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Responsible Care®
A Public Commitment

December 30, 2003
via e-mail and U.S. mail

201-15018

Mr. Michael Leavitt
Administrator
U.S. Environmental Protection Agency
PO Box 1473
Merrifield, VA 22116

RE: Chemical Right-To-Know Program

Dear Mr. Leavitt,

In November 1999, Reilly Industries, Inc. submitted a letter to USEPA indicating our intent to sponsor several pyridine derivatives in the US HPV Chemical Challenge Program. Those chemicals are as follows:

CAS Registry Number	***Chemical Name***
110-86-1	Pyridine
109-06-8	2-Methylpyridine (2-Picoline)
108-99-6	3-Methylpyridine (3-Picoline)
108-89-4	4-Methylpyridine (4-Picoline)
110-89-4	Piperidine
110-54-9	Nicotinonitrile (3-Cyanopyridine)
68391-11-7	Pyridine, alkyl derivatives
100-69-6	2-Vinylpyridine (2-Ethenylpyridine)

Reilly has previously fulfilled our commitment to provide robust summaries and test plans for Pyridine, 2-Methylpyridine, 3-Methylpyridine, 4-Methylpyridine, Piperidine, Nicotinonitrile and Pyridine, alkyl derivatives through the submission of this information by the American Chemistry Council's Pyridine and Pyridine Derivatives HPV Work Group on December 17, 2003.

Reilly hereby completes its commitment to identify and assess all existing data on the above-listed pyridine derivatives by supplying the attached test plan document for 2-Vinylpyridine. Robust summaries are included in the test plan, and may be found in Appendix B.

If you have any questions regarding our submission, please contact me at (317)248-6548, or by e-mail at mbogle@reillyind.com.

Sincerely,

Reilly Industries, Inc.

Misty L. Bogle
Senior Project Manager,
Regulatory Management

MLB/mlb

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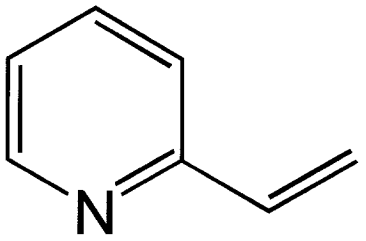
201-15018B

2-Vinylpyridine

(Chemical Abstracts Registry Number: 100-69-6)



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Test Plan
HPV Chemical Challenge
December 30, 2003

Submitted by:

Reilly Industries, Inc.
300 North Meridian Street
Suite 1500
Indianapolis, Indiana 46204

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Executive Summary

2-Vinylpyridine (CAS# 100-69-6) is a chemical intermediate used solely by the chemical industry for various purposes; the majority of the material is used by the tire industry. As such, it is not expected to be an exposure concern to the general public. 2-Vinylpyridine is a reactive monomer that is sold with an inhibitor incorporated to reduce the risk of hazardous autopolymerization.

A significant amount of data already exists regarding the hazards of 2-Vinylpyridine. It is known to be corrosive to tissues, flammable, and acutely toxic by oral and dermal routes. It has an extremely low odor threshold and a strongly disagreeable odor. The weight of the evidence from genetic toxicity testing shows that 2-Vinylpyridine is not mutagenic, but does cause toxicity to bacterial test systems at higher doses. Cytotoxicity is also likely to be the cause of lack of biodegradation in non-acclimated systems. 2-Vinylpyridine is not expected to bioaccumulate, nor is it expected to exhibit significant toxicity to aquatic systems.

Repeated dose testing has shown that rats administered 2-Vinylpyridine by oral gavage developed clear irritation, cell proliferation and thickening of the tissues in the forestomach, the site of contact of the test material. No systemic effects were noted through histological analysis, and body weight differences observed during the test were shown to be reversible after a recovery period.

Reilly Industries proposes to conduct aquatic toxicity testing and developmental toxicity testing on 2-Vinylpyridine, to better define these endpoints.

Data Availability Summary Table

CAS#: 100-69-6 2-Vinylpyridine	Information Available?	GLP	OECD Study	Other Study	Estimation Method	Acceptable?	Testing Required?	Notes
	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	
Physical/Chemical Endpoints								
Melting Point	Y	N	N	N	Y	Y	N	
Boiling Point	Y	NS*	N	Y	N	Y	N	
Vapor Pressure	Y	N	N	N	Y	Y	N	
Partition Coefficient	Y	NS	Y	N	N	Y	N	
Water Solubility	Y	NS	N	Y	N	Y	N	
Environmental Fate and Pathway Endpoints								
Photodegradation	Y	NS	N	Y	N	Y	N	
Stability in Water	Y	N	N	N	Y	Y	N	
Transport & Distribution	Y	N	N	N	Y	Y	N	
Biodegradation	Y	NS	Y	N	Y	Y	N	
Ecotoxicity Endpoints								
Acute Fish	Y	N	N	N	Y	N	Y	OECD 203
Acute Invertebrate	Y	NS	N	Y	N	N	Y	OECD 202
Acute Algae	Y	N	N	N	Y	N	Y	OECD 201
Toxicology Endpoints								
Acute Mammalian	Y	Y	Y	Y	N	Y	N	
Repeated Dose	Y	Y	Y	Y	N	Y	N	
Genetic Toxicity (in vitro)	Y	Y	Y	Y	N	Y	N	
Genetic Toxicity (in vivo)	Y	NS	Y	Y	N	Y	N	
Reproductive	Y	Y	Y	Y	N	Y	N	
Developmental	N	N	N	N	N	N	Y	OECD 421 (oral)

* NS = not stated

Background Information

2-Vinylpyridine is a specialty chemical intermediate manufactured and used solely in industrial settings. It has no direct consumer uses whatsoever. The vast majority of 2-Vinylpyridine manufactured in the United States (> 90%) is used in the production of tire cord and belt adhesives[1], with smaller quantities being used in the manufacture of pharmaceuticals. 2-Vinylpyridine can be polymerized to form products useful as catalysts, acid scavengers, ion-exchange resins and polyelectrolytes.[2]

2-Vinylpyridine is a reactive molecule and is sold with an inhibitor incorporated to reduce the risk of uncontrolled auto-polymerization. Reilly's handling recommendations for 2-Vinylpyridine include storage at reduced temperatures to prevent product quality problems resulting from this relatively slow auto-polymerization reaction.

2-Vinylpyridine is classified as a toxic, corrosive, flammable liquid. It has a pungent, disagreeable odor that is detectable at less than 1 ppm by volume in air.[3] Some reports suggest that 2-Vinylpyridine may be a skin sensitizer in certain individuals. Due to its classification and strong odor, 2-Vinylpyridine is handled only in closed systems with good ventilation. The strong, disagreeable odor acts as a natural action limit, but odor detection cannot be completely relied upon for exposure protection due to the potential for olfactory fatigue to occur. No occupational exposure limits for 2-Vinylpyridine are known to exist at this time.

The following is a review of the available literature on the physical/chemical properties, environmental, ecological and toxicological effects of 2-Vinylpyridine. Appendix A includes a detailed bibliography of the literature reviewed in this project, while Appendix B summarizes the reliable studies that address endpoints of the Screening Information Data Set (SIDS) under the Existing Chemicals program of the Organization for Economic Cooperation and Development (OECD).

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[1] Tire cord adhesive technology is well known, and a review may be found in the chapter entitled "Tire Cord" in the following: Bhakuni, RS; Chawla, SK; Kim, DK; Shuttleworth, D. In *Kirk-Othmer Encyclopedia of Chemical Technology;* 4th edition; John Wiley & Sons: New York, NY, 1997; Vol. 24 (Thioglycolic Acid to Vinyl Polymers), pp. 161-186.

[2] Khan, IM. In *Encyclopedia of Polymer Science and Engineering;* John Wiley & Sons: New York, NY, 1989; Vol. 17 (Transitions and Relaxations to Zwitterionic Polymerization), pp. 567-578.

[3] Trochimowicz, HJ; Kennedy, GL; Krivanek, ND. In *Patty's Industrial Hygiene and Toxicology;* Clayton, GD et al; 4th edition; Toxicology, Part E; John Wiley & Sons: New York, NY,1994; Vol. II, pp. 3360-3364.

Discussion of Data Availability

Introduction

In order to assess the reliability of the data found for 2-Vinylpyridine, the method described in Klimisch et al[4] was followed; that is, study reports were evaluated and scored using the following system:

Klimisch Code	Reliability Category	Examples
1	Reliable without restriction	• Guideline study (OECD, etc.) • Comparable to guideline study • Test procedure according to national standards
2	Reliable with restrictions	• Acceptable, well-documented publication / study report which meets basic scientific principles • Basic data given; comparable to guidelines / standards • Comparable to guideline study with acceptable restrictions
3	Not reliable	• Method not validated • Documentation insufficient for assessment • Does not meet important criteria of today standard methods • Relevant methodological deficiencies • Unsuitable test system
4	Not assignable	• Only short abstract available • Only secondary literature (review, tables, books, etc.)

Only studies with a Klimisch score of 1 or 2 were used to develop the robust summaries for 2-Vinylpyridine, which may be found in Appendix B. Modeled data, using models recommended for use by EPA, was considered to have a Klimisch score of 2.

Physical/Chemical Properties

Under ambient conditions, 2-Vinylpyridine is a colorless liquid with a pungent, disagreeable odor. The melting point of 2-Vinylpyridine is estimated to be –15°C. This modeled endpoint is consistent with Reilly's experience in handling this material; Reilly recommends that 2-Vinylpyridine be stored at temperatures below –5°C to ensure maintenance of product quality by inhibiting formation of polymers during storage. EPA guidance states that melting points less than 0°C do not need to be further specified.[5]

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[4] Klimisch, H-J; Andreae, M; Tillmann, U. *Regulatory Toxicology and Pharmacology*. **1997,** *25,* 1-5.

[5] U.S. Environmental Protection Agency. *Determining the Adequacy of Existing Data*, 10 February 1999 draft, available at http://www.epa.gov/chemrtk/datadfin.htm.

The boiling point of 2-Vinylpyridine (159.5°C) is available from a reliable reference book, summarized in Appendix B. A wide selection of boiling points at reduced pressures was found in the Beilstein database, and this data was used to calculate the vapor pressure of 2-Vinylpyridine at 25°C, using appropriate estimation calculations.[6] The mean vapor pressure result determined from these data points was 2.45 mm Hg (0.34 kPa) at 25°C. This correlates very well with the modeled vapor pressure (2.57 mm Hg) from the MPBPWIN™ module of the EPI Suite™ modeling software[7], as shown in Appendix B.

The octanol/water partition coefficient (log Kow) for 2-Vinylpyridine is 1.54, an experimental value. Based on this low value, bioaccumulation of 2-Vinylpyridine is not expected to occur. 2-Vinylpyridine is highly water soluble (2.75 g/100 mL at 20°C), further supporting the conclusion that 2-Vinylpyridine is not likely to bioaccumulate due to its tendency to migrate to the aqueous phase.

Environmental Fate and Pathways

An extensive study on 2-Vinylpyridine photodegradation pathways is summarized in Appendix B. The study concludes that 2-Vinylpyridine reacts with hydroxyl and nitrate radicals and ozone to form primarily 2-pyridinecarboxaldehyde; this indirect photolysis reaction is analogous to the photochemical breakdown of styrene to benzaldehyde, a well-known atmospheric fate pathway. For ambient atmospheric conditions, the calculated lifetime of 2-Vinylpyridine due to reaction with hydroxyl radicals, nitrate radicals and ozone is approximately 3 hours, 4 hours and 1 day, respectively. The study further states that the removal of 2-Vinylpyridine with gaseous nitric acid may be competitive with the above reactions as an atmospheric loss process.[8]

Hydrolysis is a potentially important environmental fate pathway for a range of organic chemicals, including alkyl halides, amides, amines, carbamates, epoxides, nitriles and esters. 2-Vinylpyridine does not contain a functional group that is susceptible to hydrolysis; in fact, alkenes are known to be generally resistant to hydrolysis.[9] As expected, attempts to model a hydrolysis rate using the HYDROWIN™ modeling program were unsuccessful.

2-Vinylpyridine was reportedly resistant to biodegradation over a 4-week period in a single aerobic screening test. Modeling of this endpoint using the BIOWIN™

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[6] Lyman, WJ; Reehl, WF; Rosenblatt, DH. *Handbook of Chemical Property Estimation Methods; Environmental Behavior of Organic Compounds;* McGraw-Hill: New York, NY, 1982; Chapter 14: "Vapor Pressure".

[7] U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics and Syracuse Research Center. Copyright 2000. *EPI Suite*™, version 3.11, including MPBPWIN, version 1.41, released June 10, 2003. (http://www.epa.gov/opptintr/exposure/docs/episuite.htm.)

[8] Tuazon, EC; Arey, J; Atkinson, R; Aschmann, SM. *Environ Sci Technol.* **1993,** *27,* 1832-1841.

[9] Lyman, WJ; Reehl, WF; Rosenblatt, DH. *Handbook of Chemical Property Estimation Methods; Environmental Behavior of Organic Compounds;* McGraw-Hill: New York, NY, 1982; Chapter 17: "Rate of Hydrolysis".

software model also suggests that 2-Vinylpyridine may not biodegrade rapidly. This result is not unexpected, as genetic toxicity testing using bacterial systems showed that 2-Vinylpyridine exhibits substantial cytotoxicity to microbes (see Appendix B); a similar cytotoxic effect in biodegradation microbes may cause inhibition of rapid biodegradation. However, Reilly's experience has been that activated sludge biosystems used for wastewater treatment, once adequately acclimated to pyridines, can degrade 2-Vinylpyridine.

Transport and distribution of 2-Vinylpyridine in the environment were predicted using Level III fugacity modeling included in the EPI Suite™ software package. User-input parameters and emission rates are detailed in Appendix B. The model was run with the default model emission value (1000 kg/hr) for air emissions, but changing the default emission values for soil and water to zero; these changes were made due to the fact that EPA waste regulations prohibit the disposal of liquids in landfills, thus limiting potential for soil emissions (except in a spill event), and that water emissions of any magnitude are unlikely due to potential for toxicity to biotreatment systems and industrial effluent permits limiting the amount of organics that can be present in wastewater. The results of this fugacity modeling are:

Air:	79.6%
Water:	13.7%
Soil:	6.59%
Sediment:	0.0296%

Ecotoxicity

Ecotoxicity data was estimated using EPA's ECOSAR™ modeling software.[10] Predicted LC_{50} and EC_{50} values are presented in Appendix B, and are summarized as follows (rounded to the nearest whole number):

Parameter	Predicted value
Fish LC_{50} (14-day)	355 mg/L
Fish LC_{50} (96-hr)	211 mg/L
Fish LC_{50} (96-hr, SW)	39 mg/L
Fish ChV (30-day)	25 mg/L
Daphnid LC_{50} (48-hr)	219 mg/L
Daphnid EC_{50} (16-day)	9 mg/L
Green Algae EC_{50} (96-hr)	133 mg/L
Green Algae ChV (96-hr)	10 mg/L

[10] Cash, G; Nabholz, V. U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics, Risk Assessment Division. Copyright 2001. *ECOSAR™ Classes for Microsoft Windows*, version 0.99g, released April 2001.(http://www.epa.gov/oppt/newchems/21ecosar.htm.)

