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Attachment 1a: Robust Summaries

Physico-Chemical Properties and Environmental Fate

General

ROBUST SUMMARY: RESIN OILS and CYCLODIENE DIMER CONCENTRATES

Boiling Point

Test Substance*:	Other TS [CAS # 26742-00-4; 68477-40-7; 68477-54-3; 68477-53-2; 68478-08-0; 68478-10-4; 68516-20-1; 68527-24-2; 68527-26-4; 68603-02-1]
Method/Guideline:	Calculated values using MPBPWIN version 1.40, a subroutine of the computer program EPIWIN version 3.04
Year (guideline):	1999
Type (test type):	Not applicable
GLP:	Not applicable
Year (study performed):	Not applicable
Estimation Pressure:	760 mm Hg
Test Conditions:	Boiling Point is calculated by the MPBPWIN subroutine, which is based on the calculation method of S. Stein and R. Brown in "Estimation of Normal Boiling Points from Group Contributions". 1994. J. Chem. Inf. Comput. Sci. 34: 581-587.
Results: Units/Value: <ul style="list-style-type: none"> • Note: Deviations from protocol or guideline, analytical method. 	<p>Calculated and measured boiling point data for representative constituents of the Resin Oils and Cyclodiene Dimer Concentrates Category are listed below. The data identify a potential boiling point range for substances represented by the 10 CAS numbers under <u>Test Substance</u>. Substances in this category do not have a specific boiling point value. Actual boiling point ranges for substances in this category will vary dependent on their constituent composition.</p> <p>Commercial substances in this category consist of complex hydrocarbon products with a carbon number distribution that is predominantly C8-C12 with some lower molecular weight constituents present. The predominant components are cycloalkenes and aromatic hydrocarbons. The five chemicals selected to represent the boiling point range of this category are C8-C12 hydrocarbons that can be found in substances identified by the 10 CAS numbers. Constituents representing category members were selected on the basis of carbon number as identified by the category name, chemistry/structure, measured boiling point ranges for category substances, and olefinic process (distillation) knowledge.</p>

<p>Results: (continued)</p> <p>Units/Value:</p> <p>Note: Deviations from protocol or guideline, analytical method.</p>	<table border="1"> <thead> <tr> <th>Substance Constituent</th> <th>Calculated BP (°C)</th> <th>Measured* BP (°C)</th> </tr> </thead> <tbody> <tr> <td>vinyl toluene</td> <td>120.42</td> <td>na</td> </tr> <tr> <td>indene</td> <td>212.89</td> <td>na</td> </tr> <tr> <td>dicyclopentadiene</td> <td>176.78</td> <td>170.0</td> </tr> <tr> <td>methylindene</td> <td>231.75</td> <td>na</td> </tr> <tr> <td>methylcyclopentadiene dimer</td> <td>225.19</td> <td>191.0†</td> </tr> </tbody> </table> <p>* Experimental values from EPIWIN database. na = not available</p> <p>The data represent a potential boiling point range for substances represented by the 10 CAS numbers under <u>Test Substance</u>.</p> <p>† Huntingdon Life Sciences, Ltd. 2003. Physicochemical Properties Study. EXN040/032421</p>	Substance Constituent	Calculated BP (°C)	Measured* BP (°C)	vinyl toluene	120.42	na	indene	212.89	na	dicyclopentadiene	176.78	170.0	methylindene	231.75	na	methylcyclopentadiene dimer	225.19	191.0†		
Substance Constituent	Calculated BP (°C)	Measured* BP (°C)																			
vinyl toluene	120.42	na																			
indene	212.89	na																			
dicyclopentadiene	176.78	170.0																			
methylindene	231.75	na																			
methylcyclopentadiene dimer	225.19	191.0†																			
<p>Test Substance:</p>	<p>The Resin Oils and Cycloidiene Dimer Concentrates Category includes the following CAS numbers:</p> <table border="0"> <tr> <td>26742-00-4</td> <td>4,7-Methano-1H-indene, 3a,4,7,7a-tetrahydrodimethyl-</td> </tr> <tr> <td>68477-40-7</td> <td>Distillates, petroleum, cracked stripped steam-cracked petroleum distillates, C10-12 fraction</td> </tr> <tr> <td>68477-54-3</td> <td>Distillates, petroleum, steam-cracked, C8-12 fraction</td> </tr> <tr> <td>68477-53-2</td> <td>Distillates, petroleum, steam-cracked, C5-12 fraction</td> </tr> <tr> <td>68478-08-0</td> <td>Naphtha, petroleum, light steam-cracked, C5-fraction, oligomer concentrate</td> </tr> <tr> <td>68478-10-4</td> <td>Naphtha, petroleum, light steam-cracked, debenzenized, C8-16-cycloalkadiene concentrate</td> </tr> <tr> <td>68516-20-1</td> <td>Naphtha, petroleum, steam-cracked middle aromatic</td> </tr> <tr> <td>68527-24-2</td> <td>Naphtha, petroleum, light steam-cracked aromatic, C5-12 cycloalkadiene fraction, polymers</td> </tr> <tr> <td>68527-26-4</td> <td>Naphtha, petroleum, light steam-cracked, debenzenized</td> </tr> <tr> <td>68603-02-1</td> <td>Distillates, petroleum, thermal cracked naphtha and gas oil, dimerized</td> </tr> </table> <p>The Resin Oils and Cycloidiene Dimer Concentrates Category was developed by grouping two Resin Oil streams, one relatively low in Dicyclopentadiene (DCPD), and a second that contains higher levels of the dimer. These Resin Oils have been further grouped with six other process streams that are concentrates of DCPD, Methylcyclopentadiene Dimer (MCDP Dimer), and co-dimers of these two cycloidiens with other hydrocarbons of similar molecular weight present, primarily cycloalkenes and aromatic hydrocarbons. The 10 CAS numbers are used to describe the nine process streams associated with the ethylene industry and associated manufacturing processes.</p> <p>More information on the Resin Oils and Cycloidiene Dimer Concentrates Category can be found in the American Chemistry Council, Olefins Panel test plan for this category (1).</p> <ol style="list-style-type: none"> <li>1. Olefins Panel, HPV Implementation Task Group. 2001. High Production Volume (HPV) Chemical Challenge Program Test 	26742-00-4	4,7-Methano-1H-indene, 3a,4,7,7a-tetrahydrodimethyl-	68477-40-7	Distillates, petroleum, cracked stripped steam-cracked petroleum distillates, C10-12 fraction	68477-54-3	Distillates, petroleum, steam-cracked, C8-12 fraction	68477-53-2	Distillates, petroleum, steam-cracked, C5-12 fraction	68478-08-0	Naphtha, petroleum, light steam-cracked, C5-fraction, oligomer concentrate	68478-10-4	Naphtha, petroleum, light steam-cracked, debenzenized, C8-16-cycloalkadiene concentrate	68516-20-1	Naphtha, petroleum, steam-cracked middle aromatic	68527-24-2	Naphtha, petroleum, light steam-cracked aromatic, C5-12 cycloalkadiene fraction, polymers	68527-26-4	Naphtha, petroleum, light steam-cracked, debenzenized	68603-02-1	Distillates, petroleum, thermal cracked naphtha and gas oil, dimerized
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	Plan For The Resin Oils and Cyclodiene Dimer Concentrates Category. American Chemistry Council, Olefins Panel, HPV Implementation Task Group. VA, USA.
Conclusion:	The calculated boiling points for some representative constituents that are present in the category streams vary from 120.42 to 231.75°C @ 760 mm Hg. Measured boiling points for two of these same constituents vary from 170.0 to 191.0°C @ 760 mm Hg. Although this does not define the actual boiling points of the category streams, it offers an indication of a range that might be expected to encompass the boiling points of these complex streams with variable compositions. Boiling points outside of these ranges may be possible for some category streams.
Reliability:	(2) Reliable with restrictions The results include calculated data based on chemical structure as modeled by EPIWIN and measured data for specific chemicals as cited in the EPIWIN database or from studies performed for the ACC Olefins Panel. The data represent a potential boiling point range for substances represented by the 10 CAS numbers listed under <u>Test Substance</u> . This robust summary has a reliability rating of 2 because the data are not for specific substances in the Resin Oils and Cyclodiene Dimer Concentrates Category, but rather for selected constituents. These selected constituents represent all substances defined by this category and as such, this robust summary represents a "key study" for boiling point range based on constituent data.
Reference:	EPIWIN. 1999. Estimation Program Interface for Windows, version 3.04. Syracuse Research Corporation, Syracuse, NY, USA. (Boiling point values were calculated by the MPBPWIN subroutine and measured data came from the database in the computer program or from testing performed in conjunction with the test plan for this category)
Other (source):	American Chemistry Council, Olefins Panel (Prepared 8/03)

* Other TS is a selection option under the Test Substance pick list that is in the IUCLID entry field for Boiling Point. Selecting this option refers the reader to information in the test substance "freetext" field to which the CAS numbers can be added.

ROBUST SUMMARY: RESIN OILS and CYCLODIENE DIMER CONCENTRATES

Melting Point

Test Substance*:	Other TS [CAS # 26742-00-4; 68477-40-7; 68477-54-3; 68477-53-2; 68478-08-0; 68478-10-4; 68516-20-1; 68527-24-2; 68527-26-4; 68603-02-1]
Method/Guideline:	Calculated values using MPBPWIN version 1.40, a subroutine of the computer program EPIWIN version 3.04
Year (guideline):	1999
Type (test type):	Not applicable
GLP:	Not applicable
Year (study performed):	Not applicable
Test Conditions: <ul style="list-style-type: none"> Note: Concentration prep., vessel type, replication, test conditions. 	<p>Melting Point is calculated by the MPBPWIN subroutine, which is based on the average result of the methods of K. Joback and Gold and Ogle.</p> <p>Joback's Method is described in Joback, K.G. 1982. A Unified Approach to Physical Property Estimation Using Multivariate Statistical Techniques. In <u>The Properties of Gases and Liquids</u>. Fourth Edition. 1987. R.C. Reid, J.M. Prausnitz and B.E. Poling, Eds.</p> <p>The Gold and Ogle Method simply uses the formula $T_m = 0.5839T_b$, where T_m is the melting point in Kelvin and T_b is the boiling point in Kelvin. The Gold and Ogle Method is described by Lyman, W.J., 1985, In: <u>Environmental Exposure from Chemicals</u>. Volume 1. Neely, W.B. and Blau, G.E. (eds), Boca Raton, FL, CRC Press, Inc., Chapter 2.</p>
Results: Units/Value: <ul style="list-style-type: none"> Note: Deviations from protocol or guideline, analytical method. 	<p>Calculated and measured melting point data for representative constituents of the Resin Oils and CycloDiene Dimer Concentrates Category are listed below. The data identify a potential melting point range for substances represented by the 10 CAS numbers under <u>Test Substance</u>. Substances in this category do not have a specific melting point value. Actual melting point ranges for substances in this category will vary dependent on their constituent composition.</p> <p>Commercial substances in this category consist of complex hydrocarbon products with a carbon number distribution that is predominantly C8-C12 with some lower molecular weight constituents present. The predominant components are cycloalkenes and aromatic hydrocarbons. The five chemicals selected to represent the melting point range of this category are C8-C12 hydrocarbons that can be found in substances identified by the 10 CAS numbers. Constituents representing category members were selected on the basis of carbon number as identified by the category name, chemistry/structure, measured boiling point ranges for category substances, and olefinic process (distillation) knowledge.</p>

<p>Results: (continued)</p> <p>Units/Value:</p> <p>Note: Deviations from protocol or guideline, analytical method.</p>	<table border="1"> <thead> <tr> <th>Substance Constituent</th> <th>Calculated MP (°C)</th> <th>Measured* MP (°C)</th> </tr> </thead> <tbody> <tr> <td>vinyl toluene</td> <td>-60.33</td> <td>na</td> </tr> <tr> <td>indene</td> <td>24.36</td> <td>na</td> </tr> <tr> <td>dicyclopentadiene</td> <td>-16.78</td> <td>32.0</td> </tr> <tr> <td>methyindene</td> <td>35.06</td> <td>na</td> </tr> <tr> <td>methylcyclopentadiene dimer</td> <td>3.13</td> <td>na</td> </tr> </tbody> </table> <p>* Experimental values from EPIWIN database. na = not available</p> <p>The data represent a potential melting point range for substances represented by the 10 CAS numbers under <u>Test Substance</u>.</p>	Substance Constituent	Calculated MP (°C)	Measured* MP (°C)	vinyl toluene	-60.33	na	indene	24.36	na	dicyclopentadiene	-16.78	32.0	methyindene	35.06	na	methylcyclopentadiene dimer	3.13	na		
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<p>Test Substance:</p>	<p>The Resin Oils and Cycloidiene Dimer Concentrates Category includes the following CAS numbers:</p> <table border="0"> <tr> <td>26742-00-4</td> <td>4,7-Methano-1H-indene, 3a,4,7,7a-tetrahydrodimethyl-</td> </tr> <tr> <td>68477-40-7</td> <td>Distillates, petroleum, cracked stripped steam-cracked petroleum distillates, C10-12 fraction</td> </tr> <tr> <td>68477-54-3</td> <td>Distillates, petroleum, steam-cracked, C8-12 fraction</td> </tr> <tr> <td>68477-53-2</td> <td>Distillates, petroleum, steam-cracked, C5-12 fraction</td> </tr> <tr> <td>68478-08-0</td> <td>Naphtha, petroleum, light steam-cracked, C5-fraction, oligomer concentrate</td> </tr> <tr> <td>68478-10-4</td> <td>Naphtha, petroleum, light steam-cracked, debenzenized, C8-16-cycloalkadiene concentrate</td> </tr> <tr> <td>68516-20-1</td> <td>Naphtha, petroleum, steam-cracked middle aromatic</td> </tr> <tr> <td>68527-24-2</td> <td>Naphtha, petroleum, light steam-cracked aromatic, C5-12 cycloalkadiene fraction, polymers</td> </tr> <tr> <td>68527-26-4</td> <td>Naphtha, petroleum, light steam-cracked, debenzenized</td> </tr> <tr> <td>68603-02-1</td> <td>Distillates, petroleum, thermal cracked naphtha and gas oil, dimerized</td> </tr> </table> <p>The Resin Oils and Cycloidiene Dimer Concentrates Category was developed by grouping two Resin Oil streams, one relatively low in Dicyclopentadiene (DCPD), and a second that contains higher levels of the dimer. These Resin Oils have been further grouped with six other process streams that are concentrates of DCPD, Methylcyclopentadiene Dimer (MCDP Dimer), and co-dimers of these two cycloidiene with other hydrocarbons of similar molecular weight present, primarily cycloalkenes and aromatic hydrocarbons. The 10 CAS numbers are used to describe the nine process streams associated with the ethylene industry and associated manufacturing processes.</p> <p>More information on the Resin Oils and Cycloidiene Dimer Concentrates Category can be found in the American Chemistry Council, Olefins Panel test plan for this category (1).</p> <p>1. Olefins Panel, HPV Implementation Task Group. 2001. High Production Volume (HPV) Chemical Challenge Program Test Plan For The Resin Oils and Cycloidiene Dimer Concentrates</p>	26742-00-4	4,7-Methano-1H-indene, 3a,4,7,7a-tetrahydrodimethyl-	68477-40-7	Distillates, petroleum, cracked stripped steam-cracked petroleum distillates, C10-12 fraction	68477-54-3	Distillates, petroleum, steam-cracked, C8-12 fraction	68477-53-2	Distillates, petroleum, steam-cracked, C5-12 fraction	68478-08-0	Naphtha, petroleum, light steam-cracked, C5-fraction, oligomer concentrate	68478-10-4	Naphtha, petroleum, light steam-cracked, debenzenized, C8-16-cycloalkadiene concentrate	68516-20-1	Naphtha, petroleum, steam-cracked middle aromatic	68527-24-2	Naphtha, petroleum, light steam-cracked aromatic, C5-12 cycloalkadiene fraction, polymers	68527-26-4	Naphtha, petroleum, light steam-cracked, debenzenized	68603-02-1	Distillates, petroleum, thermal cracked naphtha and gas oil, dimerized
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	Category. American Chemistry Council, Olefins Panel, HPV Implementation Task Group. VA, USA.
Conclusion:	The calculated melting points for some representative constituents that are present in the category streams vary from -60.33 to 35.06°C. The measured melting point for one of these same constituents (DCPD) was 32.0°C. Although this does not define the actual melting points of the category streams, it offers an indication of a range that might be expected to encompass the melting points of these complex streams with variable compositions. Melting points outside of these ranges may be possible for some category streams.
Reliability:	(2) Reliable with restrictions The results include calculated data based on chemical structure as modeled by EPIWIN and measured data for specific chemicals as cited in the EPIWIN database. The data represent a potential melting point range for substances represented by the 10 CAS numbers listed under <u>Test Substance</u> . This robust summary has a reliability rating of 2 because the data are not for specific substances in the Resin Oils and Cyclodiene Dimer Concentrates Category, but rather for selected constituents. These selected constituents represent all substances defined by this category and as such, this robust summary represents a "key study" for melting point range based on constituent data.
Reference:	EPIWIN. 1999. Estimation Program Interface for Windows, version 3.04. Syracuse Research Corporation, Syracuse, NY, USA. (Melting point values were calculated by the MPBPWIN subroutine and measured data came from the database in the computer program.)
Other (source):	American Chemistry Council, Olefins Panel (Prepared 8/03)

* Other TS is a selection option under the Test Substance pick list that is in the IUCLID entry field for Melting Point. Selecting this option refers the reader to information in the test substance "freetext" field to which the CAS numbers can be added.

ROBUST SUMMARY: RESIN OILS and CYCLODIENE DIMER CONCENTRATES

Vapor Pressure

Test Substance*:	Other TS [CAS # 26742-00-4; 68477-40-7; 68477-54-3; 68477-53-2; 68478-08-0; 68478-10-4; 68516-20-1; 68527-24-2; 68527-26-4; 68603-02-1]		
Method/Guideline:	Calculated values using MPBPWIN version 1.40, a subroutine of the computer program EPIWIN version 3.04		
Year (guideline):	1999		
Type (test type):	Not applicable		
GLP:	Not applicable		
Year (study performed):	Not applicable		
Estimation Temperature:	25°C		
Test Conditions:	<p>Vapor Pressure is calculated by the MPBPWIN subroutine, which is based on the average result of the methods of Antoine and Grain. Both methods use boiling point for the calculation.</p> <p>The Antoine Method is described in the <u>Handbook of Chemical Property Estimation</u>. Chapter 14. W.J. Lyman, W.F. Reehl and D.H. Rosenblatt, Eds. Washington, D.C.: American Chemical Society. 1990.</p> <p>A modified Grain Method is described on page 31 of Neely and Blau's <u>Environmental Exposure from Chemicals</u>, Volume 1, CRC Press. 1985.</p>		
Results: Units/Value: <ul style="list-style-type: none"> Note: Deviations from protocol or guideline, analytical method. 	<p>Calculated and measured vapor pressure data for representative constituents of the Resin Oils and Cyclo diene Dimer Concentrates Category are listed below. The data identify a potential vapor pressure range for substances represented by the 10 CAS numbers under <u>Test Substance</u>. Substances in this category do not have a specific vapor pressure value. Actual vapor pressure ranges for substances in this category will vary dependent on their constituent composition.</p> <p>Commercial substances in this category consist of complex hydrocarbon products with a carbon number distribution that is predominantly C8-C12 with some lower molecular weight constituents present. The predominant components are cycloalkenes and aromatic hydrocarbons. The five chemicals selected to represent the vapor pressure range of this category are C8-C12 hydrocarbons that can be found in substances identified by the 10 CAS numbers. Constituents representing category members were selected on the basis of carbon number as identified by the category name, chemistry/structure, measured boiling point ranges for category substances, and olefinic process (distillation) knowledge.</p>		
Results: (cont'd) Units/Value:	<u>Substance</u> <u>Constituent</u>	<u>Calculated VP</u> <u>(hPa @ 25°C)</u>	<u>Measured* VP</u> <u>(hPa @ 25°C)</u>

<ul style="list-style-type: none"> Note: Deviations from protocol or guideline, analytical method. 	<table border="0"> <tr> <td>vinyl toluene</td> <td>20.53</td> <td>na</td> </tr> <tr> <td>indene</td> <td>0.25</td> <td>na</td> </tr> <tr> <td>dicyclopentadiene</td> <td>2.2</td> <td>3.05</td> </tr> <tr> <td>methylindene</td> <td>0.07</td> <td>na</td> </tr> <tr> <td>methylcyclopentadiene dimer</td> <td>0.20</td> <td>19.0†</td> </tr> </table> <p>* Experimental values from EPIWIN database. na = not available</p> <p>The data represent a potential vapor pressure range for substances represented by the 10 CAS numbers under <u>Test Substance</u>.</p> <p>† Huntingdon Life Sciences, Ltd. 2003. Physicochemical Properties Study. EXN040/032421</p>	vinyl toluene	20.53	na	indene	0.25	na	dicyclopentadiene	2.2	3.05	methylindene	0.07	na	methylcyclopentadiene dimer	0.20	19.0†					
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methylindene	0.07	na																			
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<p>Test Substance:</p>	<p>The Resin Oils and Cycloidiene Dimer Concentrates Category includes the following CAS numbers:</p> <table border="0"> <tr> <td>26742-00-4</td> <td>4,7-Methano-1H-indene, 3a,4,7,7a-tetrahydrodimethyl-</td> </tr> <tr> <td>68477-40-7</td> <td>Distillates, petroleum, cracked stripped steam-cracked petroleum distillates, C10-12 fraction</td> </tr> <tr> <td>68477-54-3</td> <td>Distillates, petroleum, steam-cracked, C8-12 fraction</td> </tr> <tr> <td>68477-53-2</td> <td>Distillates, petroleum, steam-cracked, C5-12 fraction</td> </tr> <tr> <td>68478-08-0</td> <td>Naphtha, petroleum, light steam-cracked, C5-fraction, oligomer concentrate</td> </tr> <tr> <td>68478-10-4</td> <td>Naphtha, petroleum, light steam-cracked, debenzenized, C8-16-cycloalkadiene concentrate</td> </tr> <tr> <td>68516-20-1</td> <td>Naphtha, petroleum, steam-cracked middle aromatic</td> </tr> <tr> <td>68527-24-2</td> <td>Naphtha, petroleum, light steam-cracked aromatic, C5-12 cycloalkadiene fraction, polymers</td> </tr> <tr> <td>68527-26-4</td> <td>Naphtha, petroleum, light steam-cracked, debenzenized</td> </tr> <tr> <td>68603-02-1</td> <td>Distillates, petroleum, thermal cracked naphtha and gas oil, dimerized</td> </tr> </table> <p>The Resin Oils and Cycloidiene Dimer Concentrates Category was developed by grouping two Resin Oil streams, one relatively low in Dicyclopentadiene (DCPD), and a second that contains higher levels of the dimer. These Resin Oils have been further grouped with six other process streams that are concentrates of DCPD, Methylcyclopentadiene Dimer (MCDP Dimer), and co-dimers of these two cycloidiene with other hydrocarbons of similar molecular weight present, primarily cycloalkenes and aromatic hydrocarbons. The 10 CAS numbers are used to describe the nine process streams associated with the ethylene industry and associated manufacturing processes.</p> <p>More information on the Resin Oils and Cycloidiene Dimer Concentrates Category can be found in the American Chemistry Council, Olefins Panel test plan for this category (1).</p> <ol style="list-style-type: none"> Olefins Panel, HPV Implementation Task Group. 2001. High Production Volume (HPV) Chemical Challenge Program Test Plan For The Resin Oils and Cycloidiene Dimer Concentrates Category. American Chemistry Council, Olefins Panel, HPV Implementation Task Group. VA, USA. 	26742-00-4	4,7-Methano-1H-indene, 3a,4,7,7a-tetrahydrodimethyl-	68477-40-7	Distillates, petroleum, cracked stripped steam-cracked petroleum distillates, C10-12 fraction	68477-54-3	Distillates, petroleum, steam-cracked, C8-12 fraction	68477-53-2	Distillates, petroleum, steam-cracked, C5-12 fraction	68478-08-0	Naphtha, petroleum, light steam-cracked, C5-fraction, oligomer concentrate	68478-10-4	Naphtha, petroleum, light steam-cracked, debenzenized, C8-16-cycloalkadiene concentrate	68516-20-1	Naphtha, petroleum, steam-cracked middle aromatic	68527-24-2	Naphtha, petroleum, light steam-cracked aromatic, C5-12 cycloalkadiene fraction, polymers	68527-26-4	Naphtha, petroleum, light steam-cracked, debenzenized	68603-02-1	Distillates, petroleum, thermal cracked naphtha and gas oil, dimerized
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68603-02-1	Distillates, petroleum, thermal cracked naphtha and gas oil, dimerized																				

Conclusion:	The calculated vapor pressures for some representative constituents that are present in the category streams vary from 0.07 to 20.53 hPa @ 25°C. Measured vapor pressures for two of these same constituents vary from 3.05 to 19.0 hPa @ 25°C. Although this does not define the actual vapor pressures of the category streams, it offers an indication of a range that might be expected to encompass the vapor pressures of these complex streams with variable compositions. Vapor pressure outside of these ranges may be possible for some category streams.
Reliability:	(2) Reliable with restrictions The results include calculated data based on chemical structure as modeled by EPIWIN and measured data for specific chemicals as cited in the EPIWIN database. The data represent a potential vapor pressure range for substances represented by the 10 CAS numbers under <u>Test Substance</u> . This robust summary has a reliability rating of 2 because the data are not for specific substances in the Resin Oils and Cyclodiene Dimer Concentrates Category, but rather for selected constituents. These selected constituents represent all substances defined by this category and as such, this robust summary represents a "key study" for vapor pressure range based on constituent data.
Reference:	EPIWIN. 1999. Estimation Program Interface for Windows, version 3.04. Syracuse Research Corporation, Syracuse, NY, USA. (Vapor pressure values were calculated by the MPBPWIN subroutine and measured data came from the database in the computer program or from testing performed in conjunction with the test plan for this category.)
Other (source):	American Chemistry Council, Olefins Panel (Prepared 8/03)

* Other TS is a selection option under the Test Substance pick list that is in the IUCLID entry field for Vapor Pressure. Selecting this option refers the reader to information in the test substance "freetext" field to which the CAS numbers can be added.

ROBUST SUMMARY: RESIN OILS and CYCLODIENE DIMER CONCENTRATES

Partition Coefficient

Test Substance*:	Other TS [CAS # 26742-00-4; 68477-40-7; 68477-54-3; 68477-53-2; 68478-08-0; 68478-10-4; 68516-20-1; 68527-24-2; 68527-26-4; 68603-02-1]
Method/Guideline:	Calculated values using KOWWIN version 1.65, a subroutine of the computer program EPIWIN version 3.04
Year (guideline):	1999
Type (test type):	Not applicable
GLP:	Not applicable
Year (study performed):	Not applicable
Estimation Temperature:	25°C
Test Conditions: <ul style="list-style-type: none"> Note: Concentration prep., vessel type, replication, test conditions. 	Octanol / Water Partition Coefficient is calculated by the KOWWIN subroutine, which is based on an atom/fragment contribution method of W. Meylan and P. Howard in "Atom/fragment contribution method for estimating octanol-water partition coefficients". 1995. <i>J. Pharm. Sci.</i> 84:83-92.
Results: Units/Value: <ul style="list-style-type: none"> Note: Deviations from protocol or guideline, analytical method. 	<p>Calculated and measured log K_{ow} data for representative constituents of the Resin Oils and Cyclo diene Dimer Concentrates Category are listed below. The data identify a potential log K_{ow} range for substances represented by the 10 CAS numbers under <u>Test Substance</u>. Substances in this category do not have a specific log K_{ow} value. Actual log K_{ow} ranges for substances in this category will vary dependent on their constituent composition.</p> <p>Commercial substances in this category consist of complex hydrocarbon products with a carbon number distribution that is predominantly C8-C12 with some lower molecular weight constituents present. The predominant components are cycloalkenes and aromatic hydrocarbons. The five chemicals selected to represent the log K_{ow} range of this category are C8-C12 hydrocarbons that can be found in substances identified by the 10 CAS numbers. Constituents representing category members were selected on the basis of carbon number as identified by the category name, chemistry/structure, measured boiling point ranges for category substances, and olefinic process (distillation) knowledge.</p>

<p>Results: (continued)</p> <p>Units/Value:</p> <p>Note: Deviations from protocol or guideline, analytical method.</p>	<table border="1"> <thead> <tr> <th>Substance Constituent</th> <th>Calculated log K_{ow} @ 25°C</th> <th>Measured* log K_{ow} @ 25°C</th> </tr> </thead> <tbody> <tr> <td>vinyl toluene</td> <td>2.48</td> <td>na</td> </tr> <tr> <td>indene</td> <td>2.88</td> <td>na</td> </tr> <tr> <td>dicyclopentadiene</td> <td>3.16</td> <td>na</td> </tr> <tr> <td>methyindene</td> <td>3.42</td> <td>na</td> </tr> <tr> <td>methylcyclopentadiene dimer</td> <td>5.27</td> <td>5.5 to 5.7†</td> </tr> </tbody> </table> <p>* Experimental values from EPIWIN database. na = not available</p> <p>The data represent a potential log K_{ow} range for substances represented by the 10 CAS numbers under <u>Test Substance</u>.</p> <p>† Huntingdon Life Sciences, Ltd. 2003. Physicochemical Properties Study. EXN040/032421</p>	Substance Constituent	Calculated log K _{ow} @ 25°C	Measured* log K _{ow} @ 25°C	vinyl toluene	2.48	na	indene	2.88	na	dicyclopentadiene	3.16	na	methyindene	3.42	na	methylcyclopentadiene dimer	5.27	5.5 to 5.7†		
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<p>Test Substance:</p>	<p>The Resin Oils and Cyclodiene Dimer Concentrates Category includes the following CAS numbers:</p> <table border="0"> <tr> <td>26742-00-4</td> <td>4,7-Methano-1H-indene, 3a,4,7,7a-tetrahydrodimethyl-</td> </tr> <tr> <td>68477-40-7</td> <td>Distillates, petroleum, cracked stripped steam-cracked petroleum distillates, C10-12 fraction</td> </tr> <tr> <td>68477-54-3</td> <td>Distillates, petroleum, steam-cracked, C8-12 fraction</td> </tr> <tr> <td>68477-53-2</td> <td>Distillates, petroleum, steam-cracked, C5-12 fraction</td> </tr> <tr> <td>68478-08-0</td> <td>Naphtha, petroleum, light steam-cracked, C5-fraction, oligomer concentrate</td> </tr> <tr> <td>68478-10-4</td> <td>Naphtha, petroleum, light steam-cracked, debenzenized, C8-16-cycloalkadiene concentrate</td> </tr> <tr> <td>68516-20-1</td> <td>Naphtha, petroleum, steam-cracked middle aromatic</td> </tr> <tr> <td>68527-24-2</td> <td>Naphtha, petroleum, light steam-cracked aromatic, C5-12 cycloalkadiene fraction, polymers</td> </tr> <tr> <td>68527-26-4</td> <td>Naphtha, petroleum, light steam-cracked, debenzenized</td> </tr> <tr> <td>68603-02-1</td> <td>Distillates, petroleum, thermal cracked naphtha and gas oil, dimerized</td> </tr> </table> <p>The Resin Oils and Cyclodiene Dimer Concentrates Category was developed by grouping two Resin Oil streams, one relatively low in Dicyclopentadiene (DCPD), and a second that contains higher levels of the dimer. These Resin Oils have been further grouped with six other process streams that are concentrates of DCPD, Methylcyclopentadiene Dimer (MCDP Dimer), and co-dimers of these two cyclodienes with other hydrocarbons of similar molecular weight present, primarily cycloalkenes and aromatic hydrocarbons. The 10 CAS numbers are used to describe the nine process streams associated with the ethylene industry and associated manufacturing processes.</p> <p>More information on the Resin Oils and Cyclodiene Dimer Concentrates Category can be found in the American Chemistry Council, Olefins Panel test plan for this category (1).</p>	26742-00-4	4,7-Methano-1H-indene, 3a,4,7,7a-tetrahydrodimethyl-	68477-40-7	Distillates, petroleum, cracked stripped steam-cracked petroleum distillates, C10-12 fraction	68477-54-3	Distillates, petroleum, steam-cracked, C8-12 fraction	68477-53-2	Distillates, petroleum, steam-cracked, C5-12 fraction	68478-08-0	Naphtha, petroleum, light steam-cracked, C5-fraction, oligomer concentrate	68478-10-4	Naphtha, petroleum, light steam-cracked, debenzenized, C8-16-cycloalkadiene concentrate	68516-20-1	Naphtha, petroleum, steam-cracked middle aromatic	68527-24-2	Naphtha, petroleum, light steam-cracked aromatic, C5-12 cycloalkadiene fraction, polymers	68527-26-4	Naphtha, petroleum, light steam-cracked, debenzenized	68603-02-1	Distillates, petroleum, thermal cracked naphtha and gas oil, dimerized
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	1. Olefins Panel, HPV Implementation Task Group. 2001. High Production Volume (HPV) Chemical Challenge Program Test Plan For The Resin Oils and Cyclodiene Dimer Concentrates Category. American Chemistry Council, Olefins Panel, HPV Implementation Task Group. VA, USA.
Conclusion:	The calculated log K_{ow} for some representative constituents that are present in the category streams vary from 2.48 to 5.27 @ 25°C. The measured log K_{ow} of MCPD Dimer has been reported to range from 5.5 to 5.7 @ 25°C. Although this does not define the actual log K_{ow} of the category streams, it offers an indication of a range that might be expected to encompass the log K_{ow} of these complex streams with variable compositions. Log K_{ow} values outside of these ranges may be possible for some category streams.
Reliability:	(2) Reliable with restrictions The results include calculated data based on chemical structure as modeled by EPIWIN and measured data for specific chemicals as cited in the EPIWIN database. The data represent a potential log K_{ow} range for substances represented by the 10 CAS numbers under <u>Test Substance</u> . This robust summary has a reliability rating of 2 because the data are not for specific substances in the Resin Oils and Cyclodiene Dimer Concentrates Category, but rather for selected constituents. These selected constituents represent all substances defined by this category and as such, this robust summary represents a "key study" for log K_{ow} range based on constituent data.
Reference:	EPIWIN. 1999. Estimation Program Interface for Windows, version 3.04. Syracuse Research Corporation, Syracuse, NY, USA. (Log K_{ow} values were calculated by the KOWWIN subroutine and measured data came from the database in the computer program.)
Other (source):	American Chemistry Council, Olefins Panel (Prepared 8/03)

* Other TS is a selection option under the Test Substance pick list that is in the IUCLID entry field for Partition Coefficient. Selecting this option refers the reader to information in the test substance "freetext" field to which the CAS numbers can be added.

ROBUST SUMMARY: RESIN OILS and CYCLODIENE DIMER CONCENTRATES

Water Solubility

Test Substance*:	Other TS [CAS # 26742-00-4; 68477-40-7; 68477-54-3; 68477-53-2; 68478-08-0; 68478-10-4; 68516-20-1; 68527-24-2; 68527-26-4; 68603-02-1]
Method/Guideline:	Calculated values using WSKOWWIN version 1.36, a subroutine of the computer program EPIWIN version 3.04
Year (guideline):	1999
Type (test type):	Not applicable
GLP:	Not applicable
Year (study performed):	Not applicable
Estimation Temperature:	25°C
Test Conditions: <ul style="list-style-type: none"> Note: Concentration prep., vessel type, replication, test conditions. 	Water Solubility is calculated by the WSKOWWIN subroutine, which is based on a Kow correlation method described by W. Meylan, P. Howard and R. Boethling in "Improved method for estimating water solubility from octanol/water partition coefficient". <i>Environ. Toxicol. Chem.</i> 15:100-106. 1995.
Results: Units/Value: <ul style="list-style-type: none"> Note: Deviations from protocol or guideline, analytical method. 	<p>Calculated water solubility data for representative constituents of the Resin Oils and CycloDiene Dimer Concentrates Category are listed below. The data identify a potential water solubility range for substances represented by the 10 CAS numbers under <u>Test Substance</u>. Substances in this category do not have a specific water solubility value. Actual water solubility ranges for substances in this category will vary dependent on their loading rate (i.e., weight of test material added to a volume of water).</p> <p>Commercial substances in this category consist of complex hydrocarbon products with a carbon number distribution that is predominantly C8-C12 with some lower molecular weight constituents present. The predominant components are cycloalkenes and aromatic hydrocarbons. The five chemicals selected to represent the water solubility range of this category are C8-C12 hydrocarbons that can be found in substances identified by the 10 CAS numbers. Constituents representing category members were selected on the basis of carbon number as identified by the category name, chemistry/structure, measured boiling point ranges for category substances, and olefinic process (distillation) knowledge.</p>

<p>Results: (continued)</p> <p>Units/Value:</p> <p>Note: Deviations from protocol or guideline, analytical method.</p>	<table border="1"> <thead> <tr> <th>Substance Constituent</th> <th>Calculated WS (mg/L @ 25°C)</th> <th>Measured WS* (mg/L @ 25°C)</th> </tr> </thead> <tbody> <tr> <td>vinyl toluene</td> <td>935.0</td> <td>na</td> </tr> <tr> <td>indene</td> <td>372.1</td> <td>na</td> </tr> <tr> <td>dicyclopentadiene</td> <td>51.9</td> <td>na</td> </tr> <tr> <td>methyldiene</td> <td>112.7</td> <td>na</td> </tr> <tr> <td>methylcyclopentadiene dimer</td> <td>0.62</td> <td>na</td> </tr> </tbody> </table> <p>* Experimental values from EPIWIN database. na = not available The data represent a potential water solubility range for substances represented by the 10 CAS numbers under <u>Test Substance</u>.</p>	Substance Constituent	Calculated WS (mg/L @ 25°C)	Measured WS* (mg/L @ 25°C)	vinyl toluene	935.0	na	indene	372.1	na	dicyclopentadiene	51.9	na	methyldiene	112.7	na	methylcyclopentadiene dimer	0.62	na		
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<p>Test Substance:</p>	<p>The Resin Oils and Cycloidiene Dimer Concentrates Category includes the following CAS numbers:</p> <table border="0"> <tr> <td>26742-00-4</td> <td>4,7-Methano-1H-indene, 3a,4,7,7a-tetrahydrodimethyl-</td> </tr> <tr> <td>68477-40-7</td> <td>Distillates, petroleum, cracked stripped steam-cracked petroleum distillates, C10-12 fraction</td> </tr> <tr> <td>68477-54-3</td> <td>Distillates, petroleum, steam-cracked, C8-12 fraction</td> </tr> <tr> <td>68477-53-2</td> <td>Distillates, petroleum, steam-cracked, C5-12 fraction</td> </tr> <tr> <td>68478-08-0</td> <td>Naphtha, petroleum, light steam-cracked, C5-fraction, oligomer concentrate</td> </tr> <tr> <td>68478-10-4</td> <td>Naphtha, petroleum, light steam-cracked, debenzenized, C8-16-cycloalkadiene concentrate</td> </tr> <tr> <td>68516-20-1</td> <td>Naphtha, petroleum, steam-cracked middle aromatic</td> </tr> <tr> <td>68527-24-2</td> <td>Naphtha, petroleum, light steam-cracked aromatic, C5-12 cycloalkadiene fraction, polymers</td> </tr> <tr> <td>68527-26-4</td> <td>Naphtha, petroleum, light steam-cracked, debenzenized</td> </tr> <tr> <td>68603-02-1</td> <td>Distillates, petroleum, thermal cracked naphtha and gas oil, dimerized</td> </tr> </table> <p>The Resin Oils and Cycloidiene Dimer Concentrates Category was developed by grouping two Resin Oil streams, one relatively low in Dicyclopentadiene (DCPD), and a second that contains higher levels of the dimer. These Resin Oils have been further grouped with six other process streams that are concentrates of DCPD, Methylcyclopentadiene Dimer (MCDP Dimer), and co-dimers of these two cycloidiene with other hydrocarbons of similar molecular weight present, primarily cycloalkenes and aromatic hydrocarbons. The 10 CAS numbers are used to describe the nine process streams associated with the ethylene industry and associated manufacturing processes.</p> <p>More information on the Resin Oils and Cycloidiene Dimer Concentrates Category can be found in the American Chemistry Council, Olefins Panel test plan for this category (1).</p> <ol style="list-style-type: none"> 1. Olefins Panel, HPV Implementation Task Group. 2001. High Production Volume (HPV) Chemical Challenge Program Test Plan For The Resin Oils and Cycloidiene Dimer Concentrates 	26742-00-4	4,7-Methano-1H-indene, 3a,4,7,7a-tetrahydrodimethyl-	68477-40-7	Distillates, petroleum, cracked stripped steam-cracked petroleum distillates, C10-12 fraction	68477-54-3	Distillates, petroleum, steam-cracked, C8-12 fraction	68477-53-2	Distillates, petroleum, steam-cracked, C5-12 fraction	68478-08-0	Naphtha, petroleum, light steam-cracked, C5-fraction, oligomer concentrate	68478-10-4	Naphtha, petroleum, light steam-cracked, debenzenized, C8-16-cycloalkadiene concentrate	68516-20-1	Naphtha, petroleum, steam-cracked middle aromatic	68527-24-2	Naphtha, petroleum, light steam-cracked aromatic, C5-12 cycloalkadiene fraction, polymers	68527-26-4	Naphtha, petroleum, light steam-cracked, debenzenized	68603-02-1	Distillates, petroleum, thermal cracked naphtha and gas oil, dimerized
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68527-26-4	Naphtha, petroleum, light steam-cracked, debenzenized																				
68603-02-1	Distillates, petroleum, thermal cracked naphtha and gas oil, dimerized																				

	Category. American Chemistry Council, Olefins Panel, HPV Implementation Task Group. VA, USA.
Conclusion:	The calculated water solubility for some representative constituents that are present in the category streams vary from 0.62 to 935.0 mg/L @ 25°C. Measured water solubility data for these same constituents were not available. Although this does not define the actual water solubility of the category streams, it offers an indication of a range that might be expected to encompass the water solubility of these complex streams with variable compositions. Water solubilities outside of these ranges may be possible for some category streams.
Reliability:	(2) Reliable with restrictions The results include calculated data based on chemical structure as modeled by EPIWIN. The data represent a potential water solubility range for substances represented by the 10 CAS numbers under <u>Test Substance</u> . This robust summary has a reliability rating of 2 because the data are not for specific substances in the Resin Oils and Cyclodiene Dimer Concentrates Category, but rather for selected constituents. These selected constituents represent all substances defined by this category and as such, this robust summary represents a "key study" for water solubility range based on constituent data.
Reference:	EPIWIN. 1999. Estimation Program Interface for Windows, version 3.04. Syracuse Research Corporation, Syracuse, NY, USA. (Water solubility values were calculated by the WSKOWWIN subroutine.)
Other (source):	American Chemistry Council, Olefins Panel (Prepared 8/03)

* Other TS is a selection option under the Test Substance pick list that is in the IUCLID entry field for Water Solubility. Selecting this option refers the reader to information in the test substance "freetext" field to which the CAS numbers can be added.

ROBUST SUMMARY: RESIN OILS and CYCLODIENE DIMER CONCENTRATES

Photodegradation (Direct)

Test Substance*:	Other TS [CAS # 26742-00-4; 68477-40-7; 68477-54-3; 68477-53-2; 68478-08-0; 68478-10-4; 68516-20-1; 68527-24-2; 68527-26-4; 68603-02-1]
Method/Guideline:	Other: Technical discussion
Year (guideline):	Not applicable
GLP (Y/N):	Not applicable
Year (study performed):	Not applicable
Type (air, soil, water, other):	Water
Light Source:	Not applicable
Light Spectrum: • Wave length value (upper/lower)	Not applicable
Relative Intensity:	Not applicable
Test Substance Spectrum:	Not applicable
Test Conditions: • Note: Concentration, temperature, test system type, replication, deviations from guideline or protocol	Not applicable
Direct Photolysis**: • Results: half-life, % degradation, quantum yield	<p><u>Summary</u></p> <p>In the environment, direct photolysis will not significantly contribute to the degradation of constituent chemicals in the Resin Oils and Cyclodiene Dimer Concentrates Category. The Resin Oils and Cyclodiene Dimer Concentrates Category includes nine process streams:</p> <ul style="list-style-type: none"> • High DCPD Resin Oils • Low DCPD Resin Oils • Resin Former • Dicyclopentadiene (DCPD) Concentrate • DCPD, High Purity • DCPD Purge Stream • Methylcyclopentadiene (MCPD) Dimer • DCPD Stream • DCPD/Codimer Concentrate <p>As discussed below, the reaction process involved in direct photolysis occurs when sufficient light energy excites a molecule to the degree that a structural transformation occurs. In general, substances in this</p>

category do not contain component chemicals that will undergo direct photolysis.

The Resin Oils and Cyclodiene Dimer Concentrates Category

A process stream is a mixture of chemicals that arises from a chemical reaction or separation activity. The category includes hydrocarbon process streams consisting predominantly of the same higher-boiling hydrocarbons, mostly cycloalkenes and aromatics, but at varying concentrations. Ten CAS numbers (see Test Substance) identify products derived from these process streams. This grouping of CAS numbers represents hydrocarbon streams with a carbon number distribution that is predominantly C8-C12 with some lower molecular weight constituents present. The predominant components are cycloalkenes and aromatic hydrocarbons. That is why this group is considered a category for purposes of the High Production Volume (HPV) Chemical Program, and designated Resin Oils and Cyclodiene Dimer Concentrates.

The definitions found in the TSCA Chemical Substance Inventory for the CAS numbers included in this group are vague with respect to composition. Therefore, it is possible to find that the same CAS number is correctly used to describe different streams (compositions) or that two or more different CAS numbers are used to describe the same stream (composition or process).

More information on the Resin Oils and Cyclodiene Dimer Concentrates Category can be found in the American Chemistry Council, Olefins Panel test plan for this category (1). The plan is available on the U.S. Environmental Protection Agency website under the HPV Chemical Program. A brief description of the production and composition of the nine process streams in this category are:

- **High DCPD Resin Oils:** This stream typically contains about 55% DCPD, and significant levels of vinyl aromatics and codimers of cyclopentadiene with other monomers such as isoprene, pentadiene and methylcyclopentadiene. The highest boiling component in the stream is normally naphthalene and it is present usually at less than about 0.5%.
- **Low DCPD Resin Oils:** This stream consists of components that are similar to those found in the High DCPD stream (vinyl aromatics) with the exception that DCPD and the codimers are present only at very low levels (typically <1% DCPD).
- **Resin Former:** A participant in the Panel's HPV program who processes resin oil from various ethylene units produces this stream. It is most similar to the Low DCPD stream, with typical DCPD content reported as about 6.7%.
- **DCPD Concentrate:** is produced from the Pyrolysis C5 Fraction by a combination of distillation and heat soak (dimerization) unit operations. DCPD content of the stream is typically 75% with the balance predominantly codimers of cyclopentadiene with other C5 monomers. The stream typically contains relatively low levels of low boiling hydrocarbons (C5 to C8).

- **DCPD, High Purity:** Dicyclopentadiene can be purified to about 95% by a combination of thermal and distillation unit operations. The main impurities remaining in the stream are codimers and trimers of cyclopentadiene.
- **DCPD Purge Stream:** The DCPD Purge Stream results from the distillation process that separates the DCPD/Codimer Concentrate stream and the MCPD Dimer stream from the C8+ fraction of a thermally-processed pyrolysis gasoline. The DCPD Purge Stream typically contains 18% DCPD, with the balance largely codimers and C8 aliphatics and aromatics.
- **MCPD Dimer:** this stream is isolated by distillation from the C8+ fraction of a thermally processed pyrolysis gasoline. Typical purity is 90% as the dimer and the main impurities in the stream are codimers and trimers of DCPD and MCPD.
- **DCPD Stream:** this stream is produced as the bottoms from a distillation tower that is charged with a DCPD-containing stream together with the heavy ends and raffinate from an isoprene extractive distillation unit. This stream is reported to contain about 50% DCPD, with the balance being largely C5s, both saturates and unsaturates.
- **DCPD/Codimer Concentrate:** this stream is isolated by distillation from the C8+ fraction of a thermally processed pyrolysis gasoline. This stream typically contains about 40% DCPD with the balance primarily codimers of cyclopentadiene with piperylene, butadiene and methylcyclopentadiene.

