Recommended Groundwater Standards – Pesticides

Sarah Yang, Ph.D.
Groundwater Toxicologist

Gavin Dehnert, Ph.D.
Groundwater Fellow

WISCONSIN DEPARTMENT of HEALTH SERVICES

Today's presentation:

Groundwater standard process

Recommended groundwater standards for:

- Clothianidin*
- Imidacloprid
- Sulfentrazone*
- Thiamexthoxam*
- Thiencarbazone-methyl*
- Dacthal degradates
- Glyphosate and degradate
- Isoxaflutole and degradates

Two-thirds of Wisconsin residents use groundwater.

Wisconsin's groundwater standards have 2 parts.

Enforcement Standard

Preventive Action Limit

The enforcement standard is established from available health information.

Enforcement standards can be based on:

Federal number

State drinking water standard

EPA value

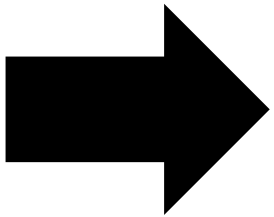
Technical information

Cancer risk

When an enforcement standard is based on:

Federal number

State drinking water standard



Use the concentration as the standard

When an enforcement standard is based on:

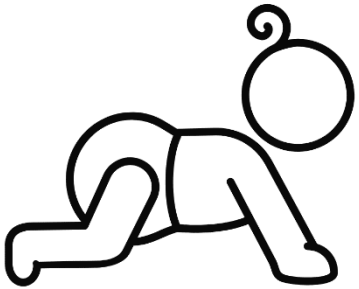
- EPA value
- Technical information
- Cancer risk

→ Calculate the appropriate standard

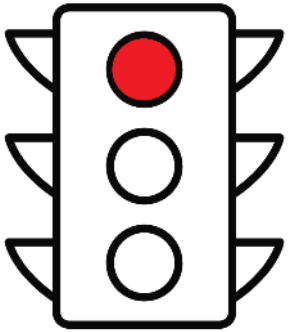
Enforcement standards based on

EPA value

Technical information

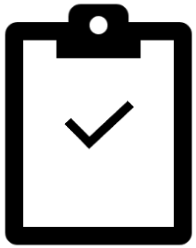


Set to protect a young child



Enforcement Standard

=



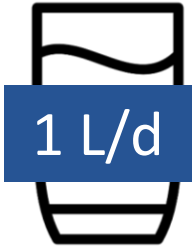
Acceptable daily intake

×

Body weight

×

Relative source contribution

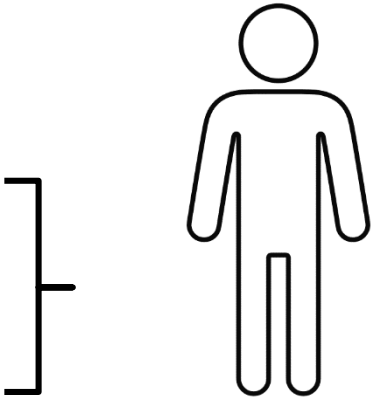


Water consumption

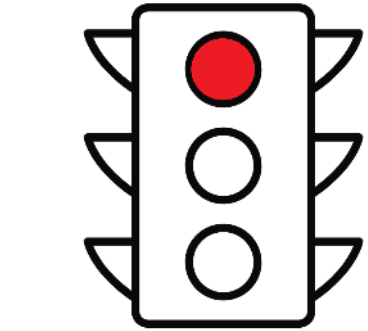
Specified in Statute

Enforcement standards based on

Cancer risk



Set to protect from a lifetime of exposure



Enforcement Standard

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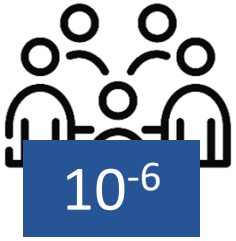
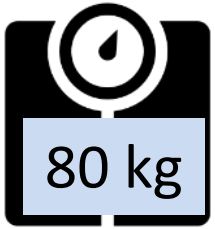
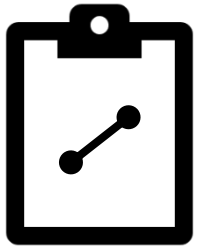


Risk level

×

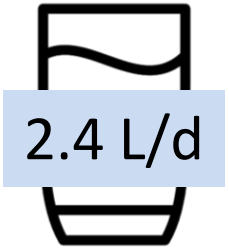


Body weight



Cancer slope factor

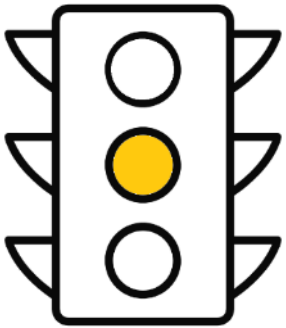
×



Water consumption

Specified in Statute | Recommended by EPA

The preventive action limit is set at a percentage of the enforcement standard.

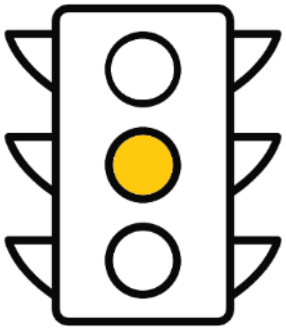


Preventive action limit

= 10%

of the enforcement standard

Substances that cause carcinogenic, mutagenic, teratogenic, or interactive effects



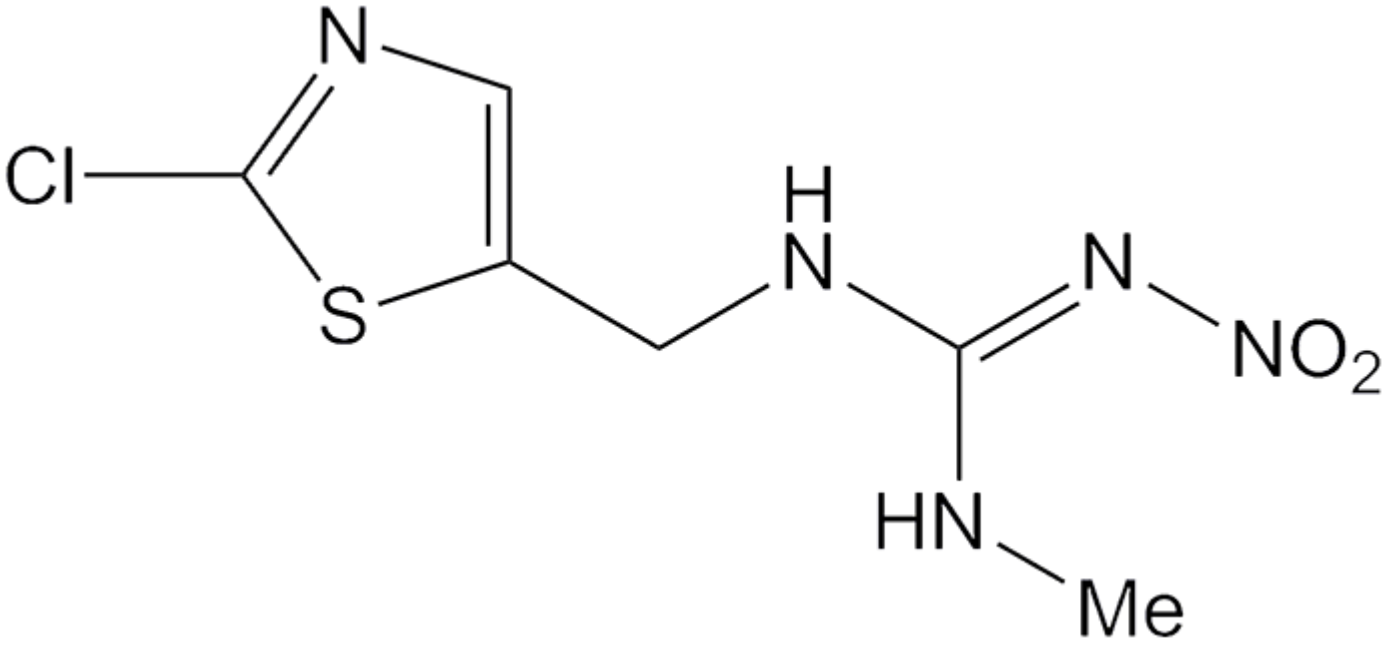
Preventive action limit

= 20%

of the enforcement standard

All other substances

Clothianidin


N
Cl
S
H
N
N
NO2
HN
Me

Clothianidin can impact:

Blood

Liver

Kidney

Wisconsin does not currently have groundwater standards for **clothianidin**.

Available scientific information for **clothianidin**:


Federal number

State drinking water standard


EPA value

Technical information


Cancer risk

Available scientific information for **clothianidin**:

EPA value

Oral reference dose (2012)

0.098 mg/kg-d

Delayed sexual maturation and increased stillbirths in offspring

2 generation oral study in rats

DHS recommends an **enforcement standard** of **1000 µg/L** for **clothianidin**.

DHS' recommended enforcement standard for **clothianidin** is based on:

Federal number

State drinking water standard

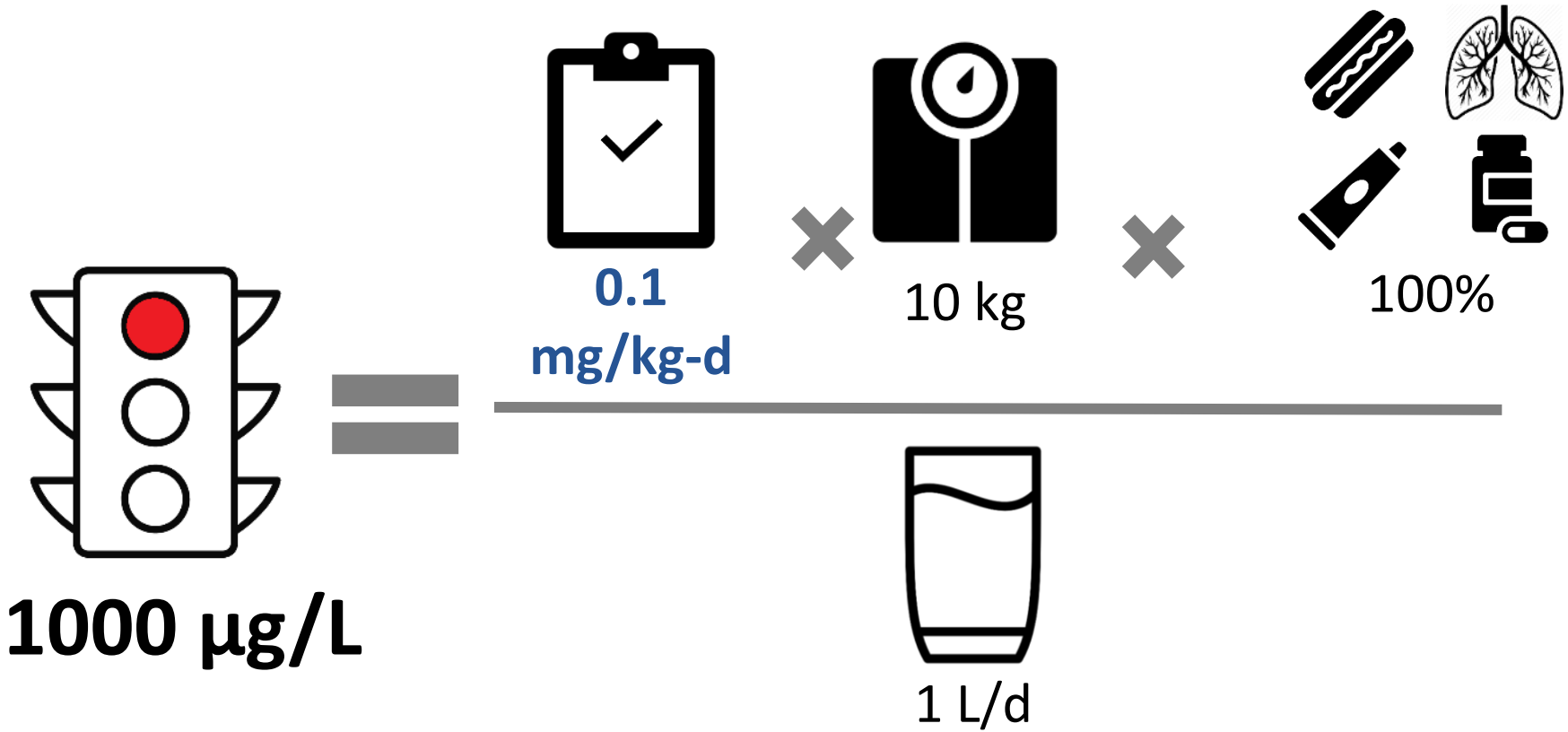
EPA value

→ oral reference dose

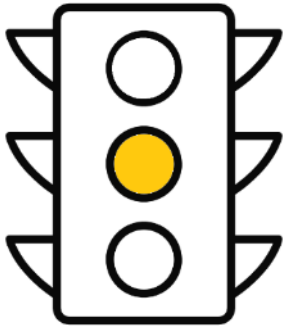
Technical information

Cancer risk

Clothianidin:



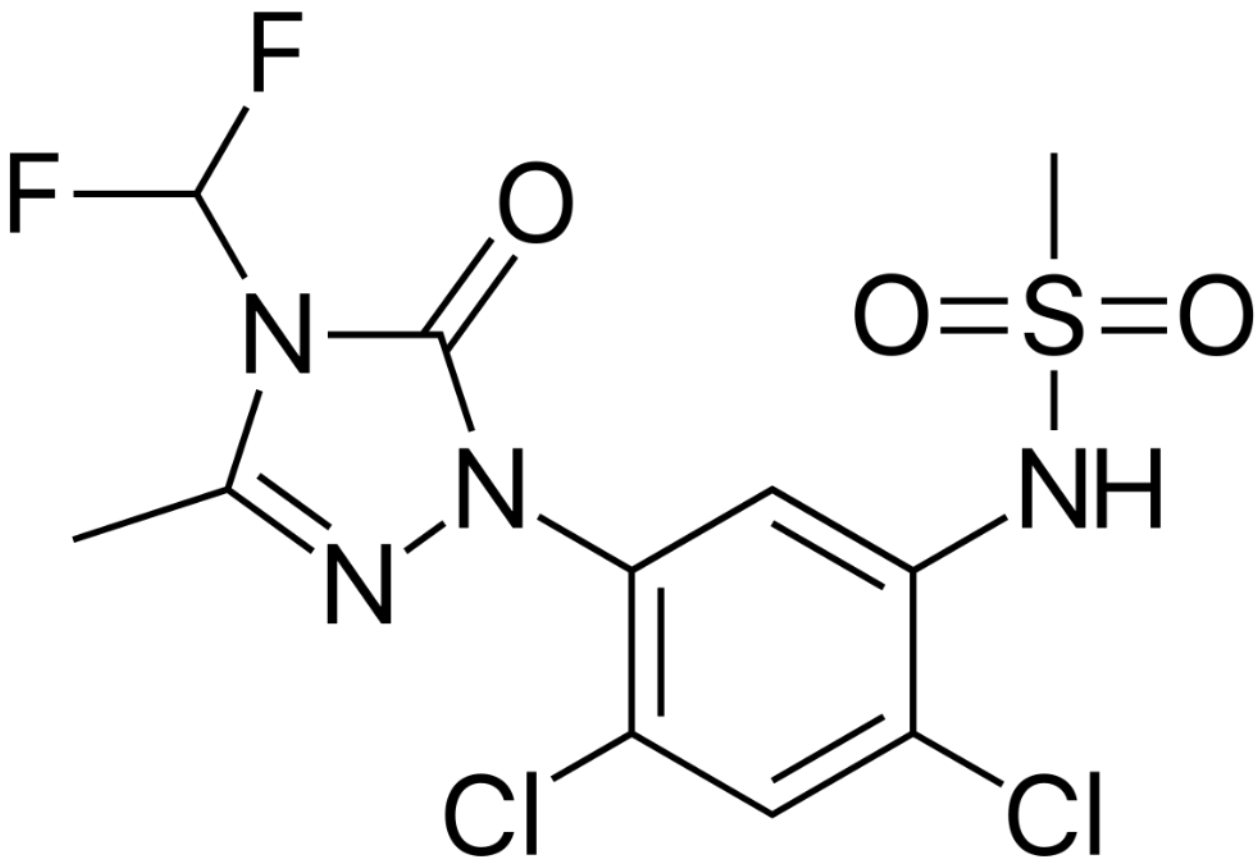
DHS recommends that the preventive action limit for **clothianidin** be set at:



= 200 µg/L

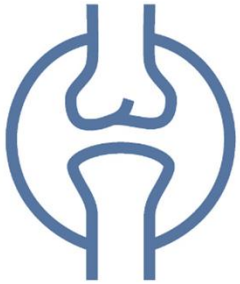
20% - no evidence of carcinogenic, mutagenic, teratogenic, or interactive effects.

Sulfentrazone


F
F
O
N
N
N
O=S=O
NH
Cl
Cl

Sulfentrazone can impact:

Body weight



Bone development

Reproduction/ development

Wisconsin does not currently have groundwater standards for **sulfentrazone**.

Available scientific information for **sulfentrazone**:


Federal number

State drinking water standard


EPA value

Technical information


Cancer risk

Available scientific information for **sulfentrazone**:

EPA value

Oral reference dose (2014)

0.14 mg/kg-d

Reduced body weight gain

2 generation oral study in rats

DHS recommends an **enforcement standard** of **1000 µg/L** for **sulfentrazone**.

DHS' recommended enforcement standard for **sulfentrazone** is based on:

Federal number

State drinking water standard

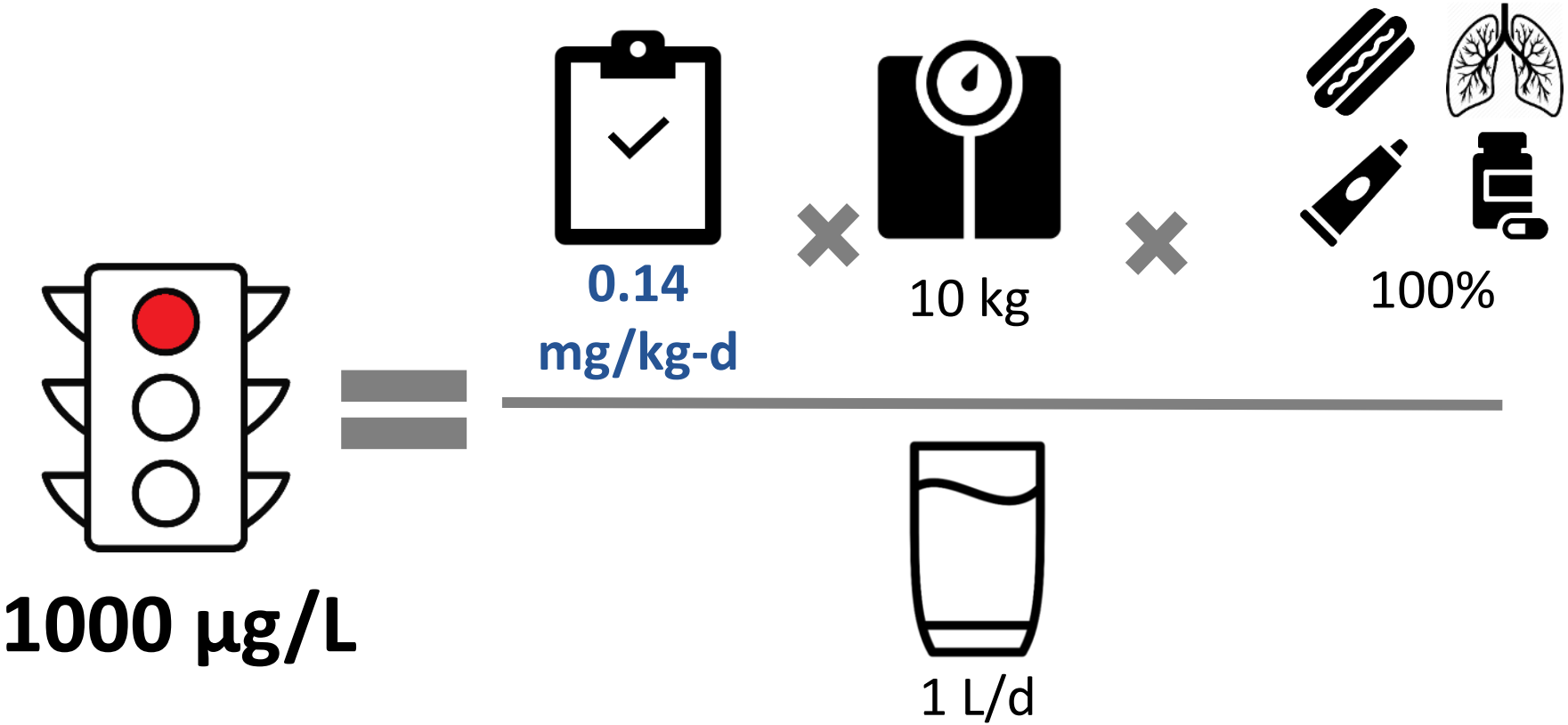
EPA value

→ oral reference dose

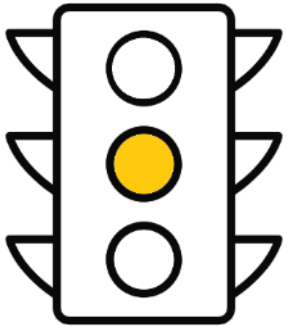
Technical information

Cancer risk

Sulfentrazone:



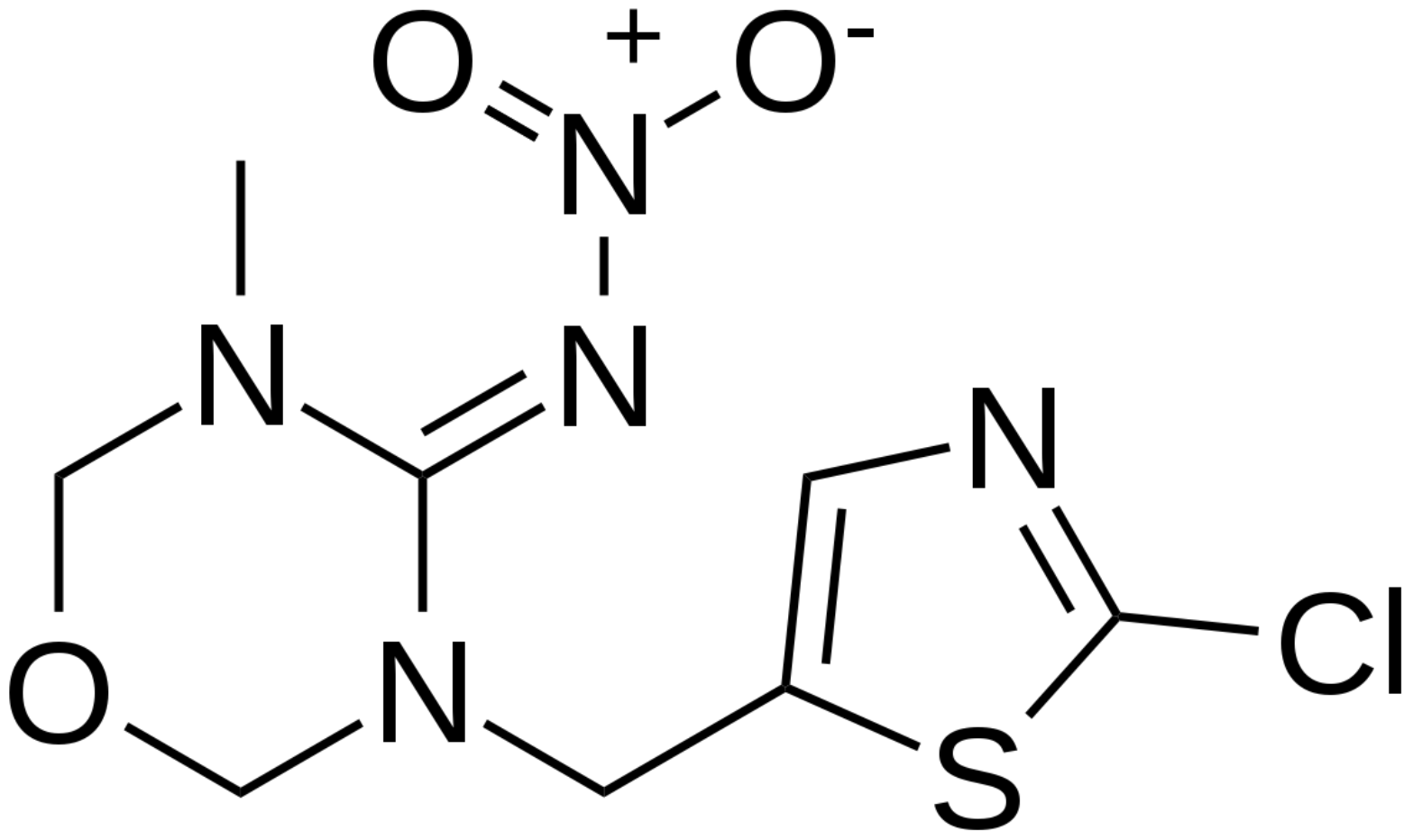
DHS recommends that the preventive action limit for **sulfentrazone** be set at:



= 100 µg/L

10% due to potential teratogenic effects

Thiamexthoxam


O
+
O-
N
N
N
N
O
N
N
S
Cl

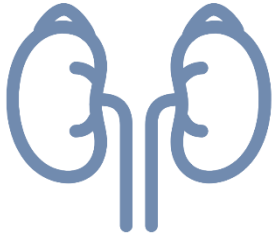
Thiamexthoxam can impact:

Liver

Kidney

Reproduction/
development

Blood



Adrenal
glands

Wisconsin does not currently have groundwater standards for **thiamexthoxam**.