A TETRATOX test was also found in the literature and the results are presented in Appendix B. Based on this data, substantial toxicity to fish, aquatic invertebrates and algae is not expected; however, the available data is admittedly limited. No data for a suitable chemical analog was available for comparison to modeled data.

Mammalian Toxicity

2-Vinylpyridine has been shown, both in laboratory testing and through human experience[11], to be strongly irritating or corrosive to tissues. Acute oral and dermal toxicity testing results show 2-Vinylpyridine is toxic by ingestion and dermal exposure, and absorption through intact skin has been noted. 2-Vinylpyridine has been shown through laboratory testing to be a potential skin sensitizer in humans, and indeed, anecdotal evidence of human exposures to vinylpyridines available in the literature supports this conclusion.[12] No inhalation toxicology information is currently available. Robust summaries for all reliable studies may be found in Appendix B.

Several reliable studies are available regarding the genetic toxicity of 2-Vinylpyridine, and robust summaries are available in Appendix B. In nearly all studies, toxicity to the test system was reported at high doses. A mammalian cell cytotoxicity assay showed that 2-Vinylpyridine caused more cytotoxicity to Chinese hamster ovary cells than did pyridine or 4-methylpyridine, but was an order of magnitude less cytotoxic than 4-vinylpyridine; the authors suggest that the increased cytotoxicity of vinylpyridines may be due to the reactivity of the vinyl group to cellular proteins and DNA.[13] Out of three reliable Ames tests reported in the literature, all were negative for mutagenicity in *Salmonella typhimurium*, both with and without metabolic activation. A reverse mutation assay using *Escherichia coli* showed a dose-response related increase in mutagenic activity in the presence of metabolic activation; no mutagenic activity was observed when metabolic activation was absent. A DNA repair assay in rat hepatocytes showed no genotoxic activity. A mammalian cell chromosomal aberration study showed a positive, dose-dependent response; however, toxicology texts warn that cytotoxicity may influence chromosomal aberration assays, giving artifactual positive responses.[14] Finally, an *in vivo* mouse lung adenoma assay conducted in A/J mice showed 2-Vinylpyridine as non-genotoxic

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[11] Stone, CA; Dunn, K. *Burns.* **1996**, *22(2)*, 150-151.

[12] a) Alarie, Y; Schaper, M; Nielsen, GD; Abraham, MH. *Arch. Toxicol.* **1998,** *72,* 125-140.
b) Sasseville, D; Kwong, P; Yu, K. *Contact Dermatitis*, **1998,** *38,* 212-214.
c) Sasseville, D; Balbul, A; Kwong, P; Yu, K. *Contact Dermatitis*, **1996,** *35,* 100-101.

[13] Bombick, DW; Doolittle, DJ. *In Vitro Toxicology*. **1995,** *8(4)*, 349-356.

[14] "Questionable positive results have been found at high chemical concentrations where osmolality may cause apparent genotoxic effects. Similarly, assays at highly cytotoxic doses and pH extremes warrant careful scrutiny, as do metabolic activation systems that may be genotoxic." From *Casarett & Doull's Toxicology: The Basic Science of Poisons*, Klaassen, CD, ed. 5th edition; McGraw-Hill: New York, NY, 1996; p. 283.

and non-tumorigenic. Based on the available data, the weight-of-evidence indicates that 2-Vinylpyridine is negative for mutagenic activity.

Three reliable, oral gavage repeat dose studies in rats are summarized in Appendix B. A 17-day study was conducted, presumably as a range-finding study in preparation for conduct of a 90-day study, which is also reported. The 17-day study concluded that the no observable effect level (NOEL) was less than 80 mg/kg, and that the site of toxic action was the non-glandular portion of the stomach (site of contact), and possibly the liver and central nervous system. The subsequent 90-day study conducted by the same laboratory did not specifically report a NOEL value, but the report indicates that no significant changes in either sex were observed at the low dose (20 mg/kg/day). Higher doses (60 and 180 mg/kg/day) resulted in reductions in weight gain and feed consumption, with a slight increase in platelet counts and a slight decrease in aspartate aminotransferase in males. Absolute and relative organ weights were affected in some cases, and the 180 mg/kg/day group showed clear irritation of the non-glandular stomach epithelium, characterized by degeneration, hyperkeratosis and acanthosis resulting in a thickening of the non-glandular epithelium.

The third repeat dose study over 28 days revealed similar findings, primarily the presence of squamous hyperplasia and submucosal edema in the forestomach in rats dosed at 50 mg/kg/day and higher. Erosion and cellular infiltration in the forestomach was also observed in males receiving 200 mg/kg/day. Reversible changes in body weight gain, food consumption, urine specific gravity and volume, and absolute and relative organ weight differences were also observed, which resolved by the end of the 14-day recovery period. The NOEL was reported to be 12.5 mg/kg/day for both sexes.

Based on the repeated dose studies available, the weight-of-evidence indicates that 2-Vinylpyridine causes primarily localized effects to the stomach due to its strongly irritating properties. While a suggestion of systemic toxicity to liver and central nervous system was noted in the 17-day range-finding study, nothing in the 28-day or 90-day studies indicated that systemic toxicity of any kind was observed, other than relative organ weight changes that were shown to be reversible in the recovery period included in the 28-day study.

The 90-day repeat dose study mentioned above includes detailed pathology examinations of reproductive organs of both males and females. Relative weight differences in testes and ovaries were observed among high dose groups, but no effects were observed upon gross pathology and histological examination. This detailed examination of reproductive organs meets the requirements for SIDS/HPV reproductive screening.

No developmental toxicity data was found for 2-Vinylpyridine.

Proposed Test Plan

Physical/Chemical Endpoints

Experimental data is available for the boiling point, partition coefficient and water solubility of 2-Vinylpyridine. The melting point of 2-Vinylpyridine is less than 0°C, and according to EPA guidance, further refinement of the melting point is unnecessary for purposes of the HPV Challenge Program. Vapor pressure data was derived using acceptable modeling software, and this modeled endpoint was further substantiated by extrapolation of vapor pressure from a collection of twenty boiling points at reduced pressure.

Conclusion: No further testing is necessary for physical/chemical endpoints of 2-Vinylpyridine.

Environmental Fate and Pathway Endpoints

Experimental data is available for photodegradation of 2-Vinylpyridine, and basic chemistry principles show that there is no potential for hydrolysis. Fugacity modeling is available to model the distribution of 2-Vinylpyridine in the environment, using the assumption that emission rates would be the same between air, water and soil. Aerobic biodegradation screening test results indicate that 2-Vinylpyridine is likely not readily biodegraded; this agrees with modeled data, and the fact that cytotoxicity is often seen upon contact with bacterial systems (as seen in genetic toxicity assays).

Conclusion: No further testing is necessary for environmental fate and pathway endpoints.

Ecotoxicity Endpoints

Modeled data suggests that substantial toxicity to fish, aquatic invertebrates and algae is not expected. However, there was no data on a chemical analog to lend support to these modeled endpoints.

Conclusion: Reilly proposes to sponsor acute fish (OECD 203), acute daphnia (OECD 202) and acute algae (OECD 201) testing for 2-Vinylpyridine.

Mammalian Toxicity Endpoints

Adequate data exists to characterize the acute toxicity of 2-Vinylpyridine. Several reliable genetic toxicity tests are available; the weight of the evidence shows that 2-Vinylpyridine is negative for mutagenic activity. Three reliable repeat dose studies are available for 2-Vinylpyridine administered by oral gavage in rats; one study reports a NOEL value of 12.5 mg/kg/day. All studies agreed that the site of toxic effect was the forestomach epithelium (site of contact of the test substance) where squamous hyperplasia was found. Statistically significant

differences in relative organ weights were found in these studies, but these differences resolved over a 14-day recovery period in the 28-day study. Detailed histopathological examination of tissues and organs revealed no statistically significant differences between test subjects and controls in the 90-day study. The reproductive endpoint is fulfilled by the complete histological examination of reproductive organs from the 90-day study; again, no statistically significant differences compared to controls were found. No data was found regarding the developmental effects of 2-Vinylpyridine.

Conclusion: Reilly proposes to sponsor an oral developmental study for 2-Vinylpyridine. For purposes of animal welfare, Reilly proposes to conduct the OECD 421 reproductive/developmental screening assay, as opposed to using the traditional OECD 414 developmental test method. This will reduce animal usage by 50%.[15] *This testing will also provide additional data for the reproductive toxicity endpoint, further supporting the conclusion that this endpoint has been adequately addressed.*

[15] U.S. Environmental Protection Agency. *HPV Chemical Human Health Testing: Animal Welfare Issues and Approaches*, **1998**, available at http://www.epa.gov/chemrtk/humnanml.pdf.

Appendix A – Bibliography

The following bibliography includes all of the studies reviewed for reliability in this data analysis, including those with Klimisch scores of 3 and 4, which were not used to develop robust summaries due to study deficiencies or lack of reported detail; such studies may be useful as supporting information.

Citation	Klimisch Score
Alarie, Y; Schaper, M; Nielsen, GD; Abraham, MH. *Archives of Toxicology.* **1998,** *72(3)*, 125-140.	4
Anonymous. *Basic Toxicity of 2-Vinylpyridine.* **1983.** Eastman Kodak Company, Corporate Health and Environment Laboratories. As submitted to USEPA under TSCA §8(e) Compliance Audit Program agreement by Eastman Kodak Company, 1992, OTS#0546362.	2
Barr, K; Wnorowski, G. *DOT Skin Corrosion*, Study #T-2927. **1994.** Product Safety Labs, East Brunswick, NJ, unpublished.	2
Beilstein Database, 2003, produced by BEILSTEIN Chemiedaten GmbH, Frankfurt, Germany. Access provided by STN International, Chemical Abstracts Service, Columbus, Ohio. (Found at http://www.cas.org.)	2
Bombick, DW; Doolitle, DJ. *In Vitro Toxicology.* **1995,** *8(4),* 349-356.	2
Brunnemann, KD; Rivenson, A; Cheng, SC; Saa, V; Hoffmann, D. *Cancer Lett.* **1992,** *65(2),* 107-113.	2
Bukhalovskii, AA; Bitkina AV. *Gigiena I Sanitariya.* **1992,** *57(9-10),* 64.	4
Bukhalovskii, AA; Shugaev, BB. *Sb. Nauchn. Tr. – Nauchno-Issled Inst Monomerov Si.* **1983,** *5,* 81-5.	4
Biodegradation and Bioaccumulation Data of Existing Chemicals Based on the CSCL Japan, Chemicals Inspections and Testing Institute. Japan Chemical Industry Ecology-Toxicology and Information Center, Japan. 1992. (ISBN 4-89074-101-1) As referenced in *Hazardous Substances Data Bank®*, National Library of Medicine, Bethesda, MD. Found at http://toxnet.nlm.nih.gov/.	2
Chemicals Inspections and Testing Institute. 1992. *Biodegradation and Bioaccumulation Data of Existing Chemicals Based on the CSCL Japan.* Japan Chemical Industry Ecology-Toxicology and Information Center. ISBN 4-89074-101-1, Japan. As referenced in *Hazardous Substances Data Bank®*, National Library of Medicine, Bethesda, Maryland, USA. Found at http://toxnet.nlm.nih.gov/.	2
CRC Handbook of Chemistry and Physics; Lide, David. R., ed. 80th edition; CRC Press, Boca Raton, FL, 1999.	2
Dukhovnaia, AI. *Gigiena Truda I Professional'nye Zabolevaniya.* **1966,** *10(3),* 9-13.	4
Farago, S; Aldea, M. *Revistade Chimie (Bucharest).* **1989,** *40(2),* 166-70.	3
Fedorowicz, A; Zheng, L; Singh, H; Demchuk, E. *9th Electronic Computational Chemistry Conference*, **2003**, 1-9 (http://eccc9.cooper.edu).	4

Fitzgerald, G. B. *Acute dermal toxicity study (single exposure), amended report.* Report number 92G-0361. **1994.** Toxikon Corp., Woburn, MA..	1
Goe, GL. *Kirk-Othmer Encycl Chem Tech.* **1982,** *19,* 454-83.	2
Hawley's Condensed Chemical Dictionary; Lewis, Richard J., Sr., ed. 13th edition; John Wiley & Sons: New York, NY; 1998.	2
Henry, JE. *Rabbit skin absorption (ALD) with pyridine, 2-ethenyl-, with cover letter.* **1981.** Haskell Laboratories. As submitted to USEPA under TSCA §8(e) Compliance Audit Program agreement by DuPont Chemical, 1992, OTS#0571402.	2
Kurlyandsky BA; Rotenberg YuS; Zav'ialov NV. *Gigiena I Sanitariya.* **1974,** *39(4),* 86-89.	4
Kurlyandsky, BA.; Mashbits, FD.; Eizengart, RS. *Gigiena Truda I Professional'nye Zabolevaniya.* **1966,** *10(11),* 44-49.	4
Lange's Handbook of Chemistry; Dean, John A., ed. 14th edition; McGraw-Hill: New York, NY, 1992.	2
Lyman, WJ; Reehl, WF; Rosenblatt, DH. *Handbook of Chemical Property Estimation Methods; Environmental Behavior of Organic Compounds*; McGraw-Hill: New York, NY, 1982.	2
Marhold, J. *Prehled Prumyslove Toxikologie; Organicke Latky.* **1986,** *845.* As referenced in *Registry of Toxic Effects of Chemical Substances®,* National Institute of Occupational Safety & Health, Washington, DC.	4
Nakajima, Madoka, et al. *In vitro chromosomal aberration test of 2-vinylpyridine on cultured Chinese hamster cells.* Biosafety Research Center, Foods, Drugs and Pesticides (An-pyo Center), Japan, 582-2 Shioshinden Arahama, Fukude-cho, Iwata-gun, Shizuoka, 437-12, Japan. (Located at Japan's Global Information Network on Chemicals, found at http://wwwdb.mhlw.go.jp/ginc/dbfile1/paper/paper100-69-6f.html.)	1
Nakajima, Madoka, et al. *Reverse mutation test of 2-vinylpyirdine on bacteria.* Biosafety Research Center, Foods, Drugs and Pesticides (An-pyo Center), Japan, 582-2 Shioshinden Arahama, Fukude-cho, Iwata-gun, Shizuoka, 437-12, Japan. (Located at Japan's Global Information Network on Chemicals, found at http://wwwdb.mhlw.go.jp/ginc/dbfile1/paper/paper100-69-6e.html.)	1
Oba, Kousuke, et al. *Twenty-eight day repeat dose oral toxicity test of 2-vinylpyridine in rats.* Biosafety Research Center, Foods, Drugs and Pesticides (An-pyo Center), Japan, 582-2 Shioshinden Arahama, Fukude-cho, Iwata-gun, Shizuoka, 437-12, Japan. (Located at Japan's Global Information Network on Chemicals, found at http://wwwdb.mhlw.go.jp/ginc/dbfile1/paper/paper100-69-6b.html.)	1
Ruth, JH. *Am. Ind. Hyg. Assoc. J.* **1986,** *47,* A142-51. As referenced in *Hazardous Substances Data Bank®,* National Library of Medicine, Bethesda, Maryland, USA. Found at http://toxnet.nlm.nih.gov/.	2
Sasseville D, Kwong P, Yu K. *Contact Dermatitis.* **1998,** *38(4),* 212-214.	4