Photolysis of Hydrocarbons

The direct photolysis of an organic molecule occurs when it absorbs sufficient light energy to result in a structural transformation (2). The reaction process is initiated when light energy in a specific wavelength range elevates a molecule to an electronically excited state. However, the excited state is competitive with various deactivation processes that can result in the return of the molecule to a non excited state.

The absorption of light in the ultra violet (UV)-visible range, 110-750 nm, can result in the electronic excitation of an organic molecule. Light in this range contains energy of the same order of magnitude as covalent bond dissociation energies (2). Higher wavelengths (e.g. infrared) result only in vibrational and rotational transitions, which do not tend to produce structural changes to a molecule.

The stratospheric ozone layer prevents UV light of less than 290 nm from reaching the earth's surface. Therefore, only light at wavelengths between 290 and 750 nm can result in photochemical transformations in the environment (2). Although the absorption of UV light in the 290-750 nm range is necessary, it is not always sufficient for a chemical to undergo photochemical degradation. Energy may be re-emitted from an excited molecule by mechanisms other than chemical transformation, resulting in no change to the parent molecule.

A conservative approach to estimating a photochemical degradation rate is to assume that degradation will occur in proportion to the amount

	<p>of light wavelengths >290 nm absorbed by the molecule (3). Saturated hydrocarbons do not absorb light above 200 nm. Some characteristic absorbance maxima (λ_{max}) and associated molar absorptivities (ϵ) for selected unsaturated hydrocarbons are shown below (2):</p> <table border="1"> <thead> <tr> <th rowspan="2"><u>Hydrocarbon</u></th> <th colspan="2">λ below 290 nm</th> <th colspan="2">λ above 290 nm</th> </tr> <tr> <th>λ_{max}</th> <th>ϵ</th> <th>λ_{max}</th> <th>ϵ</th> </tr> </thead> <tbody> <tr> <td>Ethylene</td> <td>193</td> <td>10,000</td> <td>-</td> <td>-</td> </tr> <tr> <td>Benzene</td> <td>255</td> <td>215</td> <td>-</td> <td>-</td> </tr> <tr> <td>Naphthalene</td> <td>221</td> <td>100,000</td> <td>311</td> <td>250</td> </tr> <tr> <td rowspan="2">Styrene</td> <td>270</td> <td>5,000</td> <td></td> <td></td> </tr> <tr> <td>244</td> <td>12,000</td> <td></td> <td></td> </tr> <tr> <td></td> <td>282</td> <td>450</td> <td></td> <td></td> </tr> </tbody> </table> <p>Olefins with one double bond, or two conjugated double bonds, which constitute the majority of the chemicals in the Resin Oils and Cyclodiene Dimer Concentrates Category, do not absorb appreciable light energy above 290 nm. The absorption of UV light to cause cis-trans isomerization about the double bond of an olefin occurs only if it is in conjugation with an aromatic ring (2).</p> <p>Products in the Resin Oils and Cyclodiene Dimer Concentrates Category do not contain component molecules that will undergo direct photolysis. Therefore, this fate process will not contribute to a measurable degradative removal of chemical components in this category from the environment.</p>	<u>Hydrocarbon</u>	λ below 290 nm		λ above 290 nm		λ_{max}	ϵ	λ_{max}	ϵ	Ethylene	193	10,000	-	-	Benzene	255	215	-	-	Naphthalene	221	100,000	311	250	Styrene	270	5,000			244	12,000				282	450		
<u>Hydrocarbon</u>	λ below 290 nm		λ above 290 nm																																				
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<p>Indirect Photolysis**:</p> <ul style="list-style-type: none"> • Results: type of sensitizer, concentration of sensitizer, rate constant, % degradation, half-life 	<p>Not applicable</p>																																						
<p>Degradation Products**:</p> <ul style="list-style-type: none"> • Note: Identification, concentration 	<p>Unknown</p>																																						

Test Substance:	<p>The Resin Oils and Cyclo diene Dimer Concentrates Category includes the following CAS numbers:</p> <p>26742-00-4 4,7-Methano-1H-indene, 3a,4,7,7a-tetrahydrodimethyl- 68477-40-7 Distillates, petroleum, cracked stripped steam-cracked petroleum distillates, C10-12 fraction</p> <p>68477-54-3 Distillates, petroleum, steam-cracked, C8-12 fraction 68477-53-2 Distillates, petroleum, steam-cracked, C5-12 fraction 68478-08-0 Naphtha, petroleum, light steam-cracked, C5-fraction, oligomer concentrate</p> <p>68478-10-4 Naphtha, petroleum, light steam-cracked, debenzenized, C8-16-cycloalkadiene concentrate</p> <p>68516-20-1 Naphtha, petroleum, steam-cracked middle aromatic 68527-24-2 Naphtha, petroleum, light steam-cracked aromatic, C5-12 cycloalkadiene fraction, polymers</p> <p>68527-26-4 Naphtha, petroleum, light steam-cracked, debenzenized 68603-02-1 Distillates, petroleum, thermal cracked naphtha and gas oil, dimerized</p>
Conclusion:	Not applicable
Reliability:	These data represent a key study for characterizing the potential of substances in the Resin Oils and Cyclo diene Dimer Concentrates Category to undergo direct photodegradation.
Reference:	American Chemistry Council, Olefins Panel. 2003. Photodegradation (Direct): Resin Oils and Cyclo diene Dimer Concentrates Category. Rosslyn, VA, USA.
Other (source):	American Chemistry Council, Olefins Panel (Prepared 8/03)

* Other TS is a selection option under the Test Substance pick list that is in the IUCLID entry field for Photodegradation (Direct). Selecting this option refers the reader to information in the test substance "freetext" field to which the CAS numbers can be added.

ROBUST SUMMARY: RESIN OILS and CYCLODIENE DIMER CONCENTRATES

Photodegradation (Indirect)

Test Substance*:	Other TS [CAS # 26742-00-4; 68477-40-7; 68477-54-3; 68477-53-2; 68478-08-0; 68478-10-4; 68516-20-1; 68527-24-2; 68527-26-4; 68603-02-1]
Method/Guideline:	Calculated values using AOPWIN version 1.89, a subroutine of the computer program EPIWIN version 3.04
Year (guideline):	1999
GLP (Y/N):	Not applicable
Year (study performed):	Not applicable
Type (air, soil, water, other):	Not applicable
Light Source:	Sunlight
Light Spectrum: • Wave length value (upper/lower)	Natural sunlight
Relative Intensity:	1
Test Substance Spectrum:	Not applicable
Test Conditions: • Note: Concentration, temperature, test system type, replication, deviations from guideline or protocol	Indirect photodegradation, or atmospheric oxidation potential, is based on the structure-activity relationship methods developed by R. Atkinson. Temperature: 25°C Sensitizer: OH radical Concentration of Sensitizer: 1.5 E ⁶ OH radicals/cm ³
Direct Photolysis**: Results: half-life, % degradation, quantum yield	Not applicable
Indirect Photolysis**: • Results: type of sensitizer, concentration of sensitizer, rate constant, % degradation, half-life	<u>The Resin Oils and Cyclo diene Dimer Concentrates Category</u> The Resin Oils and Cyclo diene Dimer Concentrates Category was developed by grouping two Resin Oil streams, one relatively low in Dicyclopentadiene (DCPD), and a second that contains higher levels of the dimer. These Resin Oils have been further grouped with six other process streams that are concentrates of DCPD, Methylcyclopentadiene Dimer (MCDP Dimer), and co-dimers of these two cyclo dienes with other hydrocarbons of similar molecular weight present. Commercial substances in this category consist of complex hydrocarbon products with a carbon number distribution that is predominantly C8-C12 with some lower molecular weight constituents present. The predominant components are cycloalkenes and aromatic hydrocarbons. That is why this group

is considered a category for purposes of the High Production Volume (HPV) Chemical Program, and designated Resin Oils and Cyclodiene Dimer Concentrates.

The five chemicals selected to represent the atmospheric oxidation potential of this category are C8-C12 hydrocarbons that can be found in substances identified by the 10 CAS numbers.

Constituents representing category members were selected on the basis of carbon number as identified by the category name, chemistry/structure, measured boiling point ranges for category substances, and olefinic process (distillation) knowledge.

Atmospheric Oxidation of Hydrocarbons

In the environment, organic chemicals emitted into the troposphere are degraded by several important transformation processes. The dominant transformation process for most compounds is the daylight reaction with hydroxyl (OH-) radicals (Atkinson, 1988, 1989). The rate at which an organic compound reacts with OH-radicals is a direct measure of its atmospheric persistence (Meylan and Howard, 1993).

AOPWIN estimates the rate constant for the atmospheric, gas-phase reaction between photochemically produced hydroxyl radicals and organic chemicals. The rate constants estimated by the program are then used to calculate atmospheric half-lives for organic compounds based upon average atmospheric concentrations of hydroxyl radicals.

Since the reactions only take place in the presence of sunlight, the atmospheric half-lives are normalized for a 12-hour day.

<u>Chemical</u>	<u>Calculated* half-life (hrs)</u>	<u>OH- Rate Constant (cm³/molecule-sec)</u>
vinyl toluene	44.5	2.9 E ⁻¹²
indene	53.0	2.4 E ⁻¹²
dicyclopentadiene	1.1	119.2 E ⁻¹²
methylindene	50.2	2.6 E ⁻¹²
methylcyclopentadiene dimer	0.7	173.1 E ⁻¹²

* Atmospheric half-life values are based on a 12-hr day.

More information on the Resin Oils and Cyclodiene Dimer Concentrates Category can be found in the American Chemistry Council, Olefins Panel test plan for this category (Olefins Panel, 2001).

References:

1. Atkinson, R. 1988. Estimation of gas-phase hydroxyl radical rate constants for organic chemicals. *Environ. Toxicol. Chem.* **7**:435-442.
2. Atkinson, R. 1989. Kinetics and mechanisms of the gas-phase reactions of the hydroxyl radical with organic

	<p>compounds. J. Phys. Chem. Ref. Data Monograph No. 1, Amer. Inst. Physics & Amer. Chem. Soc., NY.</p> <p>3. Meylan, W.M. and P.H. Howard. 1993. Computer estimation of the atmospheric gas-phase reaction rate of organic compounds with hydroxyl radicals and ozone. <i>Chemosphere</i> 12:2293-2299.</p> <p>4. Olefins Panel, HPV Implementation Task Group. 2001. High Production Volume (HPV) Chemical Challenge Program Test Plan For The Resin Oils and Cyclo diene Dimer Concentrates Category. American Chemistry Council, Olefins Panel, HPV Implementation Task Group. VA, USA.</p>
<p>Degradation Products**:</p> <ul style="list-style-type: none"> Note: Identification, concentration 	Unknown
<p>Test Substance:</p>	<p>The Resin Oils and Cyclo diene Dimer Concentrates Category includes the following CAS numbers:</p> <p>26742-00-4 4,7-Methano-1H-indene, 3a,4,7,7a-tetrahydrodimethyl-</p> <p>68477-40-7 Distillates, petroleum, cracked stripped steam-cracked petroleum distillates, C10-12 fraction</p> <p>68477-54-3 Distillates, petroleum, steam-cracked, C8-12 fraction</p> <p>68477-53-2 Distillates, petroleum, steam-cracked, C5-12 fraction</p> <p>68478-08-0 Naphtha, petroleum, light steam-cracked, C5-fraction, oligomer concentrate</p> <p>68478-10-4 Naphtha, petroleum, light steam-cracked, debenzenized, C8-16-cycloalkadiene concentrate</p> <p>68516-20-1 Naphtha, petroleum, steam-cracked middle aromatic</p> <p>68527-24-2 Naphtha, petroleum, light steam-cracked aromatic, C5-12 cycloalkadiene fraction, polymers</p> <p>68527-26-4 Naphtha, petroleum, light steam-cracked, debenzenized</p> <p>68603-02-1 Distillates, petroleum, thermal cracked naphtha and gas oil, dimerized</p>
<p>Conclusion:</p>	<p>Atmospheric oxidation via hydroxyl radicals can be a significant route of degradation for products in this category. Based on calculated values, products in this category can have an atmospheric half-life range of 0.7 to 53 hours as a result of indirect photolysis by hydroxyl radical attack.</p>
<p>Reliability:</p>	<p>(2) Reliable with restrictions</p> <p>The results include calculated data based on chemical structure as modeled by AOPWIN. The data represent a potential atmospheric half-life range for substances represented by the 10 CAS numbers under <u>Test Substance</u>. This robust summary has a reliability rating of 2 because the data are not for specific substances in the Resin Oils and Cyclo diene Dimer Concentrates Category, but rather for selected constituents. These selected constituents represent all substances defined by this category and as such, this robust summary represents a "key study" for atmospheric half-life range based on constituent data.</p>

Reference:	Meylan, M., SRC 1994-1999. AOPWIN is contained in the computer program EPIWIN. 1999. Estimation Program Interface for Windows, version 3.04. Syracuse Research Corporation, Syracuse, NY, USA.
Other (source):	American Chemistry Council, Olefins Panel (Prepared 10/03)

* Other TS is a selection option under the Test Substance pick list that is in the IUCLID entry field for Photodegradation (Indirect). Selecting this option refers the reader to information in the test substance "freetext" field to which the CAS numbers can be added.

** In IUCLID, provide additional discussion if needed in the results freetext

ROBUST SUMMARY: RESIN OILS and CYCLODIENE DIMER CONCENTRATES

Hydrolysis (Stability in Water)

Test Substance*:	Other TS [CAS # 26742-00-4; 68477-40-7; 68477-54-3; 68477-53-2; 68478-08-0; 68478-10-4; 68516-20-1; 68527-24-2; 68527-26-4; 68603-02-1]																				
Method/Guideline:	Other: Technical discussion																				
Year (guideline):	Not applicable																				
Type (test type):	Not applicable																				
GLP (Y/N):	Not applicable																				
Year (study performed):	Not applicable																				
Analytical Monitoring:	Not applicable																				
Test Conditions: <ul style="list-style-type: none"> Note: Concentration preparation, vessel type, volume, replication, deviations from guideline or protocol 	Not applicable																				
Results: Units/Value: <ul style="list-style-type: none"> Note: Analytical method, observations, half-lives by pH, degradation products 	Not applicable																				
Test Substance:	<p>The Resin Oils and CycloDiene Dimer Concentrates Category includes the following CAS numbers:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;">26742-00-4</td> <td>4,7-Methano-1H-indene, 3a,4,7,7a-tetrahydrodimethyl-</td> </tr> <tr> <td>68477-40-7</td> <td>Distillates, petroleum, cracked stripped steam-cracked petroleum distillates, C10-12 fraction</td> </tr> <tr> <td>68477-54-3</td> <td>Distillates, petroleum, steam-cracked, C8-12 fraction</td> </tr> <tr> <td>68477-53-2</td> <td>Distillates, petroleum, steam-cracked, C5-12 fraction</td> </tr> <tr> <td>68478-08-0</td> <td>Naphtha, petroleum, light steam-cracked, C5-fraction, oligomer concentrate</td> </tr> <tr> <td>68478-10-4</td> <td>Naphtha, petroleum, light steam-cracked, debenzenized, C8-16-cycloalkadiene concentrate</td> </tr> <tr> <td>68516-20-1</td> <td>Naphtha, petroleum, steam-cracked middle aromatic</td> </tr> <tr> <td>68527-24-2</td> <td>Naphtha, petroleum, light steam-cracked aromatic, C5-12 cycloalkadiene fraction, polymers</td> </tr> <tr> <td>68527-26-4</td> <td>Naphtha, petroleum, light steam-cracked, debenzenized</td> </tr> <tr> <td>68603-02-1</td> <td>Distillates, petroleum, thermal cracked naphtha and gas oil, dimerized</td> </tr> </table> <p>The Resin Oils and CycloDiene Dimer Concentrates Category was developed by grouping two Resin Oil streams, one relatively low in Dicyclopentadiene (DCPD), and a second that contains higher levels of</p>	26742-00-4	4,7-Methano-1H-indene, 3a,4,7,7a-tetrahydrodimethyl-	68477-40-7	Distillates, petroleum, cracked stripped steam-cracked petroleum distillates, C10-12 fraction	68477-54-3	Distillates, petroleum, steam-cracked, C8-12 fraction	68477-53-2	Distillates, petroleum, steam-cracked, C5-12 fraction	68478-08-0	Naphtha, petroleum, light steam-cracked, C5-fraction, oligomer concentrate	68478-10-4	Naphtha, petroleum, light steam-cracked, debenzenized, C8-16-cycloalkadiene concentrate	68516-20-1	Naphtha, petroleum, steam-cracked middle aromatic	68527-24-2	Naphtha, petroleum, light steam-cracked aromatic, C5-12 cycloalkadiene fraction, polymers	68527-26-4	Naphtha, petroleum, light steam-cracked, debenzenized	68603-02-1	Distillates, petroleum, thermal cracked naphtha and gas oil, dimerized
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	<p>the dimer. These Resin Oils have been further grouped with six other process streams that are concentrates of DCPD, Methylcyclopentadiene Dimer (MCDP Dimer), and co-dimers of these two cyclodienes with other hydrocarbons of similar molecular weight present, primarily cycloalkenes and aromatic hydrocarbons. The 10 CAS numbers are used to describe the nine process streams associated with the ethylene industry and associated manufacturing processes.</p> <p>More information on the Resin Oils and Cyclodiene Dimer Concentrates Category can be found in the American Chemistry Council, Olefins Panel test plan for this category (1).</p> <ol style="list-style-type: none"> 1. Olefins Panel, HPV Implementation Task Group. 2001. High Production Volume (HPV) Chemical Challenge Program Test Plan For The Resin Oils and Cyclodiene Dimer Concentrates Category. American Chemistry Council, Olefins Panel, HPV Implementation Task Group. VA, USA.
<p>Conclusion:</p>	<p><u>Summary</u></p> <p>In the environment, hydrolysis will not contribute to the degradation of constituent chemicals in the Resin Oils and Cyclodiene Dimer Concentrates Category. Resin Oils and Cyclodiene Dimer Concentrates Category includes nine process streams:</p> <ul style="list-style-type: none"> • High DCPD Resin Oils • Low DCPD Resin Oils • Resin Former • Dicyclopentadiene (DCPD) Concentrate • DCPD, High Purity • DCPD Purge Stream • Methylcyclopentadiene (MCPD) Dimer • DCPD Stream • DCPD/Codimer Concentrate <p>As discussed below, the chemicals in these streams are composed of carbon and hydrogen and are not amenable to hydrolysis because of their molecular structure and the chemical reaction required for this type of transformation to occur.</p> <p><u>The Resin Oils and Cyclodiene Dimer Concentrates Category</u></p> <p>A process stream is a mixture of chemicals that arises from a chemical reaction or separation activity. The category includes hydrocarbon process streams consisting predominantly of the same higher-boiling hydrocarbons, mostly cycloalkenes and aromatics, but at varying concentrations. Ten CAS numbers (see <u>Test Substance</u>) identify products derived from these process streams. This grouping of CAS numbers represents hydrocarbon streams with a carbon number distribution that is predominantly C8-C12 with some lower molecular weight constituents present. The predominant components are cycloalkenes and aromatic hydrocarbons. That is why this group is considered a category for purposes of the High Production Volume (HPV) Chemical Program, and designated <u>Resin Oils and Cyclodiene Dimer Concentrates</u>.</p> <p>The definitions found in the TSCA Chemical Substance Inventory for</p>

the CAS numbers included in this group are vague with respect to composition. Therefore, it is possible to find that the same CAS number is correctly used to describe different streams (compositions) or that two or more different CAS numbers are used to describe the same stream (composition or process).

More information on the Resin Oils and Cycloaddition Dimer Concentrates Category can be found in the American Chemistry Council, Olefins Panel test plan for this category (1). The plan is available on the U.S. Environmental Protection Agency website under the HPV Chemical Program. A brief description of the production and composition of the nine process streams in this category are:

- **High DCPD Resin Oils:** This stream typically contains about 55% DCPD, and significant levels of vinyl aromatics and codimers of cyclopentadiene with other monomers such as isoprene, pentadiene and methylcyclopentadiene. The highest boiling component in the stream is normally naphthalene and it is present usually at less than about 0.5%.
- **Low DCPD Resin Oils:** This stream consists of components that are similar to those found in the High DCPD stream (vinyl aromatics) with the exception that DCPD and the codimers are present only at very low levels (typically <1% DCPD).
- **Resin Former:** A participant in the Panel's HPV program who processes resin oil from various ethylene units produces this stream. It is most similar to the Low DCPD stream, with typical DCPD content reported as about 6.7%.
- **DCPD Concentrate:** is produced from the Pyrolysis C5 Fraction by a combination of distillation and heat soak (dimerization) unit operations. DCPD content of the stream is typically 75% with the balance predominantly codimers of cyclopentadiene with other C5 monomers. The stream typically contains relatively low levels of low boiling hydrocarbons (C5 to C8).
- **DCPD, High Purity:** Dicyclopentadiene can be purified to about 95% by a combination of thermal and distillation unit operations. The main impurities remaining in the stream are codimers and trimers of cyclopentadiene.
- **DCPD Purge Stream:** The DCPD Purge Stream results from the distillation process that separates the DCPD/Codimer Concentrate stream and the MCPD Dimer stream from the C8+ fraction of a thermally-processed pyrolysis gasoline. The DCPD Purge Stream typically contains 18% DCPD, with the balance largely codimers and C8 aliphatics and aromatics.
- **MCPD Dimer:** this stream is isolated by distillation from the C8+ fraction of a thermally processed pyrolysis gasoline. Typical purity is 90% as the dimer and the main impurities in the stream are codimers and trimers of DCPD and MCPD.
- **DCPD Stream:** this stream is produced as the bottoms from a distillation tower that is charged with a DCPD-containing stream together with the heavy ends and raffinate from an isoprene

	<p>extractive distillation unit. This stream is reported to contain about 50% DCPD, with the balance being largely C5s, both saturates and unsaturates.</p> <ul style="list-style-type: none"> • DCPD/Codimer Concentrate: this stream is isolated by distillation from the C8+ fraction of a thermally processed pyrolysis gasoline. This stream typically contains about 40% DCPD with the balance primarily codimers of cyclopentadiene with piperylene, butadiene and methylcyclopentadiene.
	<p><u>Hydrolysis of Hydrocarbons as a Function of Molecular Structure</u></p> <p>Hydrolysis of an organic molecule occurs when a molecule (R-X) reacts with water (H₂O) to form a new carbon-oxygen bond after the carbon-X bond is cleaved (2,3). Mechanistically, this reaction is referred to as a nucleophilic substitution reaction, where X is the leaving group being replaced by the incoming nucleophilic oxygen from the water molecule. The leaving group, X, must be a molecule other than carbon because for hydrolysis to occur, the R-X bond cannot be a carbon-carbon bond.</p> <p>The carbon atom lacks sufficient electronegativity to be a good leaving group and carbon-carbon bonds are too stable (high bond energy) to be cleaved by nucleophilic substitution. Thus, hydrocarbons, including alkenes, are not subject to hydrolysis (3) and this fate process will not contribute to the degradative loss of chemical components in this category from the environment.</p> <p>Under strongly acidic conditions the carbon-carbon double bond found in alkenes, such as those in the Resin Oils and Cycloidiene Dimer Concentrates Category, will react with water by an addition reaction mechanism (2). The reaction product is an alcohol. This reaction is not considered to be hydrolysis because the carbon-carbon linkage is not cleaved and because the reaction is freely reversible (3). Substances that have a potential to hydrolyze include alkyl halides, amides, carbamates, carboxylic acid esters and lactones, epoxides, phosphate esters, and sulfonic acid esters (4).</p> <p>The substances in the Resin Oils and Cycloidiene Dimer Concentrates Category are primarily olefins that contain at least one double bond (alkenes). The remaining chemicals are saturated hydrocarbons (alkanes). These two groups of chemicals contain only carbon and hydrogen. As such, their molecular structure is not subject to the hydrolytic mechanism discussed above. Therefore, chemicals in the Resin Oils and Cycloidiene Dimer Concentrates Category have a very low potential to hydrolyze, and this degradative process will not contribute to their removal in the environment.</p> <p><u>References</u></p> <ol style="list-style-type: none"> 1. Olefins Panel, HPV Implementation Task Group. 2001. High Production Volume (HPV) Chemical Challenge Program Test Plan For The Resin Oils and Cycloidiene Dimer Concentrates Category. American Chemistry Council, Olefins Panel, HPV Implementation Task Group. VA, USA. 2. Gould, E.S. (1959), Mechanism and Structure in Organic

	<p>Chemistry, Holt, Reinhart and Winston, New York, NY, USA.</p> <p>3. Harris, J.C. (1982), "Rate of Hydrolysis," Chapter 7 in: W.J. Lyman, W.F. Reehl, and D.H. Rosenblatt, eds., Handbook of Chemical Property Estimation Methods, McGraw-Hill Book Company, New York, NY, USA.</p> <p>4. Neely, W. B. 1985. Hydrolysis. In: W. B. Neely and G. E. Blau, eds. Environmental Exposure from Chemicals. Vol I., pp. 157-173. CRC Press, Boca Raton, FL, USA.</p>
Reliability:	These data represent a key study for characterizing the potential of substances in the Resin Oils and Cyclodiene Dimer Concentrates Category to undergo hydrolysis.
Reference:	American Chemistry Council, Olefins Panel. 2003. Hydrolysis Resin Oils and Cyclodiene Dimer Concentrates Category. Rosslyn, VA, USA.
Other (source):	American Chemistry Council, Olefins Panel (Prepared 8/03)

* Other TS is a selection option under the Test Substance pick list that is in the IUCLID entry field for Hydrolysis. Selecting this option refers the reader to information in the test substance "freetext" field to which the CAS numbers can be added.

ROBUST SUMMARY: RESIN OILS and CYCLODIENE DIMER CONCENTRATES

Transport / Distribution (Fugacity)

Test Substance*:	Other TS [CAS # 26742-00-4; 68477-40-7; 68477-54-3; 68477-53-2; 68478-08-0; 68478-10-4; 68516-20-1; 68527-24-2; 68527-26-4; 68603-02-1]
Method/Guideline:	Calculated according to Mackay Level I, EQC Model version 1.01
Year (guideline):	1997
Type (test type):	Not applicable
GLP:	Not applicable
Year (study performed):	Not applicable
Estimation Temperature:	25°C
Test Conditions: <ul style="list-style-type: none"> • Note: Concentration prep., vessel type, replication, test conditions. 	<p>The EQC Level I is a steady state, equilibrium model that utilizes the input of basic chemical properties including molecular weight, vapor pressure, and water solubility to calculate distribution within a standardized regional environment.</p> <p>Physicochemical input values for the model were calculated using the EPIWIN Estimation v 3.04 program (1). Measured input values were also used where available and obtained from the EPIWIN database (1). Distribution data from the equilibrium model provide basic information on the potential partitioning behavior of chemicals between selected environmental compartments (i.e., air, water, soil, sediment, suspended sediment, biota).</p> <p>1. EPIWIN. 1999. Estimation Program Interface for Windows, version 3.04. Syracuse Research Corporation, Syracuse, NY, USA.</p>

Results:

Units/Value:

- **Note: Deviations from protocol or guideline, analytical method.**

Calculated partitioning data for representative constituents of the Resin Oils and Cyclodiene Dimer Concentrates Category are listed below. The data identify a potential distribution for substances represented by the 10 CAS numbers under Test Substance. Actual distribution of substances in this category will vary dependent on their constituent composition.

Commercial substances in this category consist of complex hydrocarbon products with a carbon number distribution that is predominantly C8-C12 with some lower molecular weight constituents present. The predominant components are cycloalkenes and aromatic hydrocarbons. The five chemicals selected to represent the environmental distribution range of this category are C8-C12 hydrocarbons that can be found in substances identified by the 10 CAS numbers. Constituents representing category members were selected on the basis of carbon number as identified by the category name, chemistry/structure, measured boiling point ranges for category substances, and olefinic process (distillation) knowledge.

The range of distribution data for constituent chemicals in each of the compartments can be used as an estimate of the partitioning behavior for category substances.

The following Mackay Level I model distribution values for representative constituents of substances in this category were determined using physicochemical input data calculated using the EPIWIN program:

<u>Chemical</u>	<u>Calculated*</u> <u>Percent Distribution</u>			
	<u>Air</u>	<u>Water</u>	<u>Soil</u>	<u>Sediment</u>
vinyl toluene	96.94	2.40	0.64	0.02
indene	47.61	31.05	20.86	0.46
dicyclopentadiene	98.00	0.87	1.11	0.02
methylindene	32.02	20.10	46.81	1.04
methylcyclopentadiene dimer	85.98	0.09	13.62	0.03

* Distribution values determined using calculated input data from EPIWIN program

<p>Results: (cont'd)</p> <p>Units/Value:</p> <ul style="list-style-type: none"> Note: Deviations from protocol or guideline, analytical method. 	<table border="1"> <thead> <tr> <th rowspan="2"><u>Chemical</u></th> <th colspan="4"><u>Measured**</u> <u>Percent Distribution</u></th> </tr> <tr> <th><u>Air</u></th> <th><u>Water</u></th> <th><u>Soil</u></th> <th><u>Sediment</u></th> </tr> </thead> <tbody> <tr> <td>vinyl toluene</td> <td>na</td> <td>na</td> <td>na</td> <td>na</td> </tr> <tr> <td>indene</td> <td>na</td> <td>na</td> <td>na</td> <td>na</td> </tr> <tr> <td>dicyclopentadiene</td> <td>98.00</td> <td>0.87</td> <td>1.11</td> <td>0.02</td> </tr> <tr> <td>methylindene</td> <td>na</td> <td>na</td> <td>na</td> <td>na</td> </tr> <tr> <td>methylcyclopentadiene dimer</td> <td>na</td> <td>na</td> <td>na</td> <td>na</td> </tr> </tbody> </table> <p>** Distribution values determined using measured input data from the EPIWIN program experimental database. na = not available</p>	<u>Chemical</u>	<u>Measured**</u> <u>Percent Distribution</u>				<u>Air</u>	<u>Water</u>	<u>Soil</u>	<u>Sediment</u>	vinyl toluene	na	na	na	na	indene	na	na	na	na	dicyclopentadiene	98.00	0.87	1.11	0.02	methylindene	na	na	na	na	methylcyclopentadiene dimer	na	na	na	na
<u>Chemical</u>	<u>Measured**</u> <u>Percent Distribution</u>																																		
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vinyl toluene	na	na	na	na																															
indene	na	na	na	na																															
dicyclopentadiene	98.00	0.87	1.11	0.02																															
methylindene	na	na	na	na																															
methylcyclopentadiene dimer	na	na	na	na																															
<p>Test Substance:</p>	<p>The Resin Oils and Cyclodiene Dimer Concentrates Category includes the following CAS numbers:</p> <p>26742-00-4 4,7-Methano-1H-indene, 3a,4,7,7a-tetrahydrodimethyl-</p> <p>68477-40-7 Distillates, petroleum, cracked stripped steam-cracked petroleum distillates, C10-12 fraction</p> <p>68477-54-3 Distillates, petroleum, steam-cracked, C8-12 fraction</p> <p>68477-53-2 Distillates, petroleum, steam-cracked, C5-12 fraction</p> <p>68478-08-0 Naphtha, petroleum, light steam-cracked, C5-fraction, oligomer concentrate</p> <p>68478-10-4 Naphtha, petroleum, light steam-cracked, debenzenized, C8-16-cycloalkadiene concentrate</p> <p>68516-20-1 Naphtha, petroleum, steam-cracked middle aromatic</p> <p>68527-24-2 Naphtha, petroleum, light steam-cracked aromatic, C5-12 cycloalkadiene fraction, polymers</p> <p>68527-26-4 Naphtha, petroleum, light steam-cracked, debenzenized</p> <p>68603-02-1 Distillates, petroleum, thermal cracked naphtha and gas oil, dimerized</p> <p>The Resin Oils and Cyclodiene Dimer Concentrates Category was developed by grouping two Resin Oil streams, one relatively low in Dicyclopentadiene (DCPD), and a second that contains higher levels of the dimer. These Resin Oils have been further grouped with six other process streams that are concentrates of DCPD, Methylcyclopentadiene Dimer (MCDP Dimer), and co-dimers of these two cyclodienes with other hydrocarbons of similar molecular weight present, primarily cycloalkenes and aromatic hydrocarbons. The 10 CAS numbers are used to describe the nine process streams associated with the ethylene industry and associated manufacturing processes.</p> <p>More information on the Resin Oils and Cyclodiene Dimer Concentrates Category can be found in the American Chemistry Council, Olefins Panel test plan for this category (2).</p> <p>2. Olefins Panel, HPV Implementation Task Group. 2001. High Production Volume (HPV) Chemical Challenge Program Test Plan For The Resin Oils and Cyclodiene Dimer Concentrates Category. American Chemistry Council, Olefins Panel, HPV</p>																																		

	Implementation Task Group. VA, USA.
Conclusion:	<p>The partitioning data represent a potential distribution range for substances in the 10 CAS numbers listed under <u>Test Substance</u>. Substances in the Resin Oils and Cyclodiene Dimer Concentrates Category are complex hydrocarbon reaction products, and as a result, the potential environmental distribution of these substances is also expected to be complex. Constituent chemicals are calculated to partition either primarily to air or to air, water, and soil with a small percentage to sediment.</p> <p>The input data used to run the EQC Level I model included estimated values calculated by the EPIWIN program based on chemical structure and measured data from the EPIWIN database. A comparison of the distribution data developed using either all calculated input values or measured values where data were available indicate a similar partitioning behavior and support the use of the dataset for chemicals without any measured data.</p>
Reliability:	<p>(2) Reliable with restrictions</p> <p>The input data used to run the EQC Level I model include calculated and experimental values available through the EPIWIN program. The data represent a potential environmental distribution range for substances with the 10 CAS numbers listed under <u>Test Substance</u>. This robust summary has a reliability rating of 2 because the data are not for specific substances in the Resin Oils and Cyclodiene Dimer Concentrates Category, but rather for selected constituents. These selected constituents represent all substances defined by this category and as such, this robust summary represents a "key study" for distribution range based on constituent data.</p>
Reference:	Mackay, D.A. DiGuardo, S. Paterson, and C. Cowan. EQC Model Version 1.01. 1997. Available from the Environmental Modeling Centre, Trent University, Canada.
Other (source):	American Chemistry Council, Olefins Panel (Prepared 8/03)

* Other TS is a selection option under the Test Substance pick list that is in the IUCLID entry field for Transport-Distribution. Selecting this option refers the reader to information in the test substance "freetext" field to which the CAS numbers can be added.

Physico-Chemical Properties and Environmental Fate

Subcategory 1

ROBUST SUMMARY: RESIN OILS and CYCLODIENE DIMER CONCENTRATES Dicyclopentadiene/Codimer Concentrate

Boiling Point

Test Substance:	CAS No. : 68478-10-4 Dicyclopentadiene/Codimer Concentrate This stream is produced as a distillate from a C8+ fraction of thermally processed pyrolysis gasoline obtained from ethylene production (steam cracking process). The sample tested consisted of dicyclopentadiene (29%), methylcyclopentadiene dimer (13%), cyclopentadiene/methylcyclopentadiene codimer (13%), other codimers of cyclopentadiene – e.g. with 1,3-butadiene or isoprene (7%), other similar codimers of methylcyclopentadiene (22%), balance (16%). <i>Note: the above composition percentages were reported by the supplier of the test substance on December 17, 2002.</i>
Method/Guideline:	EEC A2 / OECD 103
Year (guideline):	1993 / 1995
Type (test type):	Boiling Point (distillation method)
GLP:	Yes
Year (study performed):	2003
Pressure	Corrected to Standard Atmospheric
Boiling Point Value:	150 - 197 Deg C
Test Conditions:	Test substance added to distillation flask and heated at a rate which results in initial drops of distillate condensing after approximately 15 minutes. On boiling, the heating rate was adjusted in order that the distillation rate was approximately 3 - 4 mL/min. Procedure performed in duplicate.
<ul style="list-style-type: none">Note: Concentration prep., vessel type, replication, test conditions.	
Results:	Results of duplicate measurements:
Units/Value:	Run I initial B.P. 149 Deg C final B.P. 150 Deg C <u>Run II</u> initial B.P. <u>150 Deg C</u> final B.P. <u>197 Deg C</u> Mean 150 - 197 Deg C
	A small amount of thick brown residue remained in the flask at the end of the test.
Reliability:	(1) Reliable without restriction
Reference:	Huntingdon Life Sciences, Ltd. 2003, Physicochemical Properties Study EXN043/032972.
Other (source):	Olefins Panel, American Chemistry Council

ROBUST SUMMARY: RESIN OILS and CYCLODIENE DIMER CONCENTRATES

Vapor Pressure

Test Substance:	CAS No. : 68478-10-4 Dicyclopentadiene/Codimer Concentrate This stream is produced as a distillate from a C8+ fraction of thermally processed pyrolysis gasoline obtained from ethylene production (steam cracking process). The sample tested consisted of dicyclopentadiene (29%), methylcyclopentadiene dimer (13%), cyclopentadiene/methylcyclopentadiene codimer (13%), other codimers of cyclopentadiene – e.g. with 1,3-butadiene or isoprene (7%), other similar codimers of methylcyclopentadiene (22%), balance (16%). <i>Note: the above composition percentages were reported by the supplier of the test substance on December 17, 2002.</i>
Method/Guideline:	EEC A4 / OECD 104
Year (guideline):	1993 / 1995
Type (test type):	Vapor Pressure (static measurement procedure)
GLP:	Yes
Year (study performed):	2003
Temperature:	25 Deg C
Vapor Pressure Value:	800 Pa
Test Conditions:	Test conducted at five temperatures between 303 and 323 Deg K (30 and 50 Deg C). Actual test temperatures were 303.15, 308.15, 313.15, 318.15 and 323.15. Duplicate measurements made at each temperature.
<ul style="list-style-type: none">Note: Concentration prep., vessel type, replication, test conditions.	
Results:	Mean vapor pressures were as follows:
Units/Value:	1100 Pa at 303.15 Deg K 1800 Pa at 308.15 Deg K 2500 Pa at 313.15 Deg K 3600 Pa at 318.15 Deg K 4900 Pa at 323.15 Deg K 800 Pa at 25 Deg C (calculated from linear regression)
Reliability:	(1) Reliable without restriction
Reference:	Huntingdon Life Sciences, Ltd. 2003, Physicochemical Properties Study EXN043/032972.
Other (source):	Olefins Panel, American Chemistry Council

ROBUST SUMMARY: RESIN OILS and CYCLODIENE DIMER CONCENTRATES

Partition Coefficient

Test Substance:	CAS No.: 68478-10-4 Dicyclopentadiene/Codimer Concentrate . This stream is produced as a distillate from a C8+ fraction of thermally processed pyrolysis gasoline obtained from ethylene production (steam cracking process). The sample tested consisted of dicyclopentadiene (29%), methylcyclopentadiene dimer (13%), cyclopentadiene/methylcyclopentadiene codimer (13%), other codimers of cyclopentadiene – e.g. with 1,3-butadiene or isoprene (7%), other similar codimers of methylcyclopentadiene (22%), balance (16%). <i>Note: the above composition percentages were reported by the supplier of the test substance on December 17, 2002.</i>
Method/Guideline:	EEC A8 / OECD 117
Year (guideline):	1993 / 1989
Type (test type):	N-Octanol/Water Partition Coefficient (HPLC method)
GLP:	Yes
Year (study performed):	2003
Temperature:	25 Deg C
Log P_{ow} Value:	3.2 - 5.9
Test Conditions:	Test substance was evaluated at a concentration of 254 mg/L prepared in HPLC mobile phase (3:1 methanol:water). HPLC analysis was performed on a Hewlett Packard 1050 Liquid Chromatograph with an Inertsil 5um C8 (15cm x 4.6mm id) column with a 1 mL/min flow rate, 10uL injection volume and UV detection at 210 nm. Six reference compounds (with known log P _{ow} values), each at approximately 50 mg/L, were analyzed in a combined solution including nitrobenzene (log P _{ow} =1.9), ethylbenzoate (log P _{ow} = 2.6), bromobenzene (log P _{ow} =3.0), benzylbenzoate (log P _{ow} =4.0), triphenylamine (log P _{ow} =5.7) and DDT (log P _{ow} =6.2). Additionally, an unretained standard of 4,5-dihydroxynaphthalene-2,7-disulphonic acid, disodium salt was analyzed to determine the system deadtime. Two sets of reference mixture and test substance runs were performed.
Results:	
Units/Value:	Multiple components detected with Log P _{ow} values between 3.2 and 5.9 (calculated from the mean exponential regression of reference compounds).
Reliability:	(1) Reliable without restriction
Reference:	Huntingdon Life Sciences, Ltd. 2003, Physicochemical Properties Study EXN043/032972.
Other (source):	Olefins Panel, American Chemistry Council

ROBUST SUMMARY: RESIN OILS and CYCLODIENE DIMER CONCENTRATES Methylcyclopentadiene Dimer Concentrate (MCPD Dimer Concentrate)

Boiling Point

Test Substance:	CAS No.: 26472-00-4, Methylcyclopentadiene Dimer Concentrate (MCPD Dimer Concentrate). The test substance contained 90.8% MCPD Dimer, 2.6% MCPD and 1.6% Cyclopentadiene (CPD)-MCPD codimer. The balance of the stream consisted of other hydrocarbons, primarily C4-C7 codimers of MCPD or CPD. CAS Inventory Name: 4,7-Methano-1H-indene, 3a,4,7,7a-tetrahydrodimethyl-						
Method/Guideline:	EEC A2 / OECD 103						
Year (guideline):	1993 / 1995						
Type (test type):	Boiling Point (modified Siwoloboff method)						
GLP:	Yes						
Year (study performed):	2003						
Pressure	Corrected to Standard Atmospheric						
Boiling Point Value:	191.0 Deg C						
Test Conditions:	Boiling tube filled with test substance, which is placed in Buchi Model B-545 boiling point apparatus. Temperature of apparatus set approximately 10 Deg C below anticipated boiling point. Temperature raised approximately 1 Deg C/min. Temperature recorded at which a continuous stream of bubbles is seen emerging from the inverted open end of boiling point tube. Procedure performed in duplicate.						
<ul style="list-style-type: none">Note: Concentration prep., vessel type, replication, test conditions.							
Results:	Results of duplicate measurements:						
Units/Value:	<table><tr><td>Run I</td><td>190.5 Deg C</td></tr><tr><td><u>Run II</u></td><td><u>191.0 Deg C</u></td></tr><tr><td>Mean</td><td>191.0 Deg C</td></tr></table>	Run I	190.5 Deg C	<u>Run II</u>	<u>191.0 Deg C</u>	Mean	191.0 Deg C
Run I	190.5 Deg C						
<u>Run II</u>	<u>191.0 Deg C</u>						
Mean	191.0 Deg C						
	A slight yellow color was noted upon boiling, possibly decomposition of a minor component.						
Reliability:	(1) Reliable without restriction						
Reference:	Huntingdon Life Sciences, Ltd. 2003, Physicochemical Properties for Methylcyclopentadiene Concentrate Study EXN040/032421.						
Other (source):	Olefins Panel, American Chemistry Council						

ROBUST SUMMARY: RESIN OILS and CYCLODIENE DIMER CONCENTRATES

Vapor Pressure

Test Substance:	CAS No.: 26472-00-4, Methylcyclopentadiene Dimer Concentrate (MCPD Dimer Concentrate). The test substance contained 90.8% MCPD Dimer, 2.6% MCPD and 1.6% Cyclopentadiene (CPD)-MCPD codimer. The balance of the stream consisted of other hydrocarbons, primarily C4-C7 codimers of MCPD or CPD. CAS Inventory Name: 4,7-Methano-1H-indene, 3a,4,7,7a-tetrahydrodimethyl-
Method/Guideline:	EEC A4 / OECD 104
Year (guideline):	1993 / 1995
Type (test type):	Vapor Pressure (static measurement procedure)
GLP:	Yes
Year (study performed):	2003
Temperature:	25 Deg C
Vapor Pressure Value:	1900 Pa
Test Conditions:	Test conducted at five temperatures between 303 and 323 Deg K (30 and 50 Deg C). Actual test temperatures were 303.15, 308.15, 313.15, 318.15 and 323.15). Duplicate measurements made at each temperature.
<ul style="list-style-type: none">Note: Concentration prep., vessel type, replication, test conditions.	
Results:	Mean vapor pressures were as follows:
Units/Value:	2500 Pa at 303.15 Deg K 3800 Pa at 308.15 Deg K 5200 Pa at 313.15 Deg K 7000 Pa at 318.15 Deg K 9400 Pa at 323.15 Deg K 1900 Pa at 25 Deg C (calculated from linear regression)
Reliability:	(1) Reliable without restriction
Reference:	Huntingdon Life Sciences, Ltd. 2003, Physicochemical Properties for Methylcyclopentadiene Concentrate Study EXN040/032421.
Other (source):	Olefins Panel, American Chemistry Council

ROBUST SUMMARY: RESIN OILS and CYCLODIENE DIMER CONCENTRATES

Partition Coefficient

Test Substance:	CAS No.: 26472-00-4, Methylcyclopentadiene Dimer Concentrate (MCPD Dimer Concentrate). The test substance contained 90.8% MCPD Dimer, 2.6% MCPD and 1.6% Cyclopentadiene (CPD)-MCPD codimer. The balance of the stream consisted of other hydrocarbons, primarily C4-C7 codimers of MCPD or CPD. CAS Inventory Name: 4,7-Methano-1H-indene, 3a,4,7,7a-tetrahydrodimethyl-
Method/Guideline:	EEC A8 / OECD 117
Year (guideline):	1993 / 1989
Type (test type):	N-Octanol/Water Partition Coefficient (HPLC method)
GLP:	Yes
Year (study performed):	2003
Temperature:	25 Deg C
Log P_{ow} Value:	5.5 - 5.7
Test Conditions:	<p>Test substance was evaluated at a concentration of 271 mg/L prepared in HPLC mobile phase (3:1 methanol:water). HPLC analysis was performed on a Hewlett Packard 1050 Liquid Chromatograph with an Inertsil 5um C8 (15cm x 4.6mm id) column with a 1 mL/min flow rate, 10uL injection volume and UV detection at 210 nm. Six reference compounds (with known log P_{ow} values), each at approximately 50 mg/L, were analyzed in a combined solution including nitrobenzene (1.9), ethylbenzoate (2.6), bromobenzene (3.0), benzylbenzoate (4.0), triphenylamine (5.7) and DDT (6.2). Additionally, an unretained standard of 4,5-dihydroxynaphthalene-2,7-disulphonic acid, disodium salt was analyzed to determine the system deadtime.</p> <p>Two sets of reference mixture and test substance runs were performed.</p>
Results:	
Units/Value:	Three principal components detected with Log P _{ow} values between 5.5 and 5.7 (calculated from the mean exponential regression of reference compounds).
Reliability:	(1) Reliable without restriction
Reference:	Huntingdon Life Sciences, Ltd. 2003, Physicochemical Properties for Methylcyclopentadiene Concentrate Study EXN040/032421.
Other (source):	Olefins Panel, American Chemistry Council

Physico-Chemical Properties and Environmental Fate

Subcategory 3

ROBUST SUMMARY: RESIN OILS and CYCLODIENE DIMER CONCENTRATES Low Dicyclopentadiene Resin Oil (Low DCPD Resin Oil)

Boiling Point

Test Substance: **Low Dicyclopentadiene Resin Oil** (Low DCPD Resin Oil). CAS No. 68477-54-3. Distillates, petroleum, steam-cracked, C8-12 fraction. This stream can also be described by CAS No. 68516-20-1. Naphtha, petroleum, steam-cracked middle arom.

Low DCPD Resin Oil is a C8 to C10 distillate obtained from a pyrolysis gasoline stream produced by an ethylene production process (steam cracking process). The sample tested consisted of vinyltoluenes (17%), trimethylbenzenes (9%), styrene and methylstyrenes (3%), indene (14%), methylindene (8%), and naphthalene (1%). The balance of the composition is expected to consist of other hydrocarbons with carbon range primarily 8 to 10, mainly aromatics and olefins, with some paraffins.

