 with mask APF40	0.5 mg/m ³	0.38

5.2. Environmental exposure (qualitative assessment)

Environmental release	The production of nitric acid can potentially result in aquatic emissions and locally increase the nitrate concentration while decreasing the pH in the aquatic environment. However, the pH of industrial effluents is normally measured frequently and can be neutralized easily.
Waste water treatment plants (WWTP)	Not relevant. Nitric acid dissociates in H ⁺ and NO ³⁻ and will be neutralized before reaching WWTP.
Aquatic pelagic compartment	Due to its high water solubility, nitric acid is mainly found in soil (migrating towards the groundwater table) and water compartments: there, nitric acid progressively dissociates affecting the pH of the receiving compartment. The higher the buffer capacity of the water is, the lower the effect on pH will be.
Sediments	Not relevant. There will be no absorption on particulate matter or surfaces.
Soil and groundwater	Not relevant. Infiltration, partial neutralization, dispersion, dilution.
Atmospheric compartment	Not relevant. Nitric acid release is negligible, due to its low vapour pressure and degradation in NOx.
Secondary poisoning	Bioaccumulation in organisms is not relevant for nitric acid.