Sasseville, D; Balbul, A; Kwong, P; Yu, K. *Contact Dermatitis.* **1996,** *35(2),* 100-125.	4
Scriven, EFV; Toomey, JE; Murugan, R. 1996. "Pyridine and Pyridine Derivatives" in Kirk-Othmer *Encyclopedia of Chemical Technology*, 4th Edition, "Volume 20, Power Generation to Recycling, Glass"; John Wiley & Sons: New York, NY.	2
Seward, JR; Cronin, MTD; Schultz, T. *SAR and QSAR in Environmental Research.* **2001,** *11(5-6),* 489-512.	2
Simmon VF, Baden JM. *Mutat Res.* **1980,** *78(3),* 227-232.	1
Stone, CA; Dunn, K. *Burns.* **1996,** *22(2),* 150-1.	4
Trochimowicz, HJ; Kennedy, GL; Krivanek, ND. In *Patty's Industrial Hygiene and Toxicology;* Clayton, GD et al; 4th edition; Toxicology, Part E; John Wiley & Sons: New York, NY, 1994; Vol. II, pp. 3360-3364.	2
Tuazon, EC; Arey, J; Atkinson, R; Aschmann, SM. *Environ Sci Technol.* **1993,** *27(9),* 1832-41.	2
U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics, Risk Assessment Division. Copyright 2001. *ECOSAR™ Classes for Microsoft Windows*, version 0.99g, released April 2001. (Found at http://www.epa.gov/oppt/newchems/21ecosar.htm.)	2
U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics and Syracuse Research Center. Copyright 2000. *EPI Suite™*, version 3.11, released June 10, 2003. (Found at http://www.epa.gov/opptintr/exposure/docs/episuite.htm.)	2
Vlaovic, Milan S. *Subchronic Oral Toxicology of 2-Vinylpyridine.* **1984.** Eastman Kodak Company, Toxicological Sciences Section, Health and Environment Laboratories. As submitted to USEPA under TSCA §8(e) Compliance Audit Program agreement by Eastman Kodak Company, 1992, OTS#0546362.	1

Appendix B – Robust Summaries

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Melting Point

ID:	1
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	not applicable
Test Substance Remarks:	not applicable
Method / Guideline Followed:	Modeled using EPI Suite™ v3.11, MPBPWIN v1.41.
GLP:	no
Year:	2003
Test Conditions Remarks:	not applicable
Melting Point in °C:	-15.16°C (NOTE: < 0°C)
Decomposition:	not applicable
Sublimation:	not applicable
Results Remarks:	Modeled melting point using MPBPWIN v1.41 resulted in a mean melting point of -15.16°C (mean of Adapted Joback Method and Gold and Ogle Method). This estimate is supported by the fact that Reilly Industries, a supplier of 2-Vinylpyridine, recommends storage of the material below -5°C to maintain product quality; it remains a liquid at these temperatures. (See Reference #2.)
Conclusions:	According to the EPA guidelines, if the estimated melting point is below 0°C, there is no need to provide measured data for this endpoint. (See Reference #3.)
Conclusions Remarks:	not applicable
Data Quality Reliability:	Klimisch Code = 2 Reliable with restrictions; modeled data.
Data Quality Remarks:	not applicable
References:	1) U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics and Syracuse Research Center. Copyright 2000. *EPI Suite™*, version 3.11, including MPBPWIN, version 1.41, released June 10, 2003. (Found at http://www.epa.gov/opptintr/exposure/docs/episuite.htm.) 2) Reilly Industries, Inc. *Material Safety Data Sheet for 2-Vinylpyridine*, 12 June 2000. 3) U.S. Environmental Protection Agency. *Determining the Adequacy of Existing Data*; Appendix B. 10 February 1999 draft, available at http://www.epa.gov/chemrtk/datadfin.htm.
Record Last Changed:	11/20/03
Order Number for Sorting:	M1
General Remarks:	not applicable

Boiling Point

ID:	2
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	not stated
Test Substance Remarks:	not applicable
Method / Guideline Followed:	not stated
GLP:	not stated
Year:	not stated
Test Conditions Remarks:	not applicable
Boiling Point in °C:	159.5°C
Pressure:	not stated
Pressure Unit:	not stated
Decomposition:	not stated
Results Remarks:	not applicable
Conclusions:	Boiling point is adequately characterized in a reliable reference book.
Conclusions Remarks:	Conclusions of the data submitter.
Data Quality Reliability:	Klimisch Code = 2 Reliable with restrictions; data reported in a reliable reference book.
Data Quality Remarks:	not applicable
References:	*CRC Handbook of Chemistry and Physics;* Lide, David. R., ed. 80th edition; CRC Press, Boca Raton, FL, 1999. Supporting References: • *Hawley's Condensed Chemical Dictionary;* Lewis, Richard J., Sr., ed. 13th edition; John Wiley & Sons: New York, NY; 1998. (reports b.p. = 159°C) • *Lange's Handbook of Chemistry*; Dean, John A., ed. 14th edition; McGraw-Hill: New York, NY, 1992. (reports b.p. = 158-159°C)
Record Last Changed:	11/25/03
Order Number for Sorting:	2
General Remarks:	not applicable

Vapor Pressure

ID: 3

Test Substance Identity: 2-Vinylpyridine

Test Substance Purity: not applicable

Test Substance Remarks: not applicable

Method / Guideline Followed: Modeled using EPI Suite™ v3.11, MPBPWIN v1.41.

GLP: no

Year: 2003

Test Conditions Remarks: not applicable

Vapor Pressure Value: 2.57 mm Hg

Temperature (°C): 25°C

Decomposition: not applicable

Results Remarks: Modeled melting point using MPBPWIN v1.41 resulted in a mean vapor pressure of 2.57 mm Hg (mean of Antoine & Grain Methods, which modeled 2.8 and 2.3 mm Hg, respectively). An additional method (Mackay Method) resulted in a modeled vapor pressure of 3.48 mm Hg.

Conclusions: The modeled vapor pressure of 2.57 mm Hg fits extremely well with vapor pressure estimations calculated from the available boiling points of 2-Vinylpyridine at reduced pressures, using the estimation method found in Lyman 1982 (see Reference #2). Using data from boiling point data from the Beilstein database (see Reference #3), the following extrapolation calculations were performed:

BP (°C)	P (mm Hg)	VP @ 25°C (mm Hg)
158.5	760	2.93
71	32	3.15
71.5	32	3.07
67.5	29	3.37
71	30	2.92
80	30	1.81
80.5	29	1.69
68.5	23	2.44
71	25	2.36
64.5	20	2.57
60	17	2.72
62	15	2.12
54	14.5	3.15
55	11	2.19
43	10	3.81
49	10	2.74
48.5	10	2.82
36	3	1.59
42	4	1.52
83	3	0.09
	Average VP @ 25°C	2.48 mm Hg

Conclusions Remarks: Conclusions of the data submitter.

Data Quality Reliability:	Klimisch Code = 2 Reliable with restrictions; modeled data.
Data Quality Remarks:	not applicable
References:	1) U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics and Syracuse Research Center. Copyright 2000. *EPI Suite*™, version 3.11, including MPBPWIN, version 1.41, released June 10, 2003. (Found at http://www.epa.gov/opptintr/exposure/docs/episuite.htm.) 2) Lyman, WJ; Reehl, WF; Rosenblatt, DH. 1982. *Handbook of Chemical Property Estimation Methods; Environmental Behavior of Organic Compounds*; "Chapter 14: Vapor Pressure". ISBN 0-07-039175-0, McGraw-Hill, New York, New York, USA. 3) *Beilstein Database*, 2003, produced by BEILSTEIN Chemiedaten GmbH, Frankfurt, Germany. Access provided by STN International, Chemical Abstracts Service, Columbus, Ohio. (Found at http://www.cas.org.)
Record Last Changed:	11/25/03
Order Number for Sorting:	M-2
General Remarks:	not applicable

Partition Coefficient

ID:	4
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	not stated
Test Substance Remarks:	not applicable
Method / Guideline Followed:	not stated
GLP:	not stated
Year:	not stated
Test Conditions Remarks:	not applicable
Log Pow:	log Kow = 1.54
Temperature (°C):	not stated
Results Remarks:	not applicable
Conclusions:	Partition coefficient is adequately characterized in a reliable reference book.
Conclusions Remarks:	Conclusions of the data submitter.
Data Quality Reliability:	Klimisch Code = 2 Reliable with restrictions; data reported in a reliable reference book.
Data Quality Remarks:	not applicable
References:	Chemicals Inspections and Testing Institute. 1992. *Biodegradation and Bioaccumulation Data of Existing Chemicals Based on the CSCL Japan*. Japan Chemical Industry Ecology-Toxicology and Information Center. ISBN 4-89074-101-1, Japan. As referenced in *Hazardous Substances Data Bank®*, National Library of Medicine, Bethesda, Maryland, USA. Found at http://toxnet.nlm.nih.gov/.
Record Last Changed:	11/21/03
Order Number for Sorting:	3
General Remarks:	not applicable

Water Solubility

ID:	5
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	not stated
Test Substance Remarks:	not applicable
Method / Guideline Followed:	not stated
GLP:	not stated
Year:	not stated
Test Conditions Remarks:	not applicable
Value (mg/L @ °C):	2.75×10^4 mg/L @ 20°C
Description of Solubility:	very soluble
pH value and concentration at temperature °C	not stated
pKa value at 25°C:	4.98
Results Remarks:	Reference reports value of 2.75 g/100 mL @ 20°C.
Conclusions:	Water solubility is adequately characterized in a reliable reference source.
Conclusions Remarks:	Conclusions of the data submitter.
Data Quality Reliability:	Klimisch Code = 2 Reliable with restrictions; data reported in a reliable reference book.
Data Quality Remarks:	not applicable
References:	Scriven, EFV; Toomey, JE; Murugan, R. 1996. "Pyridine and Pyridine Derivatives" in Kirk-Othmer *Encyclopedia of Chemical Technology*, 4th Edition, "Volume 20, Power Generation to Recycling, Glass", John Wiley & Sons, New York, New York, USA. p. 644.
Record Last Changed:	11/21/03
Order Number for Sorting:	4
General Remarks:	not applicable

Photodegradation

ID:	6
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	97%
Test Substance Remarks:	Source: Aldrich Chemical
Method / Guideline Followed:	not stated
Test Type:	photodegradation study
GLP:	not stated
Year:	1993
Light Source:	"cool white" fluorescent; black lamp irradiation
Light Spectrum (nm):	not stated
Spectrum of Substance:	not stated
Test Conditions Remarks:	"Initial experiments were carried out to check that 2-vinylpyridine did not undergo photolysis under normal room fluorescent lights, black lamp irradiation, or react with NO_2. Under "cool-white" fluorescent lighting at an intensity a factor of ~ 11 higher than that in an office room, < 5% decay of 2-vinylpyridine occurred over a 5.2-h period (equivalent to ~ 7 days of normal office lighting). Similarly, irradiation with black lamps at the maximum light intensity (which corresponds to an NO_2 photolysis rate of ~ 0.45 min^{-1}) for 15 min led to no observable decay of 2-vinylpyridine within the measurement uncertainties."
Concentration of Substance:	neat
Temperature (°C):	25°C
Direct Photolysis - Half-Life (t ½):	not stated
Direct Photolysis - Degradation % after:	0 after 7 day-equivalents
Direct Photolysis – Quantum Yield:	not stated
Indirect Photolysis – Sensitizer (type):	ozone; OH radical; NO_3 radicals
Indirect Photolysis - Sensitizer Concentration:	see Results Remarks
Indirect Photolysis – Rate Constant:	see Results Remarks
Indirect Photolysis – Degradation % after:	see Results Remarks
Breakdown Products:	yes (see Results Remarks)
Results Remarks:	Ozone Reaction: 1.94×10^{14} molecule·cm^{-3} of 2-vinylpyridine was reacted with 1.26×10^{14} molecule·cm^{-3} of O_3. A least-squares analysis of ozone decay rates yielded a rate constant of 10^{-17} cm^3 $molecule^{-1}$ s^{-1}. Major products observed were 2-pyridinecarboxaldehyde and formaldehyde of yields of 80 ± 9% and 34 ± 5%, respectively. Minor products were pyridine, carbon dioxide, carbon monoxide and formic acid.

OH Radical Reaction: Initial experiments showed that 2-vinylpyridine reacts with gaseous nitric acid that is present in the NO_2; subsequent experiments were designed using pyridine as an acid scavenger. 24 x 10^{13} molecule·cm^{-3} of CH_3ONO and NO were reacted with 2.4 x 10^{13} molecule·cm^{-3} of 2-vinylpyridine (and an equivalent amount of isoprene, for determining relative reaction rate) in the presence of pyridine. A least-squares analysis of the data yielded a rate constant of 10^{-11} cm^3 $molecule^{-1}$ s^{-1}. 2-Pyridinecarboxaldehyde was identified as the major product of the reaction, with a yield of 78 ± 14%.

Conclusions:

For ambient atmospheric conditions, the calculated lifetime of 2-vinylpyridine due to the reaction with OH radicals, NO_3 radicals and O_3 is ~ 3 hours, ~ 4 hours and ~ 1 day, respectively. This assumes that 2-vinylpyridine reacts with NO_3 radicals with a rate constant similar to that of styrene. (Results assume ambient concentrations of the following: OH radicals, a 12-hour average of 1.6 x 10^6 molecule·cm^{-3}; NO_3 radicals, a 12-hour average of 5 x10^8 molecule·cm^{-3}; and O_3, a 24-hour average of 7 x 10^{11} molecule·cm^{-3}.)

It is possible that the removal of 2-vinylpyridine with gaseous nitric acid is competitive with these reactions as an atmospheric loss process.

In each case, 2-vinylpyridine was found to react to form 2-pyridine-carboxaldehyde in an analogous fashion to the breakdown of styrene to benzaldehyde, in high yield.

Conclusions Remarks: Conclusions of the authors (see References section).