Method/Guideline: EEC A2 / OECD 103
Year (guideline): 1993 / 1995
Type (test type): Boiling Point (distillation method)
GLP: Yes
Year (study performed): 2003
Pressure Corrected to Standard Atmospheric
Boiling Point Value: 174 - 193 Deg C

Test Conditions:

- Note: Concentration prep., vessel type, replication, test conditions.**

Test substance added to distillation flask and heated at a rate which results in initial drops of distillate condensing after approximately 15 minutes. On boiling, the heating rate was adjusted in order that the distillation rate was approximately 3 - 4 mL/min. Procedure performed in duplicate.

Results:

Units/Value: Results of duplicate measurements:
Run I initial B.P. 173 Deg C final B.P. 192 Deg C
Run II initial B.P. 174 Deg C final B.P. 193 Deg C

Mean 174 - 193 Deg C

A small amount of thick brown residue remained in the flask at the end of the test.

Reliability: (1) Reliable without restriction

Reference: Huntingdon Life Sciences, Ltd. 2003, Physicochemical Properties for Low Dicyclopentadiene Resin Oil. Study EXN047/033073.

Other (source): Olefins Panel, American Chemistry Council

ROBUST SUMMARY: RESIN OILS and CYCLODIENE DIMER CONCENTRATES

Vapor Pressure

Test Substance:	Low Dicyclopentadiene Resin Oil (Low DCPD Resin Oil) CAS No. 68477-54-3. Distillates, petroleum, steam-cracked, C8-12 fraction. This stream can also be described by CAS No. 68516-20-1. Naphtha, petroleum, steam-cracked middle arom. <u>Low DCPD Resin Oil</u> is a C8 to C10 distillate obtained from a pyrolysis gasoline stream produced by an ethylene production process (steam cracking process). The sample tested consisted of vinyltoluenes (17%), trimethylbenzenes (9%), styrene and methylstyrenes (3%), indene (14%), methylindene (8%), and naphthalene (1%). The balance of the composition is expected to consist of other hydrocarbons with carbon range primarily 8 to 10, mainly aromatics and olefins, with some paraffins.
Method/Guideline:	EEC A4 / OECD 104
Year (guideline):	1993 / 1995
Type (test type):	Vapor Pressure (static measurement procedure)
GLP:	Yes
Year (study performed):	2003
Temperature:	25 Deg C
Vapor Pressure Value:	4100 Pa
Test Conditions:	Test conducted at five temperatures between 303 and 323 Deg K (30 and 50 Deg C). Actual test temperatures were 303.15, 308.15, 313.15, 318.15 and 323.15. Duplicate measurements made at each temperature.
<ul style="list-style-type: none">Note: Concentration prep. vessel type, replication, test conditions.	
Results:	Mean vapor pressures were as follows:
Units/Value:	4700 Pa at 303.15 Deg K 5700 Pa at 308.15 Deg K 6500 Pa at 313.15 Deg K 7500 Pa at 318.15 Deg K 8600 Pa at 323.15 Deg K 4100 Pa at 25 Deg C (calculated from linear regression)
Reliability:	(1) Reliable without restriction
Reference:	Huntingdon Life Sciences, Ltd. 2003, Physicochemical Properties for Low Dicyclopentadiene Resin Oil. Study EXN047/033073.
Other (source):	Olefins Panel, American Chemistry Council

ROBUST SUMMARY: RESIN OILS and CYCLODIENE DIMER CONCENTRATES

Partition Coefficient

Test Substance:	Low Dicyclopentadiene Resin Oil (Low DCPD Resin Oil) CAS No. 68477-54-3. Distillates, petroleum, steam-cracked, C8-12 fraction. This stream can also be described by CAS No. 68516-20-1. Naphtha, petroleum, steam-cracked middle arom. <u>Low DCPD Resin Oil</u> is a C8 to C10 distillate obtained from a pyrolysis gasoline stream produced by an ethylene production process (steam cracking process). The sample tested consisted of vinyltoluenes (17%), trimethylbenzenes (9%), styrene and methylstyrenes (3%), indene (14%), methylindene (8%), and naphthalene (1%). The balance of the composition is expected to consist of other hydrocarbons with carbon range primarily 8 to 10, mainly aromatics and olefins, with some paraffins.
Method/Guideline:	EEC A8 / OECD 117
Year (guideline):	1993 / 1989
Type (test type):	N-Octanol/Water Partition Coefficient (HPLC method)
GLP:	Yes
Year (study performed):	2003
Temperature:	25 Deg C
Log P_{ow} Value:	3.1 - 4.7
Test Conditions:	<p>Test substance was evaluated at a concentration of 104 mg/L prepared in HPLC mobile phase (3:1 methanol:water). HPLC analysis was performed on a Hewlett Packard 1050 Liquid Chromatograph with an Inertsil 5um C8 (15cm x 4.6mm id) column with a 1 mL/min flow rate, 10uL injection volume and UV detection at 210 nm. Six reference compounds (with known log P_{ow} values), each at approximately 50 mg/L, were analyzed in a combined solution including nitrobenzene (log P_{ow}=1.9), ethylbenzoate (log P_{ow}=2.6), bromobenzene (log P_{ow}=3.0), benzylbenzoate (log P_{ow}=4.0), triphenylamine (log P_{ow}=5.7) and DDT (log P_{ow}=6.2). Additionally, an unretained standard of 4,5-dihydroxynaphthalene-2,7-disulphonic acid, disodium salt was analyzed to determine the system deadtime.</p> <p>Two sets of reference mixture and test substance runs were performed.</p>
Results:	
Units/Value:	Multiple components detected with Log P _{ow} values between 3.1 and 4.7 (calculated from the mean exponential regression of reference compounds).
Reliability:	(1) Reliable without restriction
Reference:	Huntingdon Life Sciences, Ltd. 2003, Physicochemical Properties for Low Dicyclopentadiene Resin Oil. Study EXN047/033073.
Other (source):	Olefins Panel, American Chemistry Council

Attachment 1b
Mammalian Toxicology
Subcategory 1

**Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category
Dicyclopentadiene (DCPD)**

Acute Toxicity

<u>Test Substance</u>	Dicyclopentadiene (DCPD), CAS #77-73-6. approx. 97% endo- and approx. 1% cyclopentadiene. Clear colorless liquid at room temperature.
<u>Method</u>	<u>Olefins Panel HPV Stream Name: DCPD High Purity</u>
Method/guideline followed	Not specified
Type (test type)	Acute
GLP	Yes
Year	1981
Species/Strain	Rat, Fischer 344
Sex	Males and females
No. of animals per sex per dose	6
Vehicle	Air
Route of administration	Whole Body Inhalation
Test Conditions	Animals were housed 2/cage in stainless steel cages and received water and powdered chow diet ad lib except during exposure. A 12hr light/dark photoperiod cycle was maintained. Animals were kept in their respective cages during exposure. Exposure was for a single 6hr period on day 1 and sacrifice was on day 15. DCPD vapor was generated inside a heated pyrex tube to achieve complete vaporization while keeping temperature below the point (35 ⁰ C) at which fracturing to monomer occurred. Chamber concentrations of DCPD and cyclopentadiene (CPD) were monitored by gas chromatography/flame ionization detection with detection limit of 0.05ppm for both compounds. The actual exposure concentrations were 46, 130, 260 and 557ppm. This study was conducted to obtain a definitive LC ₅₀ value for DCPD exposure that was not confounded by fracturing of DCPD. Previous publications give conflicting LC ₅₀ values that might have been caused by loss of DCPD via fracturing. In the present study, CPD was below the detection limit. Animals were observed daily for clinical signs. All rats were necropsied for gross lesions. LC ₅₀ was calculated by the method of moving averages.
<u>Results</u>	LC ₅₀ males: 284 (236-341)ppm; females 353 (322-387)ppm
LC ₅₀ with confidence limits.	Rats of both sexes in the 557ppm group showed loss of righting reflex, impaired gait, stereotypic behavior, labored breathing, nasal discharge, convulsions and death. At 260ppm, both sexes showed stereotypic behavior, respiratory difficulty and nasal discharge. In rats dying from exposure, convulsions were observed immediately before death. At 130ppm, the only sign observed in both sexes, was a somewhat sluggish movement. No treatment-related clinical signs were observed in rats exposed to 46ppm. In rats that did not die during the study, all clinical signs cleared by day 2. There were no gross pathological effects noted at necropsy.
Remarks	
<u>Conclusions</u>	LC ₅₀ males: 284 (236-341)ppm; females 353 (322-387)ppm
(study author)	The LC ₅₀ s reflect the effects of DCPD. Results were not confounded by fracturing of DCPD into CPD.
<u>Data Quality</u>	
Reliability	2. Reliable with restrictions. The actual numbers of rats dying at the various exposure levels were not presented in the report.
<u>References</u>	Gad, S.C., Snellings, W.M., Egan, G.F., Nachreiner, D.J., Evancheck, R.E. and Dickey, C.L. 1981. Acute and subacute inhalation toxicity of dicyclopentadiene in rats and mice. Doc. #81-MR-R2694. Bushy Run Research Center, Export, PA for Exxon Chemical

<p><i>Other</i> <i>Last changed</i></p>	<p>Corp. Snellings, W.M. 1981. 9-day rat and mouse inhalation study. Report #43-527. Bushy Run Research Center, Export PA for Exxon Corp., Linden, NJ (test article description) Gad, S.C., Egan, G.F., Nachreiner, D.J., and Evancheck, R.E. 1980. Acute and subacute inhalation toxicity of dicyclopentadiene in rats and mice. Abst. #130 from the 19th Annual meeting of the Society of Toxicology Bevan, C., Snellings, W.M., Dodd, D.E. and Egan, G.F. 1992. Subchronic toxicity study of dicyclopentadiene vapor in rats. Toxicol. and Ind. Health 8:353-367. (detailed discussion of results)</p> <p>Revised 11/21/2001 (Prepared by a contractor to the Olefins Panel)</p>
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Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Acute Toxicity

<p><u>Test Substance</u></p>	<p>Dicyclopentadiene (DCPD), CAS #77-73-6. approx. 97% endo- and approx. 1% cyclopentadiene. Clear colorless liquid at room temperature. <u>Olefins Panel HPV Stream Name: DCPD High Purity</u></p>
<p><u>Method</u> Method/guideline followed Type (test type) GLP Year Species/Strain Sex No. of animals per sex per dose Vehicle Route of administration</p>	<p>Not specified Acute Yes 1981 Mouse, B6C3F1 Males and females 6 Air Whole Body Inhalation</p>
<p>Test Conditions</p>	<p>Animals were housed 2/cage in stainless steel cages and received water and powdered chow diet ad lib except during exposure. A 12hr light/dark photoperiod cycle was maintained. Animals were kept in their respective cages during exposure. Exposure was for a single 6hr period on day 1 and sacrifice was on day 15. DCPD vapor was generated inside a heated pyrex tube to achieve complete vaporization while keeping temperature below the point (35⁰C) at which fracturing to monomer occurred. Chamber concentrations of DCPD and cyclopentadiene (CPD) were monitored by gas chromatography/flame ionization detection with detection limit of 0.05ppm for both compounds. The actual exposure concentrations were 46, 130, 260 and 557ppm. This study was conducted to obtain a definitive LC₅₀ value for DCPD exposure that was not confounded by fracturing of DCPD. Previous publications give conflicting LC₅₀ values that might have been caused by loss of DCPD via fracturing. In the present study, CPD was below the detection limit. Animals were observed daily for clinical signs. All mice were necropsied for gross lesions. LC₅₀ was calculated by the method of moving averages.</p>
<p><u>Results</u> LC₅₀ with confidence limits.</p>	<p>LC₅₀ males: 143 (130-157)ppm; females 130 (103-153)ppm</p>
<p>Remarks</p>	<p>Mice of both sexes in the 557ppm group showed loss of righting reflex, impaired gait, stereotypic behavior, labored breathing, clear nasal discharge, and deaths. At 260ppm, mice of both sexes showed stereotypic behavior, respiratory difficulty, impaired gait, loss of coordination and convulsions prior to death. At 130ppm, mice displayed irregular breathing and stereotypic behavior; females also showed loss of coordination and slight tremors. No treatment-related clinical signs were observed in mice exposed to 46ppm. There were no gross pathological effects noted at necropsy.</p>
<p><u>Conclusions</u> (study author)</p>	<p>LC₅₀ males: 143 (130-157)ppm; females 130 (103-153)ppm The LC₅₀s reflect the effects of DCPD. Results were not confounded by fracturing of DCPD into CPD.</p>
<p><u>Data Quality</u> Reliability</p>	<p>2. Reliable with restrictions. The actual numbers of mice dying at the various exposure levels were not presented in the report.</p>
<p><u>References</u></p>	<p>Gad, S.C., Snellings, W.M., Egan, G.F., Nachreiner, D.J., Evancheck, R.E. and Dickey, C.L. 1981. Acute and subacute inhalation toxicity of dicyclopentadiene in rats and mice. Doc. #81-MR-R2694. Bushy Run Research Center, Export, PA for Exxon Chemical Corp. Snellings, W.M. 1981. 9-day rat and mouse inhalation study. Report #43-527. Bushy</p>

<p><u>Other</u> <i>Last changed</i></p>	<p>Run Research Center, Export PA for Exxon Corp., Linden, NJ (test article description) Gad, S.C., Egan, G.F., Nachreiner, D.J., and Evancheck, R.E. 1980. Acute and subacute inhalation toxicity of dicyclopentadiene in rats and mice. Abst. #130 from the 19th Annual meeting of the Society of Toxicology Bevan, C., Snellings, W.M., Dodd, D.E. and Egan, G.F. 1992. Subchronic toxicity study of dicyclopentadiene vapor in rats. Toxicol. and Ind. Health 8:353-367. (detailed discussion of results)</p> <p>Revised 11/21/2001 (Prepared by a contractor to the Olefins Panel)</p>
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Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Genetic Toxicity - in Vitro

<p><u>Test Substance</u> <i>Test substance</i></p> <p><u>Method</u> Method/guideline followed</p> <p>Type μ</p> <p>System of testing</p> <p>GLP</p> <p>Year</p> <p>Species/Strain</p> <p>Metabolic activation</p> <p>Species and cell type</p> <p>Quantity</p> <p>Induced or not induced</p> <p>Concentrations tested</p> <p>Statistical Methods</p> <p>Remarks for Test Conditions</p>	<p>Dicyclopentadiene resin grade (DCPD), CAS #77-73-6, purity 75%; stable at room temperature; clear light yellow liquid</p> <p><u>Olefins Panel HPV Stream Name: DCPD High Purity</u></p> <p>OECD guideline 471 (adopted 7/21/97); EEC Annex V of Directive 67/548/EEC, Part B 13/14: Mutagenicity: reverse mutation assay using bacteria (draft Brussels 7/23/99)</p> <p>Bacterial reverse mutation</p> <p>Salmonella typhimurium and Escherichia coli with and without metabolic activation</p> <p>Yes</p> <p>2000</p> <p>S. typhimurium TA98, TA100, TA1535, TA1537 and E. coli WP2uvrA.</p> <p>Yes</p> <p>Wistar male rat liver (S9 fraction) prepared at Notox</p> <p>5% S9 fraction in 1st experiment; 10% S9 fraction in 2nd experiment</p> <p>Aroclor 1254 induced, rats were given 500mg/kg ip 5 days prior to sacrifice</p> <p>1st exp.: -S9 0, 1 (Sal. only, except TA100), 3, 10, 33, 100, (TA100 and E.coli only) 333, 1000, 3330 and 5000μg/plate; +S9 (5%) 0, 3, 10, 33, 100, 167 (Sal. only except TA100), (TA100 and E.coli) 333, 1000, 3330 and 5000μg/plate.</p> <p>2nd exp.: -S9 0, 1 (Sal only) 3, 10, 33, 66 (E.coli only) and 100μg/plate; +S9 (10%) 0, 3 (Sal. only), 10, 33, 100 167 (Sal. only); (E. coli only) 333 and 666μg/plate</p> <p>None. Criteria for positive response were at least a 3-fold (TA1535, TA 1537, TA98, E.coli WP2) or 2-fold (TA100) dose related increase over solvent control values for the respective strains with or without metabolic activation. Positive or negative responses should be reproducible in at least one independent repeat experiment.</p> <p>Dicyclopentadiene test solutions were prepared in ethanol immediately prior to use. Salmonella strains and E. coli WP2 (approx. 10⁹ cells/ml) were exposed to either test solution or ethanol \pmS9 in 3 plates/dose/strain by the preincubation method. The range-finding test in TA100 and E. coli WP2 over a range of 3-5000μg/plate \pmS9 was incorporated into the 1st experiment. TA98, TA1535 and TA1537 were tested at 1-100μg/plate -S9 and 3-167μg/plate +S9 (5%) in the 1st experiment. The highest concentration of test solution used in the 2nd experiment was the level at which there was significant inhibition of bacterial growth in TA100 and E.coli WP2. Culture vessels containing 0.1ml bacterial culture, 0.05ml test substance in ethanol or ethanol alone for the control, and 0.5ml S9 mix (5% S9 in exp.1 and 10% S9 in exp. 2) or 0.5ml of 0.1M phosphate buffer were combined and incubated with shaking (70rpm) for 30 min at 37^oC. After preincubation, solutions were added to 3ml molten (45^oC) top agar and poured on minimal agar plates. Plates were incubated upside down in the dark at 37^oC for 48 hrs. Revertant colonies were counted automatically (Protos model 50000) or manually if < 40 colonies/plate were present, and conditions of background lawn were evaluated. Positive control compounds were: -S9 sodium azide (NaA, 1μg/plate) for TA1535; 9-aminoacridine (9-AC, 60μg/plate) for TA1537; daunomycine (DM, 4μg/plate) for TA98; methyl methanesulfonate (MMS, 650μg/plate) for TA100 and 4-nitroquinoline N-oxide (4-NQO, 1μg/plate) for E.coli WP2; +S9: 2-aminoanthracene (2-AA) 2.5, 1.0, 5.0 and 10.0μg/plate for TA1535 & TA1537, TA98, TA100 and E. coli WP2, respectively.</p> <p>In the range-finding test presented as part of experiment 1, using TA100 and E.coli WP2 uvrA at concentrations of 3-5000μg/plate with 5% S9 in mix, or no metabolic activation, DCPD precipitate in top agar at concentrations of 1000μg and above +S9. . Precipitate was present +S9 at 3330 and 5000μg/plate at the beginning of incubation but was not apparent at the end of incubation. In TA100 plates \pmS9, extreme inhibition of background lawn and</p>
<p><u>Results</u> Genotoxic effects</p>	<p>In the range-finding test presented as part of experiment 1, using TA100 and E.coli WP2 uvrA at concentrations of 3-5000μg/plate with 5% S9 in mix, or no metabolic activation, DCPD precipitate in top agar at concentrations of 1000μg and above +S9. . Precipitate was present +S9 at 3330 and 5000μg/plate at the beginning of incubation but was not apparent at the end of incubation. In TA100 plates \pmS9, extreme inhibition of background lawn and</p>

<p><u>Conclusions</u> (contractor)</p> <p><u>Data Quality</u> <i>Reliabilities</i></p> <p><u>Reference</u></p> <p><u>Other</u> <i>Last changed</i></p>	<p>appearance of microcolonies occurred from 333-500µg/plate; in E. coli WP2, extreme inhibition began at 100µg/plate-S9 and at 333µg/plate+S9. No increase in revertant colonies was observed at any non-toxic doses ±S9 (e.g. TA100-S9: 82, 84, 87, 71 and 37 avg. revertants/plate and +S9: 97, 100, 89, 92, and 58 avg. revertants/plate at 0, 3, 10, 33 and 100µg/plate, respectively). Salmonella strains TA1535, TA1537 and TA98 were tested at concentrations of 0, 1, 3, 10, 33 and 100µg/plate-S9 and 0, 3, 10, 33, 100 and 167µg/plate +S9 (5% in mix). No precipitate was observed in top agar or on plates at any dose level. Extreme toxicity to background lawns was observed at 100µg/plate-S9 and at 167µg/plate+S9 for all strains. No increase in number of revertant colonies compared to solvent controls was observed (e.g. TA98 -S9: 14, 13, 14, 16 and 8 avg. revertants/plate at 0, 1, 3, 10 and 33µg/plate; +S9: 20, 13, 19, 19 and 10 avg. revertants/plate at 0, 3, 10, 33 and 100µg/plate, respectively). In experiment 2, 10% S9 fraction (v/v) was employed in metabolically activated cultures. Salmonella strains TA1535, TA1537, TA98, TA100 were exposed to 1-100µg/plate -S9 and 3-167µg/plate +S9; E.coli WP2 was exposed to 3-100µg/plate -S9 and 10-666µg/plate +S9. No precipitate was observed in top agar solutions or on plates. Toxicity to background lawn and reduction in revertant colonies was observed at 100µg/plate at a moderate level in Salmonella strains and slightly in E. coli WP2 -S9; slight inhibition of background lawn was observed at 167µg/plate in Salmonella strains and slight to moderate inhibition was observed in E. coli WP2 at 333 and 666µg/plate +S9. No increase in revertant colonies was observed at any dose level. (e.g. TA100-S9: 96, 107, 88, 99, 78 and 57 avg. revertants/plate at 0, 1, 3, 10, 33 and 100µg/plate; +S9: 105, 117, 100, 112, 82 and 90 avg. revertants/plate at 0, 3, 10, 33, 100 and 167µg/plate. E.coli WP2 -S9: 8, 6, 13, 8, 8 and 10 avg. revertants/plate at 0, 3, 10, 33, 66 and 100µg/plate; +S9: 8, 8, 10, 9, 10 and 7 avg. revertants/plate at 0, 10, 33, 100 and 333 and 666µg/plate). Positive control compounds responded appropriately: -S9: NaA 118, 139; 9-AC 95, 160; DM 404, 421; MMS 629, 589; 4-NQO 857,644 avg. revertants/plate in experiments 1 and 2, respectively, and +S9: 2-AA 198, 217; 206,146; 494, 385; 1089, 581; 287, 189 avg. revertants/plate in experiments 1 and 2 for strains TA1535, TA1537, TA98, TA100 and E.coli WP2). DCPD resin grade did not induce a dose-related or 2-fold or 3-fold increase in the number of revertant colonies in any Salmonella strain or in E. coli WP2 uvrA ±S9 in two independent assays.</p> <p>Dicyclopentadiene resin grade did not induce a significant increase in revertant colonies in Salmonella strains or in E. coli WP2 uvrA with or without rat liver metabolic activation at any dose level and is not considered a mutagen in this test system.</p> <p>1. Reliable without restrictions</p> <p>Verspeek-Rip, C.M. 2000. Evaluation of the mutagenic activity of dicyclopentadiene resin grade in the Salmonella typhimurium reverse mutation assay and the Escherchia coli reverse mutation assay (Preincubation test) with independent repeat. Proj. #284265. Notox B.V., The Netherlands. For Dow Chemical Co., Dow Europe S.A. – Horgen</p> <p>Revised 11/21/2001 (Prepared by a contractor to the Olefins Panel)</p>
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Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Genetic Toxicity - in Vitro

<p><u>Test Substance</u> <i>Test substance</i></p> <p><u>Method</u> Method/guideline followed Type System of testing GLP Year Species/Strain Metabolic activation Species and cell type Quantity Induced or not induced Concentrations tested</p> <p>Statistical Methods</p> <p>Remarks for Test Conditions</p>	<p>Dicyclopentadiene, CAS # 77-73-6 (3a, 4, 7, 7a-Tetrahydro-4, 7-methanoindene), purity 95%.</p> <p><u>Olefins Panel HPV Stream Name: DCPD High Purity</u></p> <p>Japan: Guidelines for Screening Mutagenicity Testing on Chemicals Mammalian chromosomal aberration Chinese hamster lung cells Yes 1998 Chinese hamster lung (CHL/IU) cells Yes Rat liver (Strain not specified) Not specified Phenobarbital and 5,6-benzoflavone induced (Treatment not specified) 0.0, 0.014, 0.029, 0.057mg/ml –S9 24 hr continuous treatment; or short-term treatment (duration not specified); 0.0, 0.03, 0.05, 0.10mg/ml +S9 short-term treatment. Not specified. Japanese guidelines state “test substance is considered to be positive when assay cultures show a significantly higher incidence of cells with chromosomal aberrations as compared with the negative control, and when this effect is reasonably reproducible or dose-dependent.”</p> <p>Summarized information only. Test material was prepared in acetone and administered to Chinese hamster lung cells with and without metabolic activation in 2 cultures per dose level. The test material was incubated with CHL cells in growth phase (usually 10⁵ cells/ml growth medium) for 24 hrs continuous treatment without metabolic activation and for a shorter duration (Japanese guidelines indicate 3-6 hrs) with and without metabolic activation from rat liver S9, at 37^oC in a 5% CO₂ in air humidified atmosphere. In accordance to Japanese guidelines, the dose range was selected to produce 50% or greater inhibition of cell growth or mitosis at the maximum dose level. Following short-term exposure, cultures containing S9 mix were washed and fresh medium added. All cultures were treated with Colcemid® approximately 2 hrs prior to harvest to arrest dividing cells in metaphase. Cells were fixed and slides prepared for chromosome analysis (Giemsa is a standard stain for metaphase chromosome spreads). All slides, including positive and negative controls were coded before microscopic analysis. Japanese guidelines specify that 100 metaphase spreads should be counted and analyzed for structural aberrations (gaps, breaks, exchanges) and polyploids, and the percentage of cells with aberrations (with and without gaps) calculated. The negative control vehicle was acetone; positive control compounds were mitomycin C –S9 and cyclophosphamide + S9 (doses not specified).</p>
<p><u>Results</u> Genotoxic effects</p>	<p>Dicyclopentadiene did not induce structural chromosomal aberrations or polyploidy in CHL/IU cells up to a concentration causing more than 50% cell growth inhibition with or without metabolic activation. Structural chromosomal aberrations were marginally induced at the highest dose –S9, 0.057mg/ml, after 24 hr continuous exposure.</p>
<p><u>Conclusions</u> (contractor)</p>	<p>Dicyclopentadiene did not induce significant cytogenetic damage to mammalian cells in vitro under conditions of this assay. Although some marginal chromosome damage occurred at the highest –S9 dose after 24 hrs continuous exposure, the test material was confirmed to be negative for clastogenicity in an in vitro micronucleus assay (details not cited).</p>
<p><u>Data Quality</u> <i>Reliabilities</i></p>	<p>2. Reliable with restrictions. Limited detail; summary information sheet only provided by Japan Chemical Industry Ecology-Toxicology and Information Center (JETOC). Study</p>

Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Repeated Dose Toxicity

<p><u>Test Substance</u> Remarks</p> <p><u>Method</u> Method/guideline followed Test type GLP Year Species Strain Route of administration Duration of test Doses/concentration levels Sex Exposure period Frequency of treatment Control group and treatment Post exposure observation period Statistical methods</p> <p>Test Conditions</p>	<p>Dicyclopentadiene (DCPD), CAS #77-73-6, >95% endo-DCPD, 0.5%iso-DCPD and approx. 1% cyclopentadiene (CPD). Clear colorless liquid at room temperature. <u>Olefins Panel HPV Stream Name: DCPD High Purity</u></p> <p>Not specified Subchronic Yes 1982 Rat Fischer 344 Inhalation 26 wks 0, 1.0, 5.1 and 51ppm (actual) Males and females 2, 6 and 13 wks 6hr/day, 5 days/wk Male and female rats, Filtered air 4 and 13 wks Analysis of variance, Bartlett's test, Duncan's multiple range test, F-test, Student's t-test, Cochran t-test (applied when appropriate)</p> <p>Rats (30-34 days of age) were individually housed in stainless steel wire mesh suspended cages and maintained on a 12hr light/dark cycle. Chow diet and water were provided ad lib. Room temperature and relative humidity were maintained between 68-72°F and 40-60%, respectively; during exposure, ranges were 70-79°F and 39-68%, respectively. DCPD vapor was generated by heating the liquid in a Pyrex tube using a minimum amount of heat to prevent decomposition and formation of CPD. Filtered air was used to dilute the vapor prior to introduction into the chamber. Chamber concentrations were monitored by gas chromatography/flame ionization detection. Each dose group consisted of 51 rats/sex. Nine rats/sex/dose were scheduled for sacrifice the day after 2, 6, and 13 wks of exposure and 4 and 13 wks post-exposure. In addition, 3 rats/sex/dose were sacrificed after 13 wk exposure and 3/sex/dose after 13 wks post-exposure for electron microscopy of the kidneys. Rats were observed for clinical signs before and after each exposure, and daily during the recovery period. Body wt was recorded at initiation, weekly during both the exposure period and the first 5 wks of recovery, and then every 2 wks. High dose rats received ophthalmoscopic examination before sacrifice. Hematology and serum chemistry analyses were performed on all rats prior to sacrifice after 2, 6 and 13wk exposure and 4 and 13wk post-exposure with blood from the orbital sinus. Erythrocyte count, hemoglobin, hematocrit, mean corpuscular volume, mean corpuscular hemoglobin and concentration, and total/differential white blood cell counts were determined. Serum was analyzed for creatinine, urea nitrogen, calcium, phosphorous, chloride, alanine aminotransferase, aspartate aminotransferase, total protein, albumin, total bilirubin, alkaline phosphatase, glucose and osmolality. Urinalysis was performed weekly for the first 4 wks of the study and prior to sacrifice. Semi-quantitative assessments were made of pH, protein, glucose, bilirubin, urobilinogen and blood, and quantitative assessment of volume, specific gravity, osmolality, color, turbidity, creatinine, calcium, phosphorous, chloride, sodium and potassium. Food and water consumption were also measured. A urine concentration test was performed on day 6 (males and females) and on day 83 (males only) in rats deprived of water for 16 hrs. Necropsies were conducted on all rats. Kidneys, lungs, liver and testes were weighed. Adrenals, bone and bone marrow (sternum), brain, epididymides, eyes, heart, kidneys, larynx, liver, lungs, lymph nodes (mediastinal), muscle (gastrocnemeous), nasal turbinates, parathyroids, pituitary, sciatic nerve, spleen, testes, thymus, thyroids, trachea, urinary bladder and gross lesions were preserved for microscopic evaluation. All rat kidneys and</p>
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<p><u>Results</u> NOAEL (NOEL) LOAEL (LOEL) Remarks</p> <p><u>Conclusions</u> (study authors)</p> <p><u>Quality</u> Reliabilities</p> <p><u>References</u></p>	<p>urinary bladders were examined microscopically; other organs were only examined microscopically in control and high dose rats sacrificed after 13 wks of exposure. Electron microscopic examination was performed on rat kidneys fixed in gluteraldehyde/formaldehyde for 24hr and post-fixed in 1% osmium tetroxide, and embedded in Epon 812.</p> <p>Males<1.0ppm (renal tubule hyperplasia, epithelial cell casts); Females=51ppm Males=1.0ppm (renal tubule hyperplasia, epithelial cell casts); Females: not reached at 51ppm</p> <p>No treatment related mortality occurred. No consistent pattern of clinical signs was observed during the study, and during exposure, all rats appeared normal. There were no treatment related changes in body wt or food consumption. Males in the 51ppm group had a significant decrease in urine specific gravity and osmolality, occasionally associated with increased urine volume and/or increased water consumption; these effects were exposure, dose and time-related. Analysis of urine sediment uncovered epithelial cells indicative of renal damage in all test article dose groups. Dose-related epithelial cell casts were found at all DCPD levels during the study but not during recovery. These effects were not seen in females. At 51ppm, males showed altered excretion rates for calcium (decrease), sodium (decrease) and potassium (increase). Urine concentrating ability was also decreased at 51ppm in males but not in females. Serum chemistries were minimally altered: calcium (increase at 51 and 5.1ppm), alanine aminotransferase (decrease at 51 and 5.1ppm). No biologically significant changes in hematological parameters were seen. Mild conjunctivitis was seen in several rats during DCPD exposure in the 51 and 5.1ppm groups. No significant effects were seen at necropsy. Male rats at 51ppm had significant increases in relative liver wt and both absolute and relative kidney wts; these effects cleared during recovery. DCPD related organ wt changes were not seen in females. The only histopathological finding related to DCPD exposure was in male rat kidney. At 5.1 and 51ppm males accumulated hyaline droplets in the proximal convoluted tubular epithelial cells by the 10th DCPD exposure, and resolved during recovery. Males exposed to 5.1 and 51ppm had tubular hyperplasia, tubule proteinosis and basement membrane thickening. The frequency of kidney tubular protein accumulation after 30 exposures increased significantly in 1.0ppm males. On several occasions, parameters measured in the 1.0ppm males changed in the same direction as in the higher dose groups but the magnitude of change was lower, and hence, not significant. Examples of occurrences were for relative kidney wt., decreased urine osmolality, decreased sodium, increased potassium excretion, and kidney tubular hyperplasia. Electron microscopy supported the light microscopy observations.</p> <p>The only major effect observed was a male rat specific nephropathy, characteristic of the hyaline droplet nephropathy produced by a diverse group of compounds.</p> <p>1. Reliable without restrictions</p> <p>Dodd, D.E., Longo, L.C. and Eisler, D.L. 1982. Ninety-day vapor inhalation study on rats and mice. Report #44-520. Bushy Run Research Center, Export, PA, for Exxon Corp. East Millstone, NJ</p> <p>Bevan, C., Snellings, W.M., Dood, D.E. and Egan, G.F. 1992. Subchronic toxicity study of dicyclopentadiene vapor in rats. Toxicol. and Ind. Health 8: 353-67.</p> <p>Gad, S.C., Snellings, W.M., Egan, G.F., Nachreiner, D.J., Evanscheck, R.E. and Dickey, C.L. 1981. Acute and subacute inhalation toxicity of dicyclopentadiene in rats and mice. Doc. #81-MR-R2694. Bushy Run research Center, Export, PA for Exxon Chemical Corp.</p> <p>Snellings, W.M. 1981. 9-day rat and mouse inhalation study. Report #43-527. Bushy Run Research Center, Export PA for Exxon Corp., Linden, NJ (test article description).</p> <p>Gad, S.C., Egan, G.F., Nachreiner, D.J., and Evanscheck, R.E. 1980. Acute and subacute inhalation toxicity of dicyclopentadiene in rats and mice. Abst. #130 from the 19th Annual</p>
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<p><i>Other</i> Last changed</p>	<p>meeting of the Society of Toxicology Revised 11/21/2001 (Prepared by a contractor to the Olefins Panel)</p>
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Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Repeated Dose Toxicity

<p><u>Test Substance</u> Remarks</p> <p><u>Method</u> Method/guideline followed Test type GLP Year Species Strain Route of administration Duration of test Doses/concentration levels Sex Exposure period Frequency of treatment Control group and treatment Post exposure observation period Statistical methods</p> <p>Test Conditions</p> <p><u>Results</u> NOAEL (NOEL) LOAEL (LOEL) Remarks</p>	<p>Dicyclopentadiene (DCPD), CAS #77-73-6, >95% endo-DCPD, 0.5%iso-DCPD and approx. 1% cyclopentadiene (CPD). Clear colorless liquid at room temperature. <u>Olefins Panel HPV Stream Name: DCPD High Purity</u></p> <p>Not specified Subchronic Yes 1982 Mouse B6C3F1 Inhalation 26 wks 0, 1.0, 5.1 and 51ppm (actual) Males and females 2, 6 and 13 wks 6hr/day, 5 days/wk Male and female mice, Filtered air 4 and 13 wks Analysis of variance, Bartlett's test, Duncan's multiple range test, F-test, Student's t-test, Cochran t-test (applied when appropriate)</p> <p>Mice (30-34 days of age) were individually housed in stainless steel wire mesh suspended cages and maintained on a 12hr light/dark cycle. Chow diet and water were provided ad lib. Room temperature and relative humidity were maintained between 68-72°F and 40-60%, respectively; during exposure, ranges were 70-79°F and 39-68%, respectively. DCPD vapor was generated by heating the liquid in a Pyrex tube using a minimum amount of heat to prevent decomposition and formation of CPD. Filtered air was used to dilute the vapor prior to introduction into the chamber. Chamber concentrations were monitored by gas chromatography/flame ionization detection. Each dose group consisted of 45 mice/sex. Nine mice/sex/dose were scheduled for sacrifice after 2, 6, and 13 wks of exposure and 4 and 13 wks post-exposure. Mice were observed for clinical signs before and after each exposure, and daily during the recovery period. Body wt was recorded at initiation, weekly during both the exposure period and the first 5 wks of recovery, and then every 2 wks. High dose mice received ophthalmoscopic examination before sacrifice. Hematology and serum chemistry analyses were performed on all mice prior to sacrifice after 2, 6 and 13wk exposure and 4 and 13wk post-exposure with blood from the orbital sinus. Erythrocyte count, hemoglobin, hematocrit, mean corpuscular volume, mean corpuscular hemoglobin and concentration, and total/differential white blood cell counts were determined. Serum was analyzed for creatinine, urea nitrogen, calcium, phosphorus, chloride, alanine aminotransferase, aspartate aminotransferase, total protein, albumin, total bilirubin, alkaline phosphatase, glucose and osmolality. Necropsies were conducted on all mice. Kidneys, lungs, liver and testes were weighed. Adrenals, bone and bone marrow (sternum), brain, epididymides, eyes, heart, kidneys, larynx, liver, lungs, lymph nodes (mediastinal), muscle (gastrocnemius), nasal turbinates, parathyroids, pituitary, sciatic nerve, spleen, testes, thymus, thyroids, trachea, urinary bladder and gross lesions were preserved for microscopic evaluation. Organs were only examined microscopically in control and high dose mice sacrificed after 13 wks of exposure.</p> <p>Males and Females = 5.1ppm Males and Females = 51.0ppm (deaths) Ten males and 9 female mice exposed to 51ppm DCPD died during the study; whereas no more than 2 mice died at any other level. No significant clinical signs or body wt changes</p>
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<p><u>Conclusions</u> (study authors)</p> <p><u>Quality</u> Reliabilities</p> <p><u>References</u></p> <p><u>Other</u> Last changed</p>	<p>were noted prior to death. The likely cause of death appeared to be pulmonary congestion and possibly renal failure. These effects were not seen in mice sacrificed at the end of the study. During exposure, a few of the mice at 51 and 5.1ppm showed coordination loss and/or decreased activity. Males and females in the 51ppm group showed significant elevation in body wt gain that returned to control values during recovery. No consistent changes in serum chemistry values were found. No biologically significant effects on hematology and no alterations in blood cell differential counts were observed. Mild conjunctivitis was seen in one male mouse at 51ppm. No lesions were found at gross necropsy. No exposure related changes in organ wt were observed and no histopathological effects were noted in either sex.</p> <p>Approximately 20% of both sexes of mice died at 51ppm, apparently of pulmonary congestion, but similar effects were not seen in mice sacrificed on schedule. A significant body wt gain was also observed, only in female mice, at 51ppm (40% of the LD₅₀). No other biologically significant effects were observed.</p> <p>1. Reliable without restrictions</p> <p>Dodd, D.E., Longo, L.C. and Eisler, D.L. 1982. Ninety-day vapor inhalation study on rats and mice. Report #44-520. Bushy Run Research Center, Export, PA, for Exxon Corp. East Millstone, NJ</p> <p>Gad, S.C., Snellings, W.M., Egan, G.F., Nachreiner, D.J., Evancheck, R.E. and Dickey, C.L. 1981. Acute and subacute inhalation toxicity of dicyclopentadiene in rats and mice. Doc. #81-MR-R2694. Bushy Run Research Center, Export, PA for Exxon Chemical Corp.</p> <p>Snellings, W.M. 1981. 9-day rat and mouse inhalation study. Report #43-527. Bushy Run Research Center, Export PA for Exxon Corp., Linden, NJ (test article description).</p> <p>Gad, S.C., Egan, G.F., Nachreiner, D.J., and Evancheck, R.E. 1980. Acute and subacute inhalation toxicity of dicyclopentadiene in rats and mice. Abst. #130 from the 19th Annual meeting of the Society of Toxicology</p> <p>Revised 11/21/2001 (Prepared by a contractor to the Olefins Panel)</p>
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Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Developmental Toxicity/Teratogenicity

<p><u>Test Substance</u> Remarks</p> <p><u>Method</u> Method/guideline followed Test type GLP Year Species Strain Route of administration Concentration levels Sex Exposure period Frequency of treatment Control group and treatment Duration of test Statistical methods</p> <p>Remarks for Test Conditions.</p> <p><u>Results</u> NOAEL maternal toxicity NOAEL developmental toxicity Maternal effects</p>	<p>Dicyclopentadiene (DCPD), CAS #77-73-6, C₁₀H₁₂, purity 98% <u>Olefins Panel HPV Stream Name: DCPD High Purity</u></p> <p>Standard method, no guidelines specified Developmental toxicity – Range finding study Yes 1993 Rat Sprague Dawley (VAF), CD(SD)BR Oral gavage 0, 50, 200, 300, 400 and 500mg/kg/day in corn oil Female; timed pregnancies: 11 rats/group for 50-400mg/kg; 10 rats in 500mg/kg group Days 6-15 of gestation Once/day in the morning 11 timed pregnant rats; 5ml corn oil/kg/ day Day 5 - 20 of gestation Data analyzed using non-parametric statistical methods to identify dose response trends among treatment groups and differences between control and treatment groups. Kruskal-Wallis one-way analysis of variance used for all parameters except gestation day 5-20 body wts, gravid uterus wt and average fetal wts. Mann-Whitney Wilcoxon U test was used when Kruskal-Wallis was significant (p<0.05). Jonckheere's test for k independent samples was used for dose-response trends for gestation day 5 to day 20 body wt data. If no trend was found, Dunn's test was used for differences among dose groups; if a trend was present Shirley's test was applied. Body wt data from non-pregnant rats were not included.</p> <p>Sixty-five timed-pregnant rats (approx. 77 days old), received on day 5 of gestation (plug date=day 0 of gestation), were individually housed (room environmental information not presented) and identified by tail tattoo. Animals were assigned to control or one of 5 treatment groups using a stratified randomization method. [Reviewer's note: Actual number of animals/group was not specified but was estimated from subsequent data to be 11 rats each/treatment group 50-400mg/kg and vehicle control, and 10 rats/500mg/kg group.] All animals found dead prior to scheduled necropsies were examined for gavage injury and pregnancy. Non-pregnant animals were excluded from body wt data and all subsequent tabulations. Doses of 50-500mg/kg were selected based on the reported LD₅₀ range for DCPD in rats of 378-820mg/kg. Test solutions were formulated in corn oil (w/v) and administered at a standard volume of 5ml/kg body wt. for all dose levels. Dosages were adjusted based on body wt on gestation days 6, 8, 10, 12 and 14. Dosage solutions were analyzed by capillary gas chromatography for concentration accuracy and stability. Corn oil solutions containing 10mg/ml of DCPD were stable when stored for 30 days in sealed glass bottles at room temperature. Body wts were recorded on gestation days 5, 6, 8, 10, 12, 14, 16 and 20 (termination). Clinical signs of toxicity or mortality were evaluated twice daily during and post-dosing. At Caesarean section, the following data were collected: terminal body wt of dams, gravid uterine wt, live litter wt, number of implantation sites, resorptions, dead fetuses and live fetuses.</p> <p>NOAELmaternal was not determined. NOAELfetal = 50mg/kg (Assigned by reviewer) Signs of systemic toxicity beginning at day 7 of gestation were observed in all animals dosed at 200mg/kg and above. Clinical signs included dried material around nose and</p>
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<p>Embryo/fetal effects</p> <p><u>Conclusions</u> (study authors)</p> <p><u>Data Quality</u> <i>Reliabilities</i></p> <p><u>References</u></p> <p><u>Other</u> <i>Last changed</i></p>	<p>mouth, rough hair coat, and lethargy increasing in severity with increasing dose; convulsions (1 rat in 200mg/kg group), hunched posture (6 rats in 300mg/kg group) and ataxia (5 rats in 300mg/kg, 11rats in 400mg/kg and 9 rats in 500mg/kg/day groups). All animals in the 400 and 500mg/kg/day groups were found dead by gestation day 9; 3/7 and 8/9 pregnant rats in groups 200 and 300mg/kg/day were found dead or were sacrificed for humane reasons by gestation day 9. Body wts of treated pregnant rats were decreased in a dose-related manner beginning at gestation day 8. Statistically significant differences from vehicle control (9 total rats) were observed on gestation days 8 and 10 in the 50mg/kg/day group (10 rats; 6% lower on both days), gestation days 8-20 in 200mg/kg (4 rats; 16-21% lower during treatment, 9% lower post-treatment) and 300mg/kg (1 rat) groups, and gestation day 8 in the 400 and 500mg/kg groups (all animals died on day 9). Dose-related decreases were also noted for body wt gain: statistically significant decreases during treatment (25 and 60% less than controls, respectively) in the 50 and 200mg/kg groups, wt gain during gestation (20% less) and corrected wt gain (23% less) were significantly decreased in the 200mg/kg group. The single pregnant female in the 300mg/kg/day group was excluded from wt gain calculations.</p> <p>At the gestation day 20-caesarean section, average fetal wt was significantly lower by 10% compared to controls in the 200mg/kg group; the single rat in the 300mg/kg group resorbed her litter. All other fetal parameters, including live fetuses/litter, dead fetuses/litter, resorptions/litter, completely resorbed litter, dead implants/litter and total implants/litter in the 50 and 200mg/kg/day dose groups did not differ from vehicle controls.</p> <p>In this range-finding study, dicyclopentadiene treatment caused maternal toxicity and lethality at doses of 200mg/kg/day and above with 100% mortality of animals treated at 400 and 500mg/kg/day. Body wt and wt gain were decreased at all dose levels, reductions being greater with increasing doses. The only developmental toxicity in surviving litters was decreased fetal wt. in the 200mg/kg/day group.</p> <p>2. Reliable with restrictions. Actual number of animals/group not specified. Room environmental conditions not reported.</p> <p>Gulati, D.K. et al. 1993. Range-finding studies: Developmental toxicity of dicyclopentadiene when administered via gavage to CD Sprague-Dawley rats. Study No. NTP-92-RF/DT-038. Environmental Health Research and Testing, Inc. Lexington, KY. for National Toxicology Program, NIEHS, Research Triangle Park, NC</p> <p>Revised 11/21/2001 (Prepared by a contractor to the Olefins Panel)</p>
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Developmental Toxicity/Teratogenicity

