SECTION 1: Identification of the substance / mixture and of the company / undertaking

1.1 Product identifier
Chemical name: 2-Furaldehyde
Synonyms: Furan-2-carbaldehyde, 2-Furfuraldehyde, Furan-2-carboxaldehyde, 2-Furylmethanal, Fural, 2-Formyl furan, Furanaldehyde, Pyromucis aldehyde, Ant Oil.
Formula: C₅H₄O₂
Molecular mass: 96.09
CAS-No.: 98-01-1
EC-No.: 202-627-7
Registration number: 01-2119486861-27-0002

1.2 Relevant identified uses of the substance or mixture and uses advised against
Relevant identified uses of the substance or mixture
- Intermediate for manufacturing furan derivates  
  Exposure scenario: ES 4
- Use of Furfural as intermediate in pesticide production  
  Exposure scenario: ES 5
- Manufacturing of blends / formulations  
  Exposure scenario: ES 6
- Manufacturing of polymers  
  Exposure scenario: ES 7
- Use of Furfural in the manufacturing of abrasive wheels, brake linings and refractories - by using formulations  
  Exposure scenario: ES 8
- Use of Furfural in the petroleum refining industry as extraction agent  
  Exposure scenario: ES 9
- Professional end use of acid resistant coating – by using formulations  
  Exposure scenario: ES 10
- Spray turf indoor uses  
  Exposure scenario: ES 11
- Spray turf outdoor uses  
  Exposure scenario: ES 12
- Dripper indoor uses  
  Exposure scenario: ES 13
- Dripper outdoor uses  
  Exposure scenario: ES 14
- Spray indoor uses  
  Exposure scenario: ES 15
- Spray outdoor uses  
  Exposure scenario: ES 16

Uses advised against: None

1.3 Details of the supplier of the safety data sheet
Importer: International Furan Chemicals B.V.
Address: Rotterdam Airportplein 7
3045 AP ROTTERDAM
The Netherlands
Telephone number: +31 10 238 05 55
Telefax number: +31 10 238 05 50
E-mail address: sales@furan.com

1.4 Emergency telephone numbers
Emergency number: +32 14 58 45 45 (24 h /24 h)
Information centre of dangerous goods (BIG)
Medical information:
- England and Wales: 0844 892 01 11 NPIS London, for healthcare professionals
- Scotland: 08454 24 24 24 NHS 24
- Republic of Ireland: +353 (0) 1 837 99 64 for healthcare professionals
  +353 (0) 1 809 25 66 for healthcare professionals

SECTION 2: Hazards identification
2.1 Classification of the substance or mixture
According to Regulation (EC) No. 1272/2008 (EU-GHS / CLP)
Hazard Classes, Category- and -Statement Codes

<table>
<thead>
<tr>
<th>Classification of the substance or mixture</th>
<th>Flam. Liq. 3, H226</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flammable liquid</td>
<td></td>
</tr>
<tr>
<td>Acute toxicity</td>
<td>Acute Tox. 2, H330</td>
</tr>
<tr>
<td>Acute toxicity</td>
<td>Acute Tox. 3, H301</td>
</tr>
<tr>
<td>Acute toxicity</td>
<td>Acute Tox. 4, H312</td>
</tr>
<tr>
<td>Eye irritation</td>
<td>Eye Irrit. 2, H319</td>
</tr>
<tr>
<td>Skin irritation</td>
<td>Skin Irrit. 2, H315</td>
</tr>
<tr>
<td>Specific target organ toxicity – single exposure</td>
<td>STOT SE 3, H335</td>
</tr>
<tr>
<td>Carcinogenicity</td>
<td>Carc. 2, H351</td>
</tr>
<tr>
<td>Hazardous to the aquatic environment</td>
<td>Aquatic Chronic 3, H412</td>
</tr>
</tbody>
</table>
Safety Data Sheet  
according to Regulation (EC) No 1907/2006

Furfural  

According to Directive 67/548/EEC (EU DSD / DPD)
Indications of danger and classification

<table>
<thead>
<tr>
<th>Carcinogenicity</th>
<th>Toxic</th>
<th>Harmful</th>
<th>Irritant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carc. Cat. 3; R40</td>
<td>T; R23/25</td>
<td>Xn; R21</td>
<td>Xi; R36/37/38</td>
</tr>
</tbody>
</table>

Essential adverse effects
The substance is toxic by inhalation and if swallowed and is harmful in contact with skin. Irritating to eyes, respiratory system and skin.