Data Quality Reliability: Klimisch Code = 2

Reliable with restrictions; acceptable, well-documented publication/study report which meets basic scientific principles.

Data Quality Remarks: not applicable

References:

Tuazon, EC; Arey, J; Atkinson, R; Aschmann, SM. Gas-phase reactions of 2-vinylpyridine and styrene with OH and NO_3 radicals and O_3. *Environ Sci Technol*, **27**, 1832-1841 (1993).

Record Last Changed: 24 October 2003

Order Number for Sorting: 26

General Remarks: not applicable

Stability in Water

ID:	7
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	not applicable
Test Substance Remarks	not applicable
Method / Guideline Followed:	estimation based on chemical principles
Test Type:	not applicable
GLP:	not applicable
Year:	2003
Test Conditions Remarks:	not applicable
Nominal:	not expected to hydrolyze at environmental pH
Measured Value (mg/L):	not applicable
Degradation % at pH and °C:	not applicable
Half-life (t1/2) at pH and °C:	not applicable
Breakdown Products:	not applicable
Results Remarks:	not applicable
Conclusions:	Hydrolysis is a potentially important environmental fate pathway for a range of organic chemicals, including alkyl halides, amides, amines, carbamates, epoxides, nitriles and esters. 2-Vinylpyridine does not contain a functional group that is susceptible to hydrolysis; in fact, alkenes are known to be generally resistant to hydrolysis. As expected, attempts to model a hydrolysis rate using the HYDROWIN™ modeling program were unsuccessful.
Conclusions Remarks:	Conclusions of the data submitter.
Data Quality Reliability:	Klimisch Code = 2 Estimation based on generally accepted chemistry principles.
Data Quality Remarks:	not applicable
References:	1) Lyman, WJ; Reehl, WF; Rosenblatt, DH. 1982. *Handbook of Chemical Property Estimation Methods; Environmental Behavior of Organic Compounds*; "Chapter 17: Rate of Hydrolysis". ISBN 0-07-039175-0, McGraw-Hill, New York, New York, USA. 2) U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics and Syracuse Research Center. Copyright 2000. *EPI Suite*™, version 3.11, including HYDROWIN™, version 1.67, released June 10, 2003. (Found at http://www.epa.gov/opptintr/exposure/docs/episuite.htm.)
Record Last Changed:	11/25/03
Order Number for Sorting:	M-3
General Remarks:	not applicable

Transport and Distribution (Fugacity)

ID:	8
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	not applicable
Test Substance Remarks:	not applicable
Method / Guideline Followed:	EPI Suite™, version 3.11, including an adapted Mackay's EQC Level III Fugacity Model
Test Type:	fugacity modeling
Year:	2003
Test Conditions Remarks:	not applicable
Media:	air, soil, sediment and water
Estimated Distribution and Media Concentration:	Results from EPIWIN, v. 3.11:

```
Level III Fugacity Model (Full-Output):
=======================================
  Chem Name   : Pyridine, 2-ethenyl-
  Molecular Wt: 105.14
  Henry's LC  : 1.29e-005 atm-m3/mole (calc VP/Wsol)
  Vapor Press : 2.57 mm Hg  (user-entered)
  Log Kow     : 1.54  (user-entered)
  Soil Koc    : 14.2  (calc by model)

           Mass Amount    Half-Life    Emissions
            (percent)        (hr)       (kg/hr)
   Air       79.6           3.65         1000
   Water     13.7           360          0
   Soil      6.59           360          0
   Sediment  0.0296         1.44e+003    0

             Fugacity    Reaction    Advection   Reaction    Advection
              (atm)      (kg/hr)      (kg/hr)    (percent)   (percent)
   Air       1.16e-011   947         49.9        94.7        4.99
   Water     5.28e-013   1.65        0.86        0.165       0.086
   Soil      4.4e-012    0.795       0           0.0795      0
   Sediment  4.24e-013   0.000891    3.7e-005    8.91e-005   3.7e-006

   Persistence Time: 6.26 hr
   Reaction Time:    6.59 hr
   Advection Time:   123 hr
   Percent Reacted:  94.9
   Percent Advected: 5.07

   Half-Lives (hr), (based upon Biowin (Ultimate) and Aopwin):
      Air:      3.649
      Water:    360
      Soil:     360
      Sediment: 1440
        Biowin estimate: 2.753  (weeks       )

   Advection Times (hr):
      Air:      100
      Water:    1000
      Sediment: 5e+004
```

Results Remarks:	User inputs: • Water Solubility = 27,500 mg/L • Vapor Pressure = 2.57 mm Hg • log Kow = 1.54 • Boiling Point = 159.5°C • Melting Point = -15°C • Emission rates to air was left as model default (1000 kg/hr); emission rates to soil and water were adjusted to 0 kg/hr, due to stringent regulation on emission of 2-Vinylpyridine via these routes.
Conclusions:	Environmental transport and distribution have been adequately estimated using accepted models.
Conclusions Remarks:	Conclusions of the data submitter.
Data Quality Reliability:	Klimisch Code = 2 Reliable with restrictions; modeled data.
Data Quality Remarks:	not applicable
References:	U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics and Syracuse Research Center. Copyright 2000. *EPI Suite*™, version 3.11, including adapted Mackay's EQC Level III Fugacity Model, released June 10, 2003. (Found at http://www.epa.gov/opptintr/exposure/docs/episuite.htm.)
Record Last Changed:	11/25/03
Order Number for Sorting:	M-4
General Remarks:	not applicable

Biodegradation

ID:	9
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	not stated
Test Substance Remarks:	not applicable
Method / Guideline Followed:	aerobic biodegradation screening test
Test Type:	not applicable
GLP:	not stated
Year:	not stated
Contact time (units):	4 weeks
Inoculum:	not stated
Test Conditions Remarks:	not applicable
Degradation % after time:	0% over 4 weeks
Results:	not readily biodegradable
Kinetic:	not stated
Breakdown Products:	not stated
Results Remarks:	not applicable
Conclusions:	Biodegradation of 2-vinylpyridine in soil is not expected to be a major fate process based on a single aerobic screening test showing that 2-vinylpyridine was not biodegraded over a 4-week period.
Conclusions Remarks:	Conclusions reported in reference (see below).
Data Quality Reliability:	Klimisch Code = 2 Reliable with restrictions; data reported in a reliable reference book.
Data Quality Remarks:	not applicable
References:	Chemicals Inspections and Testing Institute. 1992. *Biodegradation and Bioaccumulation Data of Existing Chemicals Based on the CSCL Japan*. Japan Chemical Industry Ecology-Toxicology and Information Center. ISBN 4-89074-101-1, Japan. As referenced in *Hazardous Substances Data Bank®*, National Library of Medicine, Bethesda, Maryland, USA. Found at http://toxnet.nlm.nih.gov/.
Record Last Changed:	11/25/03
Order Number for Sorting:	59
General Remarks:	not applicable

Biodegradation

ID:	10
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	not applicable
Test Substance Remarks:	not applicable
Method / Guideline Followed:	Modeled using EPI Suite™ v3.11, BIOWIN v4.01.
Test Type:	biodegradation modeling
GLP:	no
Year:	2003
Contact time (units):	not applicable
Inoculum:	not applicable
Test Conditions Remarks:	User inputs: • Water Solubility = 27,500 mg/L • Vapor Pressure = 2.57 mm Hg • log Kow = 1.54 • Boiling Point = 159.5°C • Melting Point = -15°C
Degradation % after time:	see Remarks
Results:	see Remarks
Kinetic:	see Remarks
Breakdown Products:	see Remarks
Results Remarks:	• Linear Biodegradation Probability = 0.5429 • Non-Linear Biodegradation Probability = 0.4694 • MITI Linear Biodegradation Probability = 0.4173 • MITI Non-Linear Biodegradation Probability = 0.4005 • (NOTE: Values ≥ 0.5 indicate rapid biodegradation; values < 0.5 indicate slow biodegradation.) • Survey Model - Ultimate Biodegradation = 2.7527 (weeks to months) • Survey Model - Primary Biodegradation = 3.6773 (days to weeks)
Conclusions:	Modeling data suggests that 2-vinylpyridine may not biodegrade rapidly.
Conclusions Remarks:	Conclusions of the data submitter.
Data Quality Reliability:	Klimisch Code = 2 Reliable with restrictions; modeled data.
Data Quality Remarks:	not applicable
References:	U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics and Syracuse Research Center. Copyright 2000. *EPI Suite*™, version 3.11, including BIOWIN™, version 4.01, released June 10, 2003. (Found at http://www.epa.gov/opptintr/exposure/docs/episuite.htm.)
Record Last Changed:	11/26/03
Order Number for Sorting:	M-5
General Remarks:	not applicable

Aquatic Toxicity – Fish

ID:	11
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	not applicable
Test Substance Remarks:	not applicable
Method / Guideline Followed::	Modeled using ECOSAR Classes for Microsoft Windows, v0.99g, April 2001.
Test Type:	aquatic toxicity modeling
GLP:	no
Year:	2003
Species / Strain / Supplier:	fish
Analytical Monitoring:	not applicable
Exposure Duration:	14 days; 96-hr; 30 days; 96-hr (salt water)
Statistical Methods:	not applicable
Test Conditions Remarks:	User inputs: • Measured Water Solubility = 27,500 mg/L • Melting Point = -15°C • Measured log Kow = 1.54
Nominal Concentrations (mg/L):	not applicable
Measured Concentrations (mg/L):	not applicable
Unit:	not applicable
Element Value (EC50, etc):	• Predicted LC_{50} (fish, 14-day) = 355.165 mg/L • Predicted LC_{50} (fish, 96-hr) = 210.945 mg/L • Predicted LC_{50} (fish, 96-hr, SW) = 38.687 mg/L • Predicted ChV (fish, 30-day) = 25.233 mg/L
Statistical Results:	not applicable
Results:	see "Element Value"
Conclusion:	2-Vinylpyridine is not expected to exhibit severe toxicity to fish, as predicted by LC_{50} modeling data.
Conclusions Remarks:	Conclusions of the data submitter.
Data Quality Reliability:	Klimisch Code = 2 Reliable with restrictions; modeled data.
Data Quality Remarks:	not applicable
References:	Cash, G; Nabholz, V. U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics, Risk Assessment Division. Copyright 2001. *ECOSAR™ Classes for Microsoft Windows*, version 0.99g, released April 2001. (Found at http://www.epa.gov/oppt/newchems/21ecosar.htm.)
Record Last Changed:	11/26/03
Order Number for Sorting:	M-6
General Remarks:	not applicable

Aquatic Toxicity – Fish

ID:	12
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	95% or better
Test Substance Remarks:	Test substance purchased from Aldrich Chemical or MRM Research Chemicals Lancaster Synthesis.
Method / Guideline Followed:	TETRATOX protocol (see Test Conditions Remarks)
Test Type:	*Tetrahymena pyriformis* toxicity
GLP:	not stated
Year:	2001
Analytical Monitoring:	not stated
Species / Strain / Supplier:	*Tetrahymena pyriformis,* strain GL-C
Test Details:	Endpoint (population density) of static 40-hour assay was measured spectrophotometrically at 540 nm. Stock solutions were prepared in dimethyl sulfoxide, which has NOEC of 7500 mg/L; care was taken to ensure that this level was not exceeded. Two controls were used -- one with *T. pyriformis* without test chemicals or solvents, and the other control as a blank, containing neither test chemical, solvent, nor ciliates. Test conditions allowed for 8-9 cell cycles in control cultures. Each definitive test replicate consisted of 6 - 8 different concentrations with duplicate flasks of each concentration.
Exposure Duration:	40 hours
Statistical Methods:	Probit Analysis procedure of Statistical Analysis System (SAS) software
Test Conditions Remarks:	TETRATOX protocol is defined in the following citation: Schultz, T.W. 1997. TETRATOX: *Tetrahymena pyriformis* population growth impairment endpoint-A surrogate for fish lethality. *Toxicol. Methods* **7**: 289-309.
Nominal Concentrations (mg/L):	not stated
Measured Concentrations (mg/L):	not performed
Unit:	not stated
Element Value (EC50, etc.)	50% growth inhibition concentration (IGC_{50}) = 0.57 mg/L
Statistical Results:	$\log(IGC_{50}^{-1}) = 0.24$
Results Remark:	While the study report focuses on establishing a QSAR model, it is important to note that 2-vinylpyridine data were experimentally derived in this study to compare to predicted values.
Conclusions:	Authors conclude that QSAR's previously established for the estimation of toxicity of benzene derivatives can be extended to include pyridines, with the understanding that pyridines substituted with electron-releasing groups in the ortho position may not fit the model as well. The pyridine response-surface has more that 5% more unexplained error than the benzene surface, but the response-surfaces derived for the two chemical groups are virtually identical.
Conclusions Remarks:	Conclusions of the authors (see References section).

Data Quality Reliability:	Klimisch Code = 2 Reliable with restrictions; acceptable, well-documented publication / study report which meets basic scientific principles.
Data Quality Remarks:	not applicable
References:	Seward, JR; Cronin, MTD; Schultz, TW. Structure-toxicity analyses of *Tetrahymena pyriformis* exposed to pyridines - an examination into extension of surface-response domains. 2001. *SAR and QSAR in Environmental Research*, **11**, 489-512.
Record Last Changed:	10/27/03
Order Number for Sorting:	48
General Remarks:	not applicable

Aquatic Toxicity – Invertebrate

ID:	13
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	not applicable
Test Substance Remarks:	not applicable
Method / Guideline Followed:	Modeled using ECOSAR Classes for Microsoft Windows, v0.99g, April 2001.
Test Type:	aquatic toxicity modeling
GLP:	no
Year:	2003
Analytical Monitoring:	not applicable
Species / Strain / Supplier:	*Daphnia magna*
Test Details:	not applicable
Exposure Duration:	48-hr; 16-day
Statistical Methods:	not applicable
Test Conditions Remarks:	User inputs: • Measured Water Solubility = 27,500 mg/L • Melting Point = -15°C • Measured log Kow = 1.54
Nominal Concentration (mg/L):	not applicable
Measured Concentration (mg/L):	not applicable
Unit:	not applicable
Element Value (EC_{50}, etc.)	Predicted LC_{50} (48-hr, *Daphnia*) = 218.962 mg/L Predicted EC_{50} (16-day, *Daphnia*) = 9.183 mg/L
Statistical Results:	not applicable
Results Remarks:	not applicable
Conclusions:	2-Vinylpyridine is not expected to exhibit severe toxicity to aquatic invertebrates, as predicted by LC_{50} modeling data.
Conclusions Remarks:	Conclusions of the data submitter.
Data Quality Reliability:	Klimisch Code = 2 Reliable with restrictions; modeled data.
Data Quality Remarks:	not applicable
References:	Cash, G; Nabholz, V. U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics, Risk Assessment Division. Copyright 2001. *ECOSAR™ Classes for Microsoft Windows*, version 0.99g, released April 2001. (Found at http://www.epa.gov/oppt/newchems/21ecosar.htm.)
Record Last Changed:	11/26/03
Order Number for Sorting:	M-7
General Remarks:	not applicable

Aquatic Toxicity - Aquatic Plant

ID:	14
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	not applicable
Test Substance Remarks:	not applicable
Method / Guideline Followed:	Modeled using ECOSAR™ Classes for Microsoft Windows, v0.99g, April 2001.
Test Type:	modeled aquatic toxicity
GLP:	no
Year:	2003
Species / Strain / Supplier:	green algae
Element Basis:	not applicable
Exposure Duration:	96-hr
Analytical Monitoring:	not applicable
Statistical Methods:	not applicable
Test Conditions Remarks:	User inputs: • Measured Water Solubility = 27,500 mg/L • Melting Point = -15°C • Measured log Kow = 1.54
Nominal Concentrations (mg/L):	not applicable
Measured Concentrations (mg/L):	not applicable
Unit:	not applicable
Element Value (EC50, etc.):	Predicted EC_{50} (96-hr, green algae) = 133.312 mg/L Predicted ChV (96-hr, green algae) = 10.219 mg/L
NOEC, LOEC or NOEL, LOEL:	not applicable
Satisfactory Control Response:	not applicable
Statistical Results:	not applicable
Results Remarks:	not applicable
Conclusions:	2-Vinylpyridine is not expected to exhibit severe toxicity to aquatic plants, as predicted by EC_{50} modeling data.
Conclusions Remarks:	Conclusions of the data submitter.
Data Quality Reliability:	Klimisch Code = 2 Reliable with restrictions; modeled data.
Data Quality Remarks:	not applicable
References:	Cash, G; Nabholz, V. U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics, Risk Assessment Division. Copyright 2001. *ECOSAR™ Classes for Microsoft Windows*, version 0.99g, released April 2001. (Found at http://www.epa.gov/oppt/newchems/21ecosar.htm.)