<p><u>Test Substance</u> Remarks</p> <p><u>Method</u> Method/guideline followed Test type GLP Year Species Strain Route of administration Concentration levels Sex Exposure period Frequency of treatment Control group and treatment Duration of test Statistical methods</p> <p>Remarks for Test Conditions.</p> <p><u>Results</u> NOAEL maternal toxicity NOAEL developmental toxicity Maternal effects</p>	<p>Dicyclopentadiene (DCPD), CAS #77-73-6, C₁₀H₁₂, purity 98% <u>Olefins Panel HPV Stream Name: DCPD High Purity</u></p> <p>Standard method, no guidelines specified Developmental toxicity – Range finding study Yes 1993 Rabbits New Zealand White Oral gavage 0, 25, 100, 200, 300 and 400mg/kg/day in corn oil Female; presumed pregnant: 10/group Days 6-19 of gestation Once/day in the morning 10 presumed pregnant rabbits; 1ml corn oil/kg/ day Day 2 - 30 of gestation Data analyzed using non-parametric statistical methods to identify dose response trends among treatment groups and differences between control and treatment groups. Kruskal-Wallis one-way analysis of variance used for all parameters except gestation day 3--30 body wts, gravid uterus wt and average fetal wts. Mann-Whitney Wilcoxon U test was used when Kruskal-Wallis was significant (p<0.05). Jonckheere's test for k independent samples was used for dose-response trends for gestation day 3 to day 30 body wt data. If no trend was found, Dunn's test was used for differences among dose groups; if a trend was present Shirley's test was applied. Body wt data collected after animals aborted were not included.</p> <p>Sixty presumed-pregnant rabbits (approx. 22 wks old), received on day 2 of gestation (breeding date=day 0 of gestation), were individually housed (room environmental information not presented) and identified by ear tattoo. Animals were assigned to control or one of 5 treatment groups using a stratified randomization method. Doses of 25-400mg/kg were selected based on the reported LD₅₀ range for DCPD in rats of 820mg/kg, as no rabbit data were available. Test solutions were formulated in corn oil (w/v) and administered at a standard volume of 1ml/kg body wt. for all dose levels. Dosages were adjusted based on body wt on gestation days 6, 8, 10, 12, 14, 16 and 18. Dosage solutions were analyzed by capillary gas chromatography for concentration accuracy and stability. Corn oil solutions containing 10mg/ml of DCPD were stable when stored for 30 days in sealed glass bottles at room temperature. Body wts were recorded on gestation days 3, 6, 8, 10, 12, 14, 16 18, 20, 25 and 30 (termination). Clinical signs of toxicity or mortality were evaluated twice daily during and post-dosing. At Caesarean section, the following data were collected: terminal body wt of dams, gravid uterine wt, number of implantation sites, resorptions, dead fetuses and live fetuses.</p> <p>NOAELmaternal =25mg/kg. (based on abortion by 1 dam at 100mg/kg/day) NOAELfetal = 300mg/kg (Assigned by reviewer) Signs of systemic toxicity (decreased food and water consumption) were noted in all animals in the 300 and 400mg/kg/day groups beginning on gestation day 9; 1/9 and 3/9 rabbits in the 300 and 400mg/kg groups, respectively, died prior to scheduled necropsy. In the 100mg/kg/day group, one rabbit aborted her litter beginning on gestation day 18; another had bloody vaginal discharge beginning on day 26 of gestation but was pregnant at scheduled necropsy. In the 300mg/kg group, 1 rabbit had a bloody vaginal discharge</p>
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<p>Embryo/fetal effects</p> <p><u>Conclusions</u> (study authors)</p> <p><u>Data Quality</u> <i>Reliabilities</i></p> <p><u>References</u></p> <p><u>Other</u> <i>Last changed</i></p>	<p>beginning on day 19 of gestation, aborted 4 kits on day 21 with an additional 9 masses on gestational day 22. Three animals in the 400mg/kg/day group had blood vaginal discharges; 2 recovered over several days, one was dead on gestation day 23. Body wts</p> <p>taken after abortions and developmental toxicity data from the 2 animals that aborted were not included in data analysis. Maternal body wt decreased in a generally dose-related manner beginning on gestation day 8, becoming statistically significant ($p < 0.05$) from controls from day 10 through gestation day 18 for the 300mg/kg group and day 8-30 for the 400mg/kg group. Maternal wt gain during treatment was also statistically significantly decreased compared to controls in the 200mg/kg/day and higher groups. At Caesarean section, the number of resorptions and non-live implants/litter were higher, and the number of fetuses was lower, in the 400mg/kg group compared to controls but were not statistically significant. Two litters from this group showed gross deformities of kits – one with eyes open and 1 with eyes open and deformed hind limbs in one litter of 3 total live kits, and eyes open in all 12 kits from another 400mg/kg litter. No other developmental parameters were adversely affected.</p> <p>Dicyclopentadiene caused maternal toxicity at 200mg/kg/day and higher dose levels and abortion of 1 litter at 100mg/kg in this range-finding study. Gross deformities were evident in two litters from dams given 400mg/kg/day but no other developmental endpoints were significantly affected at any other maternally toxic or non-toxic dose level.</p> <p>1. Reliable without restrictions.</p> <p>Gulati, D.K. et al. 1993. Range-finding studies: Developmental toxicity of dicyclopentadiene when administered via gavage to New Zealand White rabbits. Study No. NTP-92-RF/DT-044. Environmental Health Research and Testing, Inc. Lexington, KY. for National Toxicology Program, NIEHS, Research Triangle Park, NC</p> <p>Revised 11/21/2001 (Prepared by a contractor to the Olefins Panel)</p>
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Developmental Toxicity/Teratogenicity

<p><u>Test Substance</u> Remarks</p> <p><u>Method</u> Method/guideline followed Test type GLP Year Species Strain Route of administration Concentration levels Sex Exposure period Frequency of treatment Control group and treatment Duration of test Statistical methods</p> <p>Remarks for Test Conditions.</p> <p><u>Results</u> NOAEL maternal toxicity NOAEL developmental toxicity Maternal effects</p>	<p>Dicyclopentadiene (DCPD) CAS #77-73-6, purified <u>Olefins Panel HPV Stream Name: DCPD (concentrate) or DCPD High Purity</u></p> <p>Standard method, no guideline specified Teratogenesis Not specified 1978 Rat Sprague Dawley [CRL:COBS CD(SD)BR] Diet (Purina Laboratory Meal Chow) 0, 80, 250, 750ppm Female, pregnant (20/treatment group) Days 6-15 of gestation Ad lib exposure to treated diet 21 pregnant females; diet containing 300ml corn oil/10kg meal Day 0-19 of gestation Dunnett's t-test used for body wts and food consumption of dams, mean pup wts based on litter averages. (p<0.05). Ratios (e.g. sex, pregnancy) analyzed by 2x2 contingency table with Yates' correction. Discontinuous parameters (e.g. number of abnormal fetuses in a litter) were evaluated by Wilcoxon Rank Sum. The litter was the basic sampling unit.</p> <p>Female rats were acclimated for 12 days then paired with sexually mature males (1:1) of the same strain and supplier. Females were examined daily for evidence of mating and the presence of a copulatory plug was considered day 0 of gestation. Mated female rats, approximately 11 wks old at time of first dose (day 6 of gestation) were assigned sequentially to treatment groups and identified by cage cards. Females were individually housed in wire cages in a temperature-controlled room (Temp. and humidity ranges not reported) with a 12hr light/dark cycle. Appropriate diets and fresh water (acidified pH 2.5) were provided ad lib. DCPD was incorporated in basal diet daily on days 6-15 of gestation. Test material (0.8, 2.5, and 7.5g) was suspended in 300ml corn oil and blended with 10kg basal diet in a twin shell blender for 15 min. Vehicle control diet contained 300ml corn oil in 10kg meal. Mated females were weighed on day 0, 6, 16 and 19 of gestation. Food consumption was measured during period 0-6, 6-16 and 16-19 of gestation. Animals were observed daily for changes in general appearance, behavior and condition. On day 19 of gestation, adult females were sacrificed by chloroform anesthesia, visceral and thoracic regions were examined, and the uterus removed and opened. Number of implantation sites, placement in uterine horns, live and dead fetuses, and resorption sites were recorded. Fetuses were removed, examined externally for abnormalities and weighed. One third of fetuses from each litter were fixed in Bouin's fluid for soft tissue examination of head, thoracic and visceral organs. Remaining fetuses were eviscerated and stained with Alizarin Red S for skeletal examination. Uterus and ovaries of adult females were preserved in 10% formalin.</p> <p>NOAEL maternal and embryo/fetal toxicity = 750ppm. Assigned by reviewer. No adult females died during the study and all appeared normal on day 19 of gestation, except for 1 rat in the 80ppm group that was emaciated, had an arched back and red crust around the mouth and nose. Mean body wts and food consumption indicated no significant differences between control and treated pregnant rats (Data cited in Appendix 1, not included with report). Test material did not produce any adverse effects on uterine contents on day 19 of gestation. Pregnancy ratios were: 19/21, 20/20, 19/20 and 19/20 in</p>
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Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Toxicity to Reproduction

<p><u>Test Substance</u> Remarks</p> <p><u>Method</u> Method/guideline followed Test type GLP Year Species Strain Route of administration Duration of test</p> <p>Concentration levels Sex Exposure period Frequency of treatment Control group and treatment</p> <p>Statistical methods</p> <p>Remarks for Test Conditions.</p> <p><u>Results</u> NOAEL</p> <p><u>Conclusions</u></p>	<p>Dicyclopentadiene, CAS # 77-73-6 (3a, 4, 7, 7a-Tetrahydro-4, 7-methanoindene), purity 94.65%.</p> <p><u>Olefins Panel HPV Stream Name: DCPD High Purity</u></p> <p>OECD Guideline 422: Combined repeated dose toxicity study with reproduction/ developmental toxicity screening Yes 1998 Rats Sprague Dawley (Crj:CD[SD]) from Charles River Japan, Inc Oral gavage Males 44 days; Females from 14 days before mating through gestation and parturition until day 3 of lactation 0, 4, 20, 100mg/kg/day in olive oil Males and females; 10M, 10F/group (ages not specified) Maximum 45 consecutive days Once/day Males and females; olive oil, once/day</p> <p>None specified</p> <p>No study details provided. In OECD guideline 422, test substance is administered to male and female rats daily by oral gavage from 2 weeks prior to mating and during mating (approx. 2 weeks). Male rats continue to be dosed for at least another two weeks post-mating or, as in this study, until sacrifice of females after day 3 of lactation. Females continue to be dosed through gestation to day 3 of lactation. Females are sacrificed on day 4 of lactation and males on day 45 of the study.</p> <p>NOELrepeat dose toxicity: Males < 4/mg/kg/day; Females = 20mg/kg/day NOELreproduction: Parental Males = 100mg/kg/day; Dams and offspring = 20mg/kg/day</p> <p><u>Repeat dose toxicity:</u> Two females in the high dose (100mg/kg) group died; males and surviving females showed slight suppression of body wt gain and decreased food consumption. Blood chemistry of high dose males showed increase in GOT and GPT; no test material related changes occurred in hematology parameters for any treatment group. Increased weight of liver and kidneys of male rats given 100mg/kg were accompanied by single cell necrosis in liver, and hyaline droplets and basophilic changes in tubular epithelium of kidneys under microscopic examination. Increase in fatty droplets in fascicular zone of adrenals was observed in both males and females in the 100mg/kg group. Similar histopathologic changes were seen in kidneys of 4, 20mg/kg group male rats and in adrenals of 20mg/kg group male rats.</p> <p><u>Reproduction/Developmental toxicity:</u> Dicyclopentadiene had no effect on mating, fertility, gestation, implantation, or delivery indices, or on gestation length, number of corpora lutea, implantations, or parturition. Two females in the 100mg/kg group lost 100% of their litters during lactation (days 1-4). [Reviewer's note: It is likely that these are the females that died, but not specified in summary]. A low viability index and tendency to lower birth wt and body wt gain was observed in neonates in the highest dose group (100mg/kg). No significant differences in number of offspring, live offspring at birth, sex ratio or live birth index were found. No abnormal findings were observed in external features, clinical signs in dams or during life of offspring, or at necropsy of offspring.</p>
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<p>(contractor)</p> <p><u>Data Quality</u> <i>Reliabilities</i></p> <p><u>References</u></p> <p><u>Other</u> <i>Last changed</i></p>	<p>Dicyclopentadiene induced systemic toxicity in male and female rats including death of two females at the 100mg/kg/day dose level. No compound related effects were seen on reproductive parameters although two females in the 100mg/kg group lost 100% litters during lactation. Effects on neonates included low viability index, lower birth wt and body wt gain in the 100mg/kg group, but no effects were seen on other parameters in neonates at any dose level.</p> <p>2. Reliable with restriction. Limited study design detail; no analytical data on dosing solutions, no numerical or statistical data available. Summary information sheet provided by Japan Chemical Industry Ecology-Toxicology and Information Center (JETOC). Study performed according to OECD Guideline 422 and GLP by a reputable laboratory.</p> <p>JETOC 1998. Special Issue #3; No. 32 (March 1998), Tokyo, Japan. Study performed at Mitsubishi Chemical Safety Institute, Ltd., Kashimagun, Ibaraki, Japan</p> <p>Revised 11/21/2001 (Prepared by a contractor to the Olefins Panel)</p>
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Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Toxicity to Reproduction

<p><u>Test Substance</u> Remarks</p> <p><u>Method</u> Method/guideline followed Test type GLP Year Species Strain Route of administration Duration of test Concentration levels Sex Exposure period</p> <p>Frequency of treatment Control group and treatment Statistical methods</p> <p>Remarks for Test Conditions.</p> <p><u>Results</u> NOAEL General information</p> <p>First generation</p>	<p>Dicyclopentadiene (DCPD) CAS #77-73-6, purified <u>Olefins Panel HPV Stream Name: DCPD (concentrate) or DCPD High Purity</u></p> <p>Standard method, no guideline specified Three generation Reproduction Not specified 1979 Rat Sprague Dawley [CRL:COBS CD(SD)BR] Diet (Purina Laboratory Meal Chow) 3 generations (approx. 45-50wks) 0, 80, and 750ppm nominal concentrations (0, 69.3, 693ppm actual concentrations) Males and females (10M, 20F/group in F0 generation) F0-approx 28 wks; F1a, F2a and F3- in utero, birth to weaning; F1b, F2b- in utero and approx. 31 wks. Ad lib exposure to treated diet 10M, 20F/group in F0 generation; diet containing 300ml corn oil/10kg meal No methods specified</p> <p>Weanling albino rats were acclimated for 11 days, then assigned randomly to three groups. These F0 generation rats were identified by ear tag and cage cards, housed individually in shoe-box cages on AB-SORB-DRI bedding, except when mating. Food and water were provided ad lib. Room temperature, humidity and light/dark cycle intervals were not specified. Fresh diets were prepared weekly of appropriate quantity of DCPD dissolved in 300ml corn oil, added to 10kg diet and mixed for at least 15min in a twin shell blender. Control diet was prepared in the same way of 300ml corn oil/10kg diet. Dietary batches were analyzed by gas-liquid chromatography. Seven weeks after initiation of treated diet, F0rats were mated, 1 male: 2 females, within a dose group for 2 wks. At the end of 2 weeks, rats were returned to individual cages and females were allowed to deliver. One week after weaning the first litter (F1a), F0 parents were re-mated- each male with 2 different females within the group. One week after weaning the second litter (F1b), F0 parents were killed and gross necropsies were performed. F1b pups (1M, 2F) from each litter, where possible, were selected to be parents for the next generation, and were caged, fed and watered just as the F0 rats. When F1b rats were approx. 100 days old, they were mated to produce the F2a litters and subsequently the F2b litters. Selected F2b pups were used to produce F3 litters. For each litter, observations included gross abnormalities of pups, mean body wt by sex at birth, number of pups/sex at day 4 of lactation, number of pups/sex and body wts at day 21 of lactation (weaning). At day 4 of lactation, each litter was reduced to 8 pups (4/sex if possible). At weaning, gross necropsies were performed on approx. 1/3 of the first litter (a) from all three generations and on 1/3 of F3b litters.</p> <p>NOAEL parental and offspring =750ppm (693ppm actual) [all generations]. Assigned by reviewer Weekly feed analyses showed a 69.3ppm (87%) average value for 80ppm diet level and 693ppm (92%) for the 750ppm level. Body wt and food consumption data were cited in appendices that were not included in this report. <u>F0 parents, F1a and F1b offspring:</u> One F0 female in the 80ppm group was found dead in wk. 28; all other F0 rats survived in good condition. Body wt and food consumption were comparable to controls at each interval. Necropsy findings of F0 parents were unremarkable. Reproductive data for F1a mating indicated 100% fertility for males in</p>
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	<p>control and 80ppm groups and 90% in the 750ppm group. All females mated; Fertility index (F1a litters produced/mated F0 females) was 95%, 90% and 80% in 0, 80 and 750ppm groups, respectively. Gestation index (live litter/pregnant females) was 100% and newborn viability was 99% for F1a litters in all groups. Number of live pups/litter was 11, 12, and 12 in 0, 80 and 750ppm; pup sex ratio on day 0 of lactation and pup body wt at day 0 and day 21 of lactation were comparable in all groups. F1a pup viability on day 4 of lactation was 98%, 99% and 98% in 0, 80 and 750ppm groups, and at end of lactation (day 21/day 4 after litters reduced to 8 pups) was 100% in all groups. In F1a litters, one pup in an 80ppm litter had a opaque left eye and 1 pup in a 750ppm litter had a crooked tail. In the 2nd mating of F0 parents to produce litters F1b, male fertility was 100%; female fertility was 90% in control and 80ppm groups and 95% in 750ppm group. Gestation index was 100% in all groups. F1b newborn viability was 99%, 97% and 99%, pup viability on day 4 of lactation was 97%, 95% and 94%, and viability on day 21 (weaning) was 97%, 97% and 96% in 0, 80 and 750ppm groups, respectively. Live pups/litter, sex ratio and pup body wt at day 0 and day 21 of lactation were comparable to controls and to F1a data. One pup in an 80ppm litter had a deformed hind foot.</p>
Second generation	<p><u>F1b parents, F2a and F2b offspring:</u> Body wt of F1b parent rats were comparable or greater than controls except for 80ppm females at wk 20 (just prior to 2nd mating) when a slightly lower mean body wt (not statistically significant) was seen. Food consumption was also comparable except during wk 20 when both males and females in the 750ppm group had statistically significant reduced food intake (p<0.05, Students t-test). At necropsy, no gross lesions were found in F1b parents. Male fertility was 100%, 100% and 90% for F2a and F2b mating in 0, 80 and 750ppm groups; female fertility was 95%, 90% and 70% in F2a and 95%, 95% and 85% in F2b mating. Reduction in female fertility at 750ppm was not statistically significantly (chi square) different from the 95% control values and may be attributable to failure of one 750ppm male to sire a litter in either mating, resulting in 2/6 and 2/3 non-productive females in F2a and F2b mating, respectively. Gestation index was 100% for all groups in both matings. Newborn viability indices were 100%, 97% and 100% in F2a litters and 99%, 100% and 98% in F2b litters for 0, 80 and 750ppm groups. Pup viability on day 4 of lactation for F2a litters was 98%, 94% and 98%, and at day 21 after reduction (weaning) was 98%, 97% and 98%; for F2b litters, viability at day 4 was 95%, 98% and 93% and at day 21 was 99%, 98% and 99% for 0, 80 and 750ppm groups, respectively. Live pups/litter were 13, 14; 12, 15 and 12, 14 in litters F2a and F2b in 0, 80 and 750ppm groups, respectively. Sex ratios and pup wts on day 0 and day 21 of lactation were comparable to controls and between F2a and F2b mating for both dose groups, and similar to F1 data. One male pup in 80ppm group had hydrocephalus.</p>
Third generation	<p><u>F2b parents, F3a and F3b offspring:</u> Body wt and food consumption of F2b parent rats were comparable to controls. Necropsy findings were unremarkable. Male fertility indices were 90%, 100% and 89% in the F3a mating and 90%, 100% and 100% in F3b mating for 0, 80 and 750ppm groups. Female fertility was lower than previous generations in all groups: F3a 65%, 80% and 85%; F3b 85%, 80% and 83% for 0, 80 and 750ppm groups, respectively. Gestation indices were 100% and newborn viability was 99% in F3a litters and 97-98% in F3b litters for all groups. Pup viability at day 4 of lactation was 96% and 98%; 96% and 100%; 99% and 98% in F3a and F3b litters and at day 21 was 92% and 99%; 100% and 99%; 98% and 97% in F3a and F3b litters for 0, 80 and 750ppm groups, respectively. Live pups/litter ranged from 12-14 in both F3a and F3b mating and were comparable in all groups and with previous generations. Sex ratios were also comparable. A slight reduction in mean pup wt at day 21 (weaning) compared to controls was seen in both treated groups in the F3b litters, only the 750ppm female mean pup wt value was statistically significant. The 80ppm female mean pup wt value was the same but not statistically significant probably due to a slightly larger standard deviation. F3b mean pup wt at day 21 of lactation were: males 49±10g, 44±11g and 43±11g; females 48±9.3g, 41±12g and 41±9.5g for 0, 80 and 750ppm groups, respectively. F3a mean pups wt at day 21, ranged from 46-48g for males and 42-45g for females in all groups. Since mean weanling pup wts in other generations and in the F3a mating were not appreciably different within generations, this F3b occurrence was not considered biologically significant. Pup general observations and necropsy data were unremarkable.</p>

<p><u>Conclusions</u> (contractor)</p> <p><u>Data Quality</u> <i>Reliabilities</i></p> <p><u>References</u></p> <p><u>Other</u> <i>Last changed</i></p>	<p>Dietary administration of dicyclopentadiene at nominal concentrations of 80 and 750ppm to three successive generations of male and female albino rats had no deleterious effects on reproductive performance or general condition of the animals compared to concurrent controls. No evidence of dose-related teratogenic effects was seen in pups of any generation.</p> <p>2. Reliability with restrictions. Actual body wt, food consumption data and details of necropsy of adults not included in the report. Adult organs were not reported to have been weighed or examined histopathologically. Actual volume of test material ingested in diet/group was not calculated. Adherence to GLP was not indicated.</p> <p>Johnston, C.D. and Belilies, R.P. 1979. Three generation reproduction study in rats using dicyclopentadiene. LBI Proj. #10734-07. Litton Bionetics, Inc. Kensington, MD, for U.S. Army Medical Research and Development Command, Washington, DC Contract No. DAMD17-77-C-7003 (1980)</p> <p>Revised 11/21/2001 (Prepared by a contractor to the Olefins Panel)</p>
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Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Dicyclopentadiene/Codimer (DCPD/Codimer Concentrate)

Genetic Toxicity - in Vitro

<p><u>Test Substance</u> <i>Test substance</i></p>	<p>Dicyclopentadiene/Codimer (DCPD/Codimer Concentrate), CAS# 68478-10-4; stable at room temperature below 70° F; colorless liquid</p> <p>DCPD/Codimer Concentrate is produced as a distillate from a C8+ fraction of thermally processed pyrolysis gasoline obtained from ethylene production (steam cracking process). The sample tested consisted of dicyclopentadiene (29%), methylcyclopentadiene dimer (13%), cyclopentadiene/methylcyclopentadiene codimer (13%), other codimers of cyclopentadiene - e.g. with 1,3-butadiene or isoprene (7%), other similar codimers of methylcyclopentadiene (22%), balance (16%).</p> <p>Note: the above composition percentages were reported by the supplier of the test substance on December 17, 2002.</p>
<p><u>Method</u> Methods/guidelines followed</p>	<p>OECD Guideline 471 (Genetic Toxicology: Bacterial Reverse Mutation Test), adopted July 1997 (published February 1998), OPPTS Guideline 870.5100 (Bacterial Reverse Mutation Test) and EC Commission Directive 2000/32/EC.</p>
<p>System of testing</p>	<p><i>Salmonella typhimurium</i> and <i>Escherichia coli</i> with and without S9</p>
<p>GLP</p>	<p>Yes</p>
<p>Year</p>	<p>2003</p>
<p>Species/Strain</p>	<p><i>S. typhimurium</i> TA98, TA100, TA1535, TA1537 and <i>E. coli</i> WP2 <i>uvrA</i>.</p>
<p>Metabolic activation</p>	<p>Yes</p>
<p>Species and cell type</p>	<p>Sprague-Dawley rat liver (S9 fraction) prepared in-house</p>
<p>Quantity</p>	<p>10% S9 in S9 mix</p>
<p>Induced or not induced</p>	<p>Aroclor 1254 induced, rats were given 500mg/kg ip 5 days prior to sacrifice</p>
<p>Concentrations tested</p>	<p>0, 15, 50, 150, 500, 1500 and 5000 µg/plate</p>
<p>Statistical Methods</p>	<p>None</p>

<p>Remarks for Test Conditions</p>	<p>Criteria for positive response were a dose-related increase in the mean revertants per plate of at least one tester strain over a minimum of two increasing concentrations as specified below: TA 1535, TA 1537: At the peak of the dose response an equal to or greater than 3.0-fold dose related increase over solvent control values with or without metabolic activation. TA98, TA100, <i>E. coli</i> WP2 <i>uvrA</i>: At the peak of the dose response an equal to or greater than 2.0-fold dose related increase over solvent control values with or without metabolic activation. Negative controls: Based on historical control data, all tester strains must exhibit characteristic numbers of spontaneous revertants per plate. Positive controls: The mean of each positive control value must exhibit at least a 3.0-fold increase over the respective mean negative control value (vehicle) for each tester strain. DCPD/Codimer Concentrate test solutions were prepared in ethanol immediately prior to use. <i>Salmonella</i> strains and <i>E. coli</i> WP2 <i>uvrA</i> (approx. 10⁹ cells/ml) were exposed to either test solution or vehicle ±S9 by the plate incorporation method. The preliminary toxicity assay was conducted prior to the mutagenicity test with all tester strains over a range of 6.7 to 5000 µg/plate (one plate per dose) ±S9. The dose levels tested in the mutagenicity test were 15, 50, 150, 500, 1500 and 5000 µg/plate ±S9. The mutagenicity test was conducted on triplicate plates per dose. Five hundred (500) microliters of S9 or Sham mix, 100 µl of tester strain and 50 µl vehicle or test substance dilution were added to 2.0 mL of molten selective top agar at 45±2 °C. After vortexing, the mixture was overlaid onto the surface of minimal agar plates. After the overlay had solidified, the plates were inverted and incubated for approximately 48 to 72 hours at 37±2 °C. Revertant colonies for a given tester strain and activation condition, except for the positive controls, were counted either entirely by automated colony counter or entirely by hand unless the plate exhibited toxicity, and conditions of background lawn and precipitation were evaluated. Positive control compounds for the –S9 condition were: 2-nitrofluorene (1.0 µg/plate) for TA98; sodium azide (1.0 µg/plate) for TA100 and TA1535; 9-aminoacridine (75 µg/plate) for TA1537; and methyl methanesulfonate (1000 µg/plate) for WP2<i>uvrA</i>. The positive control compound for the +S9 condition was 2-aminoanthracene, 1.0 µg/plate for all <i>Salmonella</i> strains, and 10 µg/plate for WP2<i>uvrA</i>.</p>
<p><u>Results</u> Genotoxic effects</p>	<p>In the preliminary toxicity test, the maximum dose tested was 5000 µg per plate; this dose was achieved using a concentration of 100 mg/mL and a 50 µL plating aliquot. The dose levels tested were 6.7, 10, 33, 67, 100, 333, 667, 1000, 3333 and 5000 µg per plate. Toxicity was observed with some conditions beginning at 667, 1000 or at 5000 µg per plate but no precipitate was observed. Based on the findings of the toxicity test, the maximum dose plated in the mutagenicity test was 5000 µg per plate. In the mutagenicity test, the maximum dose tested was 5000 µg per plate; this dose was achieved using a concentration of 100 mg/mL. The test substance solution was clear at this concentration. The dose levels tested were 15, 50, 150, 500, 1500 and 5000 µg per plate. Toxicity was observed with some conditions beginning at 1500 or at 5000 µg per plate but no precipitate was observed. DCPD/Codimer Concentrate did not induce a dose-related or 2.0-fold or 3.0-fold increase in the number of revertant colonies in any <i>Salmonella</i> strain or in <i>E. coli</i> WP2 <i>uvrA</i> ±S9. The vehicle controls were acceptable, and the positive control compounds responded appropriately.</p>

<p><u>Conclusions</u></p> <p><u>Data Quality</u> <i>Reliabilities</i></p> <p><u>Reference</u></p> <p><u>Other</u> <i>Last changed</i></p>	<p>Dicyclopentadiene/Codimer did not induce a significant increase in revertant colonies in <i>Salmonella</i> strains or in <i>E. coli</i> WP2 <i>uvrA</i> with or without rat liver metabolic activation at any dose level and is not considered a mutagen in this test system.</p> <p>(1) Reliable without restrictions</p> <p>Wagner, V.O. and Hines, R.M. 2003. Dicyclopentadiene/Codimer: Bacterial Reverse Mutation Test. AA71DT.502.BTL. Unpublished Report (DuPont-12038)</p> <p>03 August 2004</p>
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Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Genetic Toxicity - *In Vivo*

<p><u>Test Substance</u> Remarks</p>	<p><u>Dicyclopentadiene/Codimer Concentrate</u> (DCPD/Codimer Concentrate), CAS #68478-10-4, stable at room temperature below 70 F; clear colorless liquid.</p> <p>DCPD/Codimer Concentrate is produced as a distillate from a C8+ fraction of thermally processed pyrolysis gasoline obtained from ethylene production (steam cracking process). The sample tested consisted of dicyclopentadiene (29%), methylcyclopentadiene dimer (13%), cyclopentadiene/methylcyclopentadiene codimer (13%), other codimers of cyclopentadiene – e.g. with 1,3-butadiene or isoprene (7%), other similar codimers of methylcyclopentadiene (22%), balance (16%).</p> <p><i>Note: The above composition percentages were reported by the supplier of the test substance on December 17, 2002.</i></p>
<p><u>Method</u> Methods/guidelines followed</p>	<p>OPPTS 870.5395 OECD 474 EC Commission Directive 2000/32/EC Mammalian erythrocyte micronucleus assay.</p>
<p>Type GLP Year Species Strain Sex Route of administration Vehicle Doses/concentration levels No. of animals per dose</p>	<p>Yes 2003 Mouse CrI:CD-1[®](ICR)BR Male and female Twice by oral intubation, at an approximate 24-hour interval Corn oil 0, 437.5, 875, or 1750 mg/kg body weight 5/sex/group (0, 437.5, or 875 mg/kg body weight), 7/sex/group (1750 mg/kg body weight).</p>
<p>Control groups and treatment</p>	<p>5/sex vehicle control animals (corn oil); 5/sex positive control (cyclophosphamide, 30 mg/kg once by oral intubation)</p>
<p>Statistical methods</p>	<p>Total polychromatic erythrocytes (PCEs), micronucleated polychromatic erythrocytes, normochromatic erythrocytes (NCEs) were compared to the control using Dunnett's or Dunn's test ($p < 0.05$).</p>
<p>Test Conditions.</p>	<p>Groups of 5 mice/sex/group (7 mice/sex at the highest dose level) were administered the test substance twice (one per day for 2 days) at an approximate 24 hour interval by oral intubation (gavage). Body weights ranged from 22.9-27.6 g (males) and 18.3-24.9 g (females) at time of arrival. The animals were approximately 8 weeks old (males 56 days, females 55 days) at time of exposure. The homogeneity / concentration of the dosing formulations and the test substance stability were verified analytically. The mice were weighed prior to treatment and sacrifice. The mice were observed for clinical signs and mortality/moribundity prior to treatment, approximately 1 hour post-dosing, 3-5 hours post-dosing, and prior to sacrifice. The mice were sacrificed approximately 24 hours after administration of the second dose and smears of bone marrow erythrocytes were prepared and stained. 2000 PCEs per animal were scored for the presence of micronuclei. The proportion of PCEs among 1000 total erythrocytes was determined for each animal, and expressed as the</p>

**Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category
Combined Repeated Dose Toxicity Study and Reproductive/Developmental Toxicity
Screening Test in Rats**

Repeated Dose Toxicity

<u>Test Substance</u>	Dicyclopentadiene/Codimer Concentrate
Remarks	<p>CAS Number 68478-10-4</p> <p>Dicyclopentadiene/Codimer (DCPD/Codimer Concentrate), CAS# 68478-10-4; stable at room temperature below 70° F; colorless liquid</p> <p>DCPD/Codimer Concentrate is produced as a distillate from a C8+ fraction of thermally processed pyrolysis gasoline obtained from ethylene production (steam cracking process). The sample tested consisted of dicyclopentadiene (29%), methylcyclopentadiene dimer (13%), cyclopentadiene/methylcyclopentadiene codimer (13%), other codimers of cyclopentadiene - e.g. with 1,3-butadiene or isoprene (7%), other similar codimers of methylcyclopentadiene (22%), balance (16%).</p> <p>Note: the above composition percentages were reported by the supplier of the test substance on December 17, 2002.</p>
<u>Method</u>	OECD 422
Method/guideline followed	Combined repeated dose toxicity study with the reproduction /
Test type	developmental screening test
GLP	Yes.
Year	2003
Species	Rat
Strain	CrI:CD® (Sprague-Dawley) IGS BR
Route of administration	Gavage
Duration of test	4 Weeks
Doses/concentration levels	0, 5, 25, 100 mg/kg/day
Sex	12 male, 12 female per group.
Exposure period	Not applicable
Frequency of treatment	7 days/week
Control group and treatment	12 male, 12 female, corn oil vehicle.
Post exposure observation period	Not applicable.
Statistical methods	<p>Group means and standard deviations were calculated for all measured parameters. Body weight, weight gain, food consumption, and organ weights were analyzed by Jonckheere-Terpstra trend test. Food efficiency and clinical pathology parameters were analyzed by one-way analysis of variance followed with Dunnett's test. Clinical observations and FOB parameters were analyzed by Cochran-Armitage trend test. Grip strength, foot splay, rearing, body temperature, and motor activity were analyzed by repeated measures analysis of variance with linear contrasts or Jonckheere's trend test.</p>

<p><u>Conclusions</u></p> <p><u>Data Quality</u> Reliabilities</p> <p><u>References</u></p> <p><u>Other</u> Last changed</p>	<p><i>Clinical Pathology Parameters:</i> There were no effects on hematological or clinical chemistry parameters in male or subchronic female rats. Administration of 100 mg/kg/day of the test substance for approximately 30 days resulted in decreased serum bilirubin concentration. However, decreased serum bilirubin concentration was considered to be secondary to enzyme induction as a pharmacological response to a xenobiotic and was not considered to be adverse.</p> <p><i>Neurobehavioral Parameters:</i> No test substance-related effects were observed in motor activity, any neurobehavioral parameters in the FOB, or in grip strength, foot splay, rearing, or body temperature, in males or subchronic females.</p> <p><i>Pathology:</i> Administration of 5, 25, or 100 mg/kg/day of the test substance for approximately 30 days produced a dose-related increase in renal tubular hyaline droplets in male rats which was correlated with an increase in the incidence of bilateral pale kidney discoloration, and changes in kidney weight parameters. However, hyaline droplet nephropathy was not observed in males, and increased hyaline droplets were not observed in females. The hyaline droplet accumulation in male rats was not considered to be an adverse effect of the test substance, since it is species and sex specific, and is not predictive of an effect on other species.</p> <p>Hepatocellular hypertrophy, and associated increases in liver weight parameters were observed in 100 mg/kg/day males, and subchronic females. One subchronic female in the 25 mg/kg/day group also had hepatocellular hypertrophy. However, this change is considered to be secondary to enzyme induction as a pharmacological response to a xenobiotic, and was not considered to be adverse.</p> <p>Minimal thyroid follicular cell hypertrophy was observed in 25 and 100 mg/kg/day males and subchronic females, which was considered to be test substance-related and potentially adverse.</p> <p>Repeated administration of Dicyclopentadiene/Codimer Concentrate in male and female Sprague Dawley rats at dosages of 25 or 100 mg/kg/day produced minimal morphological changes in the thyroid of male and subchronic females rats. Based on these data, the no-observable-adverse-effect level (NOAEL) for systemic toxicity was 5 mg/kg/day in males and females.</p> <p>Klimish value = 1 (Reliable without restrictions). Malley, L. A. Dicyclopentadiene/Codimer Concentrate: Combined Repeated Dose Toxicity Study and Reproductive/Developmental Toxicity Screening Test in Rats. DuPont-12690. Report of E. I. du Pont de Nemours and Company conducted for the American Chemistry Council Olefins Panel.</p> <p>August, 27, 2004 Robust summary prepared by contract for the Olefins Panel</p>
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**Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category
Combined Repeated Dose Toxicity Study and Reproductive/Developmental Toxicity
Screening Test in Rats**

Developmental Toxicity/Teratogenicity

Test Substance	Dicyclopentadiene/Codimer Concentrate CAS Number 68478-10-4
Remarks	Dicyclopentadiene/Codimer (DCPD/Codimer Concentrate), CAS# 68478-10-4; stable at room temperature below 70° F; colorless liquid DCPD/Codimer Concentrate is produced as a distillate from a C8+ fraction of thermally processed pyrolysis gasoline obtained from ethylene production (steam cracking process). The sample tested consisted of dicyclopentadiene (29%), methylcyclopentadiene dimer (13%), cyclopentadiene/methylcyclopentadiene codimer (13%), other codimers of cyclopentadiene - e.g. with 1,3-butadiene or isoprene (7%), other similar codimers of methylcyclopentadiene (22%), balance (16%). Note: the above composition percentages were reported by the supplier of the test substance on December 17, 2002.
<u>Method</u>	
Method/guideline followed	OECD 422
Test type	Combined repeated exposure inhalation toxicity study with the reproduction / developmental screening test
GLP	Yes.
Year	2003
Species	Rat
Strain	CrI:CD® (Sprague-Dawley) IGS BR
Route of administration	Oral gavage.
Duration of test	Satellite groups of 12 young, nulliparous, female rats were administered an oral daily dose of the test substance during a pre-mating period of approximately 2 weeks, a cohabitation period of approximately 2 weeks, a gestation period of approximately 3 weeks, and a lactation period of approximately 4 days. The young adult males were exposed for 29 days.
Doses/concentration levels	0, 5, 25, or 100 mg/kg/day
Sex	12 male, 12 female per group.
Exposure period	Not applicable
Frequency of treatment	7 days/week
Control group and treatment	12 male, 12 female, corn oil vehicle.
Post exposure observation period	Not applicable.
Statistical methods	Group means and standard deviations were calculated for all measured parameters. Body weight, weight gain, food consumption, and organ weights were analyzed by Jonckheere-Terpstra trend test. Food efficiency was analyzed by one-way analysis of variance followed with Dunnett's test. Clinical observations, mating index, fertility index, and gestation index were analyzed by Cochran-Armitage trend test. Gestation length, implantation site numbers, implantation efficiency, mean number of pups per litter, percent of pups born alive, day 0-4 viability of pups, viability index, number of <i>corpora lutea</i> , sex ratio, pre-implantation loss, and post-implantation loss were analyzed by Jonckheere-Terpstra trend test. Mean pup weights were analyzed by linear contrast of the least square means.
Test Conditions	Satellite groups of 12 young, nulliparous, female rats were administered an

<p><u>Results</u> NOAEL (NOEL) LOAEL (LOEL) Remarks</p> <p><u>Conclusions</u></p> <p><u>Data Quality</u> Reliabilities <u>References</u></p> <p><u>Other</u> Last changed</p>	<p>oral, daily dose of 0, 5, 25, or 100 mg/kg/day during a pre-mating period of approximately 2 weeks, a cohabitation period of approximately 2 weeks, a gestation period of approximately 3 weeks, and a lactation period of approximately 3 days. Following the 2-week pre-mating period, each satellite female was paired with a male of the same respective dosage group during a 2-week cohabitation period. Measurements of body weight, food consumption, and clinical signs of toxicity in females were conducted throughout pre-mating, cohabitation, gestation, and lactation. On postpartum day 4, lactating females, and nonpregnant females were sacrificed, selected organs were weighed, and selected tissues were evaluated microscopically. Offspring were evaluated for external abnormalities, and sacrificed on postnatal day 4. The study design included a main study for repeated dose toxicity endpoints (summarized separately).</p> <p>100 g/day for parental animals, and 100 mg/kg/day for pups Not applicable.</p> <p><i>Clinical signs and mortality:</i> There were no test substance-related effects on pre-dosing or post-dosing clinical observations in subchronic males or satellite females administered any dosage of the test substance. Test substance-related mortality did not occur.</p> <p><i>Maternal Body Weight and Weight Gain:</i> There were no effects on body weight gain in satellite females.</p> <p><i>Food Consumption and Food Efficiency:</i> There were no effects on maternal food consumption or food efficiency.</p> <p><i>Reproductive Indices:</i> No test substance-related effects or statistically significant differences in gestation length, number of implantation sites, implantation efficiency, pre-implantation loss, post-implantation loss, or number of <i>corpora lutea</i> were observed for any dosage of the test substance in satellite maternal females.</p> <p><i>Offspring Parameters:</i> There were no test substance-related effects on mean pup weight, number of pups born, number of pups born alive, sex ratio, gestation index, external abnormalities, or litter survival for postnatal days 0-4 in the offspring from any dosage group.</p> <p>Repeated administration of Dicyclopentadiene/Codimer Concentrate to male and female Sprague Dawley rats throughout pre-mating, mating, gestation, and lactation at dosages of 0, 5, 25, or 100 mg/kg/day produced no evidence of toxicity to offspring at dosages of 100 mg/kg/day. Based on these data, the no-observable-effect level (NOEL) for developmental toxicity was 100 mg/kg/day.</p> <p>Klimish value = 1 (Reliable without restrictions). Malley, L. A. Dicyclopentadiene/Codimer Concentrate: Combined Repeated Dose Toxicity Study and Reproductive/Developmental Toxicity Screening Test in Rats. DuPont-12690. Report of E. I. du Pont de Nemours and Company conducted for the American Chemistry Council Olefins Panel.</p> <p>31-Aug-04 Robust summary prepared by contractor for the Olefins Panel</p>
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**Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category
Combined Repeated Dose Toxicity Study and Reproductive/Developmental Toxicity
Screening Test in Rats**

Toxicity to Reproduction

Test Substance	<u>Dicyclopentadiene/Codimer Concentrate</u>
Remarks	CAS Number 68478-10-4 Dicyclopentadiene/Codimer (DCPD/Codimer Concentrate), CAS# 68478-10-4; stable at room temperature below 70° F; colorless liquid DCPD/Codimer Concentrate is produced as a distillate from a C8+ fraction of thermally processed pyrolysis gasoline obtained from ethylene production (steam cracking process). The sample tested consisted of dicyclopentadiene (29%), methylcyclopentadiene dimer (13%), cyclopentadiene/methylcyclopentadiene codimer (13%), other codimers of cyclopentadiene - e.g. with 1,3-butadiene or isoprene (7%), other similar codimers of methylcyclopentadiene (22%), balance (16%). Note: the above composition percentages were reported by the supplier of the test substance on December 17, 2002.
<u>Method</u>	
Method/guideline followed	OECD 422
Test type	Combined repeated exposure toxicity study with the reproduction / developmental screening test
GLP	Yes.
Year	2003
Species	Rat
Strain	CrI:CD® (Sprague-Dawley) IGS BR
Route of administration	Gavage.
Duration of test	Satellite groups of 12 young, nulliparous, female rats were administered an oral daily dose of the test substance during a pre-mating period of approximately 2 weeks, a cohabitation period of approximately 2 weeks, a gestation period of approximately 3 weeks, and a lactation period of approximately 3 days. The young adult males were exposed for 29 days.
Doses/concentration levels	0, 5, 25, or 100 mg/kg/day.
Sex	12 male, 12 female per group.
Exposure period	Not applicable
Frequency of treatment	7 days/week
Control group and treatment	12 male, 12 female, corn oil vehicle.
Post exposure observation period	Not applicable.
Statistical methods	Group means and standard deviations were calculated for all measured parameters. Body weight, weight gain, food consumption, and organ weights were analyzed by Jonckheere-Terpstra trend test. Food efficiency was analyzed by one-way analysis of variance followed with Dunnett's test. Clinical observations, mating index, fertility index, and gestation index were analyzed by Cochran-Armitage trend test. Gestation length, implantation site numbers, implantation efficiency, mean number of pups per litter, percent of pups born alive, day 0-4 viability of pups, viability index, number of <i>corpora lutea</i> , sex ratio, pre-implantation loss, and post-implantation loss were analyzed by Jonckheere-Terpstra trend test. Mean pup weights were analyzed by linear contrast of the least square means.
Test Conditions	Satellite groups of 12 young, nulliparous, nonpregnant female rats were administered an oral, daily dose of 0, 5, 25, or 100 mg/kg/day during a

<p><u>Data Quality</u> Reliabilities</p> <p><u>References</u></p> <p><u>Other</u> Last changed</p>	<p>offspring development. Based on these data, the no-observable-effect level (NOEL) for reproductive toxicity was 100 mg/kg/day in parental animals and 100 mg/kg/day in pups.</p> <p>Klimish value = 1 (Reliable without restrictions).</p> <p>Malley, L. A. Dicyclopentadiene/Codimer Concentrate: Combined Repeated Dose Toxicity Study and Reproductive/Developmental Toxicity Screening Test in Rats. DuPont-12690. Report of E. I. du Pont de Nemours and Company conducted for the American Chemistry Council Olefins Panel.</p> <p>August 31, 2004</p> <p>Robust summary prepared by contractor for the Olefins Panel</p>
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Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Methylcyclopentadiene dimer (MCPD Dimer)

Acute Toxicity

<p><u>Test Substance</u></p>	<p>Methylcyclopentadiene – dimer (MCPD-d). MRD78-91. Analytic characterization, stability and purity refer to Project report #44-521 <u>Olefins Panel HPV Stream Name: MCPD Dimer</u></p>
<p><u>Method</u> Method/guideline followed Type (test type) GLP Year Species/Strain Sex No. of animals per sex/dose Vehicle Route of administration</p>	<p>None specified. Acute Not specified 1978 Rat, Wistar Male 5 None Oral gavage</p>
<p>Test Conditions</p>	<p>Male Wistar rats, at least 8 wks old (255-281g) were individually housed in elevated wire mesh cages in a temperature-controlled room reserved for rats. AAALAC standards were adhered to. Purina rat chow and water were available ad lib, except for the 16-20 hrs prior to dosing. Test material was delivered by gavage to 5 rats, at a dose of 10.0g/kg body wt. as calculated from the specific gravity. Rats were observed for clinical signs 1, 2, 4, and 6 hrs after dosing and once daily thereafter for 14 days. Mortality, toxicity and pharmacological effects were recorded for each rat. These included: piloerection, ptosis, lethargy, chromodacryorrhea, emaciation and diarrhea. Body wt was recorded at initiation and termination. All rats were examined for gross pathology.</p>
<p><u>Results</u> LD₅₀ with confidence limits.</p>	<p>The LD₅₀ was not reached at 10g/kg. One rat died on day 4. Significant toxic signs were lethargy, ptosis, ataxia and diarrhea, which cleared by day 7. Rats gained weight normally over the 14-day period.</p>
<p>Remarks</p>	<p>The LD₅₀ was not reached at 10g/kg.</p>
<p><u>Conclusions</u> (study author)</p>	<p>The LD₅₀ was not reached at 10g/kg.</p>
<p><u>Data Quality</u> Reliability</p>	<p>2. Reliable with restrictions. Not known whether GLP were applied to this study.</p>
<p><u>References</u></p>	<p>Cerven, D.R. 1978. Single oral dose toxicity in rats. Project #MB78-3290. MB Research Laboratories, Inc. Spinnerstown, PA., for Exxon Corp. Dodd, D.E., Fait, D.W. and Eisler, D.L. 1981. Four-hour acute LC50 inhalation study in rats and mice. Proj. Rpt. #44-521. Bushy Run Research Center, Export, PA for Exxon Corp., East Millstone, NJ.</p>
<p><u>Other</u> Last changed</p>	<p>Revised 11/21/2001 (Prepared by a contractor to the Olefins Panel)</p>

Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Acute Toxicity

<p><u>Test Substance</u></p>	<p>Methylcyclopentadiene – dimer (MCPD-d), MRD78-91. Analytic characterization, stability and purity refer to Project report #44-521. <u>Olefins Panel HPV Stream Name: MCPD Dimer</u></p>
<p><u>Method</u> Method/guideline followed Type (test type) GLP Year Species/Strain Sex No. of animals per sex/dose Vehicle Route of administration</p>	<p>None specified. Acute limit test Not specified 1978 Rabbit, New Zealand White Not specified 4 None Dermal</p>
<p>Test Conditions</p>	<p>New Zealand White rabbits, at least 8 wks old (2.0-2.7kg) were individually housed in elevated wire mesh cages in a temperature controlled room reserved exclusively for rabbits on acute tests. Cages and rooms were kept in accordance with AAALAC standards. Rabbit chow and water were freely available. Immediately prior to dosing, the abdomens of 4 rabbits were clipped (200m²; approx. 10% of body surface) and abraded deep enough to penetrate the stratum corneum, but not deep enough to produce bleeding. Test material was applied dermally to each site at a dose of 3.16g/kg. The area was covered with gauze and secured by 2mil thick plastic dams. After 24 hr of exposure, dams were removed, and the site was wiped free of test article. Signs of dermal irritation were recorded and evaluated at 24hrs, 3, 7, 10, and 14 days. Rabbits were observed for mortality and toxic effects at 2 and 4 hrs post dose and once daily for 14 days. Body wt was recorded pre-test and at termination. Necropsies were performed on all rabbits.</p>
<p><u>Results</u> LD₅₀ with confidence limits.</p>	<p>LD₅₀ was not reached at 3.16g/kg</p>
<p>Remarks</p>	<p>No mortality was observed. All rabbits exhibited signs of lethargy and ataxia, 3 rabbits had tachypnea, and 2 rabbits had visible, dilated conjunctival blood vessels during the first 4 hr of exposure, which cleared after the first day. Skin reactions were severe and worsened over time until day 10, with signs of recovery by day 14. All rabbits showed severe erythema and skin flaking with 3 rabbits showing scar formation and skin cracking. Upon removal of the binding, rabbits showed moderate skin edema (raised approx. 1mm) that resolved progressively over time. At day 14, there was barely perceptible edema. Approx. 65-70% of the applied dose remained at the application site. At necropsy, one rabbit showed dark areas on the lungs and mottled kidneys.</p>
<p><u>Conclusions</u> (study author)</p>	<p>LD₅₀ was not reached at 3.16g/kg</p>
<p><u>Data Quality</u> Reliability</p>	<p>2. Reliable with restrictions. Not known whether GLPs were applied to this study.</p>
<p><u>References</u></p>	<p>Cerven, D.R. 1978. Acute dermal toxicity in albino rabbits. Project #MB78-3290. MB Research Laboratories, Inc. Spinnerstown, PA. for Exxon Corp. Dodd, D.E., Fait, D.W. and Eisler, D.L. 1981. Four-hour acute LC50 inhalation study in rats and mice. Proj. Rpt. #44-521. Bushy Run Research Center, Export, PA for Exxon Corp., East Millstone, NJ.</p>
<p><u>Other</u> Last changed</p>	<p>Revised 11/21/2001 (Prepared by a contractor to the Olefins Panel)</p>

Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Acute Toxicity

<p><u>Test Substance</u></p>	<p>Methylcyclopentadiene dimer (MCPD-d), CAS #26472-00-4. 92% dimer. Liquid of pungent odor. Compositionally stable for at least one month <u>Olefins Panel HPV Stream Name: MCPD Dimer</u></p>
<p><u>Method</u> Method/guideline followed Type (test type) GLP Year Species/Strain Sex No. of animals per sex/dose Vehicle Route of administration</p>	<p>None specified. Acute Limit test Yes 1980 Rats, Fischer 344 Males and females 6 Filtered air Whole Body Inhalation (4hr exposure)</p>
<p>Test Conditions</p>	<p>Rats (5wk. old; males 173g; females 127g) were housed in stainless steel wire mesh cages (3/sex/cage) except during exposure (2/sex/cage). Temperatures were between 68-74^oF, with relative humidity between 35-57% and a 12 hr light-dark cycle. Powdered food and water were available ad lib except during exposure. Liquid MCPD-d was heated in a glass evaporator at the lowest temperature sufficient to produce a vapor of 495ppm. Chamber concentration of the test article was monitored by gas chromatography flame ionization detection. One group of 6 male and 6 female rats were exposed once for 4 hrs on day 1 and sacrificed on day 15. Rats were examined during exposure and daily for 14 days. Body wt was recorded at initiation and on days 2, 6, 9 and 15. All rats were necropsied for gross lesions. No tissues were saved for microscopic evaluation</p>
<p><u>Results</u> LC₅₀ with confidence limits.</p>	<p>LC₅₀ was not reached at 495ppm.</p>
<p>Remarks</p>	<p>No adverse effects were observed in any rats during exposure to 495ppm MCPD-d or post-exposure over the 14-day observation period, and no gross lesions were observed. There was no change in body wt attributable to exposure and body wt increases were within normal limits.</p>
<p><u>Conclusions</u> (study author)</p>	<p>None of the rats died during the exposure period or within the 14-day observation period. No adverse effects attributable to test article were observed.</p>
<p><u>Data Quality</u> Reliability</p>	<p>1. Reliable without restriction.</p>
<p><u>References</u></p>	<p>Zelenak, J.P. 1980. Methylcyclopentadiene dimer: Four-hour acute LC₅₀ inhalation study on rats and mice. Proj. Rpt. #43-536. Bushy Run Research Center, Pittsburgh, PA for Exxon Corp. Linden, NJ</p>
<p><u>Other</u> Last changed</p>	<p>Revised 11/21/2001 (Prepared by a contractor to the Olefins Panel)</p>

Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Acute Toxicity

<p><u>Test Substance</u></p>	<p>Methylcyclopentadiene dimer (MCPD-d), CAS #26472-00-4. 92% dimer. Liquid of pungent odor. Compositionally stable for at least one month</p> <p><u>Olefins Panel HPV Stream Name: MCPD Dimer</u></p>
<p><u>Method</u> Method/guideline followed Type (test type) GLP Year Species/Strain Sex No. of animals per sex/dose Vehicle Route of administration</p>	<p>None specified. Acute Limit test Yes 1980 Mice, B6C3F1 Males and females 6 Filtered air Whole Body Inhalation (4hr exposure)</p>
<p>Test Conditions</p>	<p>Mice (5wk. old; males 24g; females 19g) were housed in stainless steel wire mesh cages (3/sex/cage) except during exposure (2/sex/cage). Temperatures were between 68-74⁰F, with relative humidity between 35-57% and a 12 hr light-dark cycle. Powdered food and water were available ad lib except during exposure. Liquid MCPD-d was heated in a glass evaporator at the lowest temperature sufficient to produce a vapor of 495ppm. Chamber concentration of the test article was monitored by gas chromatography flame ionization detection. One group of 6 male and 6 female mice were exposed once for 4 hrs on day 1 and sacrificed on day 15. Mice were examined during exposure and daily for 14 days. Body wt was recorded at initiation and on days 2, 6, 9 and 15. All mice were necropsied for gross lesions. No tissues were saved for microscopic evaluation</p>
<p><u>Results</u> LC₅₀ with confidence limits.</p>	<p>LC₅₀ was not reached at 495ppm.</p>
<p>Remarks</p>	<p>No adverse effects were observed in any mice during exposure to 495ppm MCPD-d or post-exposure over the 14-day observation period, and no gross lesions were found. There was no change in body wt attributable to exposure, and body wt increases were within normal limits.</p>
<p><u>Conclusions</u> (study author)</p>	<p>None of the mice died during the exposure period or within the 14-day observation period. No adverse effects attributable to test article were observed.</p>
<p><u>Data Quality</u> Reliability</p>	<p>1. Reliable without restriction.</p>
<p><u>References</u></p>	<p>Zelenak, J.P. 1980. Methylcyclopentadiene dimer: Four-hour acute LC₅₀ inhalation study on rats and mice. Proj. Rpt. #43-536. Bushy Run Research Center, Pittsburgh, PA for Exxon Corp. Linden, NJ</p>
<p><u>Other</u> Last changed</p>	<p>Revised 11/21/2001 (Prepared by a contractor to the Olefins Panel)</p>

Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Genetic Toxicity - in Vitro

<p><u>Test Substance</u> <i>Test substance</i></p> <p><u>Method</u> Method/guideline followed</p> <p>System of testing GLP</p> <p>Year 2003</p> <p>Species/Strain <i>S. typhimurium</i> TA98, TA100, TA1535, TA1537 and <i>E. coli</i> WP2 <i>uvrA</i>.</p> <p>Metabolic activation Yes</p> <p>Species and cell type Sprague-Dawley rat liver (S9 fraction) prepared in-house</p> <p>Quantity 10% S9 in S9 mix</p> <p>Induced or not induced Aroclor 1254 induced, rats were given 500mg/kg ip 5 days prior to sacrifice</p> <p>Concentrations tested 0, 15, 50, 150, 500, 1500, 5000 µg/plate</p> <p>Statistical Methods None.</p> <p>Remarks for Test Conditions Criteria for positive response were a dose-related increase in the mean revertants per plate of at least one tester strain over a minimum of two increasing concentrations as specified below: TA 1535, TA 1537: At the peak of the dose response an equal to or greater than 3.0-fold dose related increase over solvent control values with or without metabolic activation. TA98, TA100, <i>E. coli</i> WP2 <i>uvrA</i>: At the peak of the dose response an equal to or greater than 2.0-fold dose related increase over solvent control values with or without metabolic activation. Negative controls: Based on historical control data, all tester strains must exhibit characteristic numbers of spontaneous revertants per plate. Positive controls: The mean of each positive control value must exhibit at least a 3.0-fold increase over the respective mean negative control value (vehicle) for each tester strain.</p> <p>MCDP Dimer test solutions were prepared in DMSO (for the preliminary toxicity assay), or in ethanol (for the mutagenicity test) immediately prior to use. <i>Salmonella</i> strains and <i>E. coli</i> WP2 <i>uvrA</i> (approx. 10⁹ cells/ml) were exposed to either test solution or vehicle ±S9 by the plate incorporation method. The preliminary toxicity assay was conducted prior to the mutagenicity test with all tester strains over a range of 6.7-5000 µg/plate (one plate per dose) ±S9. The dose levels tested in the mutagenicity test were 15, 50, 150, 500, 1500 and 5000 µg/plate ±S9. The mutagenicity test was conducted on triplicate plates per dose. Five hundred (500) microliter of S9 or Sham mix, 100 µl of tester strain and 50 µl vehicle or test substance dilution were added to 2.0 mL of molten selective top agar at 45±2 °C. After vortexing, the mixture was overlaid onto the surface of minimal agar plates. After the overlay had solidified, the plates were inverted and incubated for approximately 48 to 72 hours at 37±2 °C. Revertant colonies for a given tester strain and activation condition, except for the positive controls, were counted either entirely by automated colony counter or entirely by hand unless the plate exhibited toxicity, and conditions of background lawn and precipitation were evaluated. Positive control compounds for the –S9 condition were: 2-nitrofluorene (1.0 µg/plate) for TA98; sodium azide (1.0 µg/plate) for TA100 and TA1535; 9-aminoacridine (75 µg/plate) for TA1537; and methyl methanesulfonate (1000 µg/plate) for WP2<i>uvrA</i>. The positive control compound</p>	<p><u>Methylcyclopentadiene Dimer (MCPD Dimer)</u>, CAS #26472-00-4, purity 90%; stable at room temperature below 70 F; clear colorless liquid</p>
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Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Genetic Toxicity - In Vivo

<p><u>Test Substance</u> Remarks</p>	<p>Methylcyclopentadiene Dimer (MCPD Dimer), CAS #26472-00-4, purity 90%; stable at room temperature below 70 F; clear colorless liquid</p> <p>The test substance is a sample of an industrial intermediate stream that is produced by thermal processing and distillation of a pyrolysis gasoline fraction from the ethylene production manufacturing process. The sample tested contained 98.8% MCPD dimers, 2.6% MCPD monomer, 1.6% other C5-C8 monomers, 1.6% CPD-MDCP codimer, 3.0% DCPD and codimers of CPD or MCPD with C4 through C7 monomers and 0.4% trimers of MCPD and DCPD.</p>
<p><u>Method</u> Methods/guidelines followed</p>	<p>OPPTS 870.5395 OECD 474 EC Commission Directive 2000/32/EC</p>
<p>Type GLP Year Species Strain Sex Route of administration Vehicle Doses/concentration levels No. of animals per dose</p>	<p>Mammalian erythrocyte micronucleus assay Yes 2003 Mouse CrI:CD-1[®](ICR)BR Male and female Twice by oral intubation, at an approximately 24-hour interval Corn oil 0, 500, 1000, or 2000 mg/kg body weight 5/sex/group (0, 500, or 1000 mg/kg body weight), 7/sex/group (2000 mg/kg body weight)</p>
<p>Control groups and treatment</p>	<p>5/sex vehicle control animals (corn oil); 5/sex positive control (cyclophosphamide, 30 mg/kg once by oral intubation)</p>
<p>Statistical methods</p>	<p>Total polychromatic erythrocytes (PCEs), micronucleated polychromatic erythrocytes, normochromatic erythrocytes (NCEs) were compared to the control using Dunnett's and Dunn's test (p < 0.05).</p>
<p>Test Conditions.</p>	<p>Groups of 5 mice/sex/group (7 mice/sex at the highest dose level) were administered the test substance twice at an approximately 24 hour interval by oral intubation (gavage). Body weights ranged from 24.9-30.8 g (males) and 19.3-25.3 g (females) at time of arrival. The animals were approximately 7 weeks old (51 days) at time of exposure. The homogeneity / concentration of the dosing formulations and the test substance stability were verified analytically. The mice were weighed prior to treatment and sacrifice. The mice were observed for clinical signs and mortality/moribundity prior to treatment, approximately 1 hour post dosing, 3-5 hours post-dosing, and prior to sacrifice. The mice were sacrificed approximately 24 hours after administration of the second dose and smears of bone marrow erythrocytes were prepared and stained. Micronucleus evaluations were conducted on five animals/group. Two thousand PCEs per animal were scored for the presence of micronuclei. The proportion of PCEs among 1000 total erythrocytes was determined for each animal, and expressed as the PCE/NCE ratio.</p>
<p><u>Results</u></p>	<p>Clinical signs were present in the majority of 2000 mg/kg male animals and included eyes partially closed, wet fur, ruffled fur, prostration, abnormal gait, discharge, tremors, and lethargy, indicating that approximately the maximum tolerated dose had been achieved. Clinical signs observed in male animals at 1000 mg/kg occurred in a</p>

<p><u>Conclusions</u></p> <p><u>Data Quality</u> Reliabilities</p> <p><u>References</u></p> <p><u>Other</u> Last changed</p>	<p>lower incidence of animals and included wet fur, ruffled fur, high carriage, and stained fur/skin. At 500 mg/kg only ruffled fur was observed.</p> <p>Clinical signs were present in the majority of 2000 mg/kg female animals and included eyes partially closed, ruffled fur, prostration, abnormal gait, labored breathing, tremors, and lethargy, indicating that approximately the maximum tolerated dose had been achieved. Clinical signs observed in female animals at 1000 mg/kg occurred in a lower incidence of animals and included wet fur, ruffled fur, abnormal gait, discharge, and lethargy. No clinical signs of toxicity were observed in the 500 mg/kg dose group.</p> <p>There were no test substance-related biologically relevant changes in body weight or body weight gains in either male or female mice administered MCPD Dimer. Mortality occurred at 2000 mg/kg in 1/7 females only.</p> <p>No statistically significant increases in micronucleated PCE frequency were observed in any test substance-treated group when analyzed separately for male or female animals. However, by analyzing the male and female data combined, a statistically significant increase ($p < 0.05$) was observed at 1000 mg/kg (3.8 ± 2.6 MNPCE/2000 PCES) and 2000 mg/kg (6.2 ± 3.4), as compared with the concurrent negative control (1.3 ± 1.5). However, these observed increases are of low potency and in the range of the historical negative control data. Therefore, they, and the apparent dose-response, are considered to be of questionable biological relevance. The positive control groups exhibited a statistically significant response consistent with the micronucleated PCE historical control data. Although not statistically significant when analyzed separately for male and female animals, there were depressions in the PCE/NCE ratio in male and female mice treated twice, approximately 24 hours apart, with 2000 mg/kg MCPD Dimer. Mean values for this parameter were decreased approximately 43 and 33% in treated males and females, respectively. In the 1000 mg/kg dose groups, an approximately 27% decrease was observed in treated females only. By analyzing the male and female data combined, a statistically significant decrease ($p < 0.05$) was observed at 1000 mg/kg (0.922 ± 0.384 PCE/NCE Ratio) and 2000 mg/kg (0.732 ± 0.373), as compared with the concurrent negative control (1.194 ± 0.587). Even though these observed decreases are in the range of the historical negative control data, they represent considerable depressions of the PCE/NCE ratio as compared with the concurrent negative control. Therefore, they are indicative of bone marrow toxicity. No statistically significant depressions in the PCE/NCE ratio were found in CP-treated male or female.</p> <p>The negative and positive controls met the requirements for a valid study. Under the conditions of this study, MCPD Dimer did induce a statistically significant increase in micronucleated polychromatic erythrocytes in mouse bone marrow at 1000 and 2000 mg/kg. However, the observed frequencies are considered to be of questionable biological relevance. Therefore, the test substance was equivocal in this <i>in vivo</i> assay.</p> <p>1. Reliable without restrictions. Guideline study.</p> <p>Donner, M.E., Methylcyclopentadiene Dimer: Mouse Bone Marrow Micronucleus Test, DuPont Haskell Laboratory Report Number DuPont-11371</p> <p>June 4, 2004</p>
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Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Repeated Dose Toxicity

<p><u>Test Substance</u> Remarks</p> <p><u>Method</u> Method/guideline followed Test type GLP Year Species Strain Route of administration Duration of test Doses/concentration levels Sex Exposure period Frequency of treatment Control group and treatment Post exposure observation period Statistical methods</p> <p>Test Conditions</p> <p><u>Results</u> NOAEL (NOEL) LOAEL (LOEL) Remarks</p>	<p>Methylcyclopentadiene dimer. 92% dimer. Analytical characterization provided; refer to Project report #44-521 for stability and purity and conditions under which aerosol formation occurs.</p> <p><u>Olefins Panel HPV Stream Name: MCPD Dimer</u></p> <p>Not specified Subacute Yes 1982 Rat F344 Whole Body Inhalation 12 days 0, 5, 50 and 404ppm (actual) Male and female (10/sex/group) 6hrs/day once a day for 9 days (days 1-5, 8-11) 10 mice, filtered air, 6hrs/day for 9 days (days 1-5, 8-11). None Bartlett's test, analysis of variance, Duncan's multiple range test, F-test or Student's t-test to compare group vs. control, Cochran t-test when Student's t-test was significant.</p> <p>Fischer F-344 rats, approx. 70 days old at study initiation, were housed in stainless steel, wire mesh cages at 66-76°F and 43-78% relative humidity. The exposure chamber was maintained at 72-82°F and 37-66% relative humidity and kept on a 12 hr light-dark cycle. Food and water were available ad lib, except during exposure. During exposure, rats were housed 2 per cage. Rats were assigned to 4 test groups (10/sex). The liquid test article was vaporized in a heated, spiral-grooved Pyrex tube and diluted with air prior to entering the exposure chamber. Chamber samples were taken once/hr. and analyzed by gas chromatography/flame ionization detection. Rats were observed prior to, during and following exposure for clinical signs and toxic effects. Body weight was taken prior to exposures on days 1, 2, 5, 8, 9, and prior to sacrifice on day 12. Food consumption was measured prior to initiation and 2-3 times during the study. Urine was collected after for 17hrs. after the fifth and ninth exposures. Hematologic tests were performed on all surviving rats at sacrifice; blood was taken from the orbital sinus. At sacrifice on day 12, liver, lungs, kidneys, gonads, and any gross lesions were saved for possible histological evaluation. Histologic evaluation was performed on livers and kidneys from all rats. Livers, lungs and kidneys of all rats and testes of all males were weighed.</p> <p>NOAEL females = 50ppm; males < 5ppm LOAEL females = 404ppm (based on dec. wt. gain); males = 5ppm (based on histopathologic effects).</p> <p>Female rats in the 404ppm group had urogenital wetness and periocular redness that persisted. In the second week of exposure, male rats showed periocular redness. Also during the second week of exposure, rats of both sexes had lacrimation. Rats of both sexes at the 404ppm exposure level, had significant decreases in body wt. Male and female rats at 404ppm had significantly lower food consumption after 8 exposures; females also had decreased consumption after 4 exposures. Urinalysis indicated that males were more seriously affected than females. After 5 exposures, males at all exposure levels, had epithelial cells and cell casts in the urine; however, the effects were not seen in females. Urine specific gravity and osmolality were significantly depressed in males. The number of cells and cell casts in male urine were dose related. There were no exposure related</p>
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<p><u>Conclusions</u> (study authors)</p> <p><u>Quality</u> Reliabilities</p> <p><u>References</u></p> <p><u>Other</u> Last changed</p>	<p>hematological effects observed. Rats of both sexes had significant increases in absolute and relative wts, and relative kidney wt at 404ppm. Males, but not females from the 50ppm group had increased absolute liver and kidney wts and relative kidney wts. Gross pathology showed a significant frequency of kidney color changes at 404ppm and 2 males were affected at 50ppm; these effects were not seen in females. Treated male rats also showed an occasional reticular pattern in the liver. Histopathological lesions were seen in the kidneys of male rats at all doses; these were concentrations-related, involving protein accumulation in proximal tubule epithelial cells, and tubular hyperplasia in the cortex. In males at all doses, there was an increase in liver mitotic index; this effect was not seen in females.</p> <p>Male rats were more sensitive than females to test article vapor, exhibiting decreased wt. gain, food consumption, and urine specific gravity, increased urine epithelial cells, cell casts, relative liver, kidney and testes wt. Histopathological lesions were also noted in males, as well as increased mitotic index in the liver. Several of the findings in males were dose-related through the lowest dose. Females showed decreased food consumption, wt. gain, clinical signs and increased kidney wt at 404ppm.</p> <p>1. Reliable without restrictions.</p> <p>Dodd, D.E. and Longo, L.C. 1982. Methylcyclopentadiene – dimer vapor: Nine-day subchronic rat and mouse inhalation study. Proj. Rpt. 44-519. Bushy Run Research Center, Export, PA for Exxon Corp., East Millstone, NJ</p> <p>Dodd, D.E., Fait, D.W. and Eisler, D.L. 1981. Four-hour acute LC50 inhalation study in rats and mice. Proj. Rpt. #44-521. Bushy Run Research Center, Export, PA for Exxon Corp., East Millstone, NJ.</p> <p>Revised 11/21/2001 (Prepared by a contractor to the Olefins Panel)</p>
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Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Repeated Dose Toxicity

<p><u>Test Substance</u> Remarks</p> <p><u>Method</u> Method/guideline followed Test type GLP Year Species Strain Route of administration Duration of test Doses/concentration levels Sex Exposure period Frequency of treatment Control group and treatment Post exposure observation period Statistical methods</p> <p>Test Conditions</p> <p><u>Results</u> NOAEL (NOEL) LOAEL (LOEL) Remarks</p>	<p>Methylcyclopentadiene dimer. 92% dimer. Analytical characterization provided; refer to Project report #44-521 for stability and purity and conditions under which aerosol formation occurs.</p> <p><u>Olefins Panel HPV Stream Name: MCPD Dimer</u></p> <p>Not specified Subacute Yes 1982 Mouse B6C3F1 Whole Body Inhalation 12 days 0, 5, 50 and 404ppm (actual) Male and female (10/sex/group) 6hrs/day once a day for 9 days (days 1-5, 8-11) 10 mice, filtered air 6hrs/day for 9 days (days 1-5, 8-11). None Bartlett's test, analysis of variance, Duncan's multiple range test, F-test or Student's t-test to compare group vs. control, Cochran t-test when Student's t-test was significant.</p> <p>B6C3F1 mice, approx. 70 days old at study initiation were housed in stainless steel, wire mesh cages at 66-76^oF and 43-78% relative humidity. The exposure chamber was maintained at 72-82^oF and 37-66% relative humidity and kept on a 12 hr light-dark cycle. Food and water were available ad lib, except during exposure. During exposure, mice were housed 2 per cage. The liquid test article was vaporized in a heated, spiral-grooved Pyrex tube and diluted with air prior to entering the exposure chamber. Chamber samples were taken once/hr. and analyzed by gas chromatography/flame ionization detection. Mice were observed prior to, during and following exposure for clinical signs and toxic effects. Body weight was taken prior to exposures on days 1, 2, 5, 8, 9, and prior to sacrifice on day 12. Food consumption was measured prior to initiation and 2-3 times during the study. Hematologic tests were performed on all mice surviving to sacrifice; blood was taken from the orbital sinus. At sacrifice on day 12, liver, lungs, kidneys, gonads, and any gross lesions were saved for possible histological evaluation. Histologic evaluation was performed on livers and kidneys from all mice. Livers, lungs and kidneys of all mice and testes of all males were weighed.</p> <p>NOAEL females = 50ppm; males = 5ppm LOAEL females = 404ppm (based on hematology, liver wt, kidney wt); males = 50ppm (based on hematology, liver wt, liver mitotic figures). One male mouse in the 404ppm group died following the first exposure; no other mice died during the study. Test article-related changes in body wt. gain of females were obscured by a drop in control wt. during the first week, but there appeared to be some weight gain thereafter in the exposed groups. In males, there were no test article body wt. effects at sacrifice, but there was an initial decrease. In females there was a significant increase in food consumption after 4 and 9 exposures (values were not obtained for males). In mice of both sexes, there was a statistically significant decrease in erythrocyte count, hemoglobin concentration and hematocrit for the 404ppm group; the decrease was much smaller in the 50 and 5ppm groups, and only significant for hemoglobin concentrations in the 50ppm males. In females, lymphocyte count was decreased at 404ppm. At 404ppm, both sexes had significant increases in absolute and relative liver wt. Male mice did not show kidney or</p>
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<p><u>Conclusions</u> (study authors)</p> <p><u>Quality</u> Reliabilities</p> <p><u>References</u></p> <p><u>Other</u> Last changed</p>	<p>liver perturbations upon microscopic examination. Male mice of the 404 and 50ppm groups had increased mitotic figures in liver, but females did not. No significant histopathological effects were seen in kidneys of female or male mice.</p> <p>Most toxic effects were limited to the 404ppm exposure groups, but male mice of the 50ppm group also had an increase in absolute and relative liver wt and increased liver mitotic rate.</p> <p>1. Reliable without restrictions.</p> <p>Dodd, D.E. and Longo, L.C. 1982. Methylcyclopentadiene – Dimer vapor: Nine-day subchronic rat and mouse inhalation study. Proj. Rpt. 44-519. Bushy Run Research Center, Export, PA for Exxon Corp., East Millstone, NJ</p> <p>Dodd, D.E., Fait, D.W. and Eisler, D.L. 1981. Four-hour acute LC50 inhalation study in rats and mice. Proj. Rpt. #44-521. Bushy Run Research Center, Export, PA for Exxon Corp., East Millstone, NJ.</p> <p>Revised 11/21/2001 (Prepared by a contractor to the Olefins Panel)</p>
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Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Combined Repeated Dose Toxicity Study and Reproductive/Developmental Toxicity Screening Test in Rats

Repeated Dose Toxicity

Test Substance	<u>Methylcyclopentadiene Dimer Concentrate</u> CAS Number 26472-00-4
Remarks	The test substance is a sample of an industrial intermediate stream that is produced by thermal processing and distillation of a pyrolysis gasoline fraction from the ethylene production manufacturing process. The sample tested contained 98.8% MCPD dimers, 2.6% MCPD monomer, 1.6% other C5-C8 monomers, 1.6% CPD-MCPD codimer, 3.0% DCPD and codimers of CPD or MCPD with C4 through C7 monomers, and 0.4% trimers of MCPD and DCPD.
Method	
Method/guideline followed	OECD 422
Test type	Combined repeated dose toxicity study with the reproduction / developmental screening test
GLP	Yes.
Year	2003
Species	Rat
Strain	CrI:CD [®] (Sprague-Dawley) IGS BR
Route of administration	Gavage
Duration of test	4 Weeks
Doses/concentration levels	0, 20, 100, 300 mg/kg/day
Sex	12 male, 12 female per group.
Exposure period	Not applicable
Frequency of treatment	7 days/week
Control group and treatment	12 male, 12 female, corn oil vehicle.
Post exposure observation period	Not applicable.
Statistical methods	Group means and standard deviations were calculated for all measured parameters. Body weight, weight gain, food consumption, and organ weights were analyzed by Jonckheere-Terpstra trend test. Food efficiency and clinical pathology parameters were analyzed by one-way analysis of variance followed with Dunnett's test. Clinical observations and FOB parameters were analyzed by Cochran-Armitage trend test. Grip strength, foot splay, rearing, and body temperature were analyzed by one-way analysis of variance and Dunnett's test. Motor activity was analyzed by repeated measures analysis of variance with linear contrasts or Jonckheere's trend test.

<p>Test Conditions</p>	<p>Groups of 12 young, adult, male or nulliparous, non pregnant female rats were administered an oral, daily dose of 0, 20, 100, or 300 mg/kg/day of the test substance for approximately 30 days. The study also contained reproductive and developmental toxicity satellite groups (summarized separately).</p> <p>After approximately 30 days, blood samples were collected from all male rats and all subchronic female rats for measurement of hematology and clinical chemistry parameters. A neurobehavioral test battery, consisting of motor activity and functional observational battery assessments, was conducted on all male rats and subchronic female rats prior to test substance administration in order to obtain baseline measurements. This neurobehavioral test battery was conducted again following approximately 4 weeks of test substance administration. On test days 31 and 32, respectively all subchronic male and female rats underwent gross necropsy. Selected tissues from the control and 300 mg/kg/day groups, and target tissues from all groups were processed for histopathology and examined.</p>																
<p>Results NOAEL (NOEL)</p>	<table border="1"> <thead> <tr> <th>Parameters</th> <th>NOEL (mg/kg/day)</th> <th>NOAEL (mg/kg/day)</th> <th>LOEL (mg/kg/day)</th> </tr> </thead> <tbody> <tr> <td>Systemic</td> <td>Not determined for males; 20 F</td> <td>Not determined for males; 20 F</td> <td>20 M 100 F</td> </tr> <tr> <td>Pathology</td> <td>Not determined for males; 20 F</td> <td>100 M 300 F</td> <td>20 M 100 F</td> </tr> <tr> <td>Neurobehavioral</td> <td>100 M 300 F</td> <td>100 M 300 F</td> <td>300 M</td> </tr> </tbody> </table> <p>Note: M = Males; F = Females</p>	Parameters	NOEL (mg/kg/day)	NOAEL (mg/kg/day)	LOEL (mg/kg/day)	Systemic	Not determined for males; 20 F	Not determined for males; 20 F	20 M 100 F	Pathology	Not determined for males; 20 F	100 M 300 F	20 M 100 F	Neurobehavioral	100 M 300 F	100 M 300 F	300 M
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Neurobehavioral	100 M 300 F	100 M 300 F	300 M														
<p>LOAEL (LOEL)</p>	<p>See table above</p>																
<p>Remarks</p>	<p><i>Clinical Signs of Toxicity and Mortality in Subchronic Males and Females:</i> Increased incidences of salivation, stained fur, and/or wet fur were observed in subchronic males and subchronic females administered 100 or 300 mg/kg/day of the test substance. Lacrimation was also observed in subchronic females administered 300 mg/kg/day of the test substance. Salivation was observed in 20 mg/kg/day males and in 20 mg/kg/day satellite females. Test substance-related mortality did not occur.</p> <p><i>Body Weight and Body Weight Gain in Subchronic Males and Females:</i> Test substance-related decreases in body weight and/or weight gain were observed in males and subchronic females administered 300 mg/kg/day of the test substance. On test day 28, body weight of 300 mg/kg/day males and subchronic females was 7.5% and 4% lower than the control values, respectively. Body weight gain over the interval of test days 1-28 for 300 mg/kg/day males and subchronic females was 19% and 16% lower than the control values, respectively. In addition, instances of decreased body weight and/or weight gain were also observed in males and subchronic females administered 100 mg/kg/day of the test substance.</p> <p><i>Food Consumption and Food Efficiency in Subchronic Males and Females:</i> Test substance-related, statistically significant decreases in food consumption and/or food efficiency occurred in 300 mg/kg/day subchronic females. Food</p>																

<p><u>Conclusions</u></p> <p><u>Data Quality</u> Reliabilities</p> <p><u>References</u></p> <p><u>Other</u> Last changed</p>	<p>consumption of 300 mg/kg/day subchronic females was 9% lower than the control value over the interval of test days 1-28. Transient changes in food consumption and/or food efficiency were also observed in males and/or subchronic females administered 100 or 300 mg/kg/day of the test substance.</p> <p><i>Clinical Pathology Parameters:</i> There were no effects on hematological or clinical chemistry parameters in male or subchronic female rats.</p> <p><i>Neurobehavioral Parameters:</i> Significantly decreased motor activity was observed in 300 mg/kg/day males during the last 20 minutes of the assessment period for the week-4 evaluation. No test substance-related effects were observed in any neurobehavioral parameters in the subchronic females, or in grip strength, foot splay, rearing, body temperature, or in any of the other FOB parameters in males.</p> <p><i>Organ Weights and Pathology:</i> An increase in hyaline droplets in the kidneys was observed in all male rats administered the test substance. Increased hyaline droplets were not observed in females, although 300 mg/kg/day females had a slight increase in kidney weight parameters. The hyaline droplet accumulation in male rats is species and sex specific, and is not predictive of an effect on other species.</p> <p>Hepatocellular hypertrophy, and associated increases in liver weight parameters were observed in 100 and 300 mg/kg/day females and in 300 mg/kg/day males; however, this change may be secondary to enzyme induction as a pharmacological response to a xenobiotic.</p> <p>Minimal to mild thyroid follicular hypertrophy was also observed in 300 mg/kg/day males, which was considered to be test substance-related. Adrenal gland weight parameters in 300 mg/kg/day females were slightly increased, however, this was not associated with morphological changes.</p> <p>Repeated administration of Methylcyclopentadiene Dimer to male and female Sprague Dawley rats at dosages of 300 mg/kg/day produced effects on clinical signs of toxicity, body weight, food consumption, motor activity, and histopathological changes. In addition, effects on body weight, clinical signs and food consumption were observed at 100 mg/kg/day. Clinical signs of toxicity were observed in males at 20 mg/kg/day. Based on these data, the no-observable-effect level (NOAEL) for systemic toxicity was 20 mg/kg/day in females and was not established in males.</p> <p>Klimish value = 1 (Reliable without restrictions).</p> <p>Malley, L. A. Methylcyclopentadiene Dimer: Combined Repeated Dose Toxicity Study and Reproductive/Developmental Toxicity Screening Test in Rats. DuPont-11369. Report of E. I. du Pont de Nemours and Company conducted for the American Chemistry Council Olefins Panel.</p> <p>26-Jul-04 Robust summary prepared by the contractor for the Olefins Panel</p>
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**Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category
Combined Repeated Dose Toxicity Study and Reproductive/Developmental Toxicity
Screening Test in Rats**

Developmental Toxicity/Teratogenicity

Test Substance	Methylcyclopentadiene Dimer Concentrate CAS Number 26472-00-4
Remarks	The test substance is a sample of an industrial intermediate stream that is produced by thermal processing and distillation of a pyrolysis gasoline fraction from the ethylene production manufacturing process. The sample tested contained 98.8% MCPD dimers, 2.6% MCPD monomer, 1.6% other C5-C8 monomers, 1.6% CPD-MCPD codimer, 3.0% DCPD and codimers of CPD or MCPD with C4 through C7 monomers, and 0.4% trimers of MCPD and DCPD.
Method Method/guideline followed	OECD 422
Test type	Combined repeated exposure inhalation toxicity study with the reproduction / developmental screening test
GLP	Yes.
Year	2003
Species	Rat
Strain	CrI:CD [®] (Sprague-Dawley) IGS BR
Route of administration	Oral gavage.
Duration of test	Satellite groups of 12 young, nulliparous, female rats were administered an oral, daily dose of the test substance during a pre-mating period of approximately 2 weeks, a cohabitation period of approximately 2 weeks, a gestation period of approximately 3 weeks, and a lactation period of approximately 4 days. The males were exposed for 31 days.
Doses/concentration levels	0, 20 100, or 300 mg/kg/day
Sex	12 male, 12 female per group.
Exposure period	Not applicable
Frequency of treatment	7 days/week
Control group and treatment	12 male, 12 female, corn oil vehicle.
Post exposure observation period	Not applicable.
Statistical methods	Group means and standard deviations were calculated for all measured parameters. Body weight, weight gain, food consumption, and organ weights were analyzed by Jonckheere-Terpstra trend test. Food efficiency was analyzed by one-way analysis of variance followed with Dunnett's test. Clinical observations, mating index, fertility index, and gestation index were analyzed by Cochran-Armitage trend test. Gestation length, implantation site numbers, implantation efficiency, mean number of pups per litter, percent of pups born alive, day 0-4 viability of pups, viability index, number of <i>corpora lutea</i> , sex ratio, pre-implantation loss, and post-implantation loss were analyzed by Jonckheere-Terpstra trend test. Mean pup weights were analyzed by linear contrast of the least square means.

<p>Test Conditions</p>	<p>Satellite groups of 12 young, nulliparous, female rats were administered an oral, daily dose of 0, 20, 100, or 300 mg/kg/day during a pre-mating period of approximately 2 weeks, a cohabitation period of approximately 2 weeks, a gestation period of approximately 3 weeks, and a lactation period of approximately 4 days. Due to an error during approximately gestation days 7-14, satellite females received dosages based on their gestation day 0 or cohabitation day 0 body weights instead of gestation 7 or gestation day 14 body weights. Following the 2-week pre-mating period, each satellite female was paired with a male of the same respective dosage group during a 2-week cohabitation period. Measurements of body weight, food consumption, and clinical signs of toxicity in females were conducted throughout pre-mating, cohabitation, gestation, and lactation. After postpartum day 4, lactating females and nonpregnant females were sacrificed, selected organs were weighed, and selected tissues were evaluated microscopically. Offspring were evaluated for external abnormalities, and sacrificed on postnatal day 4. The study design included a main study for repeated dose toxicity end points (summarized separately).</p> <p>The males were exposed for a total of 31 days, and were then necropsied. In addition to the repeated dose toxicity end points assessed (discussed separately), reproductive assessment of the males included mating, conception and fertility indices, reproductive organ weights and gross/histopathology of the reproductive tract.</p>								
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Parameters	NOEL (mg/kg/day)	NOAEL (mg/kg/day)	LOEL (mg/kg/day)						
Developmental (pups)	20	20	100						
<p>LOAEL (LOEL)</p>	<p>Not applicable.</p>								
<p>Remarks</p>	<p><i>Clinical signs and mortality:</i> Increased incidences of salivation, stained fur, and/or wet fur were observed in satellite females administered 100 or 300 mg/kg/day MCPD. Salivation was also observed in 20 mg/kg/day satellite females.</p> <p><i>Body Weight and Weight Gain for Satellite Females:</i> There were no test substance-related effects on body weight or weight gain of 300 mg/kg/day satellite females during the pre-mating period. However, at the end of the gestation period (day 21), body weight of 300 mg/kg/day satellite females was 5% lower than the control value; and for the interval of gestation days 0-21, weight gain of 300 mg/kg/day satellite females was 13% lower than the control values. There were no effects on body weight or weight gain at any dosage in satellite females during the lactation period.</p> <p><i>Food Consumption and Food Efficiency for Satellite Females:</i> Test substance-related, statistically significant decreases in food consumption and/or food efficiency occurred in 300 mg/kg/day in satellite females during gestation. Food consumption and food efficiency were decreased 7.5% and 7.3%, respectively, in 300 mg/kg/day satellite females during gestation days 0-21.</p> <p><i>Offspring Parameters:</i> Decreased mean pup weight was observed in offspring from the 100 and 300 mg/kg/day groups. No effects were observed at any dosage for the number of pups born, number of pups born alive, sex ratio, gestation index, external abnormalities, or litter survival for postnatal days 0-4 in the offspring from any dosage group.</p>								
<p>Conclusions</p>	<p>Repeated administration of Methylcyclopentadiene Dimer to male and female</p>								

<p><u>Data Quality</u> Reliabilities</p> <p><u>References</u></p> <p><u>Other</u> Last changed</p>	<p>Sprague Dawley rats at dosages of 0, 20, 100, or 300 mg/kg/day produced no evidence of teratogenicity, however, pups from the 100 and 300 mg/kg/day groups had decreased body weight. Based on these data, the no-observable-effect level (NOEL) for developmental toxicity in pups was 20 mg/kg/day.</p> <p>Klimish value = 1 (Reliable without restrictions).</p> <p>Malley, L. A. Methylcyclopentadiene Dimer: Combined Repeated Dose Toxicity Study and Reproductive/Developmental Toxicity Screening Test in Rats. DuPont-11369. Report of E. I. du Pont de Nemours and Company conducted for the American Chemistry Council Olefins Panel.</p> <p>26-Jul-04 Robust summary prepared by the contractor for the Olefins Panel</p>
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**Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category
Combined Repeated Dose Toxicity Study and Reproductive/Developmental Toxicity
Screening Test in Rats**

Toxicity to Reproduction

Test Substance	<u>Methylcyclopentadiene Dimer Concentrate</u> CAS Number 26472-00-4
Remarks	The test substance is a sample of an industrial intermediate stream that is produced by thermal processing and distillation of a pyrolysis gasoline fraction from the ethylene production manufacturing process. The sample tested contained 98.8% MCPD dimers, 2.6% MCPD monomer, 1.6% other C5-C8 monomers, 1.6% CPD-MCPD codimer, 3.0% DCPD and codimers of CPD or MCPD with C4 through C7 monomers, and 0.4% trimers of MCPD and DCPD.
Method Method/guideline followed	OECD 422
Test type	Combined repeated exposure toxicity study with the reproduction/developmental screening test
GLP	Yes.
Year	2003
Species	Rat
Strain	CrI:CD® (Sprague-Dawley) IGS BR
Route of administration	Gavage.
Duration of test	Satellite groups of 12 young, nulliparous, nonpregnant female rats were administered an oral, daily dose of the test substance during a pre-mating period of approximately 2 weeks, a cohabitation period of approximately 2 weeks, a gestation period of approximately 3 weeks, and a lactation period of approximately 4 days. The males were exposed for 31 days.
Doses/concentration levels	0, 20, 100, or 300 mg/kg/day. Due to an error during approximately gestation days 7-14, satellite females received dosages based on their gestation day 0 or cohabitation day 0 body weights instead of gestation 7 or gestation day 14 body weights.
Sex	12 male, 12 female per group.
Exposure period	Not applicable
Frequency of treatment	7 days/week
Control group and treatment	12 male, 12 female, corn oil vehicle.
Post exposure observation period	Not applicable.
Statistical methods	Group means and standard deviations were calculated for all measured parameters. Body weight, weight gain, food consumption, and organ weights were analyzed by Jonckheere-Terpstra trend test. Food efficiency was analyzed by one-way analysis of variance followed with Dunnett's test. Clinical observations, mating index, fertility index, and gestation index were analyzed by Cochran-Armitage trend test. Gestation length, implantation site numbers, implantation efficiency, mean number of pups per litter, percent of pups born alive, day 0-4 viability of

<p>Test Conditions</p>	<p>pups, viability index, number of <i>corpora lutea</i>, sex ratio, pre-implantation loss, and post-implantation loss were analyzed by Jonckheere-Terpstra trend test.</p> <p>Mean pup weights were analyzed by linear contrast of the least square means.</p> <p>Satellite groups of 12 young, nulliparous, female rats were administered an oral, daily dose of 0, 20, 100, or 300 mg/kg/day during a pre-mating period of approximately 2 weeks, a cohabitation period of approximately 2 weeks, a gestation period of approximately 3 weeks, and a lactation period of approximately 4 days. Due to an error during approximately gestation days 7-14, satellite females received dosages based on their gestation day 0 or cohabitation day 0 body weights instead of gestation 7 or gestation day 14 body weights. Following the 2-week pre-mating period, each satellite female was paired with a male of the same respective dosage group during a 2-week cohabitation period. Measurements of body weight, food consumption, and clinical signs of toxicity in females were conducted throughout pre-mating, cohabitation, gestation, and lactation. After postpartum day 4, lactating females and nonpregnant females were sacrificed, selected organs were weighed, and selected tissues were evaluated microscopically. Offspring were evaluated for external abnormalities, and sacrificed on postnatal day 4. The study design included a main study for repeated dose toxicity end points (summarized separately).</p> <p>The males were exposed for a total of 31 days, and were then necropsied. In addition to the repeated dose toxicity end points assessed (discussed separately), reproductive assessment of the males included mating, conception and fertility indices, reproductive organ weights and gross/histopathology of the reproductive tract.</p>												
<p>Results NOAEL (NOEL)</p>	<table border="1"> <thead> <tr> <th>Parameters</th> <th>NOEL (mg/kg/day)</th> <th>NOAEL (mg/kg/day)</th> <th>LOEL (mg/kg/day)</th> </tr> </thead> <tbody> <tr> <td>Systemic</td> <td>Not determined for males; 20 F</td> <td>Not determined for males; 20 F</td> <td>20 M 100 F</td> </tr> <tr> <td>Reproductive (M/F)</td> <td>300</td> <td>300</td> <td>-</td> </tr> </tbody> </table>	Parameters	NOEL (mg/kg/day)	NOAEL (mg/kg/day)	LOEL (mg/kg/day)	Systemic	Not determined for males; 20 F	Not determined for males; 20 F	20 M 100 F	Reproductive (M/F)	300	300	-
Parameters	NOEL (mg/kg/day)	NOAEL (mg/kg/day)	LOEL (mg/kg/day)										
Systemic	Not determined for males; 20 F	Not determined for males; 20 F	20 M 100 F										
Reproductive (M/F)	300	300	-										
<p>LOAEL (LOEL) Remarks</p>	<p>Not applicable.</p> <p><i>Clinical signs and mortality:</i> Increased incidences of salivation, stained fur, and/or wet fur were observed in males and satellite females administered 100 or 300 mg/kg/day. Salivation was observed in 20 mg/kg/day males and satellite females.</p> <p><i>Body Weight and Body Weight Gain in Subchronic Males and Satellite Females:</i> Test substance-related decreases in body weight and/or weight gain were observed in males and satellite females administered 300 mg/kg/day of the test substance. On test day 28, body weight of 300 mg/kg/day males was 7.5% lower than the control values. Body weight gain over the interval of test days 1-28 for 300 mg/kg/day males was 19% lower than the control value. In addition, instances of decreased body weight and/or weight gain were also observed in males administered 100 mg/kg/day of the test substance.</p> <p>There were no test substance-related effects on body weight or weight gain of 300 mg/kg/day satellite females during the pre-mating period. However, at the end of the gestation period (day 21), body weight of 300 mg/kg/day</p>												

<p><u>Conclusions</u></p> <p><u>Data Quality</u> Reliabilities</p> <p><u>References</u></p> <p><u>Other</u> Last changed</p>	<p>satellite females was 5% lower than the control value; and for the interval of gestation days 0-21, weight gain of 300 mg/kg/day satellite females was 13% lower than the control values. There were no effects on body weight or weight gain at any dosage in satellite females during the lactation period.</p> <p><i>Food Consumption and Food Efficiency in Subchronic Males and Satellite Females:</i> Test substance-related, statistically significant decreases in food consumption and/or food efficiency occurred in 300 mg/kg/day in satellite females during gestation. Food consumption and food efficiency were decreased 7.5% and 7.3%, respectively, in 300 mg/kg/day satellite females during gestation days 0-21. Transient changes in food consumption and/or food efficiency were also observed in males administered 100 or 300 mg/kg/day of the test substance.</p> <p><i>Reproductive Indices:</i> No test substance-related effects or statistically significant differences in mating index, fertility index, gestation length number of implantation sites, implantation efficiency, pre-implantation loss, post-implantation loss, or number of <i>corpora lutea</i> were observed for any dosage of the test substance in satellite females.</p> <p><i>Offspring Parameters:</i> No effects were observed at any dosage for the number of pups born, number of pups born alive, sex ratio, gestation index, or litter survival for postnatal days 0-4 in the offspring from any dosage group.</p> <p><i>Reproductive Pathology:</i> There were no test substance-related effects on morphology of the reproductive tract in either males or females.</p> <p>Repeated administration of Methylcyclopentadiene Dimer to male and female Sprague Dawley rats at dosages of 0, 20, 100, or 300 mg/kg/day produced no evidence of adverse effects on any measures of reproductive function. Based on these data, the no-observable-effect level (NOEL) for reproductive toxicity was 300 mg/kg/day.</p> <p>Klimish value = 1 (Reliable without restrictions).</p> <p>Malley, L. A. Methylcyclopentadiene Dimer: Combined Repeated Dose Toxicity Study and Reproductive/Developmental Toxicity Screening Test in Rats. DuPont-11369. Report of E. I. du Pont de Nemours and Company conducted for the American Chemistry Council Olefins Panel.</p> <p>26-Jul-04 Robust summary prepared by the contractor for the Olefins Panel</p>
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Attachment 1b
Mammalian Toxicology
Subcategory 2

Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Acute Toxicity

<p><u>Test Substance</u></p>	<p>Resin-Former Feedstock; 50-60% DCPD. 15-20% CPD/methyl CPD dimer, <2% BD/CPD dimer, 10-12% styrene, <2% xylene, <2% CPD. Composition analysis, purity and stability referred to sponsor. T-119</p> <p><u>Olefins Panel HPV Stream Name: High DCPD Resin Oil</u></p>
<p><u>Method</u> Method/guideline followed Type (test type) GLP Year Species/Strain Sex No. of animals per sex per dose Vehicle Route of administration</p>	<p>None specified, comparable to standard study</p> <p>Acute</p> <p>Yes</p> <p>1983</p> <p>Rat, Fischer 344</p> <p>Males and females</p> <p>5</p> <p>Corn oil</p> <p>Oral gavage</p>
<p>Test Conditions</p>	<p>Rats (64 days old, 131-222g) were individually housed in metal, screen-bottomed cages and received food and water ad lib. Animal rooms were maintained at 75^oF with relative humidity of 61% and a 12-hour light/dark cycle. Test article was administered, as a suspension in corn oil, to 24 hr fasted animals, at levels of 0.32, 0.56, 1.0, and 1.8 g/kg. Rats were evaluated daily for 14 days following dosing. Observations for morbidity/mortality were performed daily for 14 days. Body wts were taken at initiation, day 8 and day 15. Each rat was observed at 1 and 4 hr post-dosing, and at least once daily thereafter for clinical signs for 14 days. Gross necropsies were performed on all rats. Acute oral LD₅₀s for each sex and combined sexes were determined by Probit analysis. A precise oral LD₅₀ could not be obtained in male rats because there was only one data point between 0 and 100% deaths.</p>
<p><u>Results</u> LD₅₀ with 95% confidence limits.</p>	<p>Female: 0.97 (0.57-1.96)g/kg; Male: >0.56<1.8g/kg; Combined: 0.96 (0.73-1.26)g/kg. Normal body wt. increases were observed in surviving animals at 7 and 14 days. Clinical signs (other than death) occurred sporadically in all groups. Signs included arching of the back, bloody discharge from nose/mouth, hypersensitivity, backward-moving motor activity, and tremors. All deaths occurred within 48 hrs of dosing. Deaths occurred as follows: 1) Males; 0.32g/kg, 0/5; 0.56g/kg, 0/5; 1.0g/kg, 3/5; 1.8g/kg, 5/5; 2) Females; 0.32g/kg, 0/5; 0.56g/kg, 1/5; 1.0g/kg, 3/5; 1.8g/kg, 4/5. Necropsies of rats dying during the study showed dose-related congestion in abdominal, cranial, and thoracic cavities. At terminal sacrifice, only 2 rats showed congestion (sex and dose group not reported).</p>
<p>Remarks</p>	<p>LD50 for combined sexes was 0.96 (0.73-1.26)g/kg.</p>
<p><u>Conclusions</u> (study author)</p>	<p>LD50 for combined sexes was 0.96 (0.73-1.26)g/kg.</p>
<p><u>Data Quality</u> Reliability</p>	<p>1. Reliable without restrictions</p>
<p><u>References</u></p>	<p>Rausina, G.A. 1983. Acute oral toxicity study in albino rats using Resin-Former Feedstock. Proj. #2016. Gulf Life Sciences Center, Pittsburgh, PA for Gulf Oil Chemicals Co. Houston, TX</p>
<p><u>Other</u> Last changed</p>	<p>Revised 11/21/2001 (Prepared by a contractor to the Olefins Panel)</p>

Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Acute Toxicity

<p><u>Test Substance</u></p>	<p>Resin-Former Feedstock; 50-60% DCPD. 15-20% CPD/methyl CPD dimer, <2% BD/CPD dimer, 10-12% styrene, <2% xylene, <2% CPD. Composition analysis, purity and stability referred to sponsor.</p> <p><u>Olefins Panel HPV Stream Name: High DCPD Resin Oil</u></p>
<p><u>Method</u> Method/guideline followed Type (test type) GLP Year Species/Strain Sex No. of animals per sex per dose Vehicle Route of administration</p>	<p>None specified, comparable to standard study Acute limit test Yes 1983 Rats, Fischer 344 Males and females 5 Filtered air Inhalation (whole body)</p>
<p>Test Conditions</p>	<p>Rats (16 wks old, 157-276g) were maintained at 24.6^oC with 48% relative humidity and a 12-hour light/dark cycle. One group of 10 rats was exposed to the test article at an actual concentration of 5.4g/m³, for 4 hrs in a stainless steel, dynamic exposure chamber. A test article aerosol was generated with a ball-jet nebulizer, and chamber concentration was controlled by varying both dilution air and inlet pressure of filtered air. Chambers were sampled with a gas-tight syringe and samples were directly injected directly into a gas chromatograph. Concentrations were determined by comparing peak area of sample with that of standards. Test article was volatile and gravimetric samples could not be taken, so particle size was determined during exposure by laser velocity measurement (MMAD 5.0µm±1.4 SD; 89% of particles <10µm). Body wt. was taken after exposure and on day 7 and 14. Mortality checks were made during exposure and daily thereafter. Clinical signs were noted at 1 and 4 hrs post-exposure, and daily thereafter. Non-fasted rats were sacrificed and necropsied for gross lesions.</p>
<p><u>Results</u> LC₅₀ with confidence limits.</p>	<p>Not reached at 5.4g/m³.</p>
<p>Remarks</p>	<p>There were no deaths during the study. Rats were hyper-excitable/hyperactive for the first 2 days of the study, and had dry red material around nose/mouth; clinical signs abated by day 5. Rat body wt did not change for the first 7 days, but increased normally thereafter. No gross necropsy findings were attributable to test article exposure.</p>
<p><u>Conclusions</u> (study author)</p>	<p>No deaths occurred after exposure to 5.4g/m³ for 4 hrs.</p>
<p><u>Data Quality</u> Reliability</p>	<p>1. Reliable without restrictions</p>
<p><u>References</u></p>	<p>Gordon, T. 1983. LD₅₀ Resin-Former Feedstock inhalation toxicity study in rats. Proj. #82-083. Gulf Life Sciences Center, Pittsburgh, PA for Gulf Oil Chemicals Co. Houston, TX</p>
<p><u>Other</u> Last changed</p>	<p>Revised 11/21/2001 (Prepared by a contractor to the Olefins Panel)</p>

Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Acute Toxicity

<p><u>Test Substance</u></p> <p><u>Method</u> Method/guideline followed Type (test type) GLP Year Species/Strain Sex No. of animals per sex per dose Vehicle Route of administration</p> <p>Test Conditions</p> <p><u>Results</u> LD₅₀ with confidence limits.</p> <p>Remarks</p> <p><u>Conclusions</u> (study author)</p> <p><u>Data Quality</u> Reliability</p> <p><u>References</u></p> <p><u>Other</u> Last changed</p>	<p>Resin-Former Feedstock; 50-60% DCPD. 15-20% CPD/methyl CPD dimer, <2% BD/CPD dimer, 10-12% styrene, <2% xylene, <2% CPD. Composition analysis, purity and stability referred to sponsor.</p> <p><u>Olefins Panel HPV Stream Name: High DCPD Resin Oil</u></p> <p>None specified, comparable to standard study Acute- limit test Yes 1983 Rabbit, New Zealand White Males and females 5 none dermal</p> <p>Rabbits (11-19 wks old, 2.04-3.10 kg) were individually housed in metal, screen-bottomed cages and received chow diet and water ad lib. Rooms were maintained at 72-85°F with relative humidity of 30-80% and a 12-hour light/dark cycle. Before test article application, backs of the rabbits were shaved, and 4 parallel epidermal abrasions were made lengthwise on the shaved test site that penetrated the stratum corneum but not the dermal layer. Neat test article was applied over the site at 2000mg/kg and covered with a gauze patch and occlusive dressing that was taped in place, covered with a cotton sock and wrapped in an elastic bandage. Each animal was fitted with an Elizabethan collar to prevent ingestion. Test article remained on the skin for 24hrs after which wrappings were removed and residual test article wiped off. Observations for mortality, moribundity, clinical signs, and skin reactions were made immediately after removal of test article and then daily for 14 days, after which the rabbits were sacrificed and gross necropsies performed. Irritation was scored by the Draize method (scores 2-4).</p> <p>Not reached at 2000mg/kg. No mortality occurred during the study, and body weight increased normally. Immediately after test article removal, rabbits showed slight to severe edema and slight to well-defined erythema (scores 1-4), which partially resolved over the 14-day observation period. Most of the rabbits had moderate to severe skin desquamation during the study, and by the end of the observation period, sloughing of dry patches revealed red skin, indicative of a persistent irritation. Gross necropsy did not reveal any adverse findings other than skin desquamation.</p> <p>The median lethal dose is greater than 2000mg/kg. A persistent skin irritation was observed at the application site.</p> <p>1. Reliable without restrictions</p> <p>Rausina, G.A. 1983. Acute dermal toxicity study in albino rabbits, Resin-Former Feedstock. Proj. #82-075. Gulf Life Sciences Center, Pittsburgh, PA for Gulf Oil Chemicals Co. Houston, TX</p> <p>Revised 11/21/2001 (Prepared by a contractor to the Olefins Panel)</p>
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Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Genetic Toxicity - in Vitro

<p><u>Test Substance</u> <i>Test substance</i></p> <p><u>Method</u> Method/guideline followed Type System of testing GLP Year Species/Strain</p> <p>Metabolic activation Species and cell type Quantity Induced or not induced Concentrations tested</p> <p>Statistical Methods</p> <p>Remarks for Test Conditions</p>	<p>Resin-Former Feedstock; 50-60% DCPD. 15-20% CPD/methyl CPD dimer, <2% BD/CPD dimer, 10-12% styrene, <2% xylene, <2% CPD. Amber colored, clear aromatic liquid with hydrocarbon odor. Composition analysis, purity and stability referred to sponsor. <u>Olefins Panel HPV Stream Name: High DCPD Resin Oil</u></p> <p>Standard method based on Hsie et al. (1981), O'Neill & Hsie (1979) In vitro mammalian cell forward mutation Chinese hamster ovary (CHO) cell culture Yes 1984 CHO-K-1 heterozygous for hypoxanthine-guanine phosphoribosyl transferase (HGPRT+/-) from Oak Ridge National Laboratory, TN. Yes Rat liver (S9) fraction purchased from Litton Bionetics, Kensington, MD 1.0mg S9 fraction/ml treatment medium/flask Aroclor 1254 induced (treatment not specified) Cytotoxicity: 4, 8, 64, 128, 256, 512, 1024, 2048µg/ml ± S9; Mutagenicity: 64, 128, 256, 300µg/ml (350, 400µg/ml, cytotoxicity only) ±S9; all diluted in 10% Pluronic® polyol F68 (prepared in deionized water, mol. wt. 8350).</p> <p>Frequency of mutant colonies per million clonable cells, corrected for absolute survival by viability plates, was calculated and comparisons of treated cultures with vehicle controls made on transformed data using a two-tailed t-test (Irr & Snee, 1979) using the MUTANT computer program (Snee et al., 1981). Criteria for positive results were significant (p<0.05) increase in mutant colonies (HGPRT+/- → HGPRT-/-) at any dose level and a dose related response. If only one criterion was met, results were considered equivocal.</p> <p>Sufficient Resin-Former Feedstock was weighed separately for each dose level into 10ml volumetric flasks; 6.9ml of 10% F68 was added along with sufficient medium (Ham's F-12 without hypoxanthine) to achieve final 10ml volume for testing. All dosing preparations were vortexed just after addition of medium and just prior to addition of 20µl to each 3ml medium culture flask. All cultures were incubated at 37°C in 5% CO₂ enriched, humidified atmosphere. Positive control mutagens were ethyl methanesulfonate (100µg/ml) for -S9 cultures, and benzo(a)pyrene (4µg/ml) for +S9 cultures. For cytotoxicity, each dose group was composed of 2 flasks, one -S9, one+S9, negative controls ± S9, seeded with 5x10⁵ cells on day 1. Cultures were exposed to test compound for 5 hours on day 2. On day 3, cells were trypsinized and counted with a Coulter Model ZB, then 200 cells were transferred into each of 3 60mm culture dishes. These viability plates were incubated until day 10, fixed in methanol and stained with Giemsa. Colonies were counted visually or with an Artek Model 981 colony counter. Absolute survival = total colony count ÷ number of cells seeded/flask. Relative survival = absolute survival in treated cultures ÷ vehicle control survival. Acceptable survival level is at least 10%. For mutagenicity, cells were seeded on day 1 into 6 flasks/dose group, 3-S9, 3+S9; on day 2 approximately 10⁶ cells were exposed to Resin-former feedstock for 5 hours. Vehicle control had 12 flasks, 6-S9, 6+S9. On day 3, cultures with excessive cytotoxicity were discarded. From remaining cultures, 200 cells were seeded to each of 4 viability plates/dose level; incubated to day 10, fixed with methanol, stained with Giemsa, and colonies counted for survival. Expression cultures (10⁵-10⁶ cells/one dish/dose) were seeded on day 3; subcultured three times until day 10 when 200 cells were seeded on each of 4 viability plates/dose and 2x10⁵ cells seeded on each of 5 mutagenicity plates/dose with selective medium containing 10⁻⁵M 6-thioguanine to allow expression of HGPRT mutation. Cultures were incubated undisturbed until day 17 when they were fixed and stained. For mutagenicity, a ratio of total colony</p>
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Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Genetic Toxicity - in Vitro

<p><u>Test Substance</u> <i>Test substance</i></p>	<p>Resin-Former Feedstock; 50-60% DCPD. 15-20% CPD/methyl CPD dimer, <2% BD/CPD dimer, 10-12% styrene, <2% xylene, <2% CPD. Amber colored, clear aromatic liquid with hydrocarbon odor. Composition analysis, purity and stability referred to sponsor.</p> <p><u>Olefins Panel HPV Stream Name: High DCPD Resin Oil</u></p>
<p><u>Method</u> Method/guideline followed Type System of testing GLP Year Species/Strain Metabolic activation Species and cell type Quantity Induced or not induced Concentrations tested</p>	<p>Standard method based on Williams (1977) and Williams et al. (1977,1982) In vitro mammalian cell DNA repair assay Unscheduled DNA Synthesis (UDS) in primary hepatocyte cultures. Yes 1984 Fischer 344 male rat (13-14 wks old) – 1 rat per test No NA NA NA Range-finding: 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048µg/ml: UDS assay: 10, 20, 40 100µg/ml; all diluted in 10% Pluronic[®] polyol F68 (prepared in deionized water, mol. wt 8350, 80% hydrophilic)</p>
<p>Exposure period Statistical Methods</p>	<p>18-20 hours None employed. Criteria for positive response are incorporation of radioactive precursor (³H-thymidine) in cells that are not normally synthesizing DNA, indicating repair of damage. A positive response is defined as a mean net nuclear grain count at any treatment level that exceeds concurrent negative control by at least 6 grains/nucleus; negative control value must not exceed 5 grains. A positive response need not be dose related.</p>
<p>Remarks for Test Conditions</p>	<p>Sufficient Resin-Former Feedstock was weighed separately for each dose level, 0.70ml of 10% F68 added per ml of final volume and sufficient medium (Williams Medium E with 10% fetal bovine serum and insulin) added to achieve final volume. Test preparations were stored at 37⁰C until dosing and mixed just prior to addition at 30µl to each 3ml culture. The conc. of ³H-thymidine (½ life 12.5 yrs.) used in these assays was 1mCi/ml. All cultures were incubated at 37⁰C in 5% CO₂ enriched humidified atmosphere. For range-finding, primary hepatocytes derived from freshly perfused rat liver were seeded (approx. 1x10⁵ cells/ml) into treatment vessels, exposed to test material for 19 hours (2 cultures/dose level; 2 untreated cultures, and two vehicle F68 control cultures), then fixed in formalin and stained with trypan blue for viability determination. At least 50% viability needed for the assay. In the UDS assay, 1x10⁵ cells/ml were seeded into coverslip cultures, exposed to ³H-thymidine and test substance for 18-20 hours (3 cultures/dose level). Positive control was 2-acetyl aminofluorene (0.2µg/ml). Cells growing on coverslips were rinsed, fixed and glued to microscope slides on day 2. On day 3, slides were dipped in autoradiographic emulsion and stored in the dark at 2-8⁰C. Autoradiographs were developed, stained and coverslipped on day 14. Number of grains overlying 50 randomly selected nuclei/slide were counted. The highest of 3 cytoplasmic grain counts/cell were subtracted to obtain net nuclear grain count. Avg. net nuclear grain count/slide (sum of net nuclear grain count ÷ 50) and mean net nuclear grain count (avg. net nuclear grain count/slide ÷ 3) were calculated. Slides with negative average net nuclear grain count were scored as zero.</p>
<p><u>Results</u> Genotoxic effects</p>	<p>Resin-Former Feedstock induced toxicity in primary rat hepatocytes beginning at 32µg/ml (67.8% relative viability) following 19 hours exposure. Viability continued to decrease in a dose related manner (i.e. relative viabilities of 60.6% at 64, 34.7% at 128, and 29.1% at 256µg/ml) to the maximum dose of 2048µg/ml (2.5% relative viability). Resin-former feedstock did not induce UDS at any treatment level in this assay. Negative and positive</p>

<p><u>Conclusions</u> (contractor)</p> <p><u>Data Quality</u> <i>Reliabilities</i></p> <p><u>Reference</u></p> <p><u>Other</u> <i>Last changed</i></p>	<p>controls responded appropriately (vehicle control mean net count of 0.80 and 2-acetyl aminofluorine mean net count of 122.61 net nuclear grains).</p> <p>Resin-Former Feedstock did not induce unscheduled DNA synthesis at any dose level administered to cultured rat hepatocytes. Resin-former feedstock does not cause DNA damage and repair in this assay.</p> <p>1. Reliable without restrictions. Study conforms to standard design. GLPs have been followed.</p> <p>Brecher, S., and Goode, J.W. 1984. Hepatocyte primary culture/DNA repair test of resin-former feedstock. Proj. #2067. Gulf Life Sciences Center, Pittsburgh, PA for Gulf Oil Chemicals Co., Houston, TX Williams, G.M. 1977. Cancer Res. 37: 1845-1851 Williams et al. 1977. In Vitro 13: 809-817 Williams et al. 1982. Mut. Res. 97:359-370</p> <p>Revised 11/21/2001 (Prepared by a contractor to the Olefins Panel)</p>
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Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Genetic Toxicity - in Vitro

<p><u>Test Substance</u> <i>Test substance</i></p>	<p>Resin-Former Feedstock; 50-60% DCPD. 15-20% CPD/methyl CPD dimer, <2% BD/CPD dimer, 10-12% styrene, <2% xylene, <2% CPD. Amber colored, clear aromatic liquid with hydrocarbon odor. Composition analysis, purity and stability referred to sponsor.</p> <p><u>Olefins Panel HPV Stream Name: High DCPD Resin Oil</u></p>
<p><u>Method</u> Method/guideline followed Type System of testing GLP Year Species/Strain Metabolic activation Species and cell type Quantity Induced or not induced Concentrations tested</p>	<p>Standard method based on Cortesi et al (1983), Dunkel et al (1981), Reznikoff et al (1973)</p> <p>In vitro cell transformation</p> <p>Mouse embryo cells</p> <p>Yes</p> <p>1983</p> <p>BALB/3T3-A31-1-1 from T. Kakunaga, National Cancer Inst., 1982</p> <p>No</p> <p>NA</p> <p>NA</p> <p>NA</p> <p>Cytotoxicity: 4, 8, 16, 32, 64, 128, 256, 512, 1024 and 2048µg/ml; Transformation: 16, 32, 64, 200µg/ml, all diluted in 10% Pluronic[®] polyol F68 (prepared in deionized water, mol. wt. 8350, 80% hydrophilic).</p>
<p>Exposure period Statistical Methods</p>	<p>2 days</p> <p>None employed. Criteria for positive response were a two-fold increase in type III foci at the highest dose over vehicle control (at least 2 type III foci if vehicle control had none) with or without a dose related response, or a two-fold increase at two or more consecutive doses. Test is equivocal if two-fold increase occurred at any one level other than the highest dose.</p>
<p>Remarks for Test Conditions</p>	<p>Sufficient Resin-Former Feedstock was weighed separately for each dose level; 0.7ml of 10% F68 added per ml of final volume and medium (Eagle's MEM with 10% heat-inactivated fetal calf serum + antibiotics) was added as required to achieve final volume for testing. Preparations were mixed and added at 50µl to each 5 ml culture. All cultures were incubated at 37°C in 5% CO₂ enriched humidified atmosphere. For cytotoxicity, 2 flask cultures/dose group, 2 cultures for vehicle F68 or medium negative control were seeded with 1x10⁴ cells/culture in day 1, exposed on days 2-3, trypsinized and counted with a Coulter Model ZB on day 4 for at least 20% survival. For transformation, 15 flask cultures (1x10⁴ cells/culture/dose group) and two colony formation flask cultures (100 cells/culture/dose group) were seeded on day 1, exposed on days 2-3 and culture medium changed on day 4. For transformation cultures, medium continued to be changed weekly to day 29. Positive control was 3-methylcholanthrene (1µg/ml). Colony formation cultures were fixed, stained, and counted visually on day 8 to determine cloning efficiency (avg. number colonies/flask ÷ 100 cells seeded). Transformation cultures were fixed and stained on day 29 for focus counting and evaluation. Transformation frequency = total type III foci ÷ total flasks/dose group.</p>
<p><u>Results</u> Genotoxic effects</p>	<p>Resin-former feedstock induced toxicity in BALB/3T3 cells after two days exposure beginning at 32µg/ml (63% viability) with increasing toxicity to highest dose level, 2048µg/ml (7% viability); 80% cytotoxicity occurred between 128-256µg/ml. In the transformation assay, inhibition of cloning efficiency (C.E.) became evident at 64µg/ml (30.9% relative CE) and no colonies were detected at 200µg/ml. All treated cultures induced type III foci compared to negative controls. The 16µg (6 type III foci) and 200µg (8 type III foci) dose cultures had at least twice the type III foci seen in untreated medium controls (3 type III foci), and the 32µg and 64µg cultures had 4 and 5 type III foci, respectively. The positive control, 3-methylcholanthrene induced the expected response for transformation: 17 type III foci. Transformation frequencies were 0.43, 0.29, 0.38, and</p>

<p><u>Conclusions</u> (contractor)</p> <p><u>Data Quality</u> <i>Reliabilities</i></p> <p><u>Reference</u></p> <p><u>Other</u> <i>Last changed</i></p>	<p>0.62 for 16, 32, 64, and 200µg/ml groups, respectively, compared to 0.20 for medium control and 2.43 for positive control.</p> <p>Resin-Former Feedstock induced transformation at all dose levels in BALB/3T3 cells under conditions of this assay, with a significant 2.7 fold increase at the highest dose. Cytotoxicity and impairment of cloning efficiency were also observed.</p> <p>1. Reliable without restriction. Study conforms to standard design. GLPs have been followed.</p> <p>Brecher, S, and Goode, J.W. 1983. BALB/3t3 transformation test: Resin-Former Feedstock. Proj. #2068. Gulf Life Sciences Center, Pittsburgh, PA for Gulf Oil Chemicals Co, Houston, TX Cortesi, E. et al. 1983. Teratogenesis, Carcinogenesis, Mutagenesis 3: 101-110. Dunkel, V.A. et al. 1981. J. Nat'l Cancer Inst. 67: 1303-1315. Reznikoff, C.A. et al. 1973. Cancer Res. 33: 3239-3249.</p> <p>Revised 11/21/2001 (Prepared by a contractor to the Olefins Panel).</p>
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Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Genetic Toxicity - in Vivo

<p><u>Test Substance</u> Remarks</p> <p><u>Method</u> Method/guideline followed Type GLP Year Species Strain Sex Route of administration Doses/concentration levels Exposure period</p> <p>Statistical methods</p> <p>Remarks for Test Conditions.</p> <p><u>Results</u> Genotoxic effects NOAEL (NOEL) LOAEL (LOEL)</p>	<p>Resin-Former Feedstock; 50-60% DCPD. 15-20% CPD/methyl CPD dimer, <2% BD/CPD dimer, 10-12% styrene, <2% xylene, <2% CPD. Amber colored, clear organic liquid with hydrocarbon odor. Composition analysis, purity and stability referred to sponsor.</p> <p><u>Olefins Panel HPV Stream Name: High DCPD Resin Oil</u></p> <p>Comparable to standard assay Mammalian bone marrow erythrocyte micronucleus Yes 1984 Mouse CrI:CD[®]-1 (ICR) BR Swiss Male and female: 10M, 10F/group; 15M, 15 F in 1 group (11 wks old, 24-39g at start) Oral gavage 0, 0.125, 0.25, 0.5g/kg in corn oil 1 dose/day for 2 days; 1 group- 1 dose, 1 day only</p> <p>Values from treated groups for daily mean body weights, group means and std. dev. for polychromatic erythrocytes (PCEs) with micronuclei (MN), and group mean ratios of PCE to normochromatic erythrocytes (NORMs) were calculated and compared with vehicle control values by Student's t-test. Positive response was indicated by statistically significant (p<0.05) increases in micronucleated PCE at any dose level with a dose related response evident. Results were considered equivocal if only one of these criteria was met.</p> <p>Resin-Former Feedstock dosing solutions were prepared fresh for each day of dosing – 1.25 g was weighed into a 50 ml volumetric flask, corn oil was added to make up 50ml volume and contents blended by shaking. No range finding study was performed. Four groups of mice were given 0.0 (20ml/kg corn oil), 0.125-0.5g/kg test material in a single oral dose by gavage for 2 days. All mice were weighed on day 1 and on day of sacrifice. One half of each treated group and vehicle control (5M, 5F) was killed on day 3 and the remainder on day 4. One group (15M, 15F), given 0.5g/kg by gavage in a single dose for 1 day only, was killed on days 2, 3, 4 (5/sex/day). Positive control mice given cyclophosphamide (75 mg/kg) ip daily for 2 days were killed on day 3. Slides of femoral bone marrow smears were prepared, stained with May-Grunewald /Giemsa stain and examined microscopically. For each mouse, 1000 PCE and all associated mature erythrocytes (NORMs) were evaluated for presence of micronuclei. Data collected included group mean body weights for each day, total PCEs, total NORMs, PCEs with MN, and NORMs with MN.</p> <p>NOEL (genetic) = 0.5g/kg; NOAEL (systemic) = 0.25g/kg (levels assigned by reviewer). Mortality occurred in 1/10 males, 6/10 females in the 0.5g/kg for 2 days dose group, on or before day 2; in the 0.5g/kg for 1 day dose group, 2/15 males and 9/15 females died. Gross necropsy revealed yellow oily or red material in small intestines and/or stomach; 1 female had bilateral hydrometra. Perianal staining was observed. No significant wt loss occurred in surviving animals; 50% or more total treated animals survived to sacrifice, although mortality at 0.5g/kg single dose and 2 doses was 73% and 10% respectively among males, and 60% females in both dose regimens. Surviving animals treated with Resin-former feedstock did not show any significant change in frequency of micronucleus formation in polychromatic erythrocytes. In the 2 surviving females given 0.5g/kg test material for 2 days and sacrificed on day 4, a statistically significant decrease in PCE/NORM ratio was seen – 0.7 compared to 0.8 in solvent controls; all females in other dose groups and all males had PCE/NORM ratios comparable to</p>
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<p><u>Conclusions</u> (study authors)</p> <p><u>Data Quality</u> <i>Reliabilities</i></p> <p><u>References</u></p> <p><u>Other</u> <i>Last changed</i></p>	<p>controls. Positive and negative controls produced expected results; cyclophosphamide induced 4.5% and 3.30% micronucleated PCEs in male and female mice, respectively, sacrificed on day3.</p> <p>Oral treatment of Resin-Former Feedstock for 1-2 days at doses up to 0.5g/kg/day had no effect on frequency of micronucleated PCE in bone marrow. Resin-former feedstock did induce mortality at 0.5g/kg and some inhibition of PCE/NORM ratio in 2 high dose females treated for 2 days and killed on day 4. Under conditions of this study, Resin-Former Feedstock is not a clastogen.</p> <p>2. Reliable with restrictions. Significant mortality at the highest dose.</p> <p>Khan, S.H., and Goode, J.W. 1984. Micronucleus test in mouse bone marrow: Resin-Former Feedstock administered orally for 2 days. Proj. #2066. Gulf Life Sciences Center, Pittsburgh, PA for Gulf Oil Chemicals Co., Houston, TX</p> <p>Revised 11/21/2001 (Prepared by a consultant to the Olefins Panel)</p>
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Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Repeated Dose Toxicity

<p><u>Test Substance</u> Remarks</p> <p><u>Method</u> Method/guideline followed Test type GLP Year Species Strain Route of administration Duration of test Doses/concentration levels Sex Exposure period Frequency of treatment Control group and treatment Post exposure observation period Statistical methods</p> <p>Test Conditions</p> <p><u>Results</u> NOAEL (NOEL) LOAEL (LOEL) Remarks</p>	<p>Resin-Former Feedstock; 50-60% DCPD. 15-20% CPD/methyl CPD dimer, <2% BD/CPD dimer, 10-12% styrene, <2% xylene, <2% CPD. Composition analysis, purity and stability referred to sponsor <u>Olefins Panel HPV Stream Name: High DCPD Resin Oil</u></p> <p>None specified, comparable to standard study Subacute Yes 1984 Rat Fischer 344 Dermal 14 days 0, 1.0, 2.0g/kg 5 Males, 5 Females/dosing group 6hr/day for 9 days (days 1-5, 8-11) Once/day 5 Males, 5 Females; corn oil (1g/kg) None Standard deviation, Bartlett's test, analysis of variance, Dunnett's test, Modified t-test, two-tailed Kolmogorov-Smirnov test.</p> <p>Rats (49 days old, 112-199g at initiation) were housed individually in suspended, stainless steel cages, with wire mesh fronts and bottoms, and equipped with automatic watering. Chow diet and water were provided ad lib. Room temperature and relative humidity were maintained at 75°F and 51%, respectively, with a 12-hour light/dark cycle. Rats received a fixed volume of 2g/kg/day of dosing solution (including corn oil vehicle); test article doses were 0, 1.0, 2.0g/kg applied to the shaved area on the back, representing approx. 10% of body surface area. Test site was uncovered during exposure. After 6 hrs exposure, residual test article was wiped off. During exposure, rats wore Elizabethan collars to retard ingestion. Rats were observed for mortality and moribundity twice daily on dosing days and once daily on non-dosing days. Body wt was recorded at initiation, day 6 and at necropsy on day 12. Rats were observed for clinical signs once daily on dosing days. Dermal reactions were observed/scored immediately before dosing and after test article removal. Blood was taken from the orbital sinus before initiation and at sacrifice for measurement of total/differential white blood cells, red blood cells, platelets, hemoglobin, hematocrit, mean cell vol., mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration, BUN, creatinine, alkaline phosphatase, Na, K, glucose, SGPT, protein, albumin and albumin/globulin ratio. All rats were sacrificed on day 12 and gross necropsies were performed. The following organs were weighed and processed for histopathology: liver, brain, heart, spleen, kidneys, testes. Skin sections, thymus, uterus, lungs, and ovaries were processed for histopathology.</p> <p>NOEL systemic: Male not established (hydrocarbon nephropathy); Female 2.0g/kg. NOEL dermal: Male 1.0g/kg; Female 1.0g/kg (based on skin irritation). LOEL systemic: Male 1.0g/kg (hydrocarbon nephropathy); Female not established. LOEL dermal: Male 2.0g/kg; Female 2.0g/kg (based on skin irritation). Values assigned by reviewer.</p> <p>No deaths occurred during the study and no moribund animals were found. There were no statistically or biologically significant changes in body wt. Mild to moderate erythema and edema were present in most rats at the 2.0g/kg dose (undiluted) but no rats were affected at 1.0g/kg (diluted 50:50 in corn oil). There were slight increases in total WBC counts and</p>
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<p><u>Conclusions</u> (study authors)</p> <p><u>Quality</u> Reliabilities</p> <p><u>References</u></p> <p><u>Other</u> Last changed</p>	<p>segmented neutrophils, in both males and females at 2.0g/kg. There were no biologically significant changes in organ wt at necropsy, but the skin of all high dose rats displayed variable degrees of visible pathological changes including erythema, and edema and desquamation. Histopathological examination of skin showed acanthosis, hyperkeratosis, and ballooning degeneration of keratinocytes with vesicle formation in all high dose rats. There was an excessive, statistically significant accumulation of hyaline droplets in the epithelial cytoplasm in kidneys from all male rats at the 1.0 and 2.0g/kg doses. There were no other test article related effects observed.</p> <p>The test article caused no overt signs of systemic toxicity at 2.0g/kg. Barely perceptible to well-defined erythema, edema, and desquamation were seen on the application sites of males and females. Kidneys of all test article treated male rats showed excessive levels of hyaline droplets.</p> <p>2. Reliable with restrictions. In the absence of occlusion, some test material might have been lost through volatilization.</p> <p>Rausina, G.A. 1984. Two-week repeated dose toxicity study in rats using Resin-former feedstock. Proj. # 82-085. Gulf Life Sciences Center, Pittsburgh, PA for Gulf Oil Chemicals Co., Houston, TX</p> <p>Revised 11/21/2001 (Prepared by a contractor to the Olefins Panel)</p>
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Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Repeated Dose Toxicity

<p><u>Test Substance</u> Remarks</p> <p><u>Method</u> Method/guideline followed Test type GLP Year Species Strain Route of administration Duration of test Doses/concentration levels Sex Exposure period Frequency of treatment Control group and treatment Post exposure observation period Statistical methods</p> <p>Test Conditions</p> <p><u>Results</u> NOAEL (NOEL) LOAEL (LOEL) Remarks</p>	<p>Resin-Former Feedstock; 50-60% DCPD. 15-20% CPD/methyl CPD dimer, <2% BD/CPD dimer, 10-12% styrene, <2% xylene, <2% CPD. Composition analysis, purity and stability referred to sponsor.</p> <p><u>Olefins Panel HPV Stream Name: High DCPD Resin Oil</u></p> <p>None specified Subacute Yes 1983 Rat Fischer 344 Whole body Inhalation 12 days 0, 0.6, 2.5g/m³ (actual) 5 Males, 5 Females/exposure group 9 days 6hr/day for 9 days (days 1-5, 8-11) 5 Males, 5 Females; filtered air None Bartlett's test for organ wt followed by Dunnett's test, or modified t-test and analysis of variance. Microscopic findings were evaluated using Kolmogorov-Smirnov analysis.</p> <p>Rats (14 wks old, 152-297g) were housed individually in stainless steel, screen bottomed cages in a room maintained at 76.1^oF and relative humidity 42%, with a 12-hour light/dark cycle. Animals were provided with water and chow ad lib, except during exposure. Three groups of 10 rats were exposed to aerosolized test article for 6 hr/day for 9 days. Test article was aerosolized with a ball jet nebulizer. Chambers were sampled with a gas-tight syringe and samples were injected directly into a gas chromatograph. Chamber concentrations were determined by GC; comparing sample peak area with that of standards. High volatility of the test article prevented collection of gravimetric samples, so particle size was determined during exposure by laser velocity measurement (MMAD= 4.8 at 0.6g/m³ and 6.9 at 2.5g/m³; 60-65% of particles <10µm). Rats were observed twice daily on dosing days and once daily on weekends for mortality, and once daily after exposure on dosing days for clinical signs. Body wt was taken prior to exposure on day 1 and 5, and prior to sacrifice on day 12. Blood was collected via orbital sinus on days 5 and 12 for measurement of total/differential white blood cells, red blood cells, platelets, hemoglobin, hematocrit, mean cell vol., mean corpuscular hemoglobin, mean corpuscular hemoglobin conc., blood urea nitrogen, creatinine, alkaline phosphatase, Na, K, glucose, SGPT, protein, albumin, and albumin/globulin ratio. Rats were sacrificed on day 15 and gross necropsies were performed. Organs were weighed and tissues collected for histological examination of tissues from high dose and control rats, and kidneys from low dose males and females. The following organs were weighed: liver, brain, heart, spleen, lungs, kidneys, and testes. The following organs/tissues were prepared for histopathology: brain, heart, lungs, liver, spleen, kidneys, testes, nasal turbinates, thymus, and ovaries; tissues from control and 2.5g/m³ groups were examined microscopically.</p> <p>NOEL was not established in this study. LOEL: Male 0.6g/m³ (based on walking with arched back, exclusive of hydrocarbon nephropathy which occurred at 0.6 and 2.5g/m³); Female 0.6g/m³ (based on walking with arched back, muscular tension, twitching) (All values assigned by reviewer.) There were no deaths during the study. Statistically non-significant decrease in body wt was seen in both sexes in all groups, including controls (males 1-6%, females 1-7%); it was</p>
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<p><u>Conclusions</u> (study authors)</p> <p><u>Quality</u> Reliabilities</p> <p><u>References</u></p> <p><u>Other</u> Last changed</p>	<p>suggested that nauseating test article vapors were present in the animal holding room, indicating some exposure to controls. The control group showed no remarkable clinical findings during the study and there was no indication of test article deposition on the body surface. At 0.6g/m³, by the second week, several rats walked with arched back and had body rigidity and twitching. At 2.5g/m³, arched back and rigidity were seen throughout the study, twitching was common by day 4 and lasted until termination; 8/10 rats convulsed at least once. The duration and severity of convulsions varied, but incidence increased by the second wk; males and females were equally affected. Frequency and severity of neurological symptoms were related to level and duration of exposure. There were infrequent occurrences of hyper-excitability, pupil dilation, ocular darkening, and swaying. There were no biologically significant differences in clinical pathology values between treated and untreated rats, but low glucose values were seen at 2.5g/m³ in both sexes. Liver wt was significantly increased in females at 2.5g/m³ (18%). Male rats showed microscopic and dose responsive changes in tubular epithelium of kidneys with excessive accumulation of hyaline droplets. No brain abnormalities were observed.</p> <p>Resin-Former Feedstock exposure caused no mortality. Important clinical signs were seen, including convulsions, muscular tension, arched back, ocular and respiratory discharges that were dose related. Gross and microscopic tissue changes were seen including increased liver wt in females at 2.5g/m³, and excessive hyaline droplets in proximal convoluted tubular epithelium of 0.6 and 2.5g/m³ exposed males.</p> <p>1. Reliable without restrictions</p> <p>Gordon, T. 1983. Nine-day repeated dose inhalation toxicity study in rats, Resin-former feedstock. Proj. # 2025. Gulf Life Sciences Center, Pittsburgh, PA for Gulf Oil Chemicals Co., Houston, TX</p> <p>Revised 11/21/2001 (Prepared by a contractor to the Olefins Panel)</p>
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Attachment 1b

Mammalian Toxicology
Subcategory 3

Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Acute Toxicity

<p><u>Test Substance</u></p>	<p>C9 Resin Oil (L) D-47-94. Yellowish liquid of pungent odor. Composition described; major components: indene 21.2%, vinyl toluene 13.9%, methyl styrene 7.0%, dimethyl styrene 7.9%, methyl indene 3.9%.</p> <p><u>Olefins Panel HPV Stream Name: Low DCPD Resin Oil</u></p>
<p><u>Method</u> Method/guideline followed</p> <p>Type (test type) GLP Year Species/Strain Sex No. of animals per sex/dose Vehicle Route of administration</p>	<p>Drugs Directorate Guideline, HPB, Health and Welfare Canada, 1990; OECD Guidelines, Sec. 401 and 420, Paris, France 1981 and 1992</p> <p>Acute, Limit test Yes 1995 Rats, Sprague Dawley CD[CrI: CD(SD)BR] Males and females 5 None Oral gavage</p>
<p>Test Conditions</p>	<p>Rats (200-300g) were housed in separate quarters in suspended wire cages, 3-5/cage. The animal room was maintained at 22±2⁰C and 40-70% relative humidity with 12 hr light-dark cycle. Chow diet and water were available ad lib. Rats were dosed with a single oral dose of 2.0g/kg on day 1 and sacrificed on day 15. Rats were observed daily for 14 days for morbidity, mortality and clinical signs. Rats were weighed at initiation and at sacrifice. Gross necropsies were performed on all rats.</p>
<p><u>Results</u> LD₅₀ with confidence limits Remarks</p>	<p>LD₅₀ was not reached at 2.0g/kg. There were no deaths at the limit dose of 2.0g/kg. Male rats showed signs of apathy, piloerection, dyspnea and passivity that cleared by day 3; female rats showed no abnormal signs. Rats of both sexes gained weight normally over the 14-day study period. There were no organs with gross pathological findings.</p>
<p><u>Conclusions</u> (study author)</p>	<p>The rat oral LD₅₀ of C9 resin oil was in excess of 2.0g/kg.</p>
<p><u>Data Quality</u> Reliability</p>	<p>1. Reliable without restrictions</p>
<p><u>References</u></p>	<p>Pucaj, K. 1995. Acute oral toxicity of C9Resin Oil, (L) D-47-94. Project #97383. Nucrotechnics, Scarborough, Ontario, for Novacor Chemicals, Ltd., Calgary Canada</p>
<p><u>Other</u> Last changed</p>	<p>Revised 11/21/2001 (Prepared by a contractor to the Olefins Panel)</p>

Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Acute Toxicity

<p><u>Test Substance</u></p>	<p>C9 Resin Oil (#D-16-95, and #D-17-95). Yellow oily liquid. Composition described; major components: indene 21.2%, vinyl toluene 13.9%, methyl styrene 7.0%, dimethyl styrene 7.9%, methyl indene 3.9%.</p> <p><u>Olefins Panel HPV Stream Name: Low DCPD Resin Oil</u></p>
<p><u>Method</u> Method/guideline followed Type (test type) GLP Year Species/Strain Sex No. of animals per sex/dose Vehicle Route of administration</p>	<p>OECD Guidelines, Proc. 403. Acute Yes 1995 Rats, Sprague-Dawley Males and females 5; 3 dose levels: 1.03±0.2; 2.07±0.31; 5.01±0.34mg/l (actual) None Whole Body Inhalation</p>
<p>Test Conditions</p>	<p>Rats (males 236-300g; females 220-257g) were individually housed in suspended stainless steel cages with mesh bottoms. The facility was maintained at 69-72^oF and relative humidity of 45-60% with a 12 hour light-dark cycle. Rats were fed chow diet and received water ad lib. Rats were exposed to aerosols generated by a 0.25" atomizer. Gravimetric samples were collected on a 25mm glass fiber filter (GF/B Whatman), weighed and divided by air flow volume to determine chamber concentration. Particle mass median aerodynamic diameters for the 3 dose levels were 1.9-3.4µm. The exposure period lasted slightly longer than 4 hrs to provide for chamber equilibrium. At the end of the exposure period, rats were removed from the chamber, and returned to holding cages. Body wt. was recorded at initiation day 0, day 7 and day 14. Rats were observed for toxic signs, including mortality and morbidity, every 30 min. during exposure, at removal from chambers and once daily thereafter. Gross necropsies were performed on all rats. LC₅₀ ± 95% confidence limits were determined by Probit analysis.</p>
<p><u>Results</u> LC₅₀ with confidence limits.</p>	<p>LC₅₀: Males 1.40mg/l (no confidence limits calculated); Females 1.90 (± 0.96-3.75) mg/l; combined sexes 1.65 (±1.18-2.32) mg/l.</p>
<p>Remarks</p>	<p>Following exposure, rats from all dose levels exhibited one or more of the following signs: facial staining, abnormal respiration, abnormal posture, loss of balance, piloerection, hunched posture and/or hypoactivity. All rats at the 5.01mg/l dose died within 3 days following exposure, with 4 rats dying during exposure; these rats showed irregular and shallow breathing, dyspnea and prostration. Gross necropsy showed discoloration of the lungs, liver and gastrointestinal tract. At the 2.07mg/l dose, all males and 2 females died within 3 days of exposure. The 3 surviving females developed loss of balance but all symptoms cleared by day 7, and animals showed normal body wt gain for the duration of the study. Gross necropsy of the rats dying during study showed discoloration of the lungs, but no remarkable findings were seen in rats sacrificed on day 14. At the 1.03mg/l dose, one female rat died within 3 days of exposure. Surviving rats developed loss of balance, gasping, and prostration. The surviving rats recovered by day 5, and gained body wt. normally for the remainder of the study. Gross necropsies done at terminal sacrifice were unremarkable.</p>
<p><u>Conclusions</u> (study author)</p>	<p>LC₅₀: Males 1.40mg/l (no confidence limits calculated); Females 1.90 (± 0.96-3.75) mg/l; combined sexes 1.65 (±1.18-2.32) mg/l.</p>
<p><u>Data Quality</u> Reliability</p>	<p>1. Reliable without restrictions</p>
<p><u>References</u></p>	<p>Wnorowski, G. 1995. Acute inhalation toxicity defined LC50, OECD Guideline #403,</p>

<p><u><i>Other</i></u> <i>Last changed</i></p>	<p>Study #3718. Product Safety Labs, East Brunswick, NJ, for Novacor Chemicals Ltd., Calgary, Canada</p> <p>Revised 11/21/2001 (Prepared by a contractor to the Olefins Panel)</p>
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Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Acute Toxicity

<p><u>Test Substance</u></p>	<p>C9 Resin Oil (#D-16-95, and #D-17-95). Yellowish liquid of pungent odor. Composition described; major components: indene 21.2%, vinyl toluene 13.9%, methyl styrene 7.0%, dimethyl styrene 7.9%, methyl indene 3.9%.</p> <p><u>Olefins Panel HPV Stream Name: Low DCPD Resin Oil</u></p>
<p><u>Method</u> Method/guideline followed Type (test type) GLP Year Species/Strain Sex No. of animals per sex/dose Vehicle Route of administration</p>	<p>Modified Draize method- OECD Guidelines, Sec. 404, Paris 1981 (revised 1992) Acute Irritation Yes 1995 Rabbit, New Zealand albino Females 3 None Dermal</p>
<p>Test Conditions</p>	<p>Rabbits were housed in individual stainless steel cages and received rabbit chow and water ad lib. The facility was maintained at 22⁰C and 40-70% relative humidity with a 12 hr light-dark cycle. About 24 hrs before dosing, the back of each of three rabbits was closely clipped free of hair and divided into two 3cmx3cm sites with a marker. One site was designated the control and the other, the test site. Each test site was covered with a sterile gauze patch to which 0.5ml of test article was applied and affixed to the rabbit with adhesive tape. The control site was patched but untreated. The entire trunk was wrapped in a rubber dam for a 4 hr exposure period. Control and test article-exposed sites were examined at 1, 24, 48,72, and 96hrs and on days 5, 7, 10, and 14 following exposure period, and scored by the Draize method.</p>
<p><u>Results</u> Remarks</p>	<p>The readings for the first 7 days indicated slight erythema and edema of test article-exposed skin (score 1-2). From days 10-14, there was no irritation, however, there was slight skin desquamation. The primary irritation score was 2.6±0.2.</p>
<p><u>Conclusions</u> (study author)</p>	<p>The test article was concluded to be a mild irritant to the skin.</p>
<p><u>Data Quality</u> Reliability</p>	<p>1. Reliable without restrictions</p>
<p><u>References</u></p>	<p>Pucaj, K., 1995. Dermal irritation/corrosion test of resin oil, (L) D-47-94, in rabbits. Proj. #97811. Nucrotechnics, Scarborough, Ontario, for Novacor Chemicals, LTD, Calgary, Canada.</p>
<p><u>Other</u> Last changed</p>	<p>Revised 11/21/2001 (Prepared by a contractor to the Olefins Panel)</p>

Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Acute Toxicity

<p><u>Test Substance</u></p>	<p>C9 Resin Oil (L) D-47-94. Yellowish liquid of pungent odor. Composition described; major components: indene 21.2%, vinyl toluene 13.9%, methyl styrene 7.0%, dimethyl styrene 7.9%, methyl indene 3.9%.</p> <p><u>Olefins Panel HPV Stream Name: Low DCPD Resin Oil</u></p>
<p><u>Method</u> Method/guideline followed Type (test type) GLP Year Species/Strain Sex No. of animals per sex/dose Vehicle Route of administration</p>	<p>Modified Draize method- OECD Guidelines, Sec. 405, Paris 1992 Acute Eye Irritation Yes 1995 Rabbit, New Zealand albino Not specified 3 None Lower conjunctival sac of one eye/rabbit</p>
<p>Test Conditions</p>	<p>Rabbits were housed in individual stainless steel cages and received rabbit chow and water ad lib. The facility was maintained at 22^oC and 40-70% relative humidity with a 12hr light-dark cycle. A 0.1ml volume of C9Resin oil was instilled into the lower conjunctival sac of one eye of each of 3 rabbits. The test article stayed in contact with the eye for a 24 hr exposure period. The opposite eye of each rabbit served as a control. Evaluation for irritancy was made at 24, 25, 48, 72, and 96 hrs and on day 5 following exposure. Scoring was by the Draize method.</p>
<p><u>Results</u></p>	<p>The cornea and iris were not affected by the test material, but there were conjunctival redness and discharge in treated eye of each of the 3 rabbits. Effects were maximal after 72 hrs and gradually cleared by post-dose day 5. At 72 hr, total scores for redness, chemosis and discharge in the 3 rabbits were 8, 12, and 2 with 2 of the 3 rabbits having individual scores of 2 or higher.</p>
<p>Remarks</p>	
<p><u>Conclusions</u> (study author)</p>	<p>Because 2 rabbits showed individual Draize scores for redness of 2 and 3, at 72 hr post-dose, C9 Resin oil, (L) D-47-94 was considered to be a strong eye irritant.</p>
<p><u>Data Quality</u> Reliability</p>	<p>1. Reliable without restrictions.</p>
<p><u>References</u></p>	<p>Pucaj, K., 1995. Acute eye irritation/corrosion test of C9 resin oil, (L) D-47-94, in rabbits. Proj. #97811. Nucrotechnics, Scarborough, Ontario, for Novacor Chemicals, LTD, Calgary, Canada.</p>
<p><u>Other</u> Last changed</p>	<p>Revised 11/21/2001 (Prepared by a contractor to the Olefins Panel)</p>

Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Genetic Toxicity - in Vitro

<p><u>Test Substance</u> <i>Test substance</i></p> <p><u>Method</u> Method/guideline followed</p> <p>Type</p> <p>System of testing</p> <p>GLP</p> <p>Year</p> <p>Species/Strain</p> <p>Metabolic activation</p> <p>Species and cell type</p> <p>Quantity</p> <p>Induced or not induced</p> <p>Concentrations tested</p> <p>Statistical Method</p> <p>Remarks for Test Conditions</p> <p><u>Results</u> Genotoxic effects</p>	<p>C9 Resin Oil, CAS # 68477-54-2. Steam cracked C8-C12 fraction naphtha; Lyndell Resin Oil 90. Clear, pale yellow to yellow colored liquid with gasoline-like naphtha odor <u>Olefins Panel HPV Stream Name: Low DCPD Resin Oil</u></p> <p>Standard method based on Ames et al, 1975, Maron & Ames, 1983, and Green & Muriel, 1976.</p> <p>Reverse mutation bacterial assay</p> <p>Salmonella typhimurium and Escherichia coli with and without metabolic activation</p> <p>Yes</p> <p>1994</p> <p>S. typhimurium TA97, TA98, TA100, TA102, TA1535, and E. coli WP2 uvrA (pKM101)</p> <p>Yes</p> <p>Sprague Dawley male rat liver (S9 fraction) from Molecular Toxicology, Inc. College Park, MD</p> <p>20µl S9 fraction in 0.5ml S9 mix/plate</p> <p>Aroclor 1254-induced, rats were given a single ip 500mg/kg dose, 5 days prior to sacrifice. 0, 39, 78, 156, 313, and 625µg/plate -S9, and 0, 78, 156, 313, 625, and 1250µg/plate + S9; samples diluted in dimethyl sulfoxide (DMSO). Negative control 100µl DMSO</p> <p>None. Criteria for a positive response were dose related increase in mutant frequency and more than one dose level exhibited a mutant frequency at least 2-fold greater than solvent control. Equivocal response was defined as a 2-fold increase above control level at one or more doses with no evidence of a dose response.</p> <p>C9 resin oil test solutions were prepared in DMSO immediately prior to use. Salmonella strains and E. coli WP2 (approx. 10⁹ cells/ml) were exposed to either test solution or DMSO ±S9 in 3 plates/dose/strain by the plate incorporation method. A preliminary toxicity assay using TA97 and TA100 -S9 was performed over 9 doses from 78-20,000µg/plate to establish optimal doses for the mutagenicity assay. In the mutagenicity assay, dose concentrations were 37-625µg/plate -S9, and 78-1250µg/plate +S9. All plates were incubated at 37°C for 48 hrs, then revertant colonies were counted. Positive control compounds were: -S9, ICR191 (1µg/plate) for TA97, 2-nitrofluorene (2-NF, 5µg/plate) for TA98, sodium azide (NaA, 1.5µg/plate) for TA100 and TA1535, mitomycin C (0.5µg/plate) for TA102 and methyl methanesulfonate (MMS, 1000µg/plate) for E. coli WP2; +S9 2-aminofluorene (2-AF, 10µg/plate) for all Salmonella strains and 2-aminoanthracene (2-AA, 5µg/plate) for E. coli WP2. Two independent assays were performed.</p> <p>In the preliminary toxicity assay, precipitate was visible at all dose levels (78-2000µg/plate). Number of revertants relative to solvent control was reduced for all doses, with a dose-related decline from ≥625µg/plate. Background lawn for both TA100 and TA97 showed a marked clearing beginning at 625µg/plate. In the first mutagenicity test without activation, all tester strains showed a progressive decline in revertant colony count with increasing dose (e.g. TA100: 142, 88, 124, 77, 63, and 70 revertants/plate, and E. coli: 246, 256, 262, 247, 218, and 200 at 0 [DMSO], 39, 78, 156, 313, and 625µg/plate, respectively). Clearing of background lawn was observed at 625µg/plate. In the S-9 activated cultures, all strains except TA100, TA1535 and E. coli WP2, showed a dose-related reduction in revertant frequency at all dose levels (e.g. TA97: 287, 290, 269, 247, 219, and 155 at 0, 78, 156, 313, 625, and 1250µg/plate. In TA100, TA1535 and E. coli WP2, the revertant frequency was similar to vehicle controls. No increase in revertant colonies was observed. Clearing of background lawns was observed at 625 and 1250µg/plate for all tester strains. In the independent repeat assay, although little discussion is provided in the text, the data</p>
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<p><u>Conclusions</u> (contractor)</p> <p><u>Data Quality</u> <i>Reliabilities</i></p> <p><u>Reference</u></p> <p><u>Other</u> <i>Last changed</i></p>	<p>tables demonstrate that toxicity did not appear to be as severe as in the initial assay. No significant reduction in revertants occurred over the range of doses, and there was no increase in revertant frequency above the solvent control in any strain at any dose level \pmS9 (e.g. TA100 –S9: 161, 173, 196, 190, 169, 153 at 0, 37, 78, 156, 313, and 625μg/plate; +S9: 174, 161, 154, 161, 150, and 119 at 0, 78, 156, 313, 625, and 1250μg/plate, respectively. Positive control compounds performed appropriately: in -S9 cultures: ICR191- 483; 2-NF- 1200; NaA- 1378 for TA100, 867 for TA1535; mitomycin C 800; MMS- 4277 for E. coli; in +S9: cultures: 2-AF 953-3167 for Salmonella strains; 2-AA-2083 for E.coli. C9 resin oil was considered non-mutagenic in this test system. (Reviewer’s note: This Salmonella/ E. coli assay is an acceptable, negative mutagenicity test based on the results of the independent repeat assay. Although both assays were performed at the same dose levels \pm S9, the toxicity in the first assay, evidenced by a dose-related reduction in revertant colonies and inhibition of background lawn at most doses made it a less reliable predictor of mutagenicity. The second assay had less toxicity at the same dose levels and did not demonstrate any increase in revertants above vehicle control for any dose in any strain tested.)</p> <p>C9 Resin Oil did not induce a significant increase in Salmonella strains or E. coli with or without metabolic activation at any dose level and is not considered a mutagen in this test system.</p> <p>2. Reliable with restrictions. Given toxicity seen in the preliminary test, some doses lower than 39 or 78μg/plate should have been employed to provide a better profile of effect.</p> <p>Mehta, R.D. 1995. Mutagenicity of C9 Resin Oil in the Salmonella/E. coli assay. Study No. 950315/2. Prairie Biological Research Ltd., Edmonton, Alberta, Canada, for Novacor Chemicals, Ltd., Calgary, Alberta, Canada Ames, B.N. et al. 1975. Mutat. Res. 31: 347-364. Green, M.H.L., and Muriel, W.J. 1976. Mutat. Res. 38: 3-32. Maron, D.M., and Ames, B.N. 1983. Mutat. Res. 113: 173-215.</p> <p>Revised 11/21/2001 (Prepared by a contractor to the Olefins Panel)</p>
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Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Genetic Toxicity - in Vitro

<p><u>Test Substance</u> <i>Test substance</i></p>	<p>Low Dicyclopentadiene (DCPD) Resin Oil, CAS# 68477-54-3; stable at room temperature below 70° F; colorless- light yellow liquid</p> <p><u>Olefins Panel HPV Stream Name: Low DCPD Resin Oil</u> <u>Low DCPD Resin Oil</u> is a C8 to C10 distillate obtained from a pyrolysis gasoline stream produced by an ethylene production process (steam cracking process). The sample tested consisted of vinyltoluenes (17%), trimethylbenzenes (9%), styrene and methylstyrenes (3%), indene (14%), methylindene (8%), and naphthalene (1%). The balance of the composition is expected to consist of other hydrocarbons with carbon range primarily 8 to 10, mainly aromatics and olefins, with some paraffins. Low DCPD Resin Oil can also be described as CAS number 68516-20-1.</p> <p>Note: the above composition percentages were summarized from data reported by the supplier of the test substance on February 10, 2003.</p>
<p><u>Method</u> Methods/guidelines followed</p>	<p>OECD Guideline 471 (Genetic Toxicology: Bacterial Reverse Mutation Test), adopted July 1997 (published February 1998), OPPTS Guideline 870.5100 (Bacterial Reverse Mutation Test) and EC Commission Directive 2000/32/EC.</p>
<p>System of testing</p>	<p><i>Salmonella typhimurium</i> and <i>Escherichia coli</i> with and without S9</p>
<p>GLP</p>	<p>Yes</p>
<p>Year</p>	<p>2003</p>
<p>Species/Strain</p>	<p><i>S. typhimurium</i> TA98, TA100, TA1535, TA1537 and <i>E. coli</i> WP2 <i>uvrA</i>.</p>
<p>Metabolic activation</p>	<p>Yes</p>
<p>Species and cell type</p>	<p>Sprague-Dawley rat liver (S9 fraction) prepared in-house</p>
<p>Quantity</p>	<p>10% S9 in S9 mix</p>
<p>Induced or not induced</p>	<p>Aroclor 1254 induced, rats were given 500mg/kg ip 5 days prior to sacrifice</p>
<p>Concentrations tested</p>	<p>75, 200, 600, 1800 and 5000 µg/plate</p>
<p>Statistical Methods</p>	<p>None</p>
<p>Remarks for Test Conditions</p>	<p>Criteria for positive response were a dose-related increase in the mean revertants per plate of at least one tester strain over a minimum of two increasing concentrations as specified below: TA1535, TA1537: At the peak of the dose response an equal to or greater than 3.0-fold dose related increase over solvent control values with or without metabolic activation. TA98, TA100, <i>E. coli</i> WP2 <i>uvrA</i>: At the peak of the dose response an equal to or greater than 2.0-fold dose related increase over solvent control values with or without metabolic activation. Negative controls: Based on historical control data, all tester strains must exhibit characteristic numbers of spontaneous revertants per plate. Positive controls: The mean of each positive control value must exhibit at least a 3.0-fold increase over the respective mean negative control value (vehicle) for each tester strain. Low DCPD Resin Oil test solutions were prepared in ethanol immediately prior to</p>

	<p>use. <i>Salmonella</i> strains and <i>E. coli</i> WP2 <i>uvrA</i> (approx. 10^9 cells/mL) were exposed to either test solution or vehicle \pmS9 by the plate incorporation method. The preliminary toxicity test was conducted prior to the mutagenicity test with all tester strains over a range of 6.7 to 5000 μg/plate (one plate per dose) \pmS9. The dose levels tested in the mutagenicity test were 75, 200, 600, 1800 and 5000 μg/plate \pmS9. The mutagenicity test was conducted on triplicate plates per dose. Five hundred (500) microliters of S9 or Sham mix, 100 μL of tester strain and 50 μL vehicle or test substance dilution were added to 2.0 mL of molten selective top agar at $45\pm 2^\circ\text{C}$. After vortexing, the mixture was overlaid onto the surface of minimal agar plates. After the overlay had solidified, the plates were inverted and incubated for approximately 48 to 72 hours at $37\pm 2^\circ\text{C}$. Revertant colonies for a given tester strain and activation condition, except for the positive controls, were counted either entirely by automated colony counter or entirely by hand unless the plate exhibited toxicity, and conditions of background lawn and precipitation were evaluated. Positive control compounds for the $-$S9 condition were: 2-nitrofluorene (1.0 μg/plate) for TA98; sodium azide (1.0 μg/plate) for TA100 and TA1535; 9-aminoacridine (75 μg/plate) for TA1537; and methyl methanesulfonate (1000 μg/plate) for WP2<i>uvrA</i>. The positive control compound for the $+$S9 condition was 2-aminoanthracene, 1.0 μg/plate for all <i>Salmonella</i> strains, and 10 μg/plate for WP2<i>uvrA</i>.</p>
<p><u>Results</u> Genotoxic effects</p>	<p>In the preliminary toxicity test, the maximum dose tested was 5000 μg per plate; this dose was achieved using a concentration of 100 mg/mL and a 50 μL plating aliquot. The dose levels tested were 6.7, 10, 33, 67, 100, 333, 667, 1000, 3333 and 5000 μg per plate. Toxicity was observed with some conditions beginning at 3333 or at 5000 μg per plate. Precipitate was observed beginning at 3333 or at 5000 μg per plate. Based on the findings of the preliminary toxicity test, the maximum dose plated in the mutagenicity test was 5000 μg per plate.</p> <p>In the mutagenicity test, the maximum dose tested was 5000 μg per plate; this dose was achieved using a concentration of 100 mg/mL. The test substance solution was clear at this concentration. The dose levels tested were 75, 200, 600, 1800 and 5000 μg per plate. Toxicity was observed with some conditions beginning at 1800 or at 5000 μg per plate. Precipitate was observed at 5000 μg per plate with most test conditions. Low DCPD Resin Oil did not induce a dose-related or 2.0-fold or 3.0-fold increase in the number of revertant colonies in any <i>Salmonella</i> strain or in <i>E. coli</i> WP2 <i>uvrA</i> \pmS9.</p> <p>The vehicle controls were acceptable, and the positive control compounds responded appropriately.</p>
<p><u>Conclusions</u></p>	<p>Low DCPD Resin Oil did not induce a significant increase in revertant colonies in <i>Salmonella</i> strains or in <i>E. coli</i> WP2 <i>uvrA</i> with or without rat liver metabolic activation at any dose level and is not considered a mutagen in this test system.</p>
<p><u>Data Quality</u> Reliabilities</p>	<p>(1) Reliable without restrictions</p>
<p><u>Reference</u></p>	<p>Wagner, V.O. and Hines, R.M. 2003. Low DCPD Resin Oil: Bacterial Reverse Mutation Test. AA75HB.502.BTL. Unpublished Report (DuPont-12984)</p>
<p><u>Other</u> Last changed</p>	<p>16 June 2004</p>

Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Genetic Toxicity - *In Vivo*

<p><u>Test Substance</u> Remarks</p>	<p>Low Dicyclopentadiene Resin Oil (Low DCPD Resin Oil), CAS #68477-54-3, purity NA; stable at room temperature below 70 F; clear colorless liquid; <u>Olefins Panel HPV Stream Name: Low DCPD Resin Oil</u></p> <p>Low DCPD Resin Oil is a C8 to C10 distillate obtained from a pyrolysis gasoline stream produced by an ethylene production process (steam cracking process). The sample tested consisted of vinyltoluenes (17%), trimethylbenzenes (9%), styrene and methylstyrenes (3%), indene (14%), methylindene (8%), and naphthalene (1%). The balance of the composition is expected to consist of other hydrocarbons with carbon range primarily 8 to 10, mainly aromatics and olefins, with some paraffins. Low DCPD Resin Oil can also be described as CAS number 68516-20-1.</p> <p><i>Note: The above percentages were summarized from data reported by the supplier of the test substance on February 10, 2003.</i></p>
<p><u>Method</u> Methods/guidelines followed</p>	<p>OPPTS 870.5395 OECD 474 EC Commission Directive 2000/32/EC Mammalian erythrocyte micronucleus assay.</p>
<p>Type GLP Year Species Strain Sex Route of administration Vehicle Doses/concentration levels No. of animals per dose</p>	<p>Yes 2003 Mouse CrI:CD-1[®](ICR)BR Male and female Twice by oral intubation, at an approximate 24-hour interval Corn oil 0, 437.5, 875, or 1750 mg/kg body weight 5/sex/group (0, 437.5, or 875 mg/kg body weight), 7/sex/group (1750 mg/kg body weight).</p>
<p>Control groups and treatment</p>	<p>5/sex vehicle control animals (corn oil); 5/sex positive control (cyclophosphamide, 30 mg/kg once by oral intubation)</p>
<p>Statistical methods</p>	<p>Total polychromatic erythrocytes (PCEs), micronucleated polychromatic erythrocytes, normochromatic erythrocytes (NCEs) were compared to the control using Dunnett's and Dunn's test ($p < 0.05$).</p>
<p>Test Conditions.</p>	<p>Groups of 5 mice/sex/group (7 mice/sex at the highest dose level) were administered the test substance twice (once per day for 2 days) at an approximate 24 hour interval by oral intubation (gavage). Body weights ranged from 23.6-28.3 g (males) and 19.1-23.6 g (females) at time of arrival. The animals were approximately 7 weeks old (49 days) at time of exposure. The homogeneity / concentration of the dosing formulations and the test substance stability were verified analytically. The mice were weighed prior to treatment and sacrifice. The mice were observed for clinical signs and mortality/moribundity prior to treatment, approximately 1 hour post-dosing, 3-5 hours post-dosing, and prior to sacrifice. The mice were sacrificed approximately 24 hours after administration of the second dose and smears of bone marrow erythrocytes were prepared and stained. 2000 PCEs per animal were scored for the presence of micronuclei. The proportion of PCEs among</p>

**Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category
Combined Repeated Dose Toxicity Study and Reproductive/Developmental Toxicity
Screening Test in Rats**

Repeated Dose Toxicity

<u>Test Substance</u>	
Remarks	<p>Low DCPD Resin Oil is a C8 to C10 distillate obtained from a pyrolysis gasoline stream produced by an ethylene production process (steam cracking process). The sample tested consisted of vinyltoluenes (17%), trimethylbenzenes (9%), styrene and methylstyrenes (3%), indene (14%), methylindene (8%), and naphthalene (1%). The balance of the composition is expected to consist of other hydrocarbons with carbon range primarily 8 to 10, mainly aromatics and olefins, with some paraffins.</p> <p>CAS Numbers Primary: 68477-54-3 Other Number used to represent this stream: 68516-20-1</p>
<u>Method</u>	
Method/guideline followed	OECD 422
Test type	Combined repeated dose toxicity study with the reproduction / developmental screening test
GLP	Yes.
Year	2003
Species	Rat
Strain	CrI:CD [®] (Sprague-Dawley) IGS BR
Route of administration	Gavage
Duration of test	4 Weeks
Doses/concentration levels	0, 35, 125, 375 mg/kg/day
Sex	12 male, 12 female per group.
Exposure period	Not applicable
Frequency of treatment	7 days/week
Control group and treatment	12 male, 12 female, corn oil vehicle.
Post exposure observation period	Not applicable.
Statistical methods	Group means and standard deviations were calculated for all measured parameters. Body weight, weight gain, food consumption, and organ weights were analyzed by Jonckheere-Terpstra trend test. Food efficiency and clinical pathology parameters were analyzed by one-way analysis of variance followed with Dunnett's test. Clinical observations and FOB parameters were analyzed by Cochran-Armitage trend test. Grip strength, foot splay, rearing, body temperature, and motor activity were analyzed by repeated measures analysis of variance with linear contrasts or Jonckheere's trend test.
Test conditions	Groups of 12 young, adult, male or nulliparous, female rats were administered an oral, daily dose of 0, 35, 125, or 375 mg/kg/day Low DCPD Resin Oil for approximately 30 days. The study also contained reproductive and developmental toxicity satellite groups (summarized separately).
	After approximately 30 days, blood samples were collected from all male rats and all subchronic female rats for measurement of hematology and clinical chemistry parameters. A neurobehavioral test battery, consisting of motor activity and functional observational battery assessments, was conducted on all male rats and subchronic female rats prior to test substance administration in order to obtain baseline measurements. This neurobehavioral test battery was conducted again following approximately 4 weeks of test substance

Results NOAEL (NOEL)	administration. On test days 30 and 31, respectively, all subchronic male and female rats underwent gross necropsy. Selected tissues from the control and 375 mg/kg/day groups, and target tissues from all groups were processed for histopathology and examined.			
	Parameters	NOEL (mg/kg/day)	NOAEL (mg/kg/d1)	LOEL (mg/kg/d1)
	Systemic	35 M 35 F	35 M 35 F	125 M 125 F
	Neurobehavioral	375 M 375 F	375 M 375 F	- -
	Pathology	- 35 F	125 M 375 F	35 M 125 F
LOAEL (LOEL) Remarks	<p>See table above</p> <p><i>Clinical Signs of Toxicity and Mortality in Subchronic Males and Females:</i> Test substance-related increases in the incidences of stained fur, and/or wet fur were observed in males and subchronic females following administration of 375 mg/kg/day Low DCPD Resin Oil. Stained and/or wet fur were also occasionally observed in males and subchronic females administered 125 mg/kg/day. These clinical signs were not present during either the detailed clinical observations in an open field arena, or during the FOB evaluation. Test substance-related mortality did not occur.</p> <p><i>Body Weight and Body Weight Gain in Subchronic Males and Females:</i> Test substance-related decreases in body weight and/or weight gain were observed in males and subchronic females administered 375 mg/kg/day of the test substance. In addition, decreased body weight and/or weight gain were also observed in males administered 125 mg/kg/day of the test substance. Body weight and weight gain of 375 mg/kg/day males was 10% and 24% lower than control values for test days 29 and 1-29, respectively. Body weight and weight gain of 125 mg/kg/day males was 7% and 16% lower than the control values for test days 29 and 1-29, respectively. Body weight and weight gain of 375 mg/kg/day subchronic females was 5% and 14% lower than the control values for test days 29 and 1-29, respectively.</p> <p><i>Food Consumption and Food Efficiency in Subchronic Males and Females:</i> Food consumption and food efficiency were reduced in 125 mg/kg/day and above males, and food consumption was decreased in 375 mg/kg/day females.</p> <p><i>Clinical Pathology Parameters:</i> There were no test substance-related adverse effects on hematological or clinical chemistry parameters in male or subchronic female rats.</p> <p><i>Neurobehavioral Parameters:</i> No test substance-related effects were observed in motor activity, any neurobehavioral parameters in the FOB, or in grip strength, foot splay, rearing, or body temperature, in males or subchronic females.</p> <p><i>Pathology:</i> Administration of 35, 125, or 375 mg/kg/day of the test substance for approximately 30 days produced a dose-related increase in renal tubular hyaline droplets in male rats, however, hyaline droplet nephropathy was not observed. Increased hyaline droplets were not observed in females. The hyaline droplet accumulation in male rats was not considered to be an adverse effect of the test substance, since it is species and sex specific, and is not predictive of an effect on other species.</p> <p>Minimal to mild hepatocellular hypertrophy, and associated increases in liver weight parameters were observed in 375 mg/kg/day males, and in 125 and 375 mg/kg/day females; however, this change is considered to be secondary to</p>			

<p><u>Conclusions</u></p> <p><u>Data Quality</u> Reliabilities</p> <p><u>References</u></p> <p><u>Other</u> Last changed</p>	<p>enzyme induction as a pharmacological response to a xenobiotic, and was not considered to be adverse.</p> <p>A slight increase in the incidence of minimal thyroid follicular cell hypertrophy was observed in 375 mg/kg/day males, which was considered to be test substance-related and potentially adverse.</p> <p>Thymus weight was decreased in 125 and 375 mg/kg/day males, and in 375 mg/kg/day females. However, there was no corresponding microscopic effect on the thymus.</p> <p>Repeated administration of Low Dicyclopentadiene Resin Oil in male and female Sprague Dawley rats at dosages of 375 mg/kg/day produced effects on clinical signs of toxicity, body weight, food consumption, and histopathological changes. In addition, effects on body weight, clinical signs and food consumption were observed at 125 mg/kg/day. Based on these data, the no-observable-effect level (NOAEL) for systemic toxicity was 35 mg/kg/day in males and 35 mg/kg/day in females.</p> <p>Klimish value = 1 (Reliable without restrictions).</p> <p>Malley, L. A. Low Dicyclopentadiene Resin Oil: Combined Repeated Dose Toxicity Study and Reproductive/Developmental Toxicity Screening Test in Rats. DuPont-13041. Report of E. I. du Pont de Nemours and Company conducted for the American Chemistry Council Olefins Panel.</p> <p>29-Oct-04 Robust summary prepared by contract for Olefins Panel</p>
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**Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category
Combined Repeated Dose Toxicity Study and Reproductive/Developmental Toxicity
Screening Test in Rats**

Developmental Toxicity/Teratogenicity

<u>Test Substance</u>	
Remarks	<p><u>Low DCPD Resin Oil</u> is a C8 to C10 distillate obtained from a pyrolysis gasoline stream produced by an ethylene production process (steam cracking process). The sample tested consisted of vinyltoluenes (17%), trimethylbenzenes (9%), styrene and methylstyrenes (3%), indene (14%), methylindene (8%), and naphthalene (1%). The balance of the composition is expected to consist of other hydrocarbons with carbon range primarily 8 to 10, mainly aromatics and olefins, with some paraffins.</p> <p>CAS Numbers Primary: 68477-54-3 Other Number used to represent this stream: 68516-20-1</p>
<u>Method</u>	OECD 422
Method/guideline followed	OECD 422
Test type	Combined repeated dose toxicity study with the reproduction/developmental screening test
GLP	Yes.
Year	2003
Species	Rat
Strain	CrI:CD [®] (Sprague-Dawley) IGS BR
Route of administration	Oral gavage.
Duration of test	<p>Satellite groups of 12 young, nulliparous, nonpregnant female rats were administered an oral, daily dose of the test substance during a pre-mating period of approximately 2 weeks, a cohabitation period of approximately 2 weeks, a gestation period of approximately 3 weeks, and a lactation period of approximately 4 days. The males were exposed for 30 days.</p>
Doses/concentration levels	0, 35 125, or 375 mg/kg/day
Sex	12 male, 12 female per group.
Exposure period	Not applicable
Frequency of treatment	7 days/week
Control group and treatment	12 male, 12 female, corn oil vehicle.
Post exposure observation period	Not applicable.
Statistical methods	<p>Group means and standard deviations were calculated for all measured parameters. Body weight, weight gain, food consumption, and organ weights were analyzed by Jonckheere-Terpstra trend test. Food efficiency was analyzed by one-way analysis of variance followed with Dunnett's test. Clinical observations, mating index, fertility index, and gestation index were analyzed by Cochran-Armitage trend test.</p>
	<p>Gestation length, implantation site numbers, implantation efficiency, mean number of pups per litter, percent of pups born alive, day 0-4 viability of pups, viability index, number of corpora lutea, sex ratio, pre-implantation loss, and post-implantation loss were analyzed by Jonckheere-Terpstra trend test. Mean pup weights were analyzed by linear contrast of the least square means.</p>
Test Conditions	<p>Satellite groups of 12 young, nulliparous, female rats were administered an oral, daily dose of 0, 35, 125, or 375 mg/kg/day during a pre-mating period of approximately 2 weeks, a cohabitation period of approximately 2 weeks, a gestation period of approximately 3 weeks, and a lactation period of</p>

<p><u>Data Quality</u> Reliabilities <u>References</u></p> <p><u>Other</u> Last changed</p>	<p>375 mg/kg/day group had decreased body weight. Based on these data, the no-observable-effect level (NOEL) for developmental toxicity was 125 mg/kg/day.</p> <p>Klimish value = 1 (Reliable without restrictions).</p> <p>Malley, L. A. Low Dicyclopentadiene Resin Oil: Combined Repeated Dose Toxicity Study and Reproductive/Developmental Toxicity Screening Test in Rats. DuPont-13041. Report of E. I. du Pont de Nemours and Company conducted for the American Chemistry Council Olefins Panel.</p> <p>30-Oct-04 Robust summary prepared by contract for Olefins Panel</p>
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**Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category
Combined Repeated Dose Toxicity Study and Reproductive/Developmental Toxicity
Screening Test in Rats**

Toxicity to Reproduction

<u>Test Substance</u>	
Remarks	<p>Low DCPD Resin Oil is a C8 to C10 distillate obtained from a pyrolysis gasoline stream produced by an ethylene production process (steam cracking process). The sample tested consisted of vinyltoluenes (17%), trimethylbenzenes (9%), styrene and methylstyrenes (3%), indene (14%), methylindene (8%), and naphthalene (1%). The balance of the composition is expected to consist of other hydrocarbons with carbon range primarily 8 to 10, mainly aromatics and olefins, with some paraffins.</p> <p>CAS Numbers Primary: 68477-54-3 Other Number used to represent this stream: 68516-20-1</p>
<u>Method</u>	OECD 422
Method/guideline followed	OECD 422
Test type	Combined repeated dose toxicity study with the reproduction / developmental screening test
GLP	Yes.
Year	2003
Species	Rat
Strain	CrI:CD® (Sprague-Dawley) IGS BR
Route of administration	Gavage.
Duration of test	<p>Satellite groups of 12 young, nulliparous, female rats were administered an oral, daily dose of the test substance during a pre-mating period of approximately 2 weeks, a cohabitation period of approximately 2 weeks, a gestation period of approximately 3 weeks, and a lactation period of approximately 4 days. The males were exposed for 30 days.</p>
Doses/concentration levels	0, 35, 125 or 375 mg/kg/day.
Sex	12 males, 12 females per group.
Exposure period	Not applicable
Frequency of treatment	7 days/week
Control group and treatment	12 male, 12 female, corn oil vehicle.
Post exposure observation period	Not applicable.
Statistical methods	<p>Group means and standard deviations were calculated for all measured parameters. Body weight, weight gain, food consumption, and organ weights were analyzed by Jonckheere-Terpstra trend test. Food efficiency was analyzed by one-way analysis of variance followed with Dunnett's test. Clinical observations, mating index, fertility index, and gestation index were analyzed by Cochran-Armitage trend test.</p>
	<p>Gestation length, implantation site numbers, implantation efficiency, mean number of pups per litter, percent of pups born alive, day 0-4 viability of pups, viability index, number of <i>corpora lutea</i>, sex ratio, pre-implantation loss, and post-implantation loss were analyzed by Jonckheere-Terpstra trend test. Mean pup weights were analyzed by linear contrast of the least square means.</p>
Test Conditions	<p>Satellite groups of 12 young, nulliparous, female rats were administered an oral, daily dose of 0, 35, 125, or 375 mg/kg/day during a pre-mating period of approximately 2 weeks, a cohabitation period of approximately 2 weeks, a gestation period of approximately 3 weeks, and a lactation period of</p>

	<p>approximately 4 days. Following the 2-week pre-mating period, each satellite female was paired with a male of the same respective dosage group during a 2 week cohabitation period. Measurements of body weight, food consumption, and clinical signs of toxicity in females were conducted throughout pre-mating, cohabitation, gestation, and lactation. After postpartum day 4, lactating females, and nonpregnant females were sacrificed, selected organs were weighed, and selected tissues were evaluated microscopically. Offspring were evaluated for external abnormalities, and sacrificed on postnatal day 4. The study design included a main study for repeated dose toxicity end points (summarized separately).</p> <p>The males were exposed for a total of 30 days, and were then necropsied. In addition to the repeated dose toxicity end points assessed (discussed separately), reproductive assessment of the males included mating, conception and fertility indices, reproductive organ weights and gross/histopathology of the reproductive tract.</p>																												
<p>Results NOAEL (NOEL)</p>	<table border="1"> <thead> <tr> <th>Parameters</th> <th>NOEL (mg/kg/day)</th> <th>NOAEL (mg/kg/dl)</th> <th>LOEL (mg/kg/dl)</th> </tr> </thead> <tbody> <tr> <td>Systemic</td> <td>35 M 35 Satellite F</td> <td>35 M 35 Satellite F</td> <td>125 M 125 Satellite F</td> </tr> <tr> <td>Pathology</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Paternal</td> <td>- M</td> <td>125 M</td> <td>35 M</td> </tr> <tr> <td>Reproductive</td> <td>375 M 375 Satellite F</td> <td>375 M 375 Satellite F</td> <td>- -</td> </tr> <tr> <td>Reproductive</td> <td>375 M 375 Satellite F</td> <td>375 M 375 Satellite F</td> <td>- -</td> </tr> <tr> <td>Developmental (Pups)</td> <td>125</td> <td>125</td> <td>375</td> </tr> </tbody> </table>	Parameters	NOEL (mg/kg/day)	NOAEL (mg/kg/dl)	LOEL (mg/kg/dl)	Systemic	35 M 35 Satellite F	35 M 35 Satellite F	125 M 125 Satellite F	Pathology				Paternal	- M	125 M	35 M	Reproductive	375 M 375 Satellite F	375 M 375 Satellite F	- -	Reproductive	375 M 375 Satellite F	375 M 375 Satellite F	- -	Developmental (Pups)	125	125	375
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<p>LOAEL (LOEL) Remarks</p>	<p>See table above.</p> <p><i>Clinical signs and mortality:</i> Test substance-related increases in the incidences of stained fur, and/or wet fur were observed in males, and satellite females following administration of 375 mg/kg/day Low DCPD Resin Oil. Stained and/or wet fur were also occasionally observed in males and satellite females administered 125 mg/kg/day.</p> <p><i>Body weight and weight gain:</i> Test substance-related decreases in body weight and/or weight gain were observed in males and satellite females administered 375 mg/kg/day of the test substance. In addition, decreased body weight and/or weight gain were also observed in males and satellite females administered 125 mg/kg/day of the test substance. Body weight and weight gain of 375 mg/kg/day males was 10% and 24% lower than control values for test days 29 and 1-29, respectively. Body weight and weight gain of 125 mg/kg/day males was 7% and 16% lower than the control values for test days 29 and 1-29, respectively. During the pre-mating period, body weight and weight gain of 375 mg/kg/day satellite females was 3% and 14% lower than the control values for test days 15 and 1-15, respectively. During the gestation period, body weight and weight gain of 375 mg/kg/day satellite females was 6% and 9% lower than the control values for gestation days 21 and 0-21, respectively. During lactation, body weights of 125 and 375 mg/kg/day satellite females were 8% and 7% lower than the control values on lactation day 4, respectively.</p> <p><i>Food Consumption and Food Efficiency:</i> Decreased food consumption and food efficiency occurred in 125 mg/kg/day and above males.</p> <p><i>Reproductive Indices:</i> No test substance-related effects or statistically significant differences in mating index, fertility index, gestation length,</p>																												

<p><u>Conclusions</u></p> <p><u>Data Quality</u> Reliabilities</p> <p><u>References</u></p> <p><u>Other</u> Last changed</p>	<p>number of implantation sites, implantation efficiency, pre-implantation loss, post-implantation loss, or number of <i>corpora lutea</i> were observed for any dosage of the test substance in satellite females.</p> <p><i>Offspring Parameters:</i> Decreased mean pup weight (15% lower than the control value on lactation day 4) was observed in offspring from the 375 mg/kg/day group. No effects were observed at any dosage for the number of pups born, number of pups born alive, sex ratio, gestation index, external abnormalities, or litter survival for postnatal days 0-4 in the offspring from any dosage group.</p> <p><i>Reproductive Pathology:</i> There were no test substance-related effects on morphology of the reproductive tract in either males or females.</p> <p>Repeated administration of Low Dicyclopentadiene Resin Oil to male and female Sprague Dawley rats at dosages of 0, 35, 125, or 375 mg/kg/day produced no evidence of adverse effects on any measures of reproductive function. Pups from the 375 mg/kg/day group had decreased body weight. Based on these data, the no-observable-effect level (NOEL) for reproductive toxicity was 375 mg/kg/day in parental animals and 125 mg/kg/day in pups.</p> <p>Klimish value = 1 (Reliable without restrictions).</p> <p>Malley, L. A. Low Dicyclopentadiene Resin Oil: Combined Repeated Dose Toxicity Study and Reproductive/Developmental Toxicity Screening Test in Rats. DuPont-13041. Report of E. I. du Pont de Nemours and Company conducted for the American Chemistry Council Olefins Panel.</p> <p>30-Oct-04 Robust summary prepared by contract for Olefins Panel</p>
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Attachment 1c

Biodegradation and Aquatic Toxicology

Subcategory 1

Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category Dicyclopentadiene High Purity

Invertebrate Acute Toxicity

<p><u>Test Substance</u></p> <p><u>Method</u> Method/guideline followed</p> <p>Year (guideline) Type (test type) GLP Year (study performed) Species Analytical Monitoring Exposure Period Statistical Methods</p> <p>Test Conditions Note: Concentration prep., vessel type, volume, replication, water quality parameters, environmental conditions, supplier of organisms, age, size, weight, loading</p> <p><u>Results</u> Units/Value: Note: Deviations from protocol or guideline, analytical method, biological observations, control survival</p> <p><u>Conclusions</u> (study author)</p> <p><u>Data Quality</u> <i>Reliabilities</i></p> <p><u>Reference</u></p> <p><u>Other</u> <i>Last changed</i></p>	<p>Dicyclopentadiene, CAS# 77-73-6 (95% purity) <u>Olefins Panel HPV Stream Name: DCPD High Purity</u></p> <p>U.S. EPA, Methods for Acute Toxicity Tests with Fish, Macroinvertebrates, and Amphibians 1975 Acute toxicity Unknown Unknown Water Flea (<i>Daphnia magna</i>) Unknown 48 hours Probit and least squares regression analysis</p> <p>Test organisms were obtained from Bionomics Aquatic Toxicology Laboratory and were they were cultured in static, aerated well water with a hardness of 35 mg/L as CaCO₃, pH of 7.1, temperature of 21±1°C, and dissolved oxygen concentration of greater than 60% saturation.</p> <p>Testing was conducted in 250 ml beakers, which contained 166 ml of treatment solution. Diluent water used was aged for at least 24 hours prior to test initiation. For each treatment level, the appropriate amount of test compound was pipetted into 500 ml of diluent water and mixed with a magnetic stirrer. This solution was then divided into three equal aliquots in triplicate beakers to provide replicate exposure treatments. All beakers were maintained at 20±1°C and test solutions were not aerated during the test.</p> <p>Five organisms were randomly assigned to each test vessel within 30 minutes after the test compound was added and in control vessels resulting in a total of 15 test organisms per treatment level and control.</p> <p>24-hour LL50 = 11.6 mg/L (95% confidence limits = 9.2-14.2 mg/L) based on nominal loadings 48-hour LL50 = 10.5 mg/L (95% confidence limits = 8.4-13.2 mg/L) based on nominal loadings</p> <p>(2) Reliable with restrictions There is less raw data and information on the testing procedure than is desirable in order to rate this study for reliability at a level higher than 2 (reliable with restrictions). There is sufficient information in the report to suggest that the testing procedure followed an acceptable test guideline (U.S. EPA, 1975).</p> <p>Bentley, R.E., G.A. LeBlanc, T.A. Hollister, and B.H. Sleight. 1976. Acute Toxicity of Diisopropylmethyl Phosphonate and Dicyclopentadiene to Aquatic Organisms. Gov. Rep. Announc. NTIS Report #AD-AO 37750. (original report from EG&G Bionomics, Wareham, MS, USA)</p> <p>Revised December 12, 2001 (Prepared by a contractor to the Olefins Panel)</p>
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Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Fish Acute Toxicity

<p><u>Test Substance</u></p> <p><u>Method</u> Method/guideline followed Year (guideline) Type (test type) GLP Year (study performed) Species Analytical Monitoring Exposure Period Statistical Methods</p> <p>Test Conditions Note: Concentration prep., vessel type, volume, replication, water quality parameters, environmental conditions, supplier of organisms, age, size, weight, loading</p> <p><u>Results</u> Units/Value: Note: Deviations from protocol or guideline, analytical method, biological observations, control survival</p> <p><u>Conclusions</u> (study author)</p> <p><u>Data Quality</u> Reliabilities</p> <p><u>Reference</u></p> <p><u>Other</u> Last changed</p>	<p>Dicyclopentadiene, CAS# 77-73-6 <u>Olefins Panel HPV Stream Name: DCPD High Purity</u></p> <p>Japanese Industrial Standard, JIS K 0102-1986-71 1986 Acute toxicity Unknown Unknown Orange-Red Killifish (<i>Oryzias latipes</i>) Unknown 48 hours Doudoroff or Probit method</p> <p>Organisms were supplied by Nakashima Fish Farm (Kumamoto, Japan). Fish were acclimated prior to test initiation in flow through systems using lab water at a temperature of 25+/- 2C for approximately 28 days. Test organisms used in the study were from one lot.</p> <p>Ground water from the testing lab, Kurme Research Laboratories, was used in the study. Water temperature, pH, and dissolved oxygen were continuously monitored in the lab. Total hardness, evaporated residue, chemical oxygen demand, chloride ion, ammonia nitrogen, selected organic substances, and selected heavy metals are periodically measured in water samples to ensure water quality standards are met.</p> <p>Test systems were glass vessels containing 4 L of treatment solution at 25+/- 2C with 10 fish per treatment level and the control. The exposure system used either a static or semistatic procedure with renewal of treatment solution every 8 to 16 hours.</p> <p>48-hour LC50 = 3.7 mg/L</p> <p>(2) Reliable with restrictions There is less raw data and information on the testing procedure than is desirable in order to rate this study for reliability at a level higher than 2 (reliable with restrictions). There is sufficient information in the report to suggest that the testing procedure followed an acceptable test guideline, JIS K 0102-1986-71. It is unknown if the data represent measured values.</p> <p>Chemicals Inspection and Testing Institute, Japan. 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.</p> <p>Revised December 12, 2001 (Prepared by a contract to the Olefins Panel)</p>
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**Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category
Dicyclopentadiene/Codimer Concentrate**

Biodegradation

Test Substance:	<p>CAS No. 68478-10-4: <u>Dicyclopentadiene/Codimer Concentrate (DCPD/ Codimer Concentrate)</u></p> <p>CAS Inventory Name: Naphtha, petroleum, light steam-cracked, debenzenized, C8-16 cycloalkadiene concentrate</p> <p><u>DCPD/Codimer Concentrate</u> is produced as a distillate from a C8+ fraction of thermally processed pyrolysis gasoline obtained from ethylene production (steam cracking process). The sample tested consisted of dicyclopentadiene (29%), methylcyclopentadiene dimer (13%), cyclopentadiene/methylcyclopentadiene codimer (13%), other codimers of cyclopentadiene - e.g. with 1,3-butadiene or isoprene (7%), other similar codimers of methylcyclopentadiene (22%), balance (16%).</p>
Method/Guideline:	OECD Guideline 301F
Year (guideline):	1992
Type (test type):	Ready Biodegradability: Manometric Respirometry Test
GLP (Y/N):	Yes
Year (study performed):	2003
Inoculum:	Domestic activated sludge
Exposure Period:	28 Days
<p>Test Conditions:</p> <p>Note: Concentration preparation, vessel type, replication, test conditions</p>	<p>Triplicate test systems were used to evaluate the biodegradability of the test and positive control substances at mean concentrations of 49.00 mg/L and 47.39 mg/L, respectively. Blank test systems, which did not contain the test or positive control substance, were run concurrently in triplicate.</p> <p>The total suspended solids (TSS) of the activated sludge was determined to be 4.41 g/L. The inoculum was added at a 1% loading volume of sludge supernatant to test medium. The microbial count of the inoculum was 10⁶ CFU/mL. One liter of test medium, which was aerated for 24 hours with carbon dioxide free air, was added to each one liter respirometer flask. The test substance was weighed in an air tight syringe and injected into the test medium. The test system was sealed immediately after addition of the test substance. . An aliquot of the positive control stock solution was added to the appropriate test flasks.</p> <p>An unacclimated activated sludge inoculum was used in this study. The inoculum was obtained from the Clinton Sanitary Wastewater Treatment Plant, Annandale, NJ, USA. The treatment plant receives domestic sewage.</p> <p>All test systems were placed on a Coordinated Environmental Services (CES) automated respirometer which automatically recorded the oxygen uptake in general agreement with the OECD guideline. The 28-day study was conducted at a temperature range of 21.0°C to 22.2°C.</p>
Results:	Biodegradation was based on oxygen consumption and the theoretical oxygen demand of the test substance as calculated using results of an elemental analysis of the test substance.