Available scientific information for **thiamexthoxam**:

Federal number

State drinking water standard

EPA value

Technical information

Cancer risk

Available scientific information for **thiamexthoxam**:

EPA value

Oral reference dose (2017)

0.01 mg/kg-d

Kidney damage in male parents

Two multigenerational oral studies in rats

DHS recommends an **enforcement standard** of **100 µg/L** for **thiamexthoxam**.

DHS' recommended enforcement standard for **thiamethoxam** is based on:

Federal number

State drinking water standard

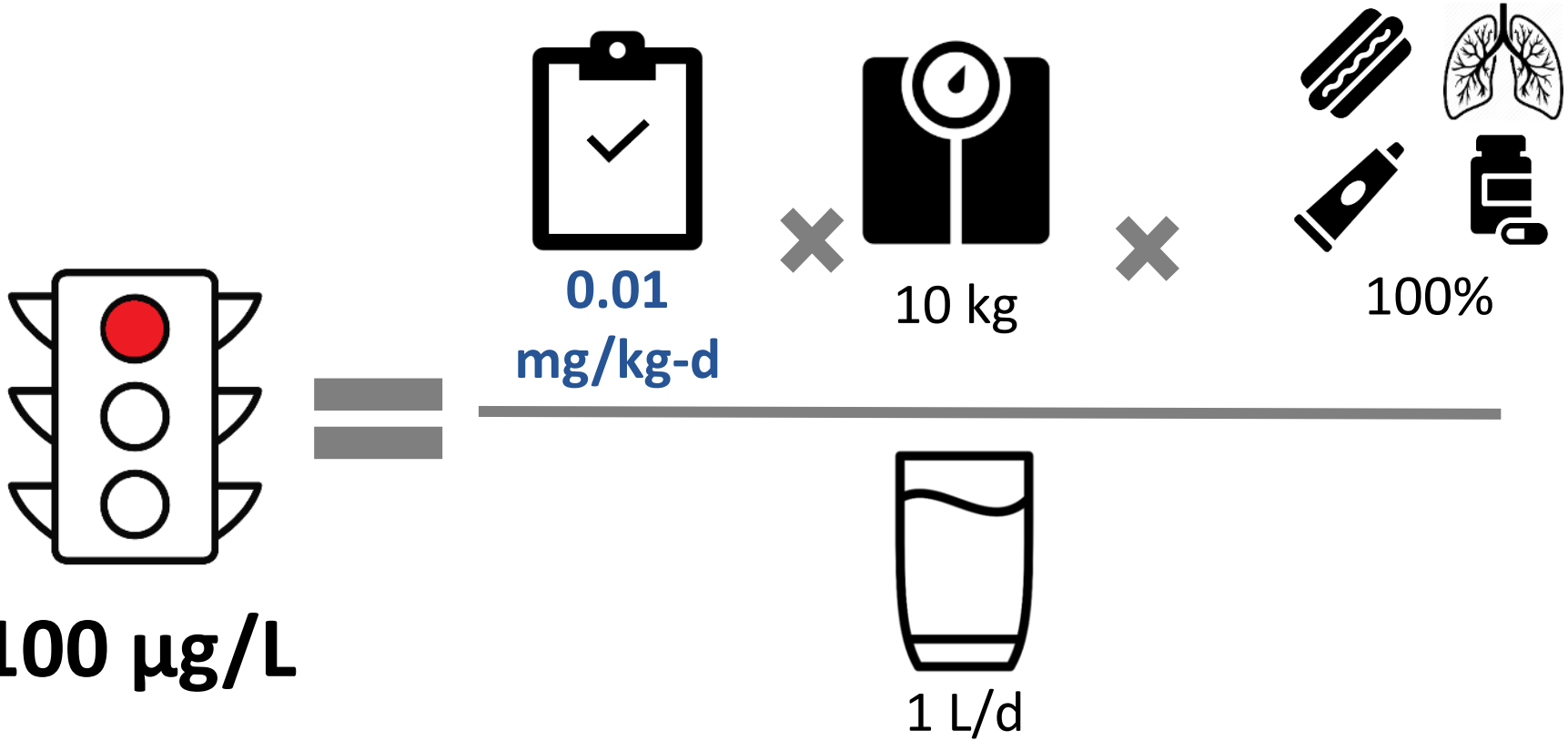
EPA value

→ oral reference dose

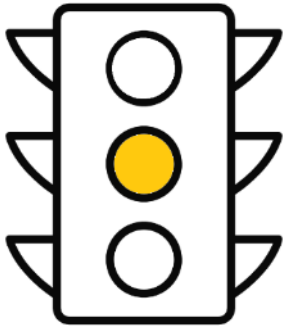
Technical information

Cancer risk

Thiamethoxam:



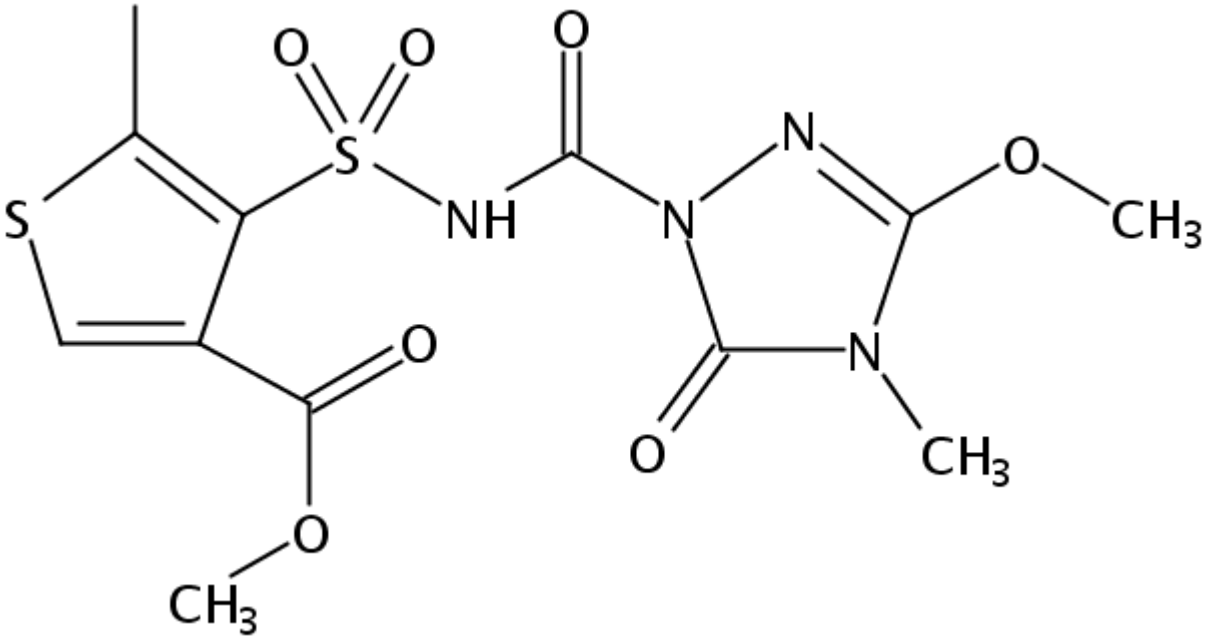
DHS recommends that the preventive action limit for **thiamexthoxam** be set at:



= 10 µg/L

10% - potential teratogenic effects

Thiencarbazone-methyl


O
O
S
S
NH
O
N
O
CH3
O
N
O
CH3
O
O
CH3

Thiencarbazone-methyl can impact:

Urinary tract

Kidney

Wisconsin does not currently have groundwater standards for **thiencarbazone-methyl**.

Available scientific information for **thiencarbazone-methyl**:

Federal number

State drinking water standard

EPA value

Technical information

Cancer risk

Available scientific information for **thiencarbazone-methyl**:

EPA value

Oral reference dose (2008)

1.17 mg/kg-d

Bladder effects in females

2 year diet study in dogs

Available scientific information for **thiencarbazone-methyl**:

Technical information

EFSA Acceptable Daily Intake

0.23 mg/kg-d

Kidney and bladder effects

Two year oral study in rats

DHS recommends an **enforcement standard** of **10 mg/L** for **thiencarbazone-methyl**.

DHS' recommended enforcement standard for **thiencarbazone-methyl** is based on:

Federal number

State drinking water standard

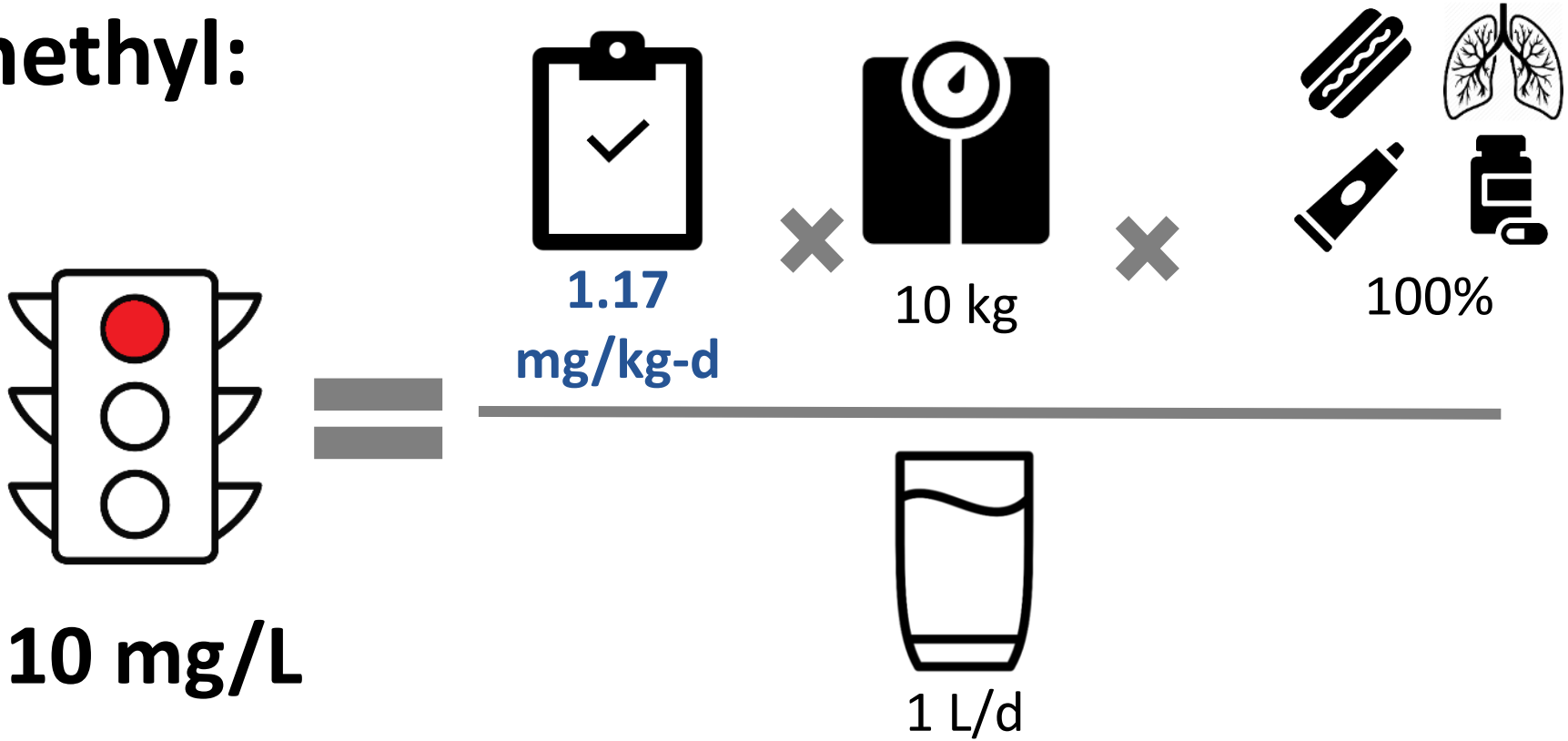
EPA value

→ oral reference dose

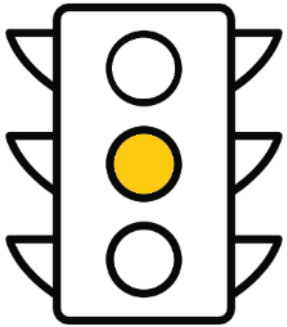
Technical information

Cancer risk

Thiencarbazone-methyl:



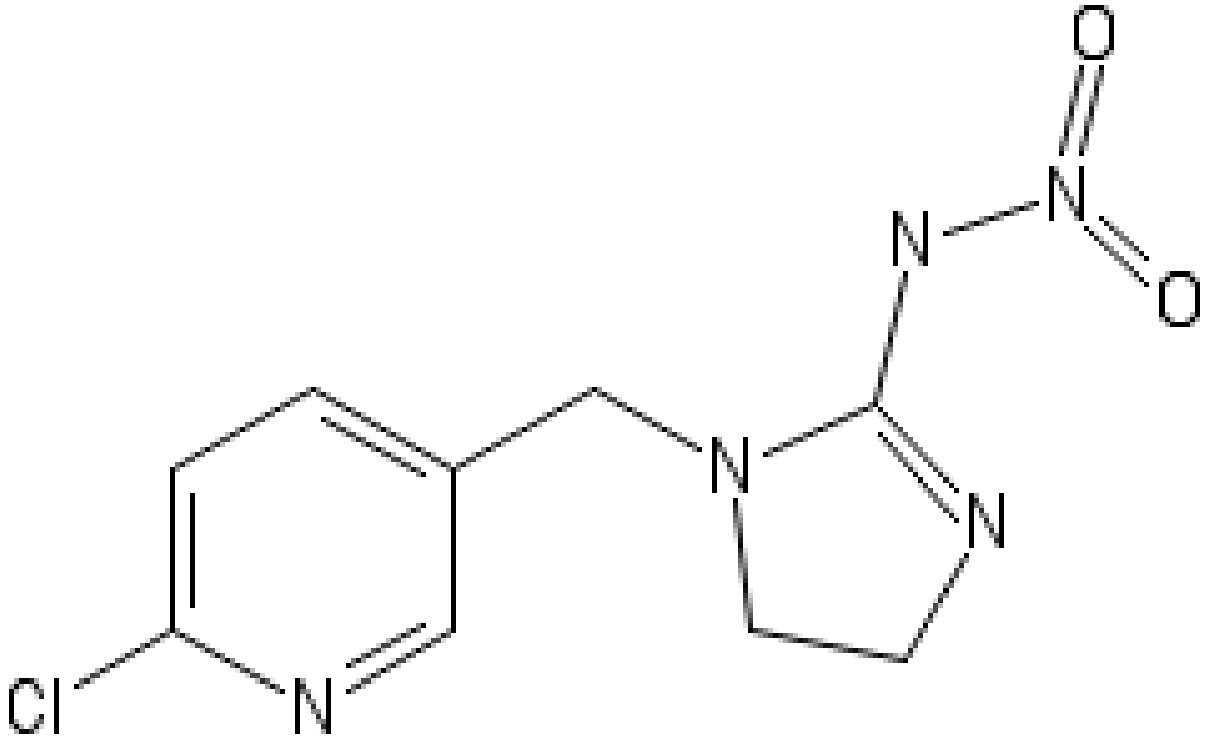
DHS recommends that the preventive action limit for **thiencarbazone-methyl** be set at:



= 2 mg/L

20% - no evidence of carcinogenic, mutagenic, teratogenic, or interactive effects.

Imidacloprid


O
N
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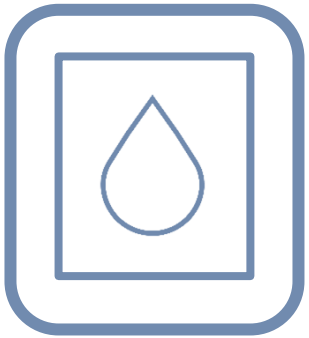
Cl
N

Imidacloprid can impact

Brain

Thyroid



Glucose regulation

Reproduction

Wisconsin does not currently have groundwater standards for **imidacloprid**.

Available scientific information for **imidacloprid**:

Federal number

State drinking water standard

EPA value

Technical information

Cancer risk

Available scientific information for **imidacloprid**:

EPA value

Oral reference dose (2010)

0.057 mg/kg-d

Thyroid effects in males rats

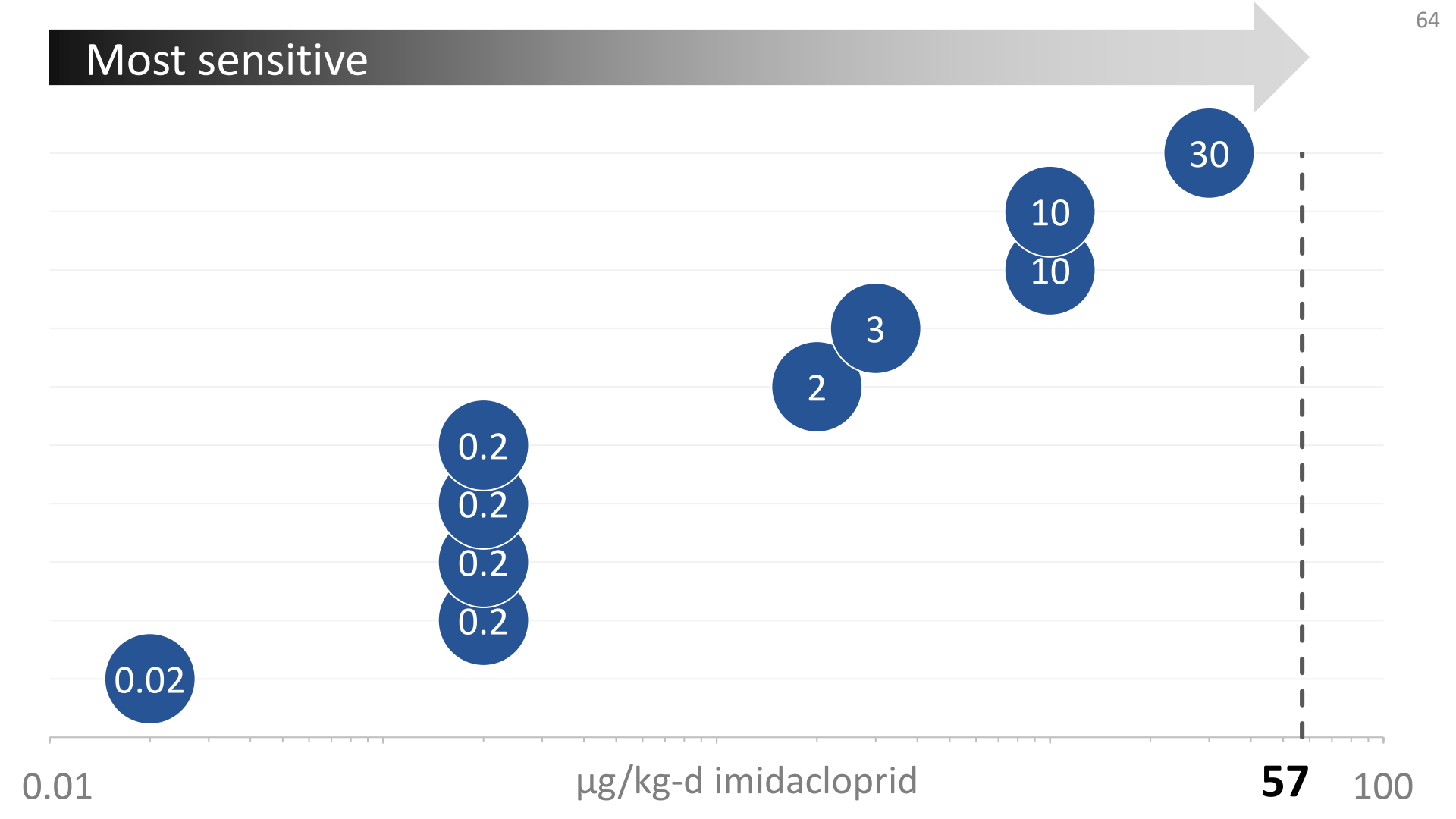
2 year oral exposure

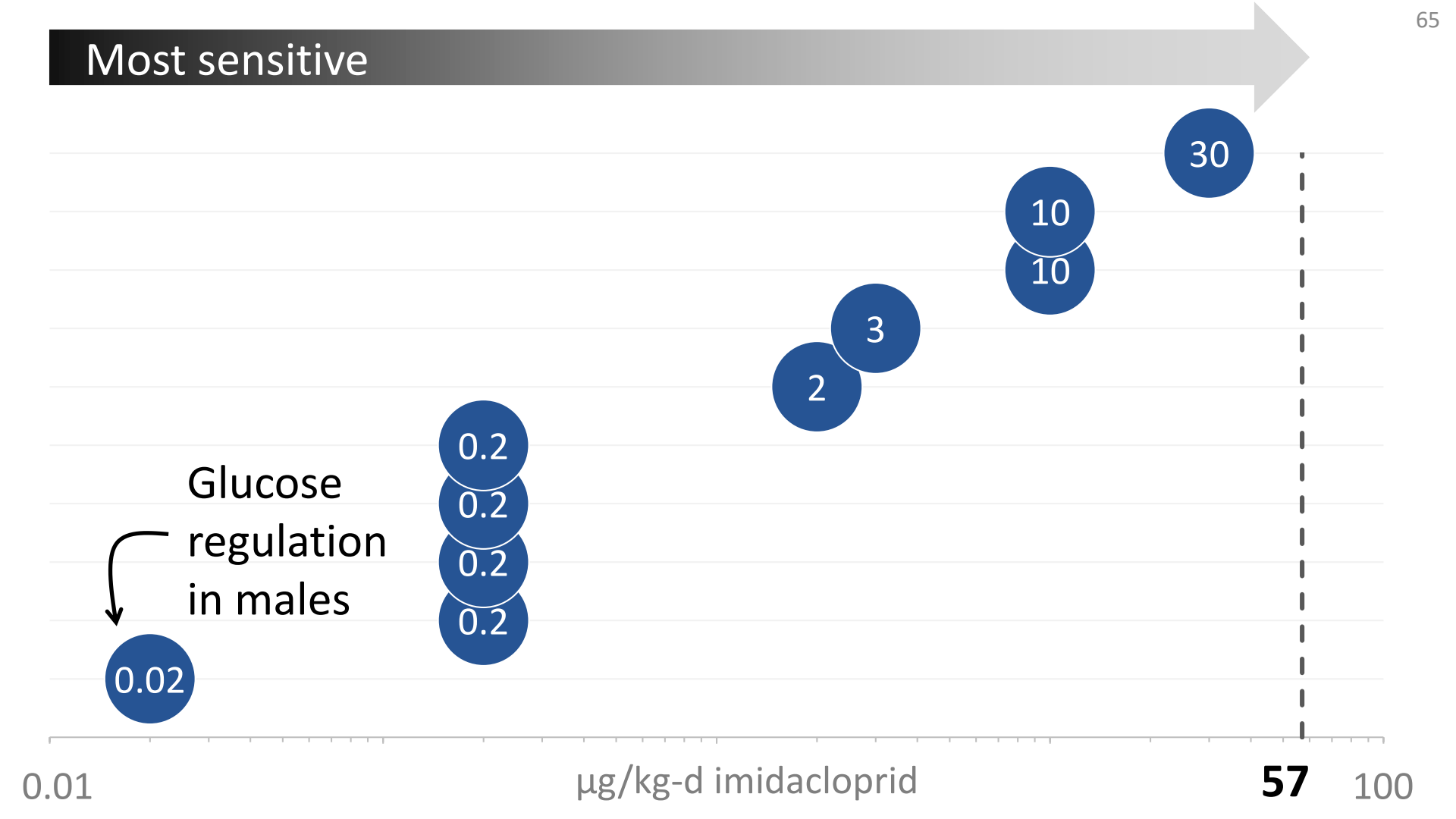
Available scientific information for **imidacloprid**:

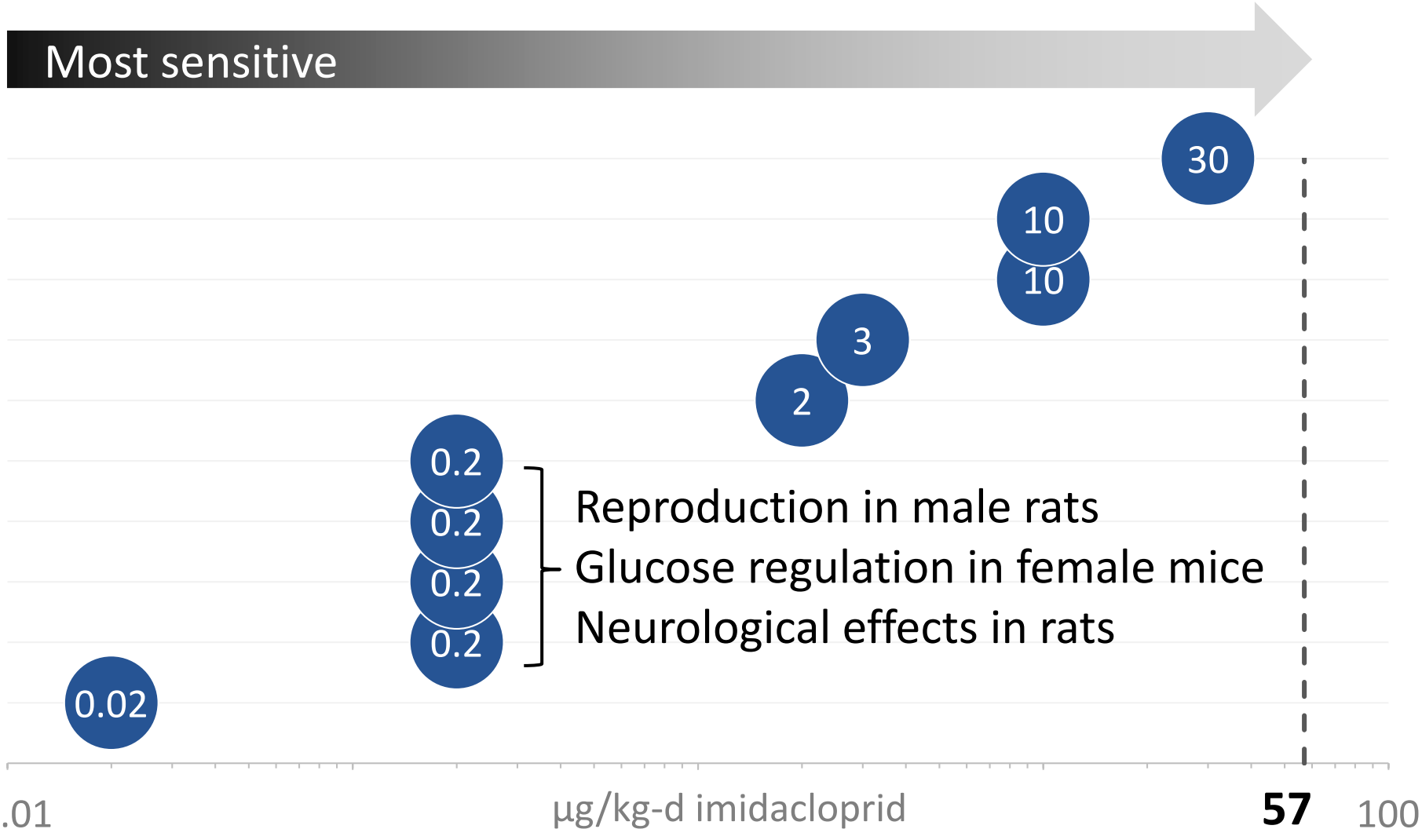
Technical information

Critical toxicity studies

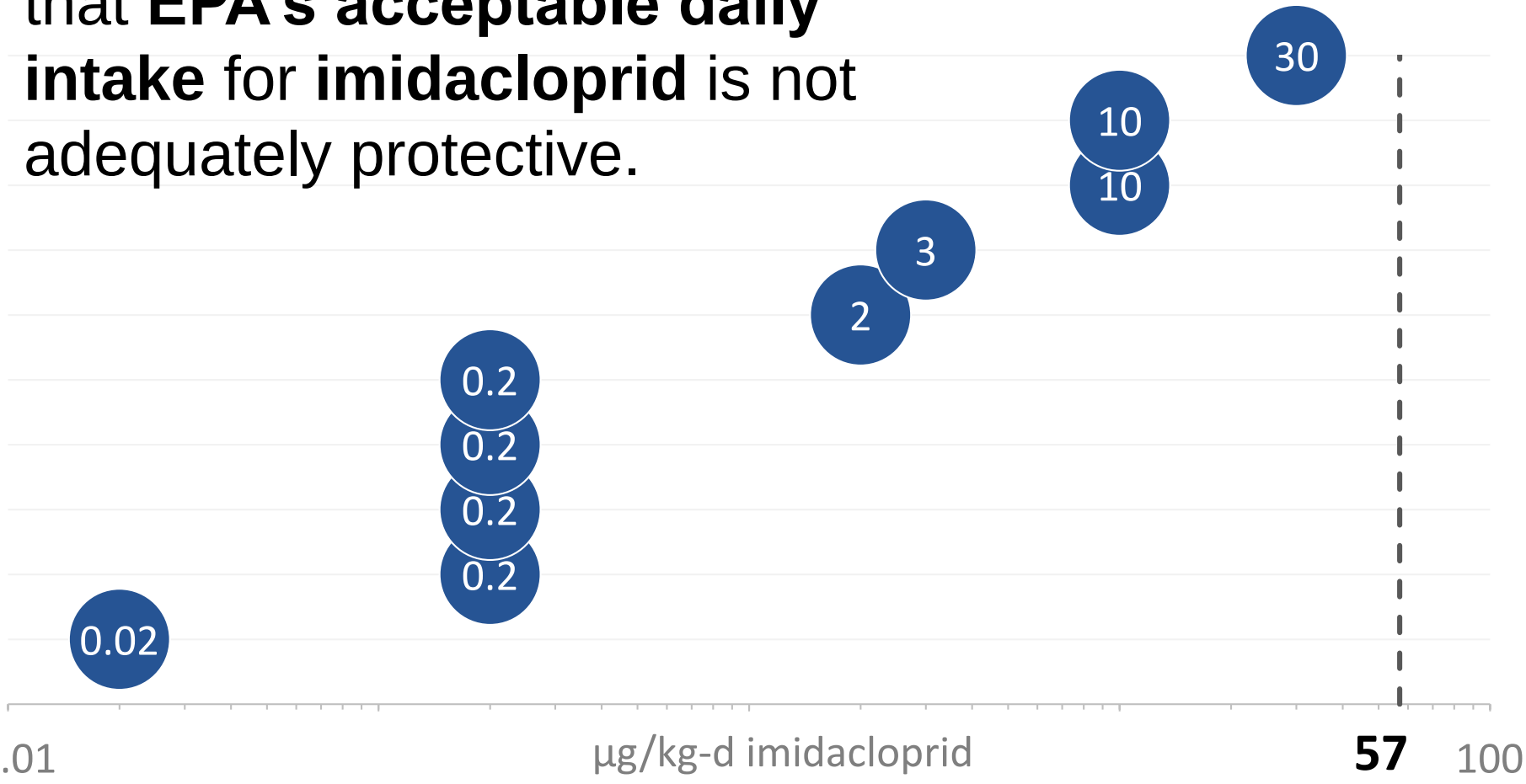
- Three on general toxicity
- Two on male reproduction
- One on development
- Two on glucose regulation
- Two on neurological effects


Most sensitive
30
10
10
3
2
0.2
0.2
0.2
0.2
0.02
0.01
µg/kg-d imidacloprid
57
100

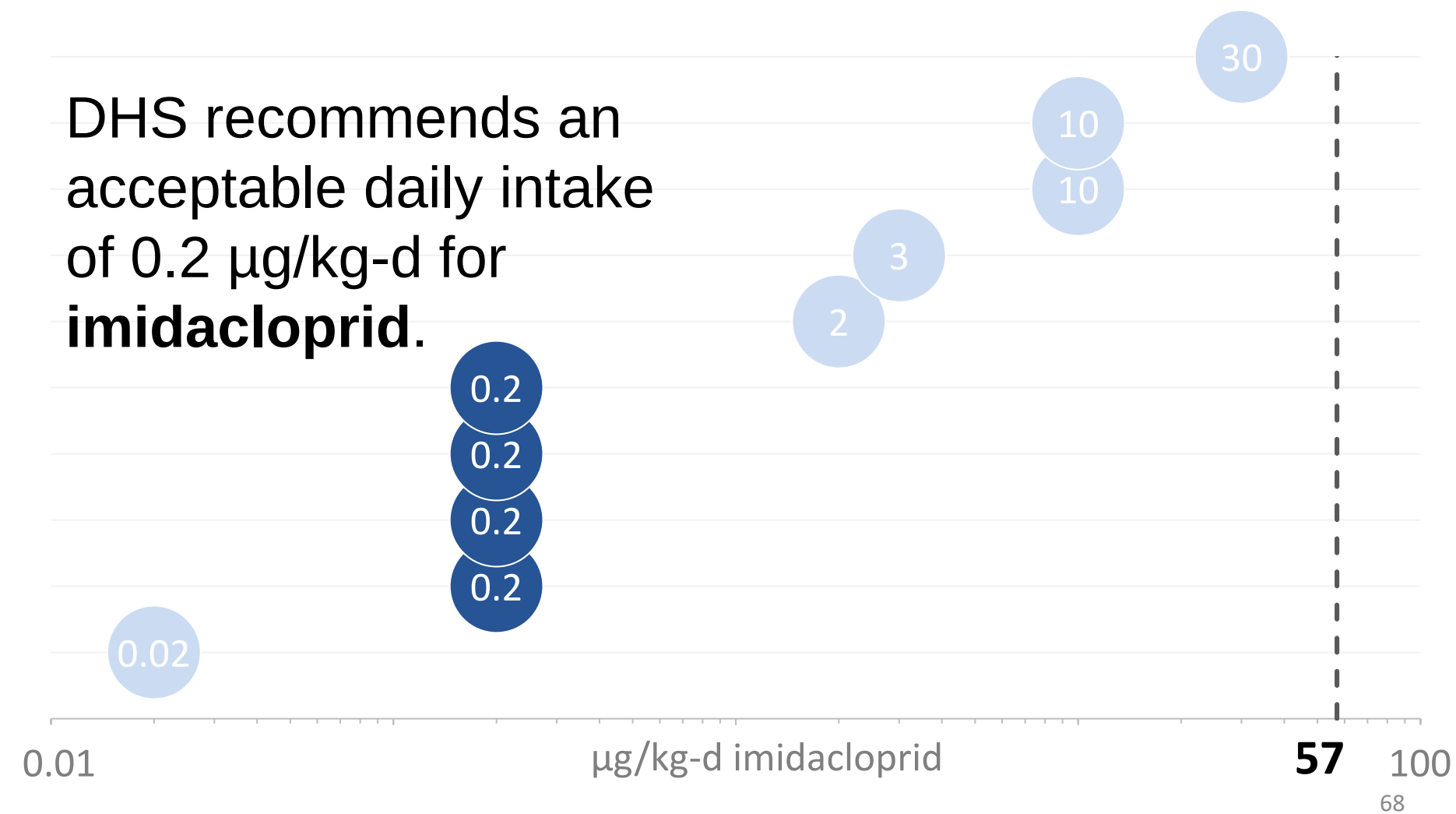

Most sensitive
30
10
10
3
2
0.2
0.2
0.2
0.2
Glucose regulation in males
0.02
0.01
µg/kg-d imidacloprid
57
100


Most sensitive
30
10
10
3
2
0.2
0.2
0.2
0.2
Reproduction in male rats
Glucose regulation in female mice
Neurological effects in rats
0.02
0.01
µg/kg-d imidacloprid
57
100

Data from recent studies suggest that **EPA's acceptable daily intake** for **imidacloprid** is not adequately protective.