Record Last Changed:	11/26/03
Order Number for Sorting:	M-8
General Remarks:	not applicable

Acute Toxicity - Mammalian

ID:	15
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	98.7%
Test Substance Remarks:	Lot number 20116AC -- characterization data on file with test sponsor
Method / Guideline Followed:	TSCA method: 40 CFR 789.1100, July 1989
Test Type:	acute dermal toxicity
GLP:	yes
Year:	1992
Species / Strain / Supplier:	New Zealand White rabbits (*Oryctolagus cuniculus*), 10-12 weeks old, Eastern Rabbit Breeding Laboratory, Taunton, MA
Sex:	male and female
No of Animals/Sex/Dose:	5
Vehicle:	none (undiluted test substance)
Route of Administration:	dermal application
Test Conditions Remarks:	Site of application was not abraded intentionally or accidentally during preparation. Exposure period = 24 hours; observation period = 14 days. Test substance was introduced under gauze patches two single layers thick and applied directly to the skin (approximately 10% of the body surface). Gauze was moistened with USP Water for Injection and patches were secured in place by wrapping the entire trunk of the animal with impervious bandaging.
Value (LD_{50}, etc) with Confidence Limits:	LD_{50} = 0.64 g/kg
Number of Deaths at Each Dose Level:	0.90 g/kg = 10/10 died (within first hour following dosing) 0.65 g/kg = 8/10 died (within 3 hours following dosing) 0.40 g/kg = 0/10 died over 14 day observation period
Results Remarks:	Necrosis of the skin was observed at all dosing sites. Estimated LD_{50} was determined utilizing the "Litchfield and Wilcoxon II" program (Tallarida, RJ; Murray, RB. 1986. *Manual of Pharmacologic Calculations with Computer Programs.* New York: Springer-Verlag, pp. 159-164).
Conclusions:	Based upon the mortality and the criteria of the study protocol, the estimated LD_{50} of the test substance has been determined to be 0.64 g/kg.
Conclusions Remarks:	Conclusions of the authors (see References section).
Data Quality Reliability:	Klimisch Code = 1 Reliable without restriction; guideline study.
Data Quality Remarks:	not applicable
References:	Fitzgerald, G. B. 1994. *Acute dermal toxicity study (single exposure), amended report.* Report number 92G-0361. Toxikon Corp., Woburn, MA.
Record Last Changed:	10/27/03
Order Number for Sorting:	29
General Remarks:	not applicable

Acute Toxicity - Mammalian

ID:	16
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	97.689%
Test Substance Remarks:	Test substance obtained from W.P. Hamilton, Camden, South Carolina.
Method / Guideline Followed:	not stated (see Remarks)
Test Type:	acute dermal toxicity
GLP:	not stated
Year:	1981
Species / Strain / Supplier:	New Zealand White rabbits
Sex:	male
No of Animals/Sex/Dose:	1 animal/dose; 6 doses
Vehicle:	none (undiluted test substance)
Route of Administration:	dermal application
Test Conditions Remarks:	While no method is stated, the procedure listed is significantly similar to US EPA's harmonized OPPTS guidance for Acute Dermal Toxicity, but with fewer animals. Exposure period = 24 hours; observation period = 14 days. Volumes of test material applied ranged from 1.66 to 0.17 mL. Test substance was applied to the trunk of each rabbit under two 12 ply gauze pads, and the trunk of each animal was wrapped with a layer of Saran® Wrap, Kling® gauze bandage and Elastoplast® adhesive bandage.
Value (LD_{50}, etc) with Confidence Limits:	approximate lethal dose = 300 mg/kg
Number of Deaths at Each Dose Level:	670 mg/kg: 1/1 died within 1 day of dosing; 450 mg/kg: 1/1 died within 2.5 hrs. of dosing; 300 mg/kg: 1/1 died within 2 hrs of dosing; 200, 90 & 60 mg/kg: 0/1 died over 14-day observation period after dosing.
Results Remarks:	not applicable
Conclusions:	2-Vinylpyridine is considered to be moderately toxic by skin absorption in male rabbits. Approximate lethal dose (ALD) is 300 mg/kg of body weight. Clinical signs included lethargy, prostration, labored breathing, aggressive behavior, convulsion, severe skin irritation and weight loss. All deaths occurred within 1 day after dosing.
Conclusions Remarks:	Conclusions of the authors (see References section).
Data Quality Reliability:	Klimisch Code = 2 Reliable with restrictions; basic data given: comparable to guidelines/standards with acceptable restrictions.
Data Quality Remarks:	not applicable
References:	Henry, JE. 1981. *Rabbit skin absorption (ALD) with pyridine, 2-ethenyl-, with cover letter.* Haskell Laboratories. As submitted to USEPA under TSCA §8(e) Compliance Audit Program agreement by DuPont Chemical, 1992, OTS#0571402.

Record Last Changed:	11/3/03
Order Number for Sorting:	36
General Remarks:	not applicable

Acute Toxicity - Mammalian

ID:	17
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	98.95%
Test Substance Remarks:	not applicable
Method / Guideline Followed:	not stated
Test Type:	acute oral toxicity
GLP:	yes
Year:	1983
Species / Strain / Supplier:	rat
Sex:	male and female
No of Animals/Sex/Dose:	not stated
Vehicle:	none (undiluted test substance)
Route of Administration:	oral
Test Conditions Remarks:	No data available on dose levels, fasting or length of post observation period.
Value (LD_{50}, etc) with Confidence Limits:	Oral LD_{50} (rat) = 336 mg/kg (confidence limits = 240 - 472 mg/kg)
Number of Deaths at Each Dose Level:	not stated
Results Remarks:	not applicable
Conclusions:	Oral LD_{50} in male and female rats was 336 mg/kg. Clinical signs of toxicity included prostration, weakness, tremors, vasodilatation, excessive salivation and anorexia.
Conclusions Remarks:	Conclusions of the authors (see References section).
Data Quality Reliability:	Klimisch Code = 2 Reliable with restrictions; basic data given: comparable to guidelines / standards.
Data Quality Remarks:	not applicable
References:	Anonymous. 1983. *Basic Toxicity of 2-Vinylpyridine.* Eastman Kodak Company, Corporate Health and Environment Laboratories. As submitted to USEPA under TSCA §8(e) Compliance Audit Program agreement by Eastman Kodak Company, 1992, OTS#0546362.
Record Last Changed:	11/3/03
Order Number for Sorting:	17
General Remarks:	not applicable

Acute Toxicity - Mammalian

ID:	18
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	98.95%
Test Substance Remarks:	not applicable
Method / Guideline Followed:	not stated
Test Type:	acute oral toxicity
GLP:	yes
Year:	1983
Species / Strain / Supplier:	rat
Sex:	male and female
No of Animals/Sex/Dose:	not stated
Vehicle:	20% compound in corn oil
Route of Administration:	oral
Test Conditions Remarks:	No data available on dose levels, length of fasting period, or length of post-dosing observation period. No data available on dosing formulation preparation or dose volumes administered.
Value (LD_{50}, etc) with Confidence Limits:	Fasted rats: LD_{50} = 951 mg/kg for males (C.I. = 677 - 1336 mg/kg); LD_{50} = 673 mg/kg for females (C.I. = 479 - 945 mg/kg). Fed rats: LD_{50} = 951 mg/kg for both males and females (C.I. = 677 - 1336 mg/kg).
Number of Deaths at Each Dose Level:	not stated
Results Remarks:	not applicable
Conclusions:	Oral LD_{50} of 20% solution in corn oil was 951 mg/kg in fasted male rats and 673 mg/kg in fasted female rats. In fed rats, LD_{50} of the 20% solution was 951 mg/kg for both males and females. Clinical signs of toxicity included prostration, weakness, tremors, diarrhea and vasodilatation.
Conclusions Remarks:	Conclusions of the authors (see References section).
Data Quality Reliability:	Klimisch Code = 2 Reliable with restrictions; basic data given: comparable to guidelines / standards.
Data Quality Remarks:	not applicable
References:	Anonymous. 1983. *Basic Toxicity of 2-Vinylpyridine*. Eastman Kodak Company, Corporate Health and Environment Laboratories. As submitted to USEPA under TSCA §8(e) Compliance Audit Program agreement by Eastman Kodak Company, 1992, OTS#0546362.
Record Last Changed:	11/3/03
Order Number for Sorting:	17
General Remarks:	not applicable

Acute Toxicity - Mammalian

ID:	19
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	98.95%
Test Substance Remarks:	not applicable
Method / Guideline Followed:	not stated
Test Type:	24-hr occluded skin irritation
GLP:	yes
Year:	1983
Species / Strain / Supplier:	guinea pig
Sex:	not stated
No of Animals/Sex/Dose:	10 animals / dose
Vehicle:	none (undiluted test substance)
Route of Administration:	dermal
Test Conditions Remarks:	Dose levels = 5, 2, 1, 0.5, 0.35, 0.2, 0.1, 0.05 mL/kg. No data on observation period or application site preparation. Scoring based on qualitative parameters of "slight, moderate, strong or severe".
Value (LD_{50}, etc) with Confidence Limits:	strong dermal irritant
Number of Deaths at Each Dose Level:	All guinea pigs given 5, 2, 1, 0.5 or 0.35 mL/kg died, six of ten guinea pigs given 0.2 mL/kg died, single guinea pig given 0.1 or 0.05 mL/kg died.
Results Remarks:	"questionable" for estimated corrosivity
Conclusions:	Skin irritation was strong as determined by a standardized 24-hour occluded skin irritation test in guinea pigs.
Conclusions Remarks:	Conclusions of the authors (see References section).
Data Quality Reliability:	Klimisch Code = 2 Reliable with restrictions; basic data given: comparable to guidelines / standards.
Data Quality Remarks:	not applicable
References:	Anonymous. 1983. *Basic Toxicity of 2-Vinylpyridine*. Eastman Kodak Company, Corporate Health and Environment Laboratories. As submitted to USEPA under TSCA §8(e) Compliance Audit Program agreement by Eastman Kodak Company, 1992, OTS#0546362.
Record Last Changed:	11/3/03
Order Number for Sorting:	17
General Remarks:	not applicable

Acute Toxicity - Mammalian

ID:	20
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	98.95%
Test Substance Remarks:	not applicable
Method / Guideline Followed:	not stated
Test Type:	skin irritation (open, repeated dose)
GLP:	yes
Year:	1983
Species / Strain / Supplier:	guinea pig
Sex:	not stated
No of Animals/Sex/Dose:	5 animals/dose
Vehicle:	none (undiluted test substance)
Route of Administration:	dermal
Test Conditions Remarks:	Test involved 4 to 7 doses of 0.1 mL/kg each. No data on length of observation period or site preparation. Qualitative scoring only.
Value (LD_{50}, etc) with Confidence Limits:	Strong exacerbation; skin absorption noted. Dermal LD_{50} is noted as 0.16 mL/kg, but not test details are reported for the LD_{50} procedure.
Number of Deaths at Each Dose Level:	0.1 mL/kg killed all guinea pigs after 4-7 doses.
Results Remarks:	not applicable
Conclusions:	The dermal LD_{50} was 0.16 mL/kg. There was evidence of percutaneous absorption.
Conclusions Remarks:	Conclusions of the authors (see References section).
Data Quality Reliability:	Klimisch Code = 2 Reliable with restrictions; basic data given: comparable to guidelines / standards.
Data Quality Remarks:	not applicable
References:	Anonymous. 1983. *Basic Toxicity of 2-Vinylpyridine*. Eastman Kodak Company, Corporate Health and Environment Laboratories. As submitted to USEPA under TSCA §8(e) Compliance Audit Program agreement by Eastman Kodak Company, 1992, OTS#0546362.
Record Last Changed:	11/3/03
Order Number for Sorting:	17
General Remarks:	not applicable

Acute Toxicity - Mammalian

ID:	21
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	98.95%
Test Substance Remarks:	not applicable
Method / Guideline Followed:	not stated
Test Type:	skin sensitization
GLP:	yes
Year:	1983
Species / Strain / Supplier:	guinea pig
Sex:	not stated
No of Animals/Sex/Dose:	10 animals total
Vehicle:	none (undiluted test substance)
Route of Administration:	dermal
Test Conditions Remarks:	Report indicates "standardized skin sensitization" test, but no details are available on study design. No details on induction or challenge phases or on concentration selection. No details on grading system used or on positive/negative controls.
Value (LD_{50}, etc) with Confidence Limits:	Estimated to be a moderate risk for skin sensitization in humans.
Number of Deaths at Each Dose Level:	not stated
Results Remarks:	Sensitization responses: 2/10 animals showed no response; 3/10 showed weak response; 4/10 showed moderate response; 1/10 showed potent response.
Conclusions:	In a standardized skin sensitization test in guinea pigs, this compound elicited reactions indicating an estimated moderate risk for human sensitization.
Conclusions Remarks:	Conclusions of the authors (see References section).
Data Quality Reliability:	Klimisch Code = 2 Reliable with restrictions; basic data given: comparable to guidelines / standards.
Data Quality Remarks:	not applicable
References:	Anonymous. 1983. *Basic Toxicity of 2-Vinylpyridine*. Eastman Kodak Company, Corporate Health and Environment Laboratories. As submitted to USEPA under TSCA §8(e) Compliance Audit Program agreement by Eastman Kodak Company, 1992, OTS#0546362.
Record Last Changed:	11/3/03
Order Number for Sorting:	17
General Remarks:	not applicable