2.2 Label elements
According to Regulation (EC) No. 1272/2008 (CLP)

Hazard pictograms

Signal word
Danger

Hazard statements
- H226: Flammable liquids and vapour.
- H330: Fatal if inhaled.
- H301: Toxic if swallowed.
- H312: Harmful in contact with skin.
- H319: Causes serious eye irritation.
- H315: Causes skin irritation.
- H335: May cause respiratory irritation.
- H351: Suspected of causing cancer.
- H412: Harmful to aquatic life with long lasting effects.

Precautionary statements
- P201: Obtain special instructions before use.
- P210: * Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
- P271: Use only outdoors or in a well-ventilated area.
- P280: * Wear protective gloves / protective clothing / eye protection.
- P403 + P233: * Store in a well-ventilated place. Keep container tightly closed.
- P304 + P340: * If INHALED: Remove person to fresh air and keep comfortable for breathing.
- P301 + P310: * IF SWALLOWED: Immediately call a POISON CENTER / doctor / physician.
- P302 + P352: * IF ON SKIN: Wash with plenty of water / soap.
- P305 + P351 + P338: * 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.
- P501: Dispose of contents / container to a specialised processing facility for disposal in accordance with local / regional regulations.

* on label

2.3 Other hazards
Furfural does not meet the criteria for PBT or vPvB according to Regulation 1907/2006.

SECTION 3: Composition / information on ingredients

3.1 Substances

<table>
<thead>
<tr>
<th>Main constituent</th>
<th>Identity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Furaldehyde</td>
<td>CAS-No. 98-01-1</td>
<td>&gt;98 %</td>
</tr>
<tr>
<td></td>
<td>EC-No. 202-627-7</td>
<td></td>
</tr>
</tbody>
</table>

Classified impurities or stabilizers
None

SECTION 4: First aid measures

4.1 Description of first aid measures

Inhalation
Fresh air, rest, half upright position. Get medical advice / attention if you feel unwell.

Skin contact
Remove contaminated clothes, rinse skin with water or shower. If skin irritation occurs: get medical advice / attention.

Eye contact
First rinse with plenty of water (remove lenses if possible). If eye irritation persists: get medical advice / attention.
Ingestion

Rinse mouth. Immediately call a doctor / physician if you feel unwell.

4.2 Most important symptoms and effects, both acute and delayed

Respiratory irritation (nose and upper respiratory tract). Eye and skin irritation.

4.3 Indication of any immediate medical attention and special treatment needed

Information on medical attendance

Not necessary.

Special means to provide treatment at the workplace

Not necessary.

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media

Powder, water spray, alcohol-resistant foam, carbon dioxide.

Unsuitable extinguishing media

Water jet, alcohol unstable foam.

5.2 Special hazards arising from the substance or mixture

Hazardous combustion products

May produce toxic fumes of carbon monoxide if burning.

Additional hazards

Extreme generation of heat in the case of larger fires.

5.3 Advice for fire-fighters

Protective actions

In case of fire: keep containers cool by spraying with water. Retain contaminated extinguishing water; do not allow entering into the sewage system. In the case of larger fires: Cordon affected area.

Special protective equipment

Self-contained respiratory protective device.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Information for non-emergency personnel

In the case of large quantities: Use filter respirator for organic vapours (filter type A). Use personal protective equipment to avoid any contamination of skin, eyes and personal clothes. Remove potential sources of ignition. Do not smoke. Assure sufficient ventilation.

Information for emergency responders

If available, observe corporate hazard-control and emergency plans.

6.2 Environmental precautions

In the case of spills: Avoid penetration into the sewage canal, surface water and ground water. In the case of accidental release: Do not discharge in surface water, sewers or soil.