DHS recommends an acceptable daily intake of 0.2 µg/kg-d for **imidacloprid**.



DHS recommends an **enforcement standard** of **0.2 µg/L** for **imidacloprid**.

DHS' recommended enforcement standard for **imidacloprid** is based on:

Federal number

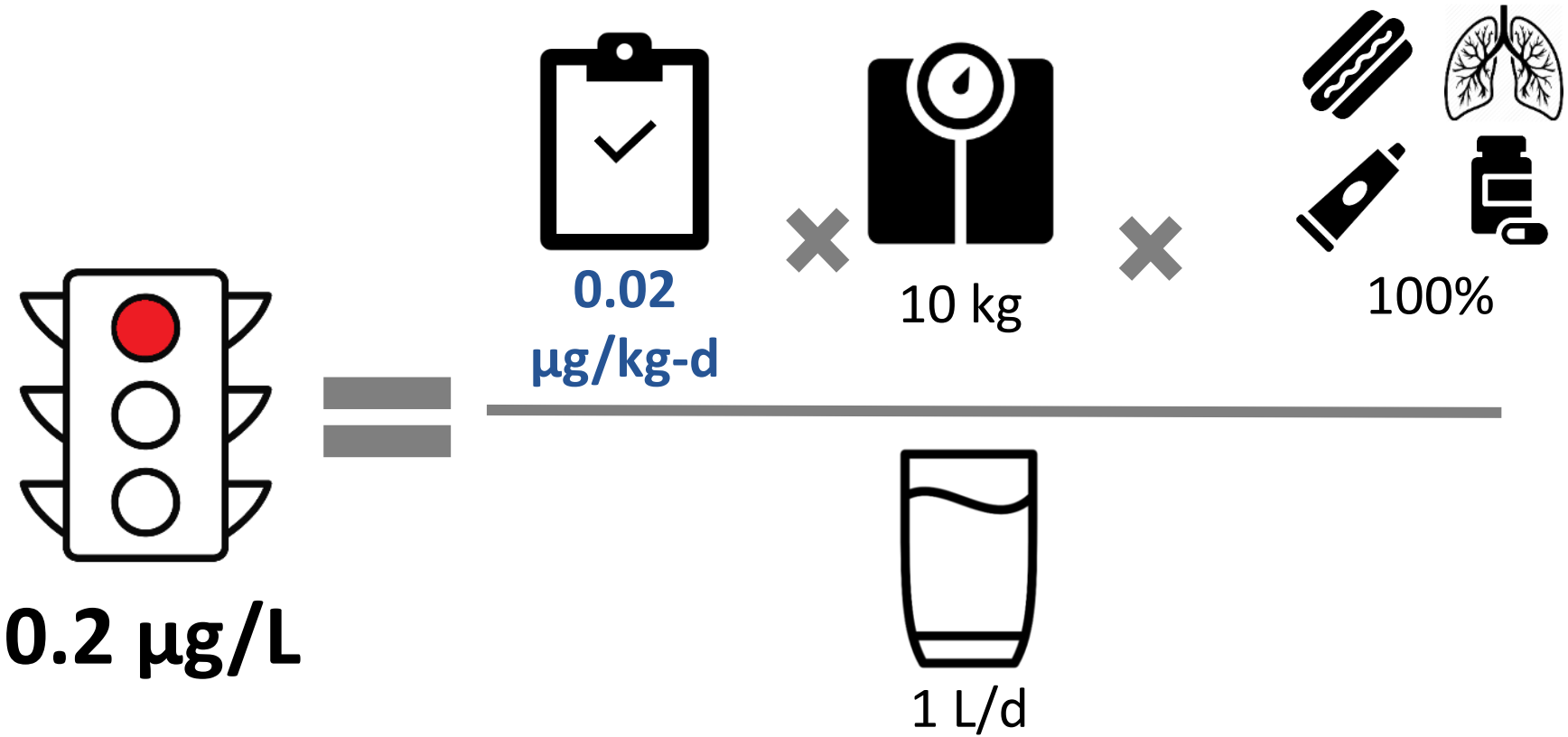
State drinking water standard

EPA value

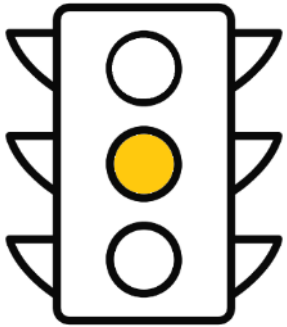
Technical information
→ Critical toxicity studies

Cancer risk

Imidacloprid:



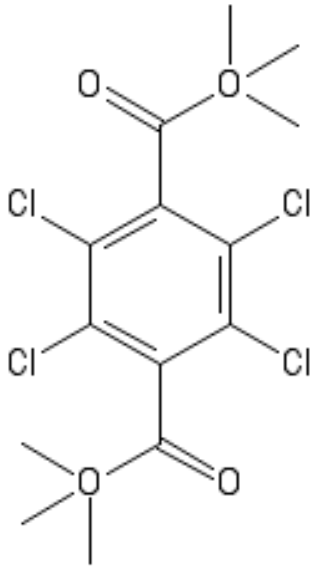
DHS recommends that the preventive action limit for **imidacloprid** be set at:



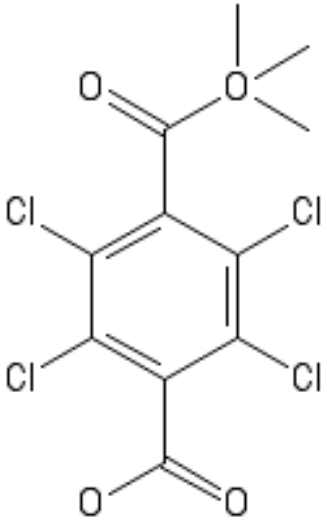
= 0.02 µg/L

10% due to potential mutagenic, teratogenic and interactive effects

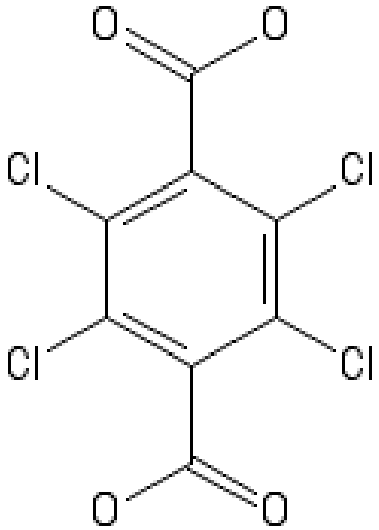
Dacthal degradates



Dacthal



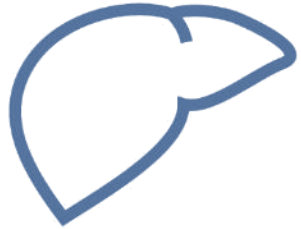
Monomethyl tetrachloro-terephthalic acid (MTP)



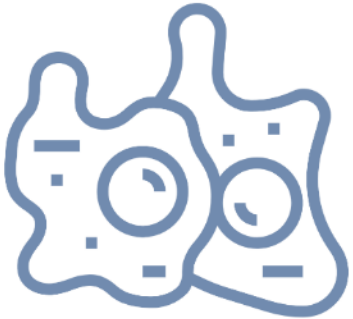
Tetrachloro-terephthalic acid (TPA)

Dacthal can impact the

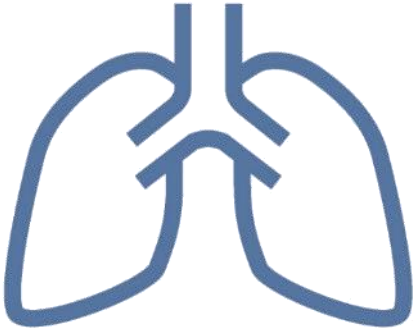
Thyroid



Liver



Cancer



Lungs

Kidney

Wisconsin currently has groundwater standards for **datchal**.

Available scientific information for **MTP and TPA**:

Federal number

State drinking water standard

EPA value

Technical information

Cancer risk

The current enforcement standard for **dacthal** of **70 µg/L** is based on:

Federal Number

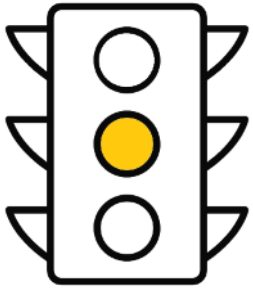
Lifetime health advisory (1994)

Effects on lung, liver, kidney, thyroid in rats.

2 year diet study

Adopted in 2006

The current preventive action limit for **dacthal** is set at:



= 20% of the enforcement standard

No carcinogenic, teratogenic, mutagenic, or interactive effects at the time.

Available scientific information for **TPA**:

Federal number

Health Advisories (2008)

10-day child = 100,000 µg/L

Longer-term child = 50,000 µg/L

Longer-term adult = 200,000 µg/L

Lifetime* = 70 µg/L

Available scientific information for **MTP**:

Federal number

Health Advisories (2008)

Lifetime* = 70 µg/L

EPA’s lifetime health advisory for
dacthal is protective of MTP and
TPA.

DHS recommends a combined **enforcement standard** of **70 µg/L** for **dacthal**, **MTP**, and **TPA.**

DHS' recommended enforcement standard for **MTP and TPA** is based on:

Federal number
→ Lifetime health advisory

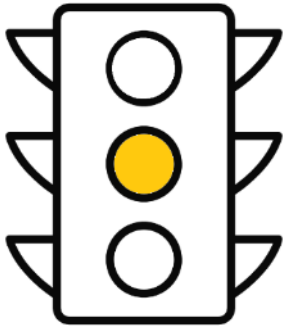
State drinking water standard

EPA value

Technical information

Cancer risk

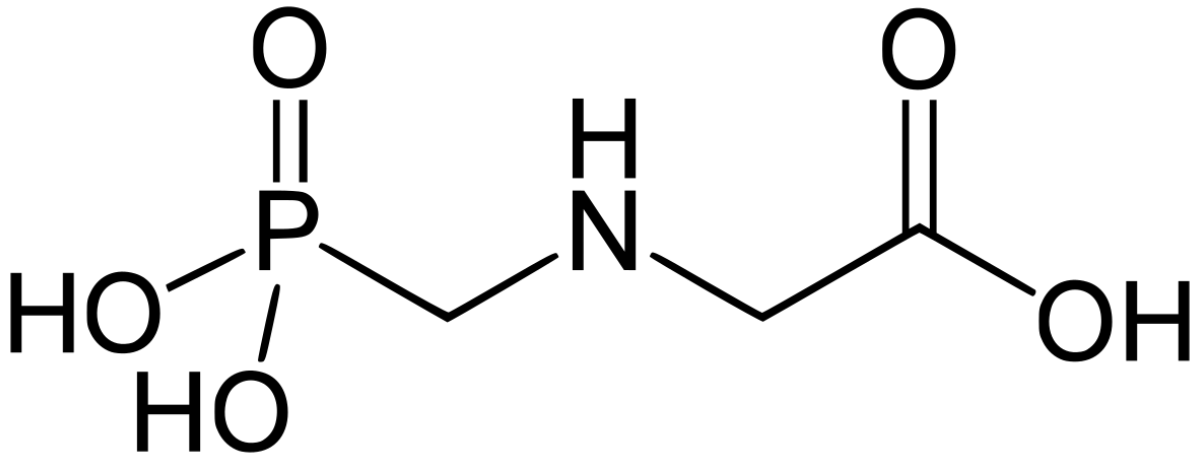
DHS recommends a combined preventive action limit for **datchal, MTP**, and **TPA.**



= 7 µg/L

10% due to potential mutagenic, teratogenic and interactive effects

Glyphosate


O
P
HO
HO
H
N
O
OH

Glyphosate can impact the

Gastrointestinal tract

Development

Wisconsin does not currently has groundwater standards for **glyphosate.**

Available scientific information for **glyphosate**:

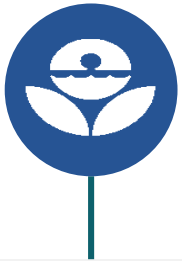
Federal number

State drinking water standard

EPA value

Technical information

Cancer risk



Reference dose (IRIS)

1987

Health advisories

1989

Maximum contaminant level

1994

Draft reference dose (OPP)

2017

Draft minimum risk level (ATSDR)

2019

IRIS = EPA's Integrated Risk information System
OPP = EPA's Office of Pesticide Programs
ATSDR = Agency for Toxic Substances and Disease Registry

Reference dose (IRIS)

1987

Health advisories

1989

Maximum contaminant level

1994

Draft reference dose (OPP)

2017

Draft minimum risk level (ATSDR)

Finalized this month

2019

Glyphosate is unlikely to cause carcinogenic effects after oral exposure.