Acute Toxicity - Mammalian

ID:	22
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	98.95%
Test Substance Remarks:	not applicable
Method / Guideline Followed:	not stated
Test Type:	eye irritation
GLP:	yes
Year:	1983
Species / Strain / Supplier:	rabbit
Sex:	not stated
No of Animals/Sex/Dose:	3 animals per test (washed and unwashed eyes)
Vehicle:	none (undiluted test substance)
Route of Administration:	ocular
Test Conditions Remarks:	not applicable
Value (LD_{50}, etc) with Confidence Limits:	Strong eye irritant in unwashed eyes; moderate eye irritant in washed eyes.
Number of Deaths at Each Dose Level:	not stated
Results Remarks:	Unwashed eyes: 3/3 showed strong irritation. Washed eyes: 3/3 showed moderate irritation. Corneal and adnexal staining in all washed and unwashed eyes. Prompt irrigation with distilled water was palliative.
Conclusions:	Rabbit eye irritation was strong in unwashed (3/3) and moderate (3/3) in washed eyes; there was corneal and adnexal staining in all washed and unwashed eyes. Prompt irrigation with distilled water was palliative.
Conclusions Remarks:	Conclusions of the authors (see References section).
Data Quality Reliability:	Klimisch Code = 2 Reliable with restrictions; basic data given: comparable to guidelines / standards.
Data Quality Remarks:	not applicable
References:	Anonymous. *Basic Toxicity of 2-Vinylpyridine.* Eastman Kodak Company, Corporate Health and Environment Laboratories, 1983. As submitted to USEPA under TSCA §8(e) Compliance Audit Program agreement by Eastman Kodak Company, 1992, OTS#0546362.
Record Last Changed:	11/3/03
Order Number for Sorting:	17
General Remarks:	not applicable

Acute Toxicity - Mammalian

ID:	23
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	not stated
Test Substance Remarks:	Source of material: Reilly Industries, Inc., lot #40310AA.
Method / Guideline Followed:	49 CFR 173.136-137, as of 16 May 1994
Test Type:	DOT skin corrosion
GLP:	no
Year:	1994
Species / Strain / Supplier:	New Zealand albino rabbit
Sex:	5 males; 1 female
No of Animals/Sex/Dose:	all animals received 0.5 mL applied to intact skin free from hair
Vehicle:	none (undiluted test substance)
Route of Administration:	dermal
Test Conditions Remarks:	Test sites were immediately covered with an adhesive-backed gauze patch, secured with 3" non-irritating Durapore tape. After one hour of exposure, patches were removed and test sites wiped clean to prevent further exposure. Test sites were evaluated at 1 hour and 48 hours post-dosing. Tissue destruction was considered to have occurred if there was ulceration and/or necrosis. Epidermal sloughing, erythema, edema or fissuring were not considered to be tissue destruction. Results reported simply as positive or negative for tissue destruction.
Value (LD_{50}, etc) with Confidence Limits:	Visible necrosis of the skin tissue was observed at all test sites, 48 hours after dosing.
Number of Deaths at Each Dose Level:	none
Results Remarks:	not applicable
Conclusions:	Visible necrosis of the skin tissue was observed at all test sites, 48 hours after dosing. These results place the test material into Class I, Packing Group II.
Conclusions Remarks:	Conclusions of the authors (see References section).
Data Quality Reliability:	Klimisch Code = 2 Reliable with restrictions; basic data given: comparable to guidelines / standards.
Data Quality Remarks:	not applicable
References:	Barr, K; Wnorowski, G. 1994. *DOT Skin Corrosion*, Study #T-2927, Product Safety Labs, East Brunswick, NJ, unpublished.
Record Last Changed:	12/8/03
Order Number for Sorting:	40
General Remarks:	not applicable

Genetic Toxicity - In Vitro

ID:	24
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	> 98%
Test Substance Remarks:	Chemicals for the study were purchased from commercial sources.
Method / Guideline Followed:	Ames test
Test Type:	reverse mutation assay
Testing System:	bacterial
GLP:	not stated
Year:	1980
Species / Strain or Cell Type:	*Salmonella typhimurium*; strains TA1535, TA98 and TA100
Metabolic Activation:	both with and without S9 (rat liver induced with Aroclor 1254)
Concentrations Tested:	0, 0.1 and 0.5 mL/9 L desiccator
Statistical Methods:	not stated
Test Conditions Remarks:	Triplicate plates prepared for each chemical concentration, both with and without S9 mix. Negative and positive controls were run with every experiment (no details given). Experiments were repeated if results were equivocal. Dosing via exposure in sealed desiccators for 7 hours, followed by incubation (37°C) for 40-50 hours. Plates with S9 mix were in different desiccators from plates without S9 mix.
Result:	negative
Cytotoxic Concentration:	Severe toxicity observed at 0.5 mL/9 L concentration level, invalidating results at this level.
Genotoxic Effects:	At 0.1 mL/9 L concentration, no mutagenic effects were observed, both with and without metabolic activation.
Statistical Results:	not stated
Results Remarks:	No mutagenic effects observed in concentrations tested, both with and without metabolic activation.
Conclusions:	2-Vinylpyridine was not observed to exhibit mutagenicity in this assay. Mutagenic activity could not be adequately assessed at high concentrations because of severe toxicity.
Conclusions Remarks:	Conclusions of the authors (see References section).
Data Quality Reliability:	Klimisch Code = 1 Comparable to guideline study.
Data Quality Remarks:	not applicable
References:	Simmon, VF; Baden, JM. Mutagenic activity of vinyl compounds and derived epoxides. 1980. *Mutation Research*, **78**, 227-231.
Record Last Changed:	10/29/03
Order Number for Sorting:	11
General Remarks:	not applicable

Genetic Toxicity - In Vitro

ID:	25
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	98.3%
Test Substance Remarks:	Upon completion of the test, analysis of the residual test substance revealed no stability problem.
Method / Guideline Followed:	"Guidelines for Screening Mutagenicity Testing of Chemicals", Japan
Test Type:	mammalian cell chromosomal aberration assay
Testing System:	mammalian cells
GLP:	yes
Year:	not stated (after 1991, per test program history)
Species / Strain or Cell Type:	Chinese hamster adenofibroblast cell strain; obtained from National Sanitation Test Center, 15 Nov 1984
Metabolic Activation:	both with and without S9 (rat liver induced with phenobarbital and 5,6-benzoflavone)
Concentrations Tested:	maximum 30.0 µg/mL (24-hr continuous); 15.0 µg/mL (48-hr continuous); 120 µg/mL (short-term, no S9); 300 µg/mL (short-term, with S9)
Statistical Methods:	not stated
Test Conditions Remarks:	Continuous treatment: test substance solution administered continuously either for 24 hours or 48 hours. Short-term treatment: test substance solution administered for 6 hours either with or without S9 mix, then transferred to fresh culture medium and cultivated an additional 18 hours. Positive controls were mitomycin C (0.05 µg/mL for 24-hr treatment; 0.025 µg/mL for 48-hr treatment) and cyclophosphamide (12.5 µg/mL for short-term tests). 2 plates per test; solvent was DMSO. Concentrations (in µg/mL): 24-hr continuous: 30.0, 15.0, 7.5, 3.75, 0 48-hr continuous: 15.0, 7.5, 3.75, 1.88, 0 Short-term, -S9: 120, 60, 30, 15, 0 Short-term, +S9: 300, 150, 75, 37.5, 0
Result:	positive
Cytotoxic Concentration:	50% cell proliferation inhibition concentrations (by Probit method) = 33.4 µg/mL (24-hr continuous); 7.90 µg/mL (48-hr continuous); 109 µg/mL (short-term, without S9); 147 µg/mL (short-term, with S9)
Genotoxic Effects:	Clear dose-dependent induction of chromosomal structural aberration was observed in all test systems. D20 value = 0.00557 mg/mL; TR value = 2,000. No notable changes such as precipitation were observed during the test.
Statistical Results:	For test systems exhibiting positive results, the D20 value was computed by the least squares method, and the TR value was computed by dividing the frequency of occurrence (%) of chromatid exchange at the corresponding dose by the test dose (mg/mL).

Results Remarks:	Positive for clastogenicity, both with and without metabolic activation. Negative for polyploidy. Lowest concentration producing cytogenetic effects in vitro: 0.00557 mg/mL over 24-hrs (clastogenicity) Chromosomal analysis conducted according to classification methods of the Mammal Test Section, Japan Environmental Mutagen Society. No polyploid cell inducing effect was found in any of the treatment groups.
Conclusions:	On the basis of the above test results, 2-vinylpyridine was determined to have a positive effect on the inducement of chromosomal aberrations in cultivated mammal cells under the conditions of this test.
Conclusions Remarks:	Conclusions of the authors (see References section).
Data Quality Reliability:	Klimisch Code = 1 Guideline study: "Guidelines for Screening Mutagenicity Testing of Chemicals", Japan
Data Quality Remarks:	not applicable
References:	Nakajima, Madoka, et al. *In vitro chromosomal aberration test of 2-vinylpyirdine on cultured Chinese hamster cells.* Biosafety Research Center, Foods, Drugs and Pesticides (An-pyo Center), Japan, 582-2 Shioshinden Arahama, Fukude-cho, Iwata-gun, Shizuoka, 437-12, Japan. (Located at Japan's Global Information Network on Chemicals, found at http://wwwdb.mhlw.go.jp/ginc/index.html.)
Record Last Changed:	10/30/03
Order Number for Sorting:	55
General Remarks:	not applicable

Genetic Toxicity - In Vitro

ID:	26
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	98.3%
Test Substance Remarks:	Upon completion of the test, analysis of the residual test substance revealed no stability problem.
Method / Guideline Followed:	"Guidelines for Screening Mutagenicity Testing of Chemicals", Japan
Test Type:	reverse mutation assay
Testing System:	bacterial
GLP:	yes
Year:	not stated (after 1991, per test program history)
Species / Strain or Cell Type:	*Salmonella typhimurium* TA100, TA98, TA1535, TA1537 and *Escherichia coli* WP2 uvrA
Metabolic Activation:	both with and without S9 (rat liver induced with phenobarbital and 5,6-benzoflavone)
Concentrations Tested:	without S9: 39.1 to 2500 µg/plate; with S9: 156 - 5000 µg/plate
Statistical Methods:	not stated
Test Conditions Remarks:	Source of *Salmonella typhimurium*: Ames, University of California, 9 September 1985. Source of *Escherichia coli*: National Sanitation Test Center, 16 March 1985. Positive control substances included 2-(2-furyl)-3-(5-nitro-2-furyl)acrylamide, sodium azide, 9-aminoacrylidine, 2-aminoanthracene. Negative controls (no test substance) were also run throughout the experiment. Three plates/test. Solvent: DMSO. Each test was independently conducted twice.
Result:	negative in *S. typhimurium*; positive in *E. coli* (+S9 only)
Cytotoxic Concentration:	Both the +S9 and -S9 groups exhibited growth-inhibiting activity due to 2-vinylpyridine treatment at high doses.
Genotoxic Effects:	None observed with *S. typhimurium* strains. *E. coli* WP2 uvrA strain to which S9 mix was added showed a clear increase accompanying dose-effect correlation. Reproducibility was confirmed. Relative mutation activity of 10.7 was exhibited. No genotoxic effects were observed in *E.coli* WP2 uvrA strain without metabolic activation.
Statistical Results:	not conducted
Results Remarks:	Negative for genetic effects with *S. typhimurium* (all strains), both with and without metabolic activation. Clear positive mutagenic response in *E. coli* strain with metabolic activation only (negative without activation). No notable changes such as precipitation were observed during the test.
Conclusions:	No genetic effects were observed with any *Salmonella typhimurium* strain, both with and without metabolic activation. A clear positive mutagenic response was obtained in *E. coli* WP2 uvrA with metabolic activation only (negative response without metabolic activation).
Conclusions Remarks:	Conclusions of the authors (see References section).

Data Quality Reliability:	Klimisch Code = 1 Guideline study: "Guidelines for Screening Mutagenicity Testing of Chemicals", Japan
Data Quality Remarks:	not applicable
References:	Nakajima, Madoka, et al. *Reverse mutation test of 2-vinylpyirdine on bacteria.* Biosafety Research Center, Foods, Drugs and Pesticides (An-pyo Center), Japan, 582-2 Shioshinden Arahama, Fukude-cho, Iwata-gun, Shizuoka, 437-12, Japan. (Located at Japan's Global Information Network on Chemicals, found at http://wwwdb.mhlw.go.jp/ginc/index.html.)
Record Last Changed:	10/30/03
Order Number for Sorting:	56
General Remarks:	not applicable

Genetic Toxicity - In Vitro

ID:	27
Test Substance Identity	2-Vinylpyridine
Test Substance Purity	not stated
Test Substance Remarks	Test substance was obtained from Aldrich Chemical Company.
Method / Guideline Followed:	Adapted from procedure described by Borenfreund and Puerner (1984)
Test Type:	mammalian cell cytotoxicity assay (neutral red)
Testing System:	mammalian cells
GLP:	not stated
Year:	1995
Species / Strain or Cell Type:	WB rat liver cells, JB-6 (clone 25) mouse keratinocytes, CHO (K1) cells, A549 human lung carcinoma cells, CCD-11 Lu human lung fibroblasts
Metabolic Activation:	none
Concentrations Tested:	not stated
Statistical Methods:	linear regression
Test Conditions Remarks:	WB rat liver cells and mouse keratinocytes were obtained from Michigan State University. All other cells obtained through American Type Culture Collection. Ammonium hydroxide and n-butanol were run as positive controls. Exposures were at 37°C incubation for 24 hours. Absorbance was measured at 540 nm, and concentration vs. absorbance was plotted. EC_{50} was defined as the chemical concentration required to reduce the absorbance value by 50% with respect to the solvent or untreated controls.
Result:	no result (toxic to test system)
Cytotoxic Concentration:	EC_{50} = 0.5 mM in Chinese hamster ovary cells
Genotoxic Effects:	not evaluated
Statistical Results:	linear regression
Results Remarks:	Cytotoxicity observed (see "Cytotoxic Concentration" below).
Conclusions:	2-Vinylpyridine caused more cytotoxicity to CHO cells than did pyridine or 4-methylpyridine, but was an order of magnitude less cytotoxic than 4-vinylpyridine. Authors suggest that the increased cytotoxicity of vinylpyridines may be due to the reactivity of the vinyl group to cellular proteins and DNA.
Conclusions Remarks:	Conclusions of the authors (see References section).
Data Quality Reliability:	Klimisch Code = 2 Reliable with restrictions; acceptable, well-documented publication/study report which meets basic scientific principles.
Data Quality Remarks:	not applicable
References:	Bombick, DW; Doolittle, DJ. 1995. The role of chemical structure and cell type in the cytotoxicity of low-molecular-weight aldehydes and pyridines. *In Vitro Toxicology*, **8**(4), 349-356.
Record Last Changed:	10/30/03
Order Number for Sorting:	32
General Remarks:	not applicable