6.3 Methods and material for containment and cleaning up

Advice on spillage containment

Take up small amounts spilled product with an inert absorbent. Dispose of as hazardous waste. Dam spilled substance in and suck carefully; recycle if possible.

Appropriate clean-up procedures

Collect remainder in inert absorbent and dispose of as hazardous waste. Wash away remainder with water.

Inappropriate containment or clean-up techniques

None known.

6.4 Reference to other sections

See also the sections 8 and 13.
**SECTION 7: Handling and storage**

### 7.1 Precautions for safe handling

**Recommendations for safe handling**

- Use only in well ventilated areas.
- Only transfer into suited and resistant containers. Containers have to be properly labelled.
- Keep away from heat / sparks / open flames / hot surfaces and do not smoke.
- Above 60 °C: use in a closed system.

**Advice on general occupational hygiene**

The usual precautionary measures when handling chemicals have to be observed. Do not eat, drink and smoke in work areas. Wash hands thoroughly with water and soap.

### 7.2 Conditions for safe storage, including any incompatibilities

#### Protection against incompatible substances

- Keep away from oxidants, strong acids and strong bases. The substance affects many synthetic materials; store only in original packing.
- Keep container tightly closed.

#### Protection against ambient influences

- Protect against heat and solar radiation. Recommended storage temperature: 20 °C.
- Store in a dark area.

#### Maintenance of the integrity of the substance

Not required.

### 7.3 Specific end use(s)

If used in food: comply with food safety regulation (HACCP).

**SECTION 8: Exposure controls / personal protection**

### 8.1 Control parameters

<table>
<thead>
<tr>
<th>Country</th>
<th>8 hours (TWA) mg/m³</th>
<th>Short term (15 min.) mg/m³</th>
<th>Notation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>20</td>
<td>5</td>
<td>skin</td>
</tr>
<tr>
<td>Belgium</td>
<td>8</td>
<td>2</td>
<td>skin</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>10</td>
<td>2.5</td>
<td>C (20 mg/m³), skin</td>
</tr>
<tr>
<td>Denmark</td>
<td>7.9</td>
<td>2</td>
<td>skin</td>
</tr>
<tr>
<td>Finland</td>
<td>8</td>
<td>2</td>
<td>skin</td>
</tr>
<tr>
<td>France</td>
<td>8</td>
<td>5</td>
<td>skin</td>
</tr>
<tr>
<td>Germany (previous 20)</td>
<td>8</td>
<td>2</td>
<td>skin</td>
</tr>
<tr>
<td>Italy</td>
<td>8</td>
<td>2</td>
<td>skin</td>
</tr>
<tr>
<td>Netherlands (previous 8)</td>
<td>8</td>
<td>2</td>
<td>skin</td>
</tr>
<tr>
<td>Norway</td>
<td>8</td>
<td>5</td>
<td>skin</td>
</tr>
<tr>
<td>Poland</td>
<td>10</td>
<td>2.5</td>
<td>skin</td>
</tr>
<tr>
<td>Portugal</td>
<td>8</td>
<td>2</td>
<td>skin</td>
</tr>
<tr>
<td>Slovakia</td>
<td>7.9</td>
<td>2</td>
<td>skin</td>
</tr>
<tr>
<td>Slovenia</td>
<td>20</td>
<td>5</td>
<td>skin</td>
</tr>
<tr>
<td>Spain</td>
<td>8</td>
<td>2</td>
<td>skin</td>
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<tr>
<td>Sweden</td>
<td>8</td>
<td>2</td>
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</tr>
<tr>
<td>Switzerland</td>
<td>8</td>
<td>2</td>
<td>skin</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>8</td>
<td>2</td>
<td>skin</td>
</tr>
</tbody>
</table>

The exposure limits may be exceeded before the odour is perceived.

