# Furfural; CASRN 98-01-1

Human health assessment information on a chemical substance is included in the IRIS database only after a comprehensive review of toxicity data, as outlined in the IRIS assessment development process. Sections I (Health Hazard Assessments for Noncarcinogenic Effects) and II (Carcinogenicity Assessment for Lifetime Exposure) present the conclusions that were reached during the assessment development process. Supporting information and explanations of the methods used to derive the values given in IRIS are provided in the guidance documents located on the IRIS website.

STATUS OF DATA FOR Furfural

**File First On-Line 09/07/1988**

| Category (section) | Assessment Available? | Last Revised |
|---|---|---|
| **Oral RfD (I.A.)** | yes | 09/07/1988 |
| **Inhalation RfC (I.B.)** | not evaluated | |
| **Carcinogenicity Assessment (II.)** | not evaluated | |

## I. Chronic Health Hazard Assessments for Noncarcinogenic Effects

### I.A. Reference Dose for Chronic Oral Exposure (RfD)

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The oral Reference Dose (RfD) is based on the assumption that thresholds exist for certain toxic effects such as cellular necrosis. It is expressed in units of mg/kg-day. In general, the RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. Please refer to the Background Document for an elaboration of these concepts. RfDs can also be derived for the noncarcinogenic health effects of substances that are also carcinogens. Therefore, it is essential to refer to other sources of

information concerning the carcinogenicity of this substance. If the U.S. EPA has evaluated this substance for potential human carcinogenicity, a summary of that evaluation will be contained in Section II of this file.

### I.A.1. Oral RfD Summary

| Critical Effect | Experimental Doses* | UF | MF | RfD |
|---|---|---|---|---|
| **Mild hepatocellular vacuolization**<br><br>**Rat Oral Subchronic Study**<br><br>**NTP, 1981a** | NOAEL: none<br><br>LOAEL: 11 mg/kg/day converted to 7.9 mg/kg/day | 3000 | 1 | 3E-3 mg/kg/day |

*Conversion Factors: Doses adjusted for gavage schedule of 5 days/week.

### I.A.2. Principal and Supporting Studies (Oral RfD)

NTP (National Toxicology Program). 1981a. 90-day Rat Report. Unpublished study performed by Southern Research Institute.

Useful studies of oral exposure are restricted to 13-week gavage experiments with F-344 rats (NTP, 1981a) and B6C3F1 mice (NTP, 1981b), which indicate that the liver is the target organ of furfural in these species. In groups of 10 male and 10 female rats treated with 11, 22, 45, 90 or 180 mg/kg, 5 days/week, mortality was associated with greater than or equal to 90 mg/kg and cytoplasmic vacuolization was seen in all treated groups. The lesions were described as mild to moderate, and the low dose level of 11 mg/kg may be considered a LOAEL in rats. Lacking a suitable NOAEL, the LOAEL of 11 mg/kg, 5 days/week in rats reported by NTP (1981a) is chosen for the derivation of an RfD. An RfD of 0.003 mg/kg/day or 0.2 mg/day for a 70 kg human is derived by application of an uncertainty factor of 3000.

### I.A.3. Uncertainty and Modifying Factors (Oral RfD)

UF — Because toxicity data is available on several animal species, a factor of 3 was used to estimate a NOAEL from a LOAEL, 10 to extrapolate from rats to humans, 10 to protect unusually sensitive individuals and 10 for the use of subchronic data in deriving the RfD.

MF — None

### I.A.4. Additional Studies/Comments (Oral RfD)

No oral exposure studies other than those reported by NTP (1981a,b) were available to consider for the derivation of the RfD, and a NOAEL could not be identified. Mice appear to be more resistant than rats to the effects of orally administered furfural. In mice treated by the same schedule as rats with doses of 75, 150, 300, 600 or 1200 mg/kg, heavy mortality occurred at greater than or equal to 600 mg/kg (NTP, 1981b). Degenerative, necrotic and inflammatory liver lesions were noted at greater than or equal to 150 but not at 75 mg/kg. A 13-week study reported by Feron et al. (1979) identifies a NOAEL and LOAEL in hamsters for subchronic inhalation exposure. Data indicate that toxicity may be greater by the oral exposure route and use of oral data eliminates the added uncertainties involved in route-to-route extrapolations. In addition, chronic toxicity and developmental and reproductive toxicity of furfural have not been adequately investigated.

### I.A.5. Confidence in the Oral RfD

Study — Low
Database — Low
RfD — Low

A low confidence in the RfD reflects a low level of confidence in the study and the database. Confidence in the RfD is low because the key study, a 13- week gavage rat study (NTP, 1981a) did not identify a NOAEL for liver effects in rats, the more sensitive of the species tested. In addition no studies supporting the RfD were available in the literature. Furthermore, the developmental and reproductive toxicity of furfural have not been adequately investigated.

### I.A.6. EPA Documentation and Review of the Oral RfD

Source Document — U.S. EPA, 1987

Limited peer review and Agency-wide review, 1987.

Other EPA Documentation — None

Agency Work Group Review — 12/15/1987

Verification Date — 12/15/1987

Screening-Level Literature Review Findings — A screening-level review conducted by an EPA contractor of the more recent toxicology literature pertinent to the RfD for Furfural conducted in November 2001 identified one or more significant new studies. IRIS users may request the references for those studies from the IRIS Hotline at hotline.iris@epa.gov or (202)566-1676.

### I.A.7. EPA Contacts (Oral RfD)

Please contact the IRIS Hotline for all questions concerning this assessment or IRIS, in general, at (202)566-1676 (phone), (202)566-1749 (FAX) or hotline.iris@epa.gov (internet address).

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### I.B. Reference Concentration for Chronic Inhalation Exposure (RfC)

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Not available at this time.

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## II. Carcinogenicity Assessment for Lifetime Exposure

Substance Name — Furfural
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Not available at this time.

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## III. [reserved]
## IV. [reserved]
## V. [reserved]

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# VI. Bibliography

Substance Name — Furfural
CASRN — 98-01-1

## VI.A. Oral RfD References

Feron, V.J., A. Druysse and H.C. Dreef-Van Der Meulen. 1979. Repeated exposure to furfural vapour: 13-week study in Syrian Golden Hamsters. Zbl. Bakt. Hyg. I. Abt. Orig. B 168: 442-451.

NTP (National Toxicology Program). 1981a. 90-day Rat Report. Unpublished study performed by Southern Research Institute.

NTP (National Toxicology Program). 1981b. 90-day Mouse Report. Unpublished study performed by Southern Research Institute.

U.S. EPA. 1987. Health and Environmental Effects Document on Furfural. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Solid Waste, Washington, DC.

## VI.B. Inhalation RfC References

None

## VI.C. Carcinogenicity Assessment References

None

## VII. Revision History

Substance Name — Furfural
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| Date | Section | Description |
|---|---|---|
| **09/07/1988** | I.A. | Oral RfD summary on-line |
| **12/03/2002** | I.A.6. | Screening-Level Literature Review Findings message has been added. |

## VIII. Synonyms

Substance Name — Furfural
CASRN — 98-01-1
Last Revised — 09/07/1988

- 98-01-1
- furale
- furancarbonal
- Furfural
- furfuraldehyde
- furfurole
- furfurylaldehyde
- furole
- pyromucic aldehyde