Genetic Toxicity - In Vitro

ID:	28
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	> 99%
Test Substance Remarks:	Test substance obtained from Aldrich Chemical and further distilled.
Method / Guideline Followed:	Ames test
Test Type:	reverse mutation assay
Testing System:	bacterial
GLP:	not stated
Year:	1992
Species / Strain or Cell Type:	*Salmonella typhimurium*; strains TA1535, TA 1538, TA98 and TA100
Metabolic Activation:	both with and without S9 (rat liver induced with Aroclor)
Concentrations Tested:	5, 10, 25 and 50 µmol/plate
Statistical Methods:	not stated
Test Conditions Remarks:	not applicable
Result:	negative
Cytotoxic Concentration:	At 5 and 10 µmol/plate, survival rates were 80-92%. At 25 and 50 µmol/plate, survival rates were 30-65%.
Genotoxic Effects:	Not mutagenic in concentrations tested.
Statistical Results:	not stated
Results Remarks:	No mutagenic effects observed in concentrations tested, both with and without metabolic activation.
Conclusions:	2-Vinylpyridine was not mutagenic in concentrations of 5, 10, 25 and 50 µmol/plate in Ames tester strains TA1535, TA 1538, TA98 and TA100 without or with metabolic activation by Aroclor-induced S9 fraction.
Conclusions Remarks:	Conclusions of the authors (see References section).
Data Quality Reliability:	Klimisch Code = 2 Reliable with restrictions; basic data given: comparable to guidelines/standards.
Data Quality Remarks:	not applicable
References:	Brunnemann, KD; Rivenson, A; Cheng, SC; Saa, V; Hoffmann, D. 1992. A study of tobacco carcinogenesis XLVII. Bioassays of vinylpyridines for genotoxicity and for tumorigenicity in A/J mice. *Cancer Letters*, 65, 107-113.
Record Last Changed:	11/7/03
Order Number for Sorting:	34
General Remarks:	not applicable

Genetic Toxicity - In Vitro

ID:	29
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	> 99%
Test Substance Remarks:	Test substance obtained from Aldrich Chemical and further distilled.
Method / Guideline Followed:	hepatocyte primary culture / DNA repair test according to G. M. Williams (see "Test Conditions Remarks").
Test Type:	rat hepatocyte DNA repair test
Testing System:	mammalian cell
GLP:	not stated
Year:	1992
Species / Strain or Cell Type:	rat hepatocytes
Metabolic Activation:	none
Concentrations Tested:	2.5, 5.0, 7.5, 10.0 mmol
Statistical Methods:	not stated
Test Conditions Remarks:	Williams test method referenced at *Mutat. Res.*, 1989, 221, 263-286. Similar to OPPTS 870.5550. 4-(Methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK) was used as a positive control.
Result:	negative
Cytotoxic Concentration:	2-Vinylpyridine was toxic to rat hepatocytes at 5,0, 7.5 and 10.0 mmol doses. (Toxicity defined as < 80% viable liver cells.)
Genotoxic Effects:	2-Vinylpyridine did not exhibit genotoxicity at 2.5 mmol dose.
Statistical Results:	not stated
Results Remarks:	No genotoxicity observed at non-toxic doses.
Conclusions:	2-Vinylpyridine was inactive as a genotoxic agent in the rat hepatocyte primary culture / DNA repair test when assayed at non-toxic doses.
Conclusions Remarks:	Conclusions of the authors (see References section).
Data Quality Reliability:	Klimisch Code = 2 Reliable with restrictions; basic data given: comparable to guidelines/standards.
Data Quality Remarks:	not applicable
References:	Brunnemann, KD; Rivenson, A; Cheng, SC; Saa, V; Hoffmann, D. 1992. A study of tobacco carcinogenesis XLVII. Bioassays of vinylpyridines for genotoxicity and for tumorigenicity in A/J mice. *Cancer Letters*, 65, 107-113.
Record Last Changed:	11/7/03
Order Number for Sorting:	34
General Remarks:	not applicable

Genetic Toxicity - In Vivo

ID:	30
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	> 99%
Test Substance Remarks:	Test substance obtained from Aldrich Chemical and further distilled.
Method / Guideline Followed:	not stated
Test Type:	mouse lung adenoma assay
GLP:	not stated
Year:	1992
Species:	mouse
Strain:	A/J strain, Jackson Laboratories, Bar Harbor, ME
Sex:	female
Route of Administration:	intraperitoneal injection
Doses / Concentration Levels:	200 µmol/mouse total dose
Exposure Period:	injected 3 times weekly for total of 20 injections; 20 weeks post-dose observation period
Statistical Methods:	Student's t-test
Test Conditions Remarks:	4-(Methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK) was used as a positive control. 2-Vinylpyridine was injected in 0.1 mL olive oil, using 23 mice. Negative control (olive oil only) was also run for comparison.
Effect on Mitotic Index or PCE / NCE Ratio:	not stated
Genotoxic Effects:	No induction of significant numbers of lung adenomas, or of any other tumors, at a total dose of 200 µmol/mouse.
NOAEL (NOEL) / LOAEL (LOEL):	not stated
Statistical Results:	Lung tumor / mouse = 0.09 ± 0.28, compared to 0.04 ± 0.20 for negative control.
Results Remarks:	not applicable
Conclusions:	2-Vinylpyridine is regarded as non-genotoxic and non-tumorigenic in strain A/J mice.
Conclusions Remarks:	Conclusions of the authors (see References section).
Data Quality Reliability:	Klimisch Code = 2 Reliable with restrictions; acceptable, well-documented publication/study report which meets basic scientific principles.
Data Quality Remarks:	not applicable
References:	Brunnemann, KD; Rivenson, A; Cheng, SC; Saa, V; Hoffmann, D. 1992. A study of tobacco carcinogenesis XLVII. Bioassays of vinylpyridines for genotoxicity and for tumorigenicity in A/J mice. *Cancer Letters*, 65, 107-113.
Record Last Changed:	11/7/03

Order Number for Sorting: 34

General Remarks: not applicable

Repeated Dose Toxicity

ID:	31
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	98.95%
Test Substance Remarks:	not applicable
Method / Guideline Followed:	not stated
Test Type:	repeated oral exposure
GLP:	yes
Year:	1983
Species:	rat
Strain:	not stated
Route of Administration:	gavage (corn oil carrier)
Duration of Test:	17 days
Doses / Concentration Levels:	13 doses over 17 day period
Sex:	male and female
Exposure Period:	17 days
Frequency of Treatment:	once daily
Control Group and Treatment:	0 mg/kg of test compound
Post Exposure Observation Period:	none
Statistical Methods:	not stated
Test Conditions Remarks	5 rats/sex/dose group; doses were 500, 200, 80 and 0 mg/kg. No data available on age of animals. Hematology for 80 and 200 mg/kg groups included RBC, Hgb., Hct., RBC Ind., platelets, WBC, Diff. Clinical chemistry for 80 and 200 mg/kg groups included AST (GOT), ADT (GPT), SDH, AP, creatinine, UN, glucose.
NOAEL (NOEL):	NOEL < 80 mg/kg (males and females)
LOAEL (LOEL):	not determined
Actual Dose Received:	500, 200, 80, 0 mg/kg
Toxic Response / Effects:	500 mg/kg: Clinical signs: weakness, depressed activity, tremors, convulsions, sialorrhea. Gross pathology: edema of glandular stomach (females only), pallor of spleen (both sexes), enlarged and dark liver (females only). No data on weight gain, hematology, clinical chemistry or organ weights due to early deaths. 200 mg/kg: Clinical signs generally the same as 500 mg/kg group. Histopathology: hyperkeratosis, acanthosis, hemorrhage, acute inflammation, edema and focal necrosis of nonglandular gastric mucosa in both males and females. Slight increase in liver weight in both sexes. Hematology: slight increase in atypical lymphocytes in females; slight increase in polymorphonuclear leucocytes in males; slight decrease in number of lymphocytes in males; all other parameters normal. Clinical chemistry normal except for slight increase in ALT (GPT) in females. Weight gain and feed intake normal in females, slightly

	depressed (during first 4 days) in males. 80 mg/kg: Clinical signs: sialorrhea in both males and females. Histopathology: hyperkeratosis and acanthosis of non-glandular stomach mucosa in both males and females; edema of gastric mucosa also observed in males only. Slight increase in liver weights in males only. Hematology: slight increase in polymorphonuclear leucocytes in males only. Clinical chemistry all normal except for slight increase in AP in males. Weight gain and feed intake normal for both sexes.
Statistical Results:	not stated
Results Remarks:	500 mg/kg dose killed all rats after 1-2 treatments. Because of early deaths, no tissue samples were taken.
Conclusions:	Site of toxic action was non-glandular portion of the stomach (contact tissue) and possibly the liver and central nervous system. The no effect level was less than 80 mg/kg.
Conclusions Remarks:	Conclusions of the authors (see References section).
Data Quality Reliability:	Klimisch Code = 2 Reliable with restrictions; basic data given: comparable to guidelines / standards.
Data Quality Remarks:	not applicable
References:	Anonymous. 1983. *Basic Toxicity of 2-Vinylpyridine*. Eastman Kodak Company, Corporate Health and Environment Laboratories. As submitted to USEPA under TSCA §8(e) Compliance Audit Program agreement by Eastman Kodak Company, 1992, OTS#0546362.
Record Last Changed:	11/5/03
Order Number for Sorting:	17
General Remarks:	not applicable

Repeated Dose Toxicity

ID:	32
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	97.34%
Test Substance Remarks:	Test substance obtained from Reilly Tar & Chemical, lot number 30912. When diluted in corn oil to concentrations of 0.8 to 7.2% and refrigerated, mixture was stable for 11 days.
Method / Guideline Followed:	Essentially the same as OPPTS 870.3100, "90-Day Oral Toxicity in Rodents"
Test Type:	90-day repeated dose
GLP:	yes
Year:	1983
Species:	rat
Strain:	Sprague-Dawley
Route of Administration:	oral (gavage)
Duration of Test:	92 days
Doses / Concentration Levels:	180, 60, 20 and 0 mg/kg/day (7.2, 2.4, 0.8 and 0% solutions in corn oil)
Sex:	both males and females
Exposure Period:	90 days
Frequency of Treatment:	once daily, excluding weekends
Control Group and Treatment:	yes
Post Exposure Observation Period:	none
Statistical Methods:	one-way analysis of variance (anova), Bartlett's test, and Duncan's multiple range test. F-tests were performed where Bartlett's test indicated significant difference in variances.
Test Conditions Remarks:	30 male and 30 female rats were assigned to each experimental group. All animals were about six weeks of age at the start of the study. 10 randomly selected rats of each sex per dose were necropsied approximately halfway through the study (43-day). Ophthalmology exams were performed prior to star and during last week of study. Clinical pathology: Blood was collected at time of necropsy from the posterior vena cava under CO_2 anesthesia. Serum clinical chemistry tests included: • Aspartate aminotransferase (AST) • Alanine aminotransferase (ALT) • Alkaline phosphatase (AP) • Urea nitrogen • Glucose • Creatinine • Lactic dehydrogenase (LDH) • γ-Glutamyl transpeptidase (GGTP) • Potassium • Calcium • Cholesterol • Sodium • Chloride • Phosphorus

Hematology tests included:

- Hemoglobin concentration
- Hematocrit
- Red blood cell count
- White blood cell count
- Differential white blood cell count
- Platelet count
- Red blood cell indices
- Cell morphology

Necropsy: Rats were fasted overnight, anesthetized with CO_2 and exsanguinated by severing the posterior vena cava after collective blood samples. The following organs were weighed and their weights relative to body weight and to brain weight calculated:

- liver
- kidneys
- spleen
- brain
- heart
- adrenal glands
- ovaries
- testes

The following organs were examined and collected in 10% buffered formalin. Eyes were fixed in a modified Zenker's (Russel's) fixative. All tissues from high and control groups were examined histologically. Target organs and gross lesions from other dose levels and interim kill groups were also examined histologically. (Examination of reproductive organs from this 90-day study meets the requirements for SIDS/HPV reproductive screening.)

- trachea
- lungs
- aorta
- tongue
- esophagus
- stomach
- duodenum
- jejunum
- ileum
- colon
- cecum
- rectum
- urinary bladder
- pituitary gland
- pancreas
- thyroid gland
- parathyroid glands
- thymus
- mesenteric lymph nodes
- bone marrow
- cervical spinal cord
- sciatic nerve
- eyes
- skin
- femur
- rib
- salivary glands
- vagina
- uterus
- female mammary gland
- testes
- epididymides
- accessory sex organs (male)
- male mammary gland

NOAEL (NOEL): NOEL < 20 mg/kg/day for males; NOEL = 20 mg/kg/day for females

LOAEL (LOEL): not stated

Actual Dose Received: 180, 60, 20 and 0 mg/kg/day

Toxic Response / Effects: In male rats gavaged with 180 mg/kg/day, 2-vinylpyridine affected terminal body weight, absolute weight of liver, kidneys, brain, heart and adrenal glands, relative organ to body weight of liver, kidneys, brain, adrenal glands, and testes, and relative organ to brain weight of heart and adrenal glands.

In female rats gavaged with 180 mg/kg/day, 2-vinylpyridine affected terminal body weight, absolute weights of liver; and relative organ to body weights of liver, kidneys, and ovaries; and relative organ to brain weights of liver and ovaries.

Gavage with 60 mg/kg/day 2-vinylpyridine affected relative organ to body weights of liver and kidneys of male rats, relative liver to body and liver to brain weights of female rats.

Gavage with 20 mg/kg/day 2-vinylpyridine affected only the following weights in male rats: relative organ to body weights of kidneys and adrenal glands, absolute adrenal gland weight, and relative adrenal gland to brain weight.

After 92 days of experiment, gavage with 2-vinylpyridine, the principal effects were reduced body weights of high dose male rats to a greater degree than the female rats resulting in relative weight changes. No statistically significant effects on body weight gain of female rats was observed, but a slight reduction in weight gain of male rats given 180 mg/kg/day was seen, becoming statistically significant on day 4 of the study. The difference varied from 7.4% on day 21 to 13.8% on day 91. Male rats given 20 or 60 mg/kg/day had weight gains comparable to controls. In the female high dose group, weight reduction never exceeded 7%.