#### DNEL / DMEL

**Workers short term exposition**

- DNEL worker (acute, inhalation - systemic) 152 mg/m³
- DNEL worker (acute, inhalation - local) 20 mg/m³

**Workers long term exposition**

- DNEL worker (long-term, inhalation - systemic) 17.8 mg/m³
- DNEL worker (long-term, inhalation - local) 8 mg/m³
- DNEL worker (long-term, dermal - systemic) 4 mg/kg bw/day
Consumers short term exposition

DNEL general population (acute, inhalation - systemic) 136 mg/m³
DNEL general population (acute, inhalation - local) 20 mg/m³
DNEL general population (acute, oral - systemic) 2.4 mg/kg bw/day

Consumers long term exposition

DNEL general population (long-term, inhalation - systemic) 8 mg/m³
DNEL general population (long-term, inhalation - local) 8 mg/m³
DNEL general population (long-term, oral - systemic) 2.4 mg/kg bw/day
DNEL general population (long-term, dermal - systemic) 2.4 mg/kg bw/day

PNEC

Aquatic
- fresh water PNEC aquatic (freshwater) 0.033 mg/L
- marine water PNEC aquatic (marine water) 0.0033 mg/L
- intermittent release PNEC aquatic (intermittent release) 0.027 mg/L

Sedimentary
- fresh water sediment PNEC sediment 0.12 mg/kg sediment dw
- marine water sediment PNEC marine-sediment 0.012 mg/kg sediment dw

Terrestrial
- soil PNEC soil 2.6 mg/kg dw

Sewage treatment
- sewage treatment plants PNEC STP 7.6 mg/L

Secondary poisoning
- food chain PNEC oral 35.3 mg/kg food
  Negligible potential to bioaccumulate in the food chain (logKow <3).

8.2 Exposure controls
8.2.1 Appropriate engineering controls
  Ventilation and local exhaust.
8.2.2 Individual protection measures, such as personal protective
  a) Eye/face protection
    Safety goggles (EN 166).
  b) Skin protection
    Hand protection
    Gloves butyl rubber 0.7 mm Breakthrough time > 8 hours (EN 374)
    Gloves neoprene 0.75 mm Breakthrough time 2 hours (EN 374)
    Other Protective clothing.
  c) Respiratory protection
    In case of insufficient local exhaust: filter respirator with filtertype A for organic vapours (EN 14387).
  d) Thermal hazards
    Not applicable.

8.2.3 Environmental exposure controls
  Direct polluted air of the local exhaust ventilation out of the plant in a manner in accordance with environmental regulations.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

Appearance Colourless to yellow oily liquid.
Odour Characteristic: pungent, almond.
Odour threshold (mg/m³) 0.25 - 1.0
pH 3.5 - 4.5
Melting point / freezing point (°C) – 37
Boiling point (°C) at 1013 hPa 162
Flash point (°C) 60 (closed cup)
Evaporation rate (ether=1) 75
Safety Data Sheet  
according to Regulation (EC) No 1907/2006

Furfural

International  
Furan  
Chemicals B.V.

Upper / lower explosive limits (vol%)  2.1 - 19.3  
Vapour pressure at 25 °C (hPa)  3.33  
Vapour density (air=1)  3.3  
Relative density (water=1)  1.16  
Solubility(ies)  
- Solubility in water at 20 °C (g/l)  83  
- Solubility in fat  Good  
Partition coefficient (log K octanol/water)  0.41  
Auto-ignition temperature (°C)  392  
Decomposition temperature  Not applicable  
Viscosity at 25 °C (mPa.s)  1.49  
Explosive properties  Non explosive  
Oxidising properties  None

9.2 Other information  
Miscibility with  Solvents (acetone, ethanol, ether, xylene, chloroform, petroleum ether, ethyl acetate)  
Conductivity (pS/m)  1.5 * 10^8  
Heat of combustion (kJ/kg)  24 410  
Surface tension at 20 °C (mN/m)  43.5

SECTION 10: Stability and reactivity

10.1 Reactivity  
The substance may polymerize violently (resinification) under the influence of strong acids or strong bases. Reacts violently with oxidants.

10.2 Chemical stability  
Oxidizes slowly on exposure to air.  
Decomposes slowly on exposure to light.  
Discolours on exposure to light and resinifies.