DHS recommends an **enforcement standard** of **10 mg/L** for **glyphosate**.

DHS' recommended enforcement standard for **glyphosate** is based on:

Federal number

State drinking water standard

EPA value

→ Draft oral reference dose

Technical information

Cancer risk

Reference dose (IRIS)

1987

Health advisories

1989

Maximum contaminant level

1994

Draft reference dose (OPP)

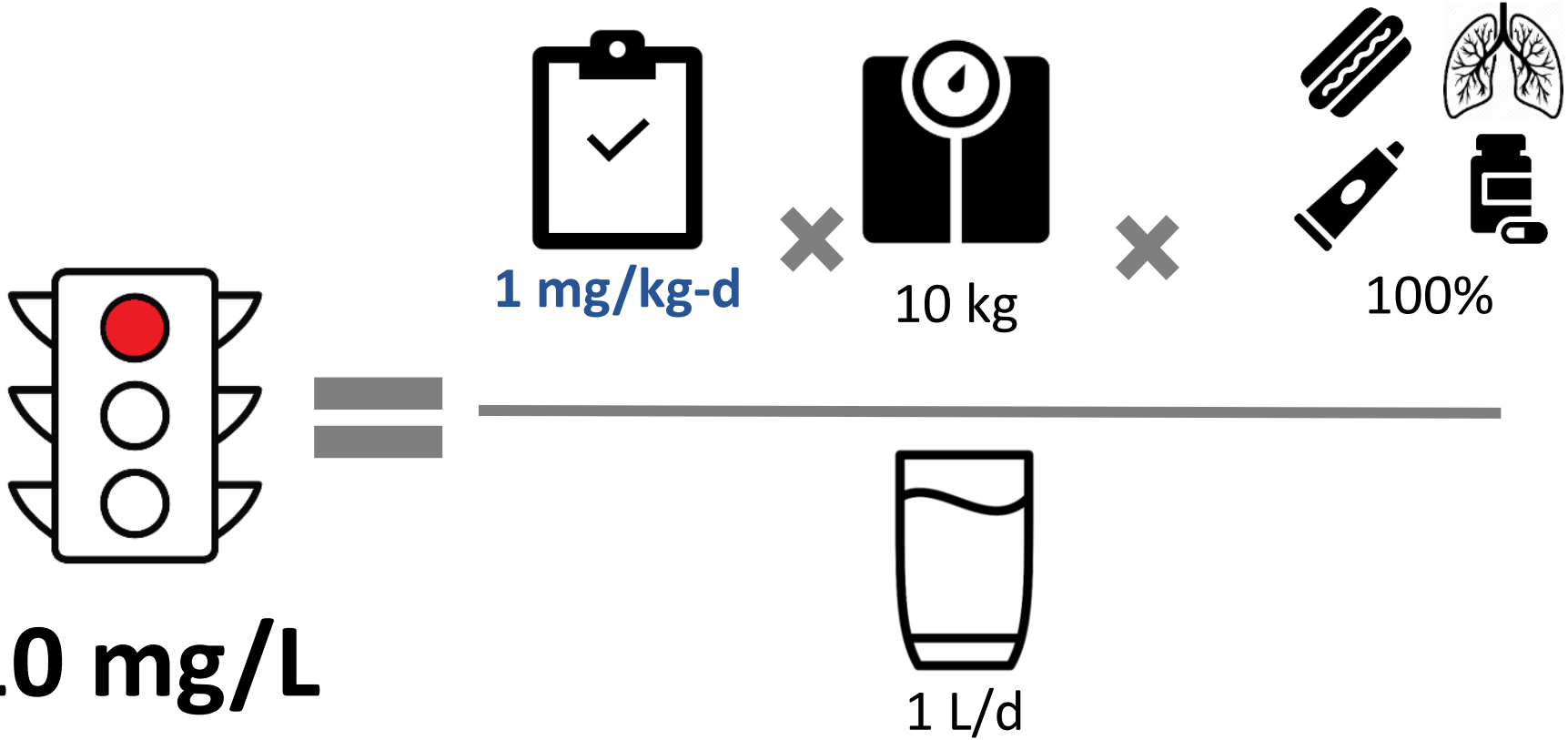
2017

Draft minimum risk level (ATSDR)*

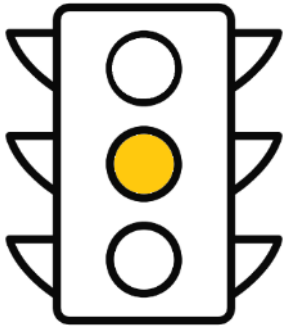
2019

*ATSDR recently finalized this document.

Glyphosate:



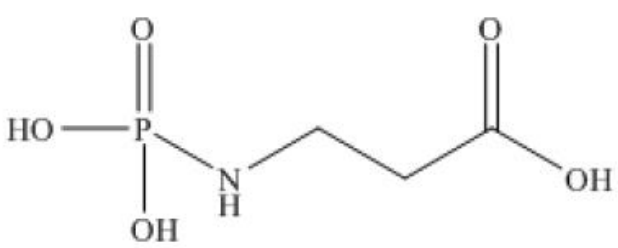
DHS recommends that the preventive action limit for **glyphosate** be set at:



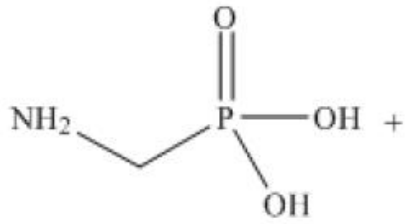
= 1 mg/L

10% due to potential mutagenic and teratogenic effects

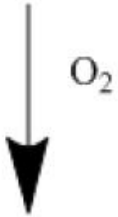
Aminomethyl-phosphonic acid (AMPA)



Glyphosate



AMPA **Glyoxylate**



$PO_4^- + NH_4^+ + CO_2 + H_2O$

AMPA can impact the

Gastrointestinal tract

Liver

Urinary tract

Development

Wisconsin does not currently has groundwater standards for **AMPA.**

Available scientific information for **AMPA**:

Federal number

State drinking water standard

EPA value

Technical information

Cancer risk

Available scientific information for **AMPA**:

Technical Information

JMPR acceptable daily intake (2016)

1 mg/kg-d - sum of glyphosate and AMPA

Based on similar chemical structure and toxicity profiles

Available scientific information for **AMPA**:

Technical Information

Estes et al., 1979

Effects on body weight and urinary tract in rats

90 day oral study

Candidate ADI = 1 mg/kg-d

Available scientific information for **AMPA**:

Technical Information

Holson et al., 1979

Clinical toxicity in mothers and decreased growth in offspring

Oral Developmental oral study

Candidate ADI = 4 mg/kg-d

DHS recommends an **enforcement standard** of **10 mg/L** for **AMPA**.

DHS' recommended enforcement standard for **AMPA** is based on:

Federal number

State drinking water standard

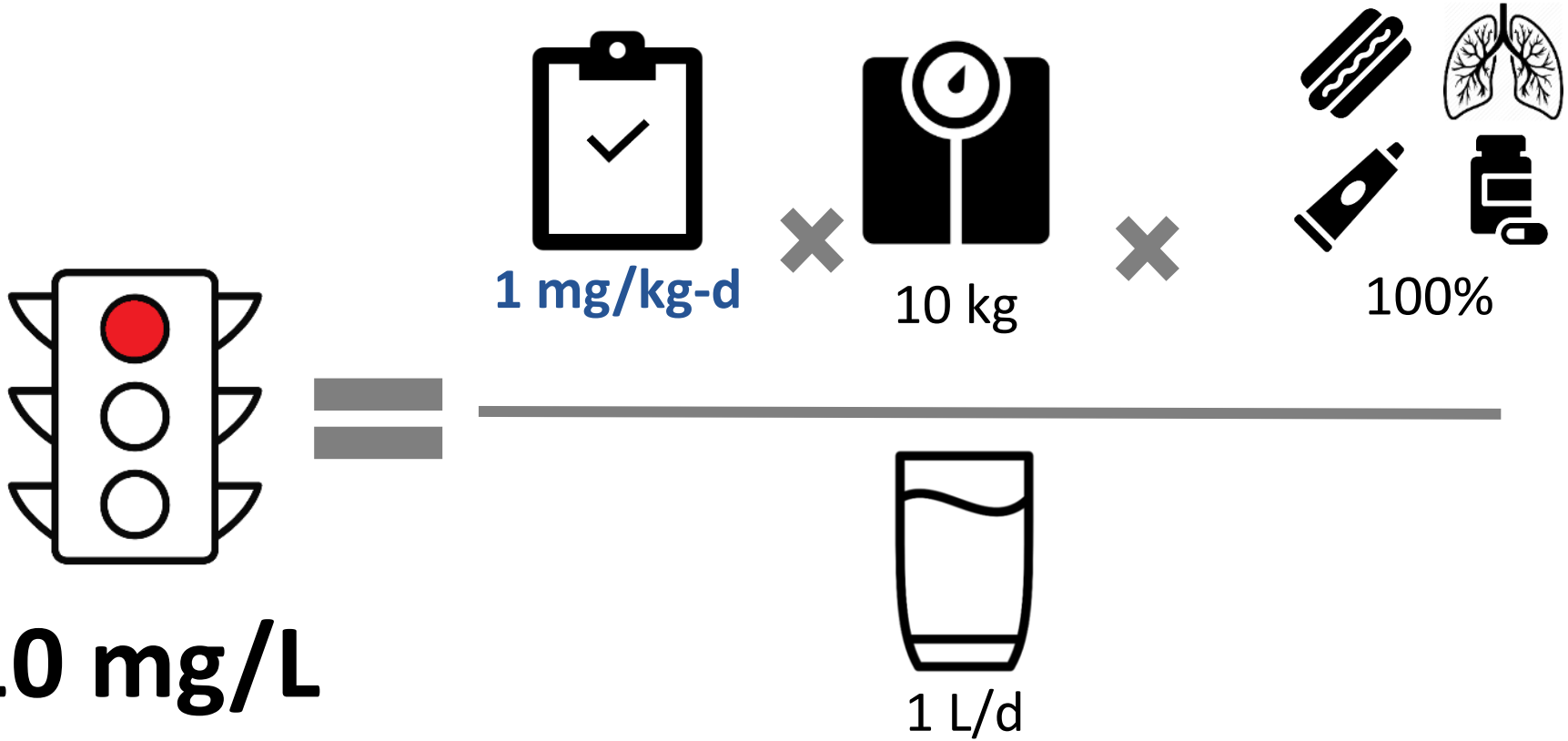
EPA value

Technical information

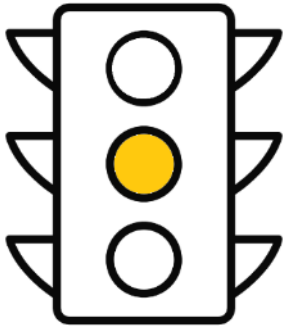
→ Critical toxicity study

Cancer risk

AMPA:



DHS recommends that the preventive action limit for **AMPA** be set at:

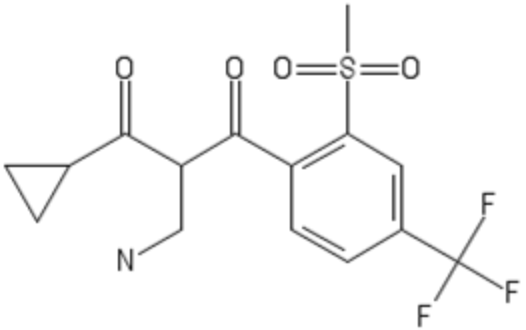


= 2 mg/L

20% - no evidence of carcinogenic, mutagenic, teratogenic, or interactive effects

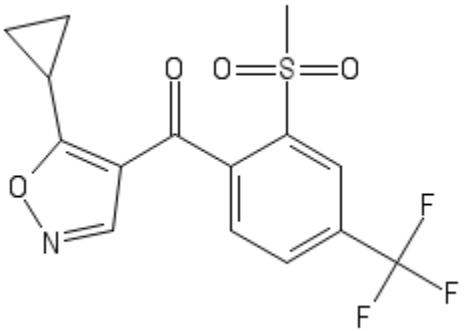
Isoxaflutole and degradates

Isoxaflutole breaks down quickly in the **environment**.