With the exception of day 57 in the 92-day group, high dose group males consistently ate less feed than controls, and the change was statistically significant. Lower dose group males (20 and 60 mg/kg/day) ate essentially identical amounts of feed as controls throughout the study, except for day 21 when the 20 mg/kg/day dose group ate less than the control group. On day 53 and 91, the 92-day female high dose group ate significantly more feed than controls, with differences of 14.2 and 11.1% respectively. No other statistically significant differences were observed in feed consumption.

Microscopically, the only compound-related effects observed were due to irritation of the gastric mucosa. These involved primarily the non-glandular epithelium and were characterized by degeneration of the superficial epithelial cells at the highest dose, hyperkeratosis and acanthosis of the epithelium resulting in a thickening of the non-glandular epithelium, and mild inflammatory changes (congestion, edema, and inflammatory cell infiltrates). Irritation of the glandular mucosa was generally much milder and not a consistent or dose-related effect.

Statistical Results: All reported results were analyzed for statistical significance.

Results Remarks: Only observations found to be statistically different from control groups are reported under "Toxic Response / Effects". All other examinations were comparable to control groups.

Conclusions: The high dose (180 mg/kg/day) results in reduced body weight gain in males, reduced feed consumption in males and also toward the end of the study in female rats; a slight increase in the number of platelets in both sexes, and a slight decrease in aspartate aminotransferase in male rats. This dose also affected male absolute weights of brain, heart, and adrenal glands, relative organ to body weight ratio of liver, kidney, brain, adrenal glands, and testes, and relative organ to brain weight ratio of heart and adrenal gland. In female rats, gavage with 180 mg/kg/day 2-vinylpyridine affected the absolute weight of the liver, and relative organ to body weight ratios of liver, kidneys and ovaries, and relative organ to brain weight ratios of liver and ovaries. The high dose (180 mg/kg/day) was clearly irritating to the non-glandular stomach epithelium of both sexes and microscopically was characterized by degeneration, hyperkeratosis and acanthosis resulting in a thickening of the non-glandular epithelium.

Conclusions Remarks: Conclusions of the authors (see References section).

Data Quality Reliability: Klimisch Code = 1

Reliable without restriction; comparable to guideline study.

Data Quality Remarks: not applicable

References:

Vlaovic, Milan S. 1984. *Subchronic Oral Toxicology of 2-Vinylpyridine.* Eastman Kodak Company, Toxicological Sciences Section, Health and Environment Laboratories. As submitted to USEPA under TSCA §8(e) Compliance Audit Program agreement by Eastman Kodak Company, 1992, OTS#0546362.

Record Last Changed:	11/7/03
Order Number for Sorting:	17
General Remarks:	not applicable

Repeated Dose Toxicity

ID:	33
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	98.3%
Test Substance Remarks:	Test substance obtained from Organic Synthetic Pharmaceutical Industries, lot 95-022. Stability of administration solution was checked at one week of storage in a refrigerator, showing no stability problems.
Method / Guideline Followed:	"Guidelines for 28-day Repeat Dose Toxicity Testing of Chemicals", Japan
Test Type:	28-day repeat dose
GLP:	yes
Year:	> 1991
Species:	rat
Strain:	Crj: CD (SD)
Route of Administration:	oral (gavage)
Duration of Test:	28-day exposure, up to 14-day recovery period
Doses / Concentration Levels:	0, 12.5, 50, 200 mg/kg/day
Sex:	males and females, 5 / sex / group
Exposure Period:	28 days
Frequency of Treatment:	once daily
Control Group and Treatment:	5 males; 5 females. Only corn oil was administered to the control group.
Post Exposure Observation Period:	14-day recovery period for 0 and 200 mg/kg groups
Statistical Methods:	multiple comparison testing and Fisher probability computation
Test Conditions Remarks:	Recovery groups were employed for the 0 and 200 mg/kg dosages. Test substance was dissolved in corn oil and administered via gavage at about 0.5 mL per 100 g body weight. Animals were 6 weeks of age at study initiation. Body weight was measure once weekly through the end of the recovery period, and feed consumption was calculated weekly. Clinical examination: Implemented twice (once at the end of administration and once at the end of recovery period). Hematological analysis included: • white blood cell count • red blood cell count • hemoglobin level • hematocrit level • mean red blood cell volume • mean red blood cell hematochrome • mean red blood cell hematochrome concentration • platelet number • white blood cell percentage • reticulocyte count • prothrombin time • activated partial thromblastin time • fibrinogen level

Hematobiochemical analysis included:

- total protein
- albumin
- A/G ratio
- blood sugar
- neutral fats
- total cholesterol
- urea nitrogen
- total bilirubin
- calcium
- inorganic phosphorus
- sodium
- potassium
- chlorine
- creatinine
- glutamic acid oxazaloacetate transaminase
- glutamic acid pyruvic acid transaminase
- gamma-glutamyl transpeptidase
- alkali phosphatase

Urinalysis included:

- quantity
- color
- turbidity
- specific gravity
- sedimentation residue microscopy
- pH
- occult blood
- ketones
- sugar
- protein
- bilirubin
- urobilinogen

Necropsy: Animals were deprived of food for about 16 hours, anesthetized with ether, cut open at the abdomen and blood was collected from the large abdominal artery. Pathological examination included weights of the following organs:

- brain
- liver
- kidneys
- spleen
- adrenals
- testes
- ovaries
- thymus

Histopathology examination of control group and 200 mg/kg group included:

- stomach
- duodenum
- thymus
- heart
- liver
- spleen
- kidneys
- adrenals
- bone marrow (femur)

Stomachs of medium and low dose groups were also examined.

NOAEL (NOEL): NOEL = 12.5 mg/kg/day

LOAEL (LOEL): not stated

Actual Dose Received: 0, 12.5, 50, 200 mg/kg/day

Toxic Response / Effects: General Condition: Salivation was observed in both sexes receiving 50 and 200 mg/kg. All symptoms disappeared within hours of test substance administration.

Body Weight: Body weight gain was suppressed and food consumption decreased in males receiving 200 mg/kg. Once in the recovery period, a clear recovery trend was observed, and the increase in body weight was greater than in controls. Total feed consumption returned to control levels as of week 4 of administration.

Hematological examination: No difference was noted in either males or females in the examination of the control group and the groups administered the test substance. In males, the 200 mg/kg group had a

higher reticulocyte count than controls, but was still within the normal range of background values. In females, the 200 mg/kg group had a lower MCHC level than controls, but this was not a significant change, as there was no difference with controls in the MCV and MCH values computed.

Blood coagulation ability examination: At the ends of both the administration and recovery periods, no difference was found between the control group and the groups administered the test substance in either males or females.

Blood biochemical examination: At the end of the administration period, minor differences in certain biochemical levels were reported, sometimes in only one animal, but none were found to be statistically significant changes. No differences in any biochemical levels were found in either controls or administration groups in either males or females at the end of the recovery period.

Clinical Examination: Urinalysis at the end of administration revealed decreases in specific gravity in females receiving 50 and 200 mg/kg and volume increase in females receiving 200 mg/kg; these differences were not observed after the recovery period. No changes were observed in males vs. controls at any time.

Organ Weights and Ratios: Relative testes weights were increased in males receiving 200 mg/kg. Absolute and relative spleen weights were decreased and relative liver weights increased in females receiving 200 mg/kg. In both males and females, no differences in organ weights or ratios were observed at the end of the recovery period.

Pathological examination: Squamous hyperplasia and submucosal edema in the forestomach were observed in both sexes receiving 50 and 200 mg/kg, along with thickening of the mucosa at the higher dose. Moreover, erosion and cellular infiltration in the forestomach were observed in males receiving 200 mg/kg. Submucosal edema and/or erosion in the glandular stomach were also observed in females receiving 50 or 200 mg/kg. At the end of the recovery period, light squamous hyperplasia was observed in the forestomachs of three males and two females of the 200 mg/kg group.

Squamous hyperplasia in the forestomach was still observed in both sexes receiving 200 mg/kg at the end of the recovery period, but its incidence and extent were decreased in comparison to those of the same groups at the end of the administration period.

Statistical Results: See "Toxic Response / Effects"

Results Remarks: Only observations found to be statistically different from control groups are reported under "Toxic Response / Effects". All other examinations were comparable to control groups.

Conclusions: Salivation was observed in both sexes receiving 50 and 200 mg/kg. Body weight gain was suppressed and food consumption decreased in males receiving 200 mg/kg. Urinalysis revealed decreases in specific gravity in females receiving 50 and 200 mg/kg and volume increase in females receiving 200 mg/kg. Relative testes weights were increased in males receiving 200 mg/kg. Absolute and relative spleen weights were decreased and relative liver weights increased in females receiving 200 mg/kg. Squamous hyperplasia and submucosal edema in the forestomach were observed in both sexes receiving 50 and 200 mg/kg, along with thickening of the mucosa at the higher dose. Moreover, erosion and cellular infiltration in the forestomach were observed in males receiving 200 mg/kg. Submucosal edema and/or erosion in the glandular stomach were also observed in females receiving 50 or 200 mg/kg. Squamous hyperplasia in the forestomach was still observed in both sexes receiving 200 mg/kg at the end of the recovery period, but its incidence and extent were decreased in comparison to those of the same groups at the end of the administration period. The NOEL for repeat dose toxicity is considered to be 12.5 mg/kg/day for both sexes.

Conclusions Remarks: Conclusions of the authors (see References section).

Data Quality Reliability:	Klimisch Code = 1 Reliable without restriction; guideline study.
Data Quality Remarks:	not applicable
References:	Oba, Kousuke, et al. *Twenty-eight day repeat dose oral toxicity test of 2-vinylpyridine in rats*. Biosafety Research Center, Foods, Drugs and Pesticides (An-pyo Center), Japan, 582-2 Shioshinden Arahama, Fukude-cho, Iwata-gun, Shizuoka, 437-12, Japan. (Located at Japan's Global Information Network on Chemicals, found at http://wwwdb.mhlw.go.jp/ginc/index.html.)
Record Last Changed:	11/7/03
Order Number for Sorting:	54
General Remarks:	not applicable

Reproductive Toxicity

ID:	34
Test Substance Identity:	2-Vinylpyridine
Test Substance Purity:	97.34%
Test Substance Remarks:	Test substance obtained from Reilly Tar & Chemical, lot number 30912. When diluted in corn oil to concentrations of 0.8 to 7.2% and refrigerated, mixture was stable for 11 days.
Method / Guideline Followed:	essentially the same as OPPTS 870.3100, 90-Day Oral Toxicity in Rodents
Test Type:	90-day repeated dose
GLP:	yes
Year:	1983
Species:	rat
Strain:	Sprague-Dawley
Route of Administration:	oral (gavage)
Duration of Test:	92 days
Doses / Concentration Levels:	180, 60, 20 and 0 mg/kg/day (7.2, 2.4, 0.8 and 0% solutions in corn oil)
Sex:	both males and females
Duration of Test:	92 days
Frequency of Treatment:	once daily, excluding weekends
Control Group and Treatment:	see "Doses/Concentration Levels" above
Premating Exposure Period (males):	not stated
Premating Exposure Period (females):	not stated
Statistical Methods:	one-way analysis of variance (anova), Bartlett's test, and Duncan's multiple range test. F-tests were performed where Bartlett's test indicated significant difference in variances.
Test Conditions Remarks:	See Robust Summary #32 for test conditions details. All tissues from high and control groups, including testes, epididymides, accessory male sex organs, ovaries, uterus, vagina, fallopian tubes and mammary glands (both sexes), were examined histologically. Target organs and gross lesions from other dose levels and interim kill groups were also examined histologically.
NOAEL (NOEL):	not stated
Actual Dose Received:	180, 60, 20 and 0 mg/kg/day
Toxic Response / Effects:	<u>Males:</u> Organ weights: There was a dose dependent increase in relative testes to body weights, however, only the high dose group reached statistical significance with a 20.3% increase. Statistical significance was also reached in relative testes to body weights in the 20 and 180 mg/kg/day dose groups killed mid-way through the experiment (at day 43), with 9.7% and 14.6% increases, respectively. Gross pathology: Enlarged prostate was observed in control group as well as some dose groups at day-92 (4/20 in control group; 3/20 in 20 mg/kg

group; 1/20 in 60 mg/kg group; 2/20 in 180 mg/kg group). No effects in epididymides or testes for any dose group.

Histopathology: No testicular effects observed any dose group. Chronic focal inflammation of the epididymides was observed in 4/20 rats in control group; 7/20 rats in 180 mg/kg group. Chronic inflammation of the prostate was observed in 6/20 rats in control group; 1/3 rats in 20 mg/kg group; and 9/20 rats in 180 mg/kg group.

Females:

Organ weights: In the 92-day rats, there was a statistically significant increase in relative ovary to body weight and ovary to brain weight in the high dose group with 24.1% and 18.2% increases, respectively.

Gross pathology: No effects at any dose level on fallopian tubes, vagina, uterus, mammary gland and ovaries. A single rat (0 mg/kg group at day 43) showed uterine hydrometra.

Histopathology: A single rat (1/20) at the 180 mg/kg dose level exhibited ovarian congestion; no other ovarian effects were observed at any dose level. No effects at any dose level were observed on fallopian tubes, vagina and female mammary gland. A single control group rat at 43-days showed uterine hydrometra.

Statistical Results: All reported results were analyzed for statistical significance.

Results Remarks: Additional results not related to reproductive organs are reported in Robust Summary #32.

Conclusions: A dose-dependent increase in relative testes to body weights was observed, but gross pathology and histopathology showed no testicular effects.

Likewise, a statistically significant increase in relative ovary weights was observed in the highest dose group, but again, no effects were observed upon gross pathology and histopathological examination.

No other pathology findings differed significantly from control groups, in either males or females.

Conclusions Remarks: Conclusions of the authors (see References)

LOAEL (LOEL): not stated

Data Quality Reliability: Klimisch Code = 1

Reliable without restriction; comparable to guideline study.

Data Quality Remarks: not applicable

References:

Vlaovic, Milan S. 1984. *Subchronic Oral Toxicology of 2-Vinylpyridine.* Eastman Kodak Company, Toxicological Sciences Section, Health and Environment Laboratories. As submitted to USEPA under TSCA §8(e) Compliance Audit Program agreement by Eastman Kodak Company, 1992, OTS#0546362.

Record Last Changed: 12/4/03

Order Number for Sorting: 17R

General Remarks: See Robust Summary #32 for additional testing details.

Per EPA guidance, an existing, adequate 90-day repeat dose study that "demonstrates no effects on reproductive organs, in particular the testes, then a developmental study (e.g., OECD Test Guideline 414) can be considered as an adequate test for information on reproduction / developmental effect." Thus, this 90-day study satisfies the requirements for SIDS/HPV reproductive screening.