10.3 Possibility of hazardous reactions  
Reacts violently with strong acids and strong bases with the possibility of fire and explosion (resinification).  
At elevated temperatures, a risk for fire or explosion exists.

10.4 Conditions to avoid  
Temperatures in storage > 40 °C should be avoided. Also contact with direct sunlight, heat sources and air. Avoid static discharge and sources of ignition (open flames, warm surfaces, sparks).  
Avoid contact with combustible materials and plastics.

10.5 Incompatible materials  
Strong acids or alkaline substances and oxidants. Many plastics.

10.6 Hazardous decomposition products  
Upon decomposition emits carbon monoxide, carbon dioxide and/or low molecular weight hydrocarbons.

SECTION 11 Toxicological information

11.1 Information on toxicological effects  
a) Acute toxicity  
- Oral  LD50 (rat)  100 mg/kg  
- Dermal  LD50 (rat)  >2000 mg/kg  
- Inhalation  LC50 (rat, 4 hours)  ~ 1 mg/L (0.53 – 1.63 mg/L)

b) Skin corrosion/irritation  
The substance is irritating to skin.

c) Serious eye damage/irritation  
The substance is irritating to eyes.

d) Respiratory or skin sensitisation  
Concluded not to be sensitising.
e) Germ cell mutagenicity
Concluded not to be genotoxic in vivo.

f) Carcinogenicity
NOAEL (oral) 53 mg/kg bw/day
Target organ(s): digestive: liver.
Suspected of causing cancer. Liver tumors induced via mechanism involving liver toxicity. Concluded that at levels at which no liver toxicity is induced (in rats 53 mg/kg bw/d), tumors will not arise.

g) Reproductive toxicity
- Fertility/developmental
Concluded not to be reprotoxic.

h) Specific target organ toxicity – single exposure
- Respiratory tract
From acute toxicity studies, evident that the substance may cause respiratory irritation, particularly to the upper respiratory tract and the nose.

i) Specific target organ toxicity – repeated exposure
- Respiratory tract
From repeated dose toxicity studies, evident that the substance may cause respiratory irritation particularly to the upper respiratory tract and the nose. No classification warranted.

j) Aspiration hazard
Based on available data, the classification criteria for this hazard class are not met.

11.2 Likely routes of exposure
Furfural can be easily absorbed in the lungs and from the skin, with dermal absorption of liquid furfural being approx. 3 µg/cm² per minute. Following absorption, the biological half life is 2-2.5 h.

SECTION 12: Ecological information
12.1 Toxicity
Aquatic compartment and sediment
- Fish
  LC50 (fresh water, 96 h) 10.5 mg/L
  NOEC (fresh water, 12 d) 0.33 mg/L
- Aquatic invertebrates
  EC50 (Daphnia, fresh water, 48 h) 13 mg/L
  NOEC (Daphnia, fresh water, 21 d) 1.9 mg/L
- Algae and aquatic plants
  NOEC (algae, fresh water, 8d) 2.7 mg/L
- Aquatic micro-organisms
  EC50 760 mg/L
- Sediment organisms
  NOEC (algae, fresh water, 8d) 2.7 mg/L

Terrestrial compartment
- Soil macro-organisms
  LC50 (earthworm, 14 d) 406.18 mg/kg soil dw
  NOEC (earthworm, 14 d) 225 mg/kg soil dw
- Anthropods
  NOEC (collembolan, 21 d) 37.5 mg/kg soil dw
- Terrestrial plants
  NOEC (sugarbeet) 26 mg/kg soil dw
- Soil micro-organisms
  NOEC (soil micro-organisms) 597 mg/kg soil dw

12.2 Persistence and degradability
Abiotic degradability
- Photolysis
  Half-life (DT50 in air) 0.44 d
Biodegradability
- Biodegradability in water
  Readily biodegradable.
- Biochemical oxygen demand
  BOD (14 days) 93.5% degradation
12.3 Bioaccumulative potential
Aquatic bioaccumulation

BCF (estimation based on a calculation method): 1.41 L/kg
No remarkable bioaccumulation potential (log K$_{ow}$ 0.41).