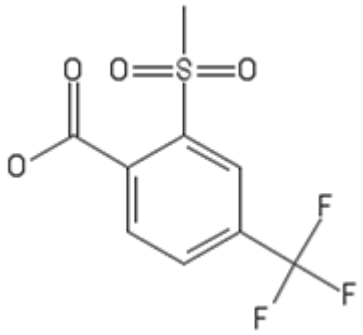
Isoxaflutole

Hours to days



Diketonitrile (DKN)

Weeks to months



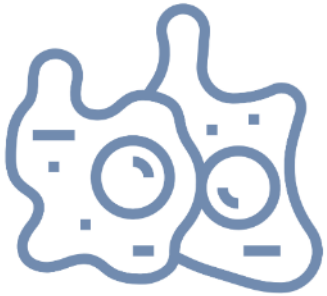
Benzoic Acid (BA)

Half-life

Isoxaflutole can impact the

Eye

Liver

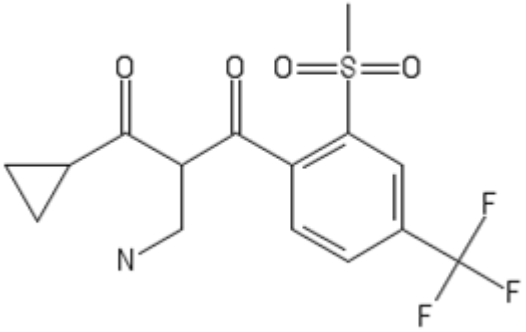


Cancer

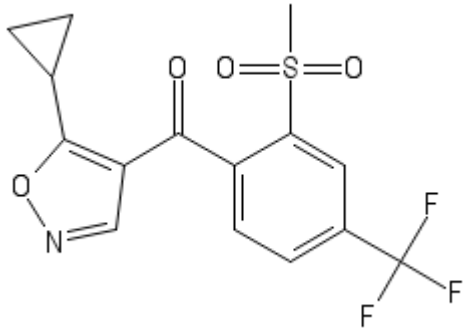
Muscles and nerves

Thyroid

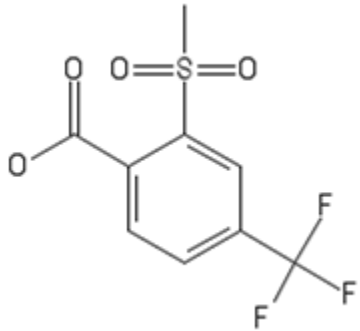
Isoxaflutole breaks down quickly in the **body**.



Isoxaflutole



Diketonitrile (DKN)



Benzoic Acid (BA)

Half-life = 60 hours

Wisconsin does not currently has groundwater standards for **isoxaflutole and its degradates.**

Available scientific information for **Isoxaflutole**:

Federal number

State drinking water standard

EPA value

Technical information

Cancer risk

Available scientific information for **Isoxaflutole:**

EPA Value

Oral Reference Dose (2011)

0.02 mg/kg-d

Effects on liver, thyroid, eyes, and nervous system

2 year oral study in rats

Available scientific information for **isoxaflutole:**

Cancer risk

EPA Cancer Slope Factor (2011)

0.0114 $(mg/kg\text{-}d)^{-1}$

Liver tumors in mice and rats

2 year oral study

DHS recommends a **combined enforcement standard** of **3 µg/L** for **Isoxaflutole and DKN**.

DHS' recommended enforcement standard for **isoxaflutole and DKN** is based on:

Federal number

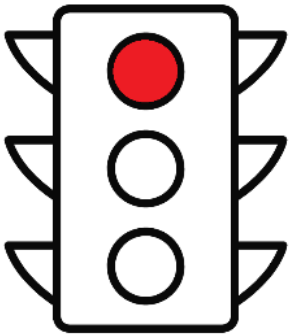
State drinking water standard

EPA value

Technical information

Cancer risk

Isoxaflutole and DKN:

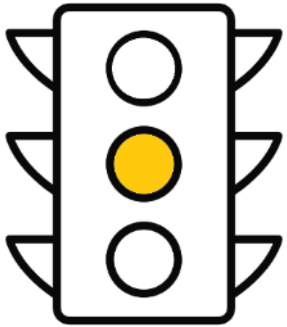


3 µg/L

=

$$\frac{10^{-6} \times 80\ \text{kg}}{0.0114\ (\text{mg/kg-d})^{-1} \times 2.4\ \text{L/d}}$$

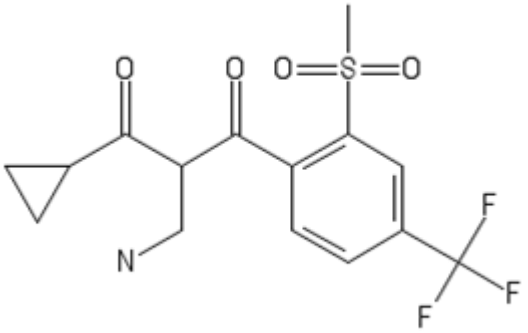
DHS recommends that a combined preventive action limit for **isoxaflutole** and **DKN.**



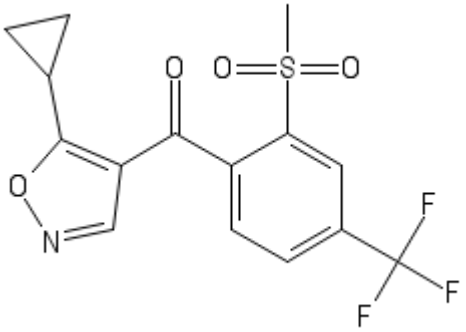
= 0.3 µg/L

10% - carcinogenic effects

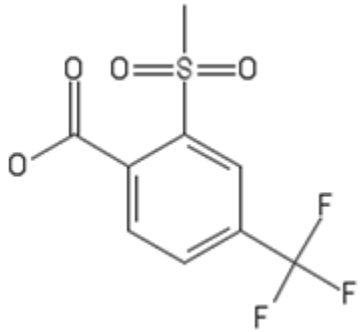
Wisconsin recommends **standalone standards** for **isoxaflutole benzoic acid.**



Isoxaflutole



Diketonitrile (DKN)



Benzoic Acid (BA)

Isoxaflutole BA can impact the

Weight gain

Food consumption

Clinical chemistry

Available scientific information for **Isoxaflutole BA**:

Federal number

State drinking water standard

EPA value

Technical information

Cancer risk

Available scientific information for **isoxaflutole BA**:

Technical Information

Repetto-Larsay, 1999

Decreased weight gain and feed consumption in pregnant rats

Oral developmental study

Candidate ADI = 0.8 mg/kg-d

DHS recommends an **enforcement standard** of **800 µg/L** for **isoxaflutole BA**.

DHS' recommended enforcement standard for **isoxaflutole BA** is based on:

Federal number

State drinking water standard

EPA value

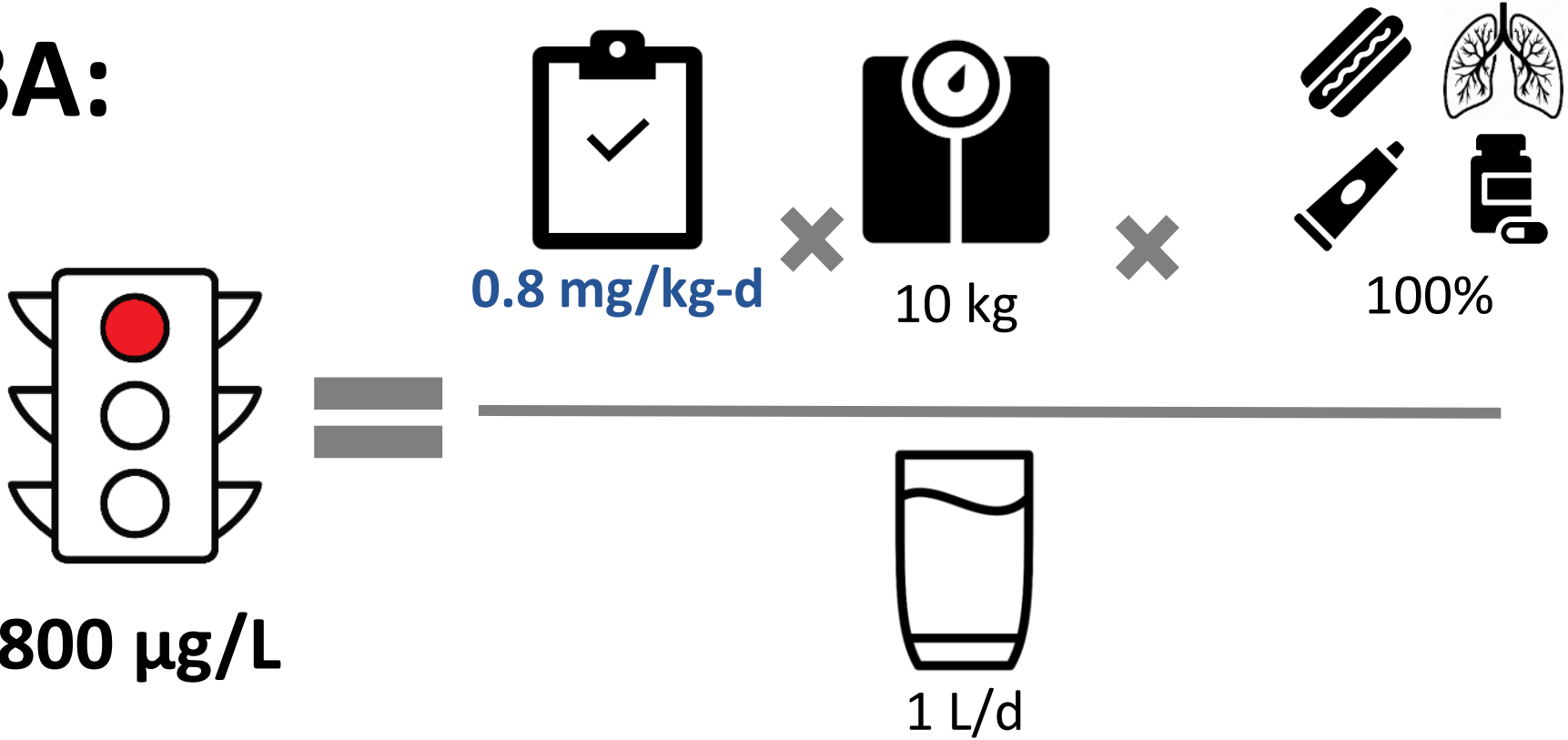
Technical information

→ Critical toxicity study

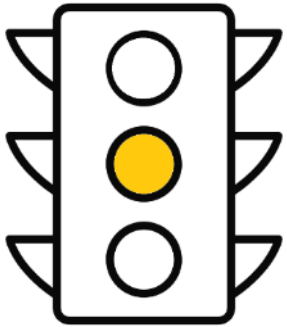
Cancer risk

Isoxaflutole

BA:



DHS recommends that the preventive action limit for **isoxaflutole BA** be set at:



= 160 µg/L

20% - no evidence of carcinogenic, mutagenic, teratogenic, or interactive effects

DHS recommended groundwater standards for:

- Clothianidin
- Imidacloprid
- Sulfentrazone
- Thiamexthoxam
- Thiencarbazone-methyl
- Dacthal degradates
- Glyphosate and degradate
- Isoxaflutole and degradates

Additional information can be found on DHS' webpage: dhs.wisconsin.gov\water\gws.htm

The full scientific support document for all of the Cycle 10 compounds is available here: dhs.wisconsin.gov\publications\p02434v.pdf.

Thanks!

Sarah Yang, Ph.D.

Groundwater Toxicologist

Wisconsin Department of Health Services

sarahp.yang@wi.gov

608-266-9337