12.4 Mobility in soil
Adsorption/desorption $K_{oc}$ at 20 °C (calculated) 17.1 L/kg
Volatilisation Henry constant at 20 °C (in Pa m$^3$/mol) 0.2

12.5 Results of PBT and vPvB assessment
The substance does not meet the PBT and vPvB criteria according to annex XIII of Regulation (EC) No 1907/2006.

12.6 Other adverse effects
Hazardous to water (Water hazard class 2, WGK Germany)

SECTION 13: Disposal considerations

13.1 Waste treatment methods
Product disposal
Recycling by distillation. Removal to an authorized waste incinerator for solvents or as chemical waste in accordance with local regulations. Do not discharge wastewater into sewer.

Packaging disposal
Uncleaned empty package have to be treated like the content. The labelling of uncleaned containers must not be removed.

Waste treatment-relevant information
European waste list (EURAL) 07 01 04

SECTION 14: Transport information

14.1 UN number 1199

14.2 UN proper shipping name FURALDEHYDES

14.3 Transport hazard class(es) 6.1

14.4 Packing group II

14.5 Environmental hazards
Marine pollutant No

14.6 Specials precautions for user
Classification code TF1
Risk label(s) 6.1 + 3
Tunnel category (D/E)
Hazard Identification Number (Kemler code) 63
Limited quantity (LQ) 100 ml
Excepted quantity E4
ERICard 6-54
Emergency Schedules (EmS)
- Fire schedule Echo (F - E)
- Spillage schedule Delta (S - D)

14.7 Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code
Ship type required 3
Pollution category Y

SECTION15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture
Approved as a flavouring agent in the EU FL No 13.018 (Regulation (EC) No 2232/96) (EFSA review, 2004).

15.2 Chemical safety assessment
A Chemical Safety Assessment has been carried out for furfural.
SECTION 16: Other information

16.1 Changes to the previous version

<table>
<thead>
<tr>
<th>Previous version</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9</td>
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</tbody>
</table>

- Addition of ‘SECTION’ in the headings.
- Addition of the subheading ‘3.1 Substances’.
- Adaptation of the Emergency telephone numbers.
- Addition of ‘Revision: (date)’ in the footer.
- Addition of the numbers of the European standards for eye- and hand- and respiratory protection.
- Adaptation of P-phrases according to the 4th and 5th ATP of Regulation (EC) No.1272/2008.
- Adaptation of DNEL (acute, inhalation - local).
- Deleting of ‘Atmospheric compartment’ and ‘Secondary poisoning’ from subheading 12.1.
- Moving of ‘Oxygen demand’ from subheading 12.6 to 12.2.

16.2 Abbreviations and acronyms

- DNEL: Derived No Effect Level
- DMEL: Derived Minimal Effect Level
- EC50: Effect Concentration, 50 percent
- ERICard: Emergency Response Intervention Card
- GHS / CLP: Globally Harmonised System / Classification, Labelling and Packaging
- IC50: Inhibitory Concentration, 50 percent
- LC50: Lethal Concentration, 50 percent
- LD50: Lethal Dose, 50 percent
- NOAEC: No observed adverse effect concentration
- NOAEL: No observed adverse effect level
- NOEC: No observed adverse effect concentration
- NOEL: No observed effect level
- PBT: Persistent, Bioaccumulative and Toxic
- PNEC: Predicted No Effect Concentration
- TWA: Time Weighted Average
- vPvB: very Persistent and very Bioaccumulative

16.3 Literature references and sources for data

- REACH dossier.

16.4 Full text of R phrases and Hazard statements which are not written out in full under Sections 2 to 15

- R21: Harmful in contact with skin.
- R23/25: Toxic by inhalation and if swallowed.
- R36/37/38: Irritating to eyes, respiratory system and skin.
- R40: Limited evidence of a carcinogenic effect.

This data sheet has been compiled by KWA. Despite the careful attention paid to the setting up of the text, KWA cannot be held responsible for any error appearing in the text and resulting in whatever damage it may cause.

KWA, Spijksedijk 18c, 4207 GN Gorinchem, The Netherlands. Phone +31 183 649 556