<p>Units/Value:</p> <p>Note: Deviations from protocol or guideline, analytical method.</p>	<p>By day 14, >60% biodegradation of positive control was observed, which meets the guideline requirement. No deviations from the protocol occurred that affected the integrity of the study data.</p> <p>No biodegradation was observed in each of the triplicate test substance systems, therefore the test substance cannot be considered readily biodegradable.</p> <table> <thead> <tr> <th><u>Sample</u></th> <th><u>% Degradation*</u> <u>(day 28)</u></th> <th><u>Mean % Degradation</u> <u>(day 28)</u></th> </tr> </thead> <tbody> <tr> <td>Test Substance</td> <td>0, 0, 0</td> <td>0</td> </tr> <tr> <td>Na Benzoate</td> <td>99, 100, 92</td> <td>97</td> </tr> </tbody> </table> <p>* replicate data</p>	<u>Sample</u>	<u>% Degradation*</u> <u>(day 28)</u>	<u>Mean % Degradation</u> <u>(day 28)</u>	Test Substance	0, 0, 0	0	Na Benzoate	99, 100, 92	97
<u>Sample</u>	<u>% Degradation*</u> <u>(day 28)</u>	<u>Mean % Degradation</u> <u>(day 28)</u>								
Test Substance	0, 0, 0	0								
Na Benzoate	99, 100, 92	97								
<p>Conclusion:</p>	<p>Not readily biodegradable</p>									
<p>Reliability:</p>	<p>(1)-Reliable without restriction.</p>									
<p>Reference:</p>	<p>ExxonMobil Biomedical Sciences, Inc. 2003. Ready Biodegradability: Manometric Respirometry test. Study # 160594A</p>									
<p>Other (source): (FT - SO)</p>	<p>Olefins Panel, American Chemistry Council</p>									

Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Invertebrate Acute Toxicity

Test Substance:	<p>CAS No. 68478-10-4: <u>Dicyclopentadiene/Codimer Concentrate</u> (DCPD/ Codimer Concentrate)</p> <p>CAS Inventory Name: Naphtha, petroleum, light steam-cracked, debenzenized, C8-16 cycloalkadiene concentrate</p> <p>DCPD/Codimer Concentrate is produced as a distillate from a C8+ fraction of thermally processed pyrolysis gasoline obtained from ethylene production (steam cracking process). The sample tested consisted of dicyclopentadiene (29%), methylcyclopentadiene dimer (13%), cyclopentadiene/methylcyclopentadiene codimer (13%), other codimers of cyclopentadiene - e.g. with 1,3-butadiene or isoprene (7%), other similar codimers of methylcyclopentadiene (22%), balance (16%).</p>
Method/Guideline:	OECD Guideline 202
Year (guideline):	1984
Type (test type):	Daphnid Acute Toxicity Test
GLP (Y/N):	Yes
Year (study performed):	2003
Species:	<i>Daphnia magna</i> Straus
Analytical Monitoring:	Yes
Exposure Period:	48 hours
Statistical Method:	<p>The 24 hour EL₅₀ and EC₅₀ values were determined using a Binomial Method (Stephan, 1977) and a maximum likelihood analysis based on D. J. Finney (1971) was used to determine the 48 hour EL₅₀ and EC₅₀ values.</p> <p>Stephan, C. E., Methods for Calculating an LC₅₀, <i>Aquatic Toxicology and Hazard Evaluation, ASTM STP 634</i>, F. L. Mayer and J. L. Hamelink, Eds., American Society for Testing and Materials, 1977, pp. 65-84.</p> <p>Finney, D.J., 1971. Probit Analysis, 3rd Edition, London: Cambridge University Press.</p>
Test Conditions: <ul style="list-style-type: none"> • Note: Concentration preparation, vessel type, volume, replication, environmental conditions, organisms supplier, loading, deviations from guideline or protocol. 	<p>Individual Water Accommodated Fractions (WAF's) were prepared for each treatment. The test substance was added to 12.4 L of reconstituted water in glass aspirator bottles (capacity 13.5 L). The solutions were mixed for approximately 24 hours using an 8% vortex (of the static liquid depth). The test solutions were removed through the outlet at the bottom of each mixing vessel into four replicates of 140 mL in 125 mL Erlenmeyer flasks (no headspace). Five daphnids were added to each replicate and the replicates sealed. The test was performed under static conditions with no aeration.</p> <p>Mean test temperature: 20.1°C (S.D. = 0.2), diurnal light: approximately 16 hours light and 8 hours dark with 179 to 182 Lux during full daylight periods. Dissolved oxygen ranged from 8.0 to 8.2 mg/L and pH ranged from 7.8 to 8.2 during the study. Water hardness was 164 mg/L as CaCO₃.</p> <p>The daphnids were cultured in-house. Age was <24 hours old from 18-day old parents.</p> <p>Due to the relatively complex nature and limited water solubility of the test substance, the following exceptions to the OECD guideline 202 apply for this study: The concentration of the test substance in solution was not</p>

	determined prior to use. It was deemed more appropriate to prepare individual treatment solutions by adding the test substance to dilution water and removing the WAF of each mixture for testing than to prepare dilutions of a stock solution.																																							
Results: Units/Value: Note: Analytical method, biological observations, control survival.	<p>Effect Loading (EL₅₀) / Effect Concentration (EC₅₀) Values (mg/L)</p> <table border="1"> <thead> <tr> <th></th> <th>EL₅₀</th> <th>EC₅₀</th> </tr> </thead> <tbody> <tr> <td>24 hours</td> <td>1.6 (1.1-2.4*)</td> <td>1.4 (0.92-2.1*)</td> </tr> <tr> <td>48 hours</td> <td>0.91 (0.75-1.2)</td> <td>0.76 (0.62-0.99)</td> </tr> </tbody> </table> <p>Values in parentheses are 95% confidence intervals unless otherwise noted. * 99% confidence interval</p> <p>The maximum loading rate causing no immobilization after 48-hours was 0.09 mg/L. The minimum actual loading rate causing 100% immobilization after 48-hours was 2.4 mg/L.</p> <p>The maximum measured concentration causing no immobilization after 48-hours was 0.07 mg/L. The minimum measured concentration causing 100% immobilization after 48-hours was 2.1 mg/L.</p> <p>The method of analysis was automated static headspace gas chromatography with flame ionization detection (HS GC-FID).</p> <table border="1"> <thead> <tr> <th rowspan="2">Loading Rate (mg/L)</th> <th rowspan="2">Measured Conc. (mg/L)</th> <th colspan="2">% Immobilization</th> </tr> <tr> <th>24 hour</th> <th>48 hour</th> </tr> </thead> <tbody> <tr> <td>Control</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>0.09</td> <td>0.07</td> <td>0</td> <td>0</td> </tr> <tr> <td>0.23</td> <td>0.17</td> <td>0</td> <td>15</td> </tr> <tr> <td>0.49</td> <td>0.40</td> <td>0</td> <td>15</td> </tr> <tr> <td>1.1</td> <td>0.92</td> <td>0</td> <td>65</td> </tr> <tr> <td>2.4</td> <td>2.1</td> <td>100</td> <td>100</td> </tr> </tbody> </table>		EL ₅₀	EC ₅₀	24 hours	1.6 (1.1-2.4*)	1.4 (0.92-2.1*)	48 hours	0.91 (0.75-1.2)	0.76 (0.62-0.99)	Loading Rate (mg/L)	Measured Conc. (mg/L)	% Immobilization		24 hour	48 hour	Control	0	0	0	0.09	0.07	0	0	0.23	0.17	0	15	0.49	0.40	0	15	1.1	0.92	0	65	2.4	2.1	100	100
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Conclusion:	After <i>Daphnia magna</i> were exposed to WAFs prepared from Dicyclopentadiene/Codimer Concentrate for 48-hours, the EL ₅₀ was 0.91 mg/L and the EC ₅₀ was 0.76 mg/L.																																							
Reliability:	1-Reliable without restrictions.																																							
Reference:	ExxonMobil Biomedical Sciences, Inc. 2003. <i>Daphnia sp.</i> , ACUTE IMMOBILIZATION TEST on DICYCLOPENTADIENE/CODIMER CONCENTRATE. Study # 160542																																							
Other (source):	Olefins Panel, American Chemistry Council																																							

Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Fish Acute Toxicity

Test Substance:	<p>CAS No. 68478-10-4: <u>Dicyclopentadiene/Codimer Concentrate</u> (DCPD/Codimer Concentrate)</p> <p>CAS Inventory Name: Naphtha, petroleum, light steam-cracked, debenzenized, C8-16 cycloalkadiene concentrate</p> <p>DCPD/Codimer Concentrate is produced as a distillate from a C8+ fraction of thermally processed pyrolysis gasoline obtained from ethylene production (steam cracking process). The sample tested consisted of dicyclopentadiene (29%), methylcyclopentadiene dimer (13%), cyclopentadiene/methylcyclopentadiene codimer (13%), other codimers of cyclopentadiene - e.g. with 1,3-butadiene or isoprene (7%), other similar codimers of methylcyclopentadiene (22%), balance (16%).</p>
Method/Guideline:	OECD Guideline 203
Year (guideline):	1992
Type (test type):	Fish Acute Toxicity Test
GLP (Y/N):	Yes
Year (study performed):	2003
Species:	<i>Oncorhynchus mykiss</i>
Analytical Monitoring:	Yes
Exposure Period:	96 hours
Statistical Method:	<p>The 3 hour LL₅₀ and LC₅₀ values were determined using a maximum likelihood analysis based on D. J. Finney (1971). The 6 hour, 48 hour and 72 hour LL₅₀ and LC₅₀ values were determined using a Trimmed Spearman-Kärber Method (Hamilton et al., 1977). A Binomial Method (Stephan, 1977) was used to determine the 24 hour and 96 hour LL₅₀ and LC₅₀ values.</p> <p>Finney, D.J., 1971. Probit Analysis, 3rd Edition, London: Cambridge University Press.</p> <p>Hamilton, M., R. Russo, R. Thurston, 1977. Trimmed Spearman-Kärber Method for Estimating Median Lethal Concentrations in Toxicity Bioassays. <i>Environmental Science and Technology</i>, Vol. 11, No. 7, p.714-719.</p> <p>Stephan, C. E., Methods for Calculating an LC₅₀, <i>Aquatic Toxicology and Hazard Evaluation, ASTM STP 634</i>, F. L. Mayer and J. L. Hamelink, Eds., American Society for Testing and Materials, 1977, pp. 65-84.</p>
Test Conditions: <ul style="list-style-type: none"> • Note: Concentration preparation, vessel type, volume, replication, environmental conditions, organisms supplier, loading, deviations from guideline or protocol. 	<p>Individual Water Accommodated Fractions (WAF's) were prepared for each treatment. The test substance was added to 19 L of reconstituted water in glass aspirator bottles (capacity 22 L). The solutions were mixed for 24 hours using a 3-5% vortex (of the static liquid depth). The test solutions were removed through the outlet at the bottom of each mixing vessel into three replicates of 4.5 L in 4 L size aspirator bottles (no headspace). Four fish were added to each replicate and the replicates sealed. Daily renewals were performed by removing ~90% of the test solution through the outlet at the bottom of the aspirator bottle and refilling with fresh solution. The fish were received from Thomas Fish Company, Anderson, CA. The fish were not fed during the study. They were held for 13 days in study dilution water prior to use and were 36 days old at the start of the study. Fish mean weight = 0.239 g, mean total length = 3.3 cm, test loading = 0.212 g of fish/L.</p> <p>Mean test temperature: 13.6°C (S.D. = 0.04), diurnal light: approximately 16 hours light and 8 hours dark with 585 to 588 Lux during full daylight periods. Dissolved</p>

	<p>oxygen ranged from 6.5 to 8.6 mg/L and pH ranged from 6.8 to 8.1 during the study. Water hardness was 108 mg/L as CaCO₃.</p> <p>Due to the complex nature and limited water solubility of the test substance, the following exceptions to the guideline apply for this study: The concentration of the test substance in solution was not determined prior to use. It was deemed more appropriate to prepare individual treatment solutions by adding the test substance to dilution water and removing the WAF of each mixture for testing than to prepare dilutions of a stock solution.</p>																																																																													
<p>Results: Units/Value: Note: Analytical method, biological observations, control survival.</p>	<p>The maximum actual loading rate causing no mortality after 96-hours was 0.49 mg/L. The maximum measured concentration causing no mortality after 96-hours was 0.39 mg/L. The minimum actual loading rate causing 100% mortality after 96-hours was 1.1 mg/L. The minimum measured concentration causing 100% mortality after 96-hours was 0.85 mg/L. The method of analysis was automated static headspace gas chromatography with flame ionization detection (HS GC-FID).</p> <p>Lethal Loading (LL₅₀) / Lethal Concentration (LC₅₀) Values (mg/L)</p> <table border="1"> <thead> <tr> <th></th> <th>LL₅₀</th> <th>LC₅₀</th> </tr> </thead> <tbody> <tr> <td>3 hours</td> <td>4.5 (CNC)</td> <td>4.5 (CNC)</td> </tr> <tr> <td>6 hours</td> <td>2.5 (2.0-3.0)</td> <td>2.2 (1.7-2.8)</td> </tr> <tr> <td>24 hours</td> <td>1.6 (1.1-2.3*)</td> <td>1.3 (0.85-2.0*)</td> </tr> <tr> <td>48 hours</td> <td>1.3 (1.1-1.6)</td> <td>1.1 (0.87-1.3)</td> </tr> <tr> <td>72 hours</td> <td>0.84 (0.71-0.99)</td> <td>0.66 (0.55-0.79)</td> </tr> <tr> <td>96 hours</td> <td>0.73 (0.49-1.1*)</td> <td>0.58 (0.39-0.85*)</td> </tr> </tbody> </table> <p>Values in parentheses are 95% confidence intervals unless otherwise noted. CNC - Could Not Calculate a confidence interval. * 99% confidence interval</p> <p>Summary of In-Life observations - % Mortality</p> <table border="1"> <thead> <tr> <th>Loading Rate (mg/L)</th> <th>Control</th> <th>0.21</th> <th>0.49</th> <th>1.1</th> <th>2.3</th> <th>4.9</th> </tr> </thead> <tbody> <tr> <td>Meas. Conc. (mg/L)</td> <td>0</td> <td>0.25</td> <td>0.39</td> <td>0.85</td> <td>2.0</td> <td>5.0</td> </tr> <tr> <td>3 hours</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>92</td> </tr> <tr> <td>6 hours</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>42</td> <td>100</td> </tr> <tr> <td>24 hours</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>100</td> <td>100</td> </tr> <tr> <td>48 hours</td> <td>0</td> <td>0</td> <td>0</td> <td>25</td> <td>100</td> <td>100</td> </tr> <tr> <td>72 hours</td> <td>0</td> <td>0</td> <td>0</td> <td>83</td> <td>100</td> <td>100</td> </tr> <tr> <td>96 hours</td> <td>0</td> <td>0</td> <td>0</td> <td>100</td> <td>100</td> <td>100</td> </tr> </tbody> </table>		LL ₅₀	LC ₅₀	3 hours	4.5 (CNC)	4.5 (CNC)	6 hours	2.5 (2.0-3.0)	2.2 (1.7-2.8)	24 hours	1.6 (1.1-2.3*)	1.3 (0.85-2.0*)	48 hours	1.3 (1.1-1.6)	1.1 (0.87-1.3)	72 hours	0.84 (0.71-0.99)	0.66 (0.55-0.79)	96 hours	0.73 (0.49-1.1*)	0.58 (0.39-0.85*)	Loading Rate (mg/L)	Control	0.21	0.49	1.1	2.3	4.9	Meas. Conc. (mg/L)	0	0.25	0.39	0.85	2.0	5.0	3 hours	0	0	0	0	0	92	6 hours	0	0	0	0	42	100	24 hours	0	0	0	0	100	100	48 hours	0	0	0	25	100	100	72 hours	0	0	0	83	100	100	96 hours	0	0	0	100	100	100
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Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Alga Toxicity

Test Substance:	<p>CAS No. 68478-10-4: <u>Dicyclopentadiene/Codimer Concentrate</u> (DCPD/ Codimer Concentrate)</p> <p>CAS Inventory Name: Naphtha, petroleum, light steam-cracked, debenzenized, C8-16 cycloalkadiene concentrate</p> <p>DCPD/Codimer Concentrate is produced as a distillate from a C8+ fraction of thermally processed pyrolysis gasoline obtained from ethylene production (steam cracking process). The sample tested consisted of dicyclopentadiene (29%), methylcyclopentadiene dimer (13%), cyclopentadiene/methylcyclopentadiene codimer (13%), other codimers of cyclopentadiene - e.g. with 1,3-butadiene or isoprene (7%), other similar codimers of methylcyclopentadiene (22%), balance (16%).</p>
Method/Guideline:	OECD Guideline 201
Year (guideline):	1984
Type (test type):	Alga Toxicity Test
GLP (Y/N):	Yes
Year (study performed):	2003
Species:	<i>Pseudokirchneriella subcapitata</i>
Analytical Monitoring:	Yes
Exposure Period:	96 hours
Statistical Method:	<p>The E_bC_{50}, E_rC_{50} and confidence intervals for inhibition of growth/growth rate slope were determined based on the linear regression (Snedecor and Cochran, 1989). Confidence intervals for the E_bC_{50} were calculated using the inverse interpolation equations from section 9.12 of (Snedecor and Cochran, 1989). Calculations were based on the PROC REGRESSION procedure and standard data manipulation methods in (SAS, 2002). The NOEC for the E_bC_{50} and E_rC_{50} was based on (Duncan's, 1975) Multiple Range test and (Dunnett's, 1964) test, determined from the GLM procedure of (SAS, 2002). The (Shapiro-Wilk, 1965) test for normality was used to test if the assumption of normality of the residuals was met; since the residuals were normally distributed the NOEC was based on the estimated values.</p> <p>Snedecor, G.W. and W.G. Cochran 1989, <i>Statistical Methods</i>, 8th Edition. Iowa State University Press / Ames.</p> <p>SAS Version 8, SAS Institute, Inc., Cary, NC. 2002.</p> <p>Duncan, D.B. 1975, "t-Tests and Intervals for Comparisons Suggested by the Data", <i>Biometrics</i>, 31, 339-359.</p> <p>Dunnett, C. 1964, "New Tables for Multiple Comparisons With A Control", <i>Biometrics</i>, Vol 20, No. 3, pg 482-491.</p> <p>Shapiro, S.S. and Wilk, M.B. 1965, "n analysis of variance test for normality (complete samples)" <i>Biometrika</i>, 52, pg 591-611.</p>
Test Conditions:	Individual Water Accommodated Fractions (WAF's) were prepared for each treatment. The test substance was added to 8.4 L of algal nutrient
<ul style="list-style-type: none"> • Note: Concentration preparation, 	

<p>vessel type, volume, replication, environmental conditions, organisms supplier, loading, deviations from guideline or protocol.</p>	<p>medium augmented with sodium bicarbonate in glass aspirator bottles (capacity 8.7 L). The solutions were mixed for approximately 24 hours using a 9% vortex (of the static liquid depth). The test solutions were removed through the outlet at the bottom of each mixing vessel into 12 replicates of 140 mL in 125 mL Erlenmeyer flasks (no headspace) containing two 14mm glass spheres to facilitate mixing. The test chambers were inoculated with algae (1.0×10^4 cells/mL) and were sealed with ground glass stoppers. Three replicates were sacrificed daily for cell density determination. The test chambers were placed on shaker tables (100 rpm) to keep the algae in suspension. The test was performed under static conditions with no aeration. The algae was cultured in-house from 5 day old stock cultures in log phase growth.</p> <p>Mean test temperature: 24.2°C (sd = 0.1). Continuous light: intensity was 7780 to 8892 Lux. The pH ranged from 7.5 to 7.6 in the test solutions at test initiation and ranged from 8.1 to 9.8 at test termination.</p> <p>Due to the complex nature and limited water solubility of the test substance, the following exceptions to the guideline apply for this study: The concentration of the test substance in solution was not determined prior to use. Test substance analysis was performed on samples of the WAFs at the start of the test (day 0) and at termination (day 4). The initial concentration of the test substance was not maintained at 80% in the three lower loading rates throughout the test (this may be due to biological activity or physical processes in the test chambers). It was appropriate to prepare individual treatment solutions by adding the test substance to dilution water and removing the WAF of each mixture for testing rather than to prepare dilutions of a stock solution. The test duration was 96 hours, instead of 72 hours. However, both 72 and 96-hour endpoints were determined.</p> <p>None of the above exceptions are believed to have affected the outcome, integrity, or quality of the study.</p>														
<p>Results: Units/Value: Note: Analytical method, biological observations, control survival.</p>	<p>Effects on growth rate (r) based upon actual loading rates: 72 hr ErL50 = 1.3 mg/L (<0.17* - >6.9* mg/L) 96 hr ErL50 = 1.4 mg/L (0.26* - >6.9* mg/L) 72 & 96 hr NOELR = 0.47 mg/L</p> <p>Effects on biomass (b) based upon actual loading rates: 72 and 96 hr EbL50 = 1.6 mg/L (<0.17* - >6.9* mg/L) 72 & 96 hr NOELR = 0.17 mg/L</p> <p>Effects on growth rate (r) based upon measured concentrations: 72 hr ErC50 = 0.94 mg/L (0.14 - >5.7* mg/L) 96 hr ErC50 = 1.0 mg/L (0.29 - 3.5 mg/L) 72 & 96 hr NOEC = 0.30 mg/L</p> <p>Effects on biomass (b) based upon measured concentrations: 72 and 96 hr EbC50 = 1.2 mg/L (<0.14* - >5.7* mg/L) 72 & 96 hr NOEC = 0.14 mg/L</p> <p>Values in parentheses are 95% confidence intervals. * Confidence interval exceeded the highest or lowest loading rate or concentration tested.</p> <p>The analytical method used was headspace gas chromatography with flame ionization detection.</p> <p style="text-align: center;">Summary of In-Life observations - % Inhibition</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: left;">Loading Rate (mg/L)</td> <td style="text-align: center;">Control</td> <td style="text-align: center;">0.21</td> <td style="text-align: center;">0.49</td> <td style="text-align: center;">1.1</td> <td style="text-align: center;">2.3</td> <td style="text-align: center;">4.9</td> </tr> <tr> <td style="text-align: left;">Meas. Conc. (mg/L)</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0.25</td> <td style="text-align: center;">0.39</td> <td style="text-align: center;">0.85</td> <td style="text-align: center;">2.0</td> <td style="text-align: center;">5.0</td> </tr> </table>	Loading Rate (mg/L)	Control	0.21	0.49	1.1	2.3	4.9	Meas. Conc. (mg/L)	0	0.25	0.39	0.85	2.0	5.0
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	<p>Based on Growth Rate</p> <table> <tbody> <tr> <td>72 hours</td> <td>n/a</td> <td>1.8</td> <td>5.6</td> <td>20</td> <td>71</td> <td>100</td> </tr> <tr> <td>96 hours</td> <td>n/a</td> <td>0.5</td> <td>1.5</td> <td>21</td> <td>77</td> <td>100</td> </tr> </tbody> </table> <p>Based on Biomass</p> <table> <tbody> <tr> <td>72 hours</td> <td>n/a</td> <td>5.5</td> <td>22</td> <td>55</td> <td>94</td> <td>99</td> </tr> <tr> <td>96 hours</td> <td>n/a</td> <td>2.8</td> <td>14</td> <td>60</td> <td>96</td> <td>100</td> </tr> </tbody> </table>	72 hours	n/a	1.8	5.6	20	71	100	96 hours	n/a	0.5	1.5	21	77	100	72 hours	n/a	5.5	22	55	94	99	96 hours	n/a	2.8	14	60	96	100
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Reliability:	(1)-Reliable without restrictions.																												
Reference:	ExxonMobil Biomedical Sciences, Inc. 2003. ALGA, GROWTH INHIBITION TEST on DICYCLOPENTADIENE/CODIMER CONCENTRATE. Study # 160567.																												
Other (source):	Olefins Panel, American Chemistry Council																												

**Robust Summary: Resin Oils and Cycloodiene Dimer Concentrates Category
MCPD Dimer Concentrate**

Biodegradation

Test Substance:	CAS No.: 26472-00-4, Methylcyclopentadiene Dimer Concentrate (MCPD Dimer Concentrate). The test substance contained 90.8% MCPD Dimer, 2.6% MCPD and 1.6% Cyclopentadiene (CPD)-MCPD codimer. The balance of the stream consisted of other hydrocarbons, primarily C4-C7 codimers of MCPD or CPD. CAS Inventory Name: 4,7-Methano-1H-indene, 3a,4,7,7a-tetrahydromethyl-
Method/Guideline:	OECD Guideline 301F
Year (guideline):	1992
Type (test type):	Ready Biodegradability: Manometric Respirometry Test
GLP (Y/N):	Yes
Year (study performed):	2002
Inoculum:	Domestic activated sludge
Exposure Period:	28 Days
Test Conditions: <ul style="list-style-type: none"> Note: Concentration preparation, vessel type, replication, test conditions. 	<p>Triplicate test systems were used to evaluate the biodegradability of the test and positive control substances at mean concentrations of 49.77 mg/L and 48.49 mg/L, respectively. Blank test systems, which did not contain the test or positive control substance, were run concurrently in triplicate.</p> <p>The total suspended solids (TSS) of the activated sludge was determined to be 3.74 g/L. The inoculum was added at a 1% loading volume of sludge supernatant to test medium. The microbial count of the inoculum was 10⁵ CFU/mL. One liter of test medium, which was aerated for 24 hours with carbon dioxide free air, was added to each one liter respirometer flask. The test substance was weighed in an air tight syringe and injected into the test medium. The test system was sealed immediately after addition of the test substance. An aliquot of the positive control stock solution was added to the appropriate test flasks.</p> <p>An unacclimated activated sludge inoculum was used in this study. The inoculum was obtained from the Clinton Sanitary Wastewater Treatment Plant, Annandale, NJ, USA. The treatment plant receives domestic sewage.</p> <p>All test systems were placed on a Coordinated Environmental Services (CES) automated respirometer which automatically recorded the oxygen uptake in general agreement with the OECD guideline. The 28-day study was conducted at a temperature range of 21.2°C to 21.7°C.</p>

<p>Results:</p> <p>Units/Value:</p> <p>Note: Deviations from protocol or guideline, analytical method.</p>	<p>Biodegradation was based on oxygen consumption and the theoretical oxygen demand of the test substance as calculated using results of an elemental analysis of the test substance.</p> <p>By day 14, >60% biodegradation of positive control was observed, which meets the guideline requirement. No deviations from the protocol occurred that affected the integrity of the study data.</p> <p>No biodegradation was observed in each of the triplicate test substance systems, therefore the test substance cannot be considered readily biodegradable.</p> <table> <thead> <tr> <th><u>Sample</u></th> <th><u>% Degradation*</u> <u>(day 28)</u></th> <th><u>Mean % Degradation</u> <u>(day 28)</u></th> </tr> </thead> <tbody> <tr> <td>Test Substance</td> <td>0, 0, 0</td> <td>0</td> </tr> <tr> <td>Na Benzoate</td> <td>92, 109, 93</td> <td>98</td> </tr> </tbody> </table> <p>* replicate data</p>	<u>Sample</u>	<u>% Degradation*</u> <u>(day 28)</u>	<u>Mean % Degradation</u> <u>(day 28)</u>	Test Substance	0, 0, 0	0	Na Benzoate	92, 109, 93	98
<u>Sample</u>	<u>% Degradation*</u> <u>(day 28)</u>	<u>Mean % Degradation</u> <u>(day 28)</u>								
Test Substance	0, 0, 0	0								
Na Benzoate	92, 109, 93	98								
<p>Conclusion:</p>	<p>Not readily biodegradable</p>									
<p>Reliability:</p>	<p>(1)-Reliable without restriction.</p>									
<p>Reference:</p>	<p>ExxonMobil Biomedical Sciences, Inc. 2002. Ready Biodegradability: Manometric Respirometry test. Study # 154594A</p>									
<p>Other (source): (FT - SO)</p>	<p>Olefins Panel, American Chemistry Council</p>									

Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Alga Toxicity

Test Substance:	CAS No.: 26472-00-4, Methylcyclopentadiene Dimer Concentrate (MCPD Dimer Concentrate). The test substance contained 90.8% MCPD Dimer, 2.6% MCPD and 1.6% Cyclopentadiene (CPD)-MCPD codimer. The balance of the stream consisted of other hydrocarbons, primarily C4-C7 codimers of MCPD or CPD. CAS Inventory Name: 4,7-Methano-1H-indene, 3a,4,7,7a-tetrahydrodimethyl-
Method/Guideline:	OECD Guideline 201
Year (guideline):	1984
Type (test type):	Alga Toxicity Test
GLP (Y/N):	Yes
Year (study performed):	2003
Species:	<i>Pseudokirchneriella subcapitata</i>
Analytical Monitoring:	Yes
Exposure Period:	96 hours
Statistical Method:	The E_bC_{50} , E_rC_{50} and confidence intervals for inhibition of growth/growth rate slope were determined by a probit regression calculation of the probit of the growth inhibition/growth rate slope vs the log of the concentration and associated confidence intervals based on the methods of Finney (1971). Calculations were based on the PROC PROBIT procedure of SAS (2002). The NOEC for the E_bC_{50} and E_rC_{50} was based on Duncan's (1975) Multiple Range test and Dunnett's (1964) test, determined from the GLM procedure of SAS (2002). The Shapiro-Wilk (1965) test for normality was used to test if the assumption of normality of the residuals was met; since the residuals were normally distributed the NOEC was based on the estimated values. Finney, D.J. 1971. <i>Probit Analysis</i> , 3rd Edition, London: Cambridge University Press. SAS Version 8, SAS Institute, Inc., Cary, NC. 2002. Duncan, D.B. 1975, "t-Tests and Intervals for Comparisons Suggested by the Data", <i>Biometrics</i> , 31, 339-359. Dunnett, C. 1964, "New Tables for Multiple Comparisons With A Control", <i>Biometrics</i> , Vol 20, No. 3, pg 482-491. Shapiro, S.S. and Wilk, M.B. 1965, "n analysis of variance test for normality (complete samples)" <i>Biometrika</i> , 52, pg 591-611.
Test Conditions: <ul style="list-style-type: none">Note: Concentration preparation, vessel type, volume, replication, environmental conditions, organisms supplier, loading, deviations from guideline or protocol.	Individual Water Accommodated Fractions (WAF's) were prepared for each treatment. The test substance was added to 20.7L of algal nutrient medium augmented with sodium bicarbonate in glass aspirator bottles (capacity 22 L). The solutions were mixed for approximately 23 hours using an 8% vortex (of the static liquid depth). The test solutions were removed through the outlet at the bottom of each mixing vessel into 12 replicates of 140 mL in 125 mL Erlenmeyer flasks (no headspace) containing two 14mm glass spheres to facilitate mixing. The test chambers were inoculated with algae (1.0×10^4 cells/mL) and were sealed with ground glass stoppers. Three replicates were sacrificed daily for cell density determination. The test chambers were placed on shaker tables (100 rpm) to keep the algae in suspension. The test was performed

	<p>under static conditions with no aeration. The algae was cultured in-house from 5 day old stock cultures in log phase growth.</p> <p>Mean test temperature: 23.4°C (sd = 0.2). Continuous light: intensity was 8440 to 8636 Lux. The pH was 7.6 in all of the test solutions at test initiation and ranged from 8.8 to 10.1 at test termination.</p> <p>Due to the relatively complex nature and limited water solubility of the test substance, the following exceptions to the guideline apply for this study: The concentration of the test substance in solution was not determined prior to use. Test substance analysis was performed on samples of the WAFs at the start of the test (day 0) and at termination (day 4). The initial concentration of the test substance was not maintained at 80% throughout the test (this may be due to biological activity or physical processes in the test chambers). It was deemed more appropriate to prepare individual treatment solutions by adding the test substance to dilution water and removing the WAF of each mixture for testing than to prepare dilutions of a stock solution. The test duration was 96 hours, instead of 72 hours. However, both 72 and 96-hour endpoints were determined.</p> <p>None of the above exceptions are believed to have affected the outcome, integrity, or quality of the study.</p>																																																								
<p>Results: Units/Value: Note: Analytical method, biological observations, control survival.</p>	<p>Effects on growth rate (r) based upon actual loading rates: 72 hr ErL50 (loading rate) = 1.2* mg/L (1.0 - 1.6 mg/L) 96 hr ErL50 (loading rate) = 1.2* mg/L (1.1 - 1.3 mg/L) 72 & 96 hr NOELR (loading rate) = 0.17 mg/L</p> <p>Effects on biomass (b) based upon actual loading rates: 72 hr EbL50 (loading rate) = 0.64 mg/L (0.46 - 0.92 mg/L) 96 hr EbL50 (loading rate) = 0.65 mg/L (0.47 - 0.93 mg/L) 72 & 96 hr NOELR (loading rate) = 0.17 mg/L</p> <p>Effects on growth rate (r) based upon measured concentrations: 72 hr ErC50 (measured conc.) = 0.82** mg/L (0.63 - 1.3 mg/L) 96 hr ErC50 (measured conc.) = 0.83** mg/L (0.71 - 1.1 mg/L) 72 & 96 hr NOEC (measured conc.) = 0.096 mg/L</p> <p>Effects on biomass (b) based upon measured concentrations: 72 hr EbC50 (measured conc.) = 0.42 mg/L (0.23 - 0.91** mg/L) 96 hr EbC50 (measured conc.) = 0.42 mg/L (0.25 - 0.86** mg/L) 72 & 96 hr NOEC (measured conc.) = 0.096 mg/L</p> <p>Values in parenthesis are 95% confidence intervals. * Values are extrapolated, the maximum actual loading rate was 1.1 mg/L. ** Values are extrapolated, the maximum measured concentration was 0.76 mg/L.</p> <p>The analytical method used was headspace gas chromatography with flame ionization detection.</p> <p style="text-align: center;">Summary of In-Life observations - % Inhibition</p> <table border="1"> <thead> <tr> <th>Loading Rate (mg/L)</th> <th>Control</th> <th>0.019</th> <th>0.068</th> <th>0.17</th> <th>0.51</th> <th>1.1</th> </tr> </thead> <tbody> <tr> <td>Meas. Conc. (mg/L)</td> <td>0</td> <td>0.029</td> <td>0.048</td> <td>0.096</td> <td>0.28</td> <td>0.76</td> </tr> <tr> <td colspan="7">Based on Growth Rate</td> </tr> <tr> <td>72 hours</td> <td>n/a</td> <td>1.5</td> <td>2.0</td> <td>1.6</td> <td>17</td> <td>42</td> </tr> <tr> <td>96 hours</td> <td>n/a</td> <td>0.8</td> <td>1.4</td> <td>0.0</td> <td>12</td> <td>41</td> </tr> <tr> <td colspan="7">Based on Biomass</td> </tr> <tr> <td>72 hours</td> <td>n/a</td> <td>4.4</td> <td>5.0</td> <td>6.0</td> <td>50</td> <td>85</td> </tr> <tr> <td>96 hours</td> <td>n/a</td> <td>3.9</td> <td>4.1</td> <td>1.7</td> <td>46</td> <td>87</td> </tr> </tbody> </table>	Loading Rate (mg/L)	Control	0.019	0.068	0.17	0.51	1.1	Meas. Conc. (mg/L)	0	0.029	0.048	0.096	0.28	0.76	Based on Growth Rate							72 hours	n/a	1.5	2.0	1.6	17	42	96 hours	n/a	0.8	1.4	0.0	12	41	Based on Biomass							72 hours	n/a	4.4	5.0	6.0	50	85	96 hours	n/a	3.9	4.1	1.7	46	87
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<p>Conclusion:</p>	<p>Effects on growth rate (r) based upon actual loading rates: 72 and 96 hr ErL50 = 1.2 mg/L</p>																																																								

	<p>Effects on biomass (b) based upon actual loading rates: 72 hr EbL50 = 0.64 mg/L 96 hr EbL50 = 0.65 mg/L</p> <p>Effects on growth rate (r) based upon measured concentrations: 72 hr ErC50 = 0.82 mg/L 96 hr ErC50 = 0.83 mg/L</p> <p>Effects on biomass (b) based upon measured concentrations: 72 and 96 hr EbC50 = 0.42 mg/L</p>
Reliability:	(1)-Reliable without restriction
Reference:	ExxonMobil Biomedical Sciences, Inc. 2003. Alga, Growth Inhibition Test on Methylcyclopentadiene Dimer Concentrate. Study # 154567A.
Other (source):	Olefins Panel, American Chemistry Council

Attachment 1c
Biodegradation and Aquatic Toxicology
Subcategory 2

<p><u>Results</u> Units/Value: Note: Deviations from protocol or guideline, analytical method, biological observations, control survival</p> <p><u>Conclusions</u> (study author)</p> <p><u>Data Quality</u> <i>Reliabilities</i></p> <p><u>Reference</u></p> <p><u>Source</u></p>	<p>Castalia, OH, USA. Bluegill sunfish: 30-50 mm length, 0.57-2.99 g supplied from Sea Plantations, Inc., Salem MA, USA.</p> <p>LL50 values (with 95% feducial limits) are based on nominal concentrations:</p> <table border="1"> <thead> <tr> <th></th> <th><u>Rainbow Trout (mg/L)</u></th> <th><u>Bluegill Sunfish (mg/L)</u></th> </tr> </thead> <tbody> <tr> <td>24-hr LL50</td> <td>14.34 (12.5-16.27)</td> <td>21.95 (19.71-25.80)</td> </tr> <tr> <td>48-hr LL50</td> <td>10.92 (not determined)</td> <td>17.91 (16.28-20.69)</td> </tr> <tr> <td>96-hr LL50</td> <td>10.60 (3.60-63.88)</td> <td>13.54 (12.28-14.66)</td> </tr> </tbody> </table> <p>For rainbow trout, % mortality at 96 hours was 5, 10, 25, 95, 100% at nominal concentrations of 3.2, 5.6, 10, 18, 32 mg/l respectively, with pharmacotoxic signs of surfacing, rapid respiration, dark discoloration, bloated abdomens, gyratory swimming, and lying on bottom of vessels. For bluegill sunfish, % mortality at 96 hrs was 0, 75, 85, 100, 100, 100% at nominal concentrations of 10, 14,18, 32, 56, 100 mg/l, respectively, with pharmacotoxic signs of surfacing, rapid respiration, swimming on side, excreting mucus, and lying on bottom of vessel. The benzene 96-hour LC50 in rainbow trout = 7.64 mg/l. Results of chemical analysis of water samples were inconsistent and highly variable, and analyses were discontinued. Test material was observed on water surface and adhering to sides of vessels in treatment solutions.</p> <p>(2) Reliable with restrictions Analytical characterization of test material in aqueous test solution was inaccurate and unreliable. Quality Assurance final report statement had not been signed by a reviewer. Test material was observed on water surface and adhering to sides of vessels in treatment solutions.</p> <p>Glenn, L.S. and Rausina, G.A. 1983. 96-Hour Aquatic Toxicity Study in Rainbow Trout and Bluegill Sunfish with Resin-Former Feedstock. Project #2021. Gulf Life Sciences Center, Pittsburgh, PA for Gulf Oil Chemicals Co., Houston, TX, USA.</p> <p>American Chemistry Council, Olefins Panel</p>		<u>Rainbow Trout (mg/L)</u>	<u>Bluegill Sunfish (mg/L)</u>	24-hr LL50	14.34 (12.5-16.27)	21.95 (19.71-25.80)	48-hr LL50	10.92 (not determined)	17.91 (16.28-20.69)	96-hr LL50	10.60 (3.60-63.88)	13.54 (12.28-14.66)
	<u>Rainbow Trout (mg/L)</u>	<u>Bluegill Sunfish (mg/L)</u>											
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Attachment 1c
Biodegradation and Aquatic Toxicology
Subcategory 3

**Robust Summary: Resin Oils and Cyclo diene Dimer Concentrates Category
Low Dicyclopentadiene Resin Oil**

Biodegradation

Test Substance:	<p>Low Dicyclopentadiene Resin Oil (Low DCPD Resin Oil) CAS No. 68477-54-3. Distillates, petroleum, steam-cracked, C8-12 fraction. This stream can also be described by CAS No. 68516-20-1. Naphtha, petroleum, steam-cracked middle arom.</p> <p><u>Low DCPD Resin Oil</u> is a C8 to C10 distillate obtained from a pyrolysis gasoline stream produced by an ethylene production process (steam cracking process). The sample tested consisted of vinyltoluenes (17%), trimethylbenzenes (9%), styrene and methylstyrenes (3%), indene (14%), methylindene (8%), and naphthalene (1%). The balance of the composition is expected to consist of other hydrocarbons with carbon range primarily 8 to 10, mainly aromatics and olefins, with some paraffins.</p>
Method/Guideline:	OECD Guideline 301F
Year (guideline):	1992
Type (test type):	Ready Biodegradability: Manometric Respirometry Test
GLP (Y/N):	Yes
Year (study performed):	2003
Inoculum:	Domestic activated sludge
Exposure Period:	41 Days
<p>Test Conditions:</p> <ul style="list-style-type: none"> Note: Concentration preparation, vessel type, replication, test conditions. 	<p>Triplicate test systems were used to evaluate the biodegradability of the test and positive control substances at mean concentrations of 50.13 mg/L and 49.13 mg/L, respectively. Blank test systems, which did not contain the test or positive control substance, were run concurrently in triplicate.</p> <p>The total suspended solids (TSS) of the activated sludge was determined to be 4.13 g/L. The inoculum was added at a 1% loading volume of sludge supernatant to test medium. The microbial count of the inoculum was 10⁶ CFU/mL. One liter of test medium, which was aerated for 24 hours with carbon dioxide free air, was added to each one liter respirometer flask. The test substance was weighed in an air tight syringe and injected into the test medium. The test system was sealed immediately after addition of the test substance. An aliquot of the positive control stock solution was added to the appropriate test flasks.</p> <p>An unacclimated activated sludge inoculum was used in this study. The inoculum was obtained from the Clinton Sanitary Wastewater Treatment Plant, Annandale, NJ, USA. The treatment plant receives domestic sewage.</p>

<p>Test Conditions (cont'd):</p> <ul style="list-style-type: none"> Note: Concentration preparation, vessel type, replication, test conditions. 	<p>All test systems were placed on a Coordinated Environmental Services (CES) automated respirometer which automatically recorded the oxygen uptake in general agreement with the OECD guideline. The 41-day study was conducted at a temperature range of $22 \pm 1^\circ\text{C}$.</p>									
<p>Results:</p> <p>Units/Value:</p> <p>Note: Deviations from protocol or guideline analytical method.</p>	<p>Biodegradation was based on oxygen consumption and the theoretical oxygen demand of the test substance as calculated using results of an elemental analysis of the test substance.</p> <p>By day 14, >60% biodegradation of positive control was observed, which meets the guideline requirement. No deviations from the protocol occurred that affected the integrity of the study data.</p> <p>The average percent biodegradation of the test substance was determined to be 6.48% on day 41. The test substance cannot be considered readily biodegradable.</p> <table border="0"> <thead> <tr> <th style="text-align: left;"><u>Sample</u></th> <th style="text-align: center;">% Degradation* <u>(day 41)</u></th> <th style="text-align: center;">Mean % Degradation <u>(day 41)</u></th> </tr> </thead> <tbody> <tr> <td>Test Substance</td> <td style="text-align: center;">6, 5, 9</td> <td style="text-align: center;">6</td> </tr> <tr> <td>Na Benzoate</td> <td style="text-align: center;">86, 91, 82</td> <td style="text-align: center;">86</td> </tr> </tbody> </table> <p>* replicate data</p>	<u>Sample</u>	% Degradation* <u>(day 41)</u>	Mean % Degradation <u>(day 41)</u>	Test Substance	6, 5, 9	6	Na Benzoate	86, 91, 82	86
<u>Sample</u>	% Degradation* <u>(day 41)</u>	Mean % Degradation <u>(day 41)</u>								
Test Substance	6, 5, 9	6								
Na Benzoate	86, 91, 82	86								
<p>Conclusion:</p>	<p>Not readily biodegradable</p>									
<p>Reliability:</p>	<p>(1)-Reliable without restriction.</p>									
<p>Reference:</p>	<p>ExxonMobil Biomedical Sciences, Inc. 2003. Ready Biodegradability: Manometric Respirometry test. Study # 163094A</p>									
<p>Other (source): (FT - SO)</p>	<p>Olefins Panel, American Chemistry Council</p>									

Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Biodegradation (Acclimated)

Test Substance:	<p><u>Low Dicyclopentadiene Resin Oil</u> (Low DCPD Resin Oil) CAS No. 68477-54-3. Distillates, petroleum, steam-cracked, C8-12 fraction. This stream can also be described by CAS No. 68516-20-1. Naphtha, petroleum, steam-cracked middle arom.</p> <p><u>Low DCPD Resin Oil</u> is a C8 to C10 distillate obtained from a pyrolysis gasoline stream produced by an ethylene production process (steam cracking process). The sample tested consisted of vinyltoluenes (17%), trimethylbenzenes (9%), styrene and methylstyrenes (3%), indene (14%), methylindene (8%), and naphthalene (1%). The balance of the composition is expected to consist of other hydrocarbons with carbon range primarily 8 to 10, mainly aromatics and olefins, with some paraffins.</p>
Method/Guideline:	OECD Guideline 301F
Year (guideline):	1992
Type (test type):	Ready Biodegradability: Manometric Respirometry Test
GLP (Y/N):	Yes
Year (study performed):	2003
Inoculum:	Acclimated Inoculum prepared from 163094A test systems.
Exposure Period:	56 Days
Test Conditions: <ul style="list-style-type: none"> • Note: Concentration preparation, vessel type, replication, test conditions. 	<p>Triplicate test systems with acclimated inoculum were used to evaluate the biodegradability of the test and positive control substances at mean concentrations of 47.20 mg/L and 51.49 mg/L, respectively. Blank test systems, which did not contain the test or positive control substance, were run concurrently in triplicate. Triplicate toxicity control test systems, containing both test and positive control substance, were also run concurrently.</p> <p>Acclimated Inoculum was prepared from solids filtered from 163094A test systems. The inoculum for 163094A test systems was obtained from the Clinton Sanitary Wastewater Treatment Plant, Annandale, NJ, USA which receives domestic sewage. The solids were mixed with 200 mL of fresh test medium and added at a 1% loading volume of solids mixture to test medium. The microbial count of the inoculum was 10⁴CFU/mL. The test medium was aerated for 24 hours with carbon dioxide free air and one liter added to each one liter respirometer flask.</p>

<p>Test Conditions (cont'd):</p> <ul style="list-style-type: none"> Note: Concentration preparation, vessel type, replication, test conditions. 	<p>The test substance was weighed in an air tight syringe and injected into the test medium. The test system was sealed immediately after addition of the test substance. An aliquot of the positive control stock solution was added to the appropriate test flasks.</p> <p>All test systems were placed on a Coordinated Environmental Services (CES) automated respirometer which automatically recorded the oxygen uptake in general agreement with the OECD guideline. The 56 day study was conducted at a temperature range of $22 \pm 1^\circ\text{C}$.</p>												
<p>Results:</p> <p>Units/Value:</p> <p>Note: Deviations from protocol or guideline analytical method.</p>	<p>Biodegradation was based on oxygen consumption and the theoretical oxygen demand of the test substance as calculated using results of an elemental analysis of the test substance.</p> <p>By day 14, >60% biodegradation of the positive control was observed, which meets the guideline requirement. No deviations from the protocol occurred that affected the integrity of the study data.</p> <p>The mean biodegradation of the test substance was determined to be 43.87% by day 56. The toxicity control exceeded 25% therefore the test substance cannot be considered inhibitory.</p> <table border="1"> <thead> <tr> <th><u>Sample</u></th> <th><u>% Degradation*</u> <u>(day 56)</u></th> <th><u>Mean % Degradation</u> <u>(day 56)</u></th> </tr> </thead> <tbody> <tr> <td>Test Substance</td> <td>44, 43, 45</td> <td>44</td> </tr> <tr> <td>Na Benzoate</td> <td>80, 86, 75</td> <td>80</td> </tr> <tr> <td>Toxicity Control</td> <td>53, 48, 54</td> <td>52</td> </tr> </tbody> </table> <p>* replicate data</p>	<u>Sample</u>	<u>% Degradation*</u> <u>(day 56)</u>	<u>Mean % Degradation</u> <u>(day 56)</u>	Test Substance	44, 43, 45	44	Na Benzoate	80, 86, 75	80	Toxicity Control	53, 48, 54	52
<u>Sample</u>	<u>% Degradation*</u> <u>(day 56)</u>	<u>Mean % Degradation</u> <u>(day 56)</u>											
Test Substance	44, 43, 45	44											
Na Benzoate	80, 86, 75	80											
Toxicity Control	53, 48, 54	52											
<p>Conclusion:</p>	<p>Not readily biodegradable</p> <p>Not Inhibitory at loading concentration of approximately 50 mg/L.</p>												
<p>Reliability:</p>	<p>(1)-Reliable without restriction.</p>												
<p>Reference:</p>	<p>ExxonMobil Biomedical Sciences, Inc. 2003. Ready Biodegradability: Manometric Respirometry test. Study # 163094A(A)</p>												
<p>Other (source): (FT - SO)</p>	<p>Olefins Panel, American Chemistry Council</p>												

Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Invertebrate Acute Toxicity

Test Substance:	<p><u>Low Dicyclopentadiene Resin Oil</u> (Low DCPD Resin Oil) CAS No. 68477-54-3. Distillates, petroleum, steam-cracked, C8-12 fraction. This stream can also be described by CAS No. 68516-20-1. Naphtha, petroleum, steam-cracked middle arom.</p> <p>.</p> <p>Low DCPD Resin Oil is a C8 to C10 distillate obtained from a pyrolysis gasoline stream produced by an ethylene production process (steam cracking process). The sample tested consisted of vinyltoluenes (17%), trimethylbenzenes (9%), styrene and methylstyrenes (3%), indene (14%), methylindene (8%), and naphthalene (1%). The balance of the composition is expected to consist of other hydrocarbons with carbon range primarily 8 to 10, mainly aromatics and olefins, with some paraffins.</p>
Method/Guideline:	OECD Guideline 202
Year (guideline):	1984
Type (test type):	Daphnid Acute Toxicity Test
GLP (Y/N):	Yes
Year (study performed):	2003
Species:	<i>Daphnia magna</i> Straus
Analytical Monitoring:	Yes
Exposure Period:	48 hours
Statistical Method:	<p>The 48 hour EL₅₀ and EC₅₀ values were determined using a maximum likelihood analysis based on D. J. Finney (1971).</p> <p>Finney, D.J., 1971. Probit Analysis, 3rd Edition, London: Cambridge University Press.</p>
Test Conditions: <ul style="list-style-type: none"> • Note: Concentration preparation, vessel type, volume, replication, environmental conditions, organisms supplier, loading, deviations from guideline or protocol. 	<p>Individual Water Accommodated Fractions (WAF's) were prepared for each treatment. The test substance was added to 12 L of reconstituted water in glass aspirator bottles (capacity 13.5 L). The solutions were mixed for approximately 24 hours using a 10% vortex (of the static liquid depth). The test solutions were removed through the outlet at the bottom of each mixing vessel into four replicates of 140 mL in 125 mL Erlenmeyer flasks (no headspace). Five daphnids were added to each replicate and the replicates were closed. The test was performed under static conditions with no aeration.</p> <p>Mean test temperature: 20.1°C (S.D. = 0.2), diurnal light: approximately 16 hours light and 8 hours dark with 125 to 178 lux during full daylight periods. Dissolved oxygen ranged from 8.4 to 8.7 mg/L and pH ranged from 7.5 to 8.0 during the study. Water hardness was 154 mg/L as CaCO₃.</p> <p>The daphnids were cultured in-house. Age was <24 hours old from 15-day old parents.</p> <p>Due to the relatively complex nature and limited water solubility of the test substance, the following exceptions to the guideline apply for this study: The concentration of the test substance in solution was not determined prior to use. It was deemed more appropriate to prepare individual treatment solutions by adding the test substance to dilution water and removing the WAF of each mixture for testing than to prepare dilutions of a stock solution.</p>

<p>Results: Units/Value: Note: Analytical method, biological observations, control survival.</p>	<p>Effect Loading (EL₅₀) / Effect Concentration (EC₅₀) Values (mg/L)</p> <table border="0"> <tr> <td></td> <td style="text-align: center;">EL₅₀</td> <td style="text-align: center;">EC₅₀</td> </tr> <tr> <td>24 hours</td> <td style="text-align: center;">>4.9*</td> <td style="text-align: center;">>4.6*</td> </tr> <tr> <td>48 hours</td> <td style="text-align: center;">3.2 (CNC)</td> <td style="text-align: center;">2.9 (CNC)</td> </tr> </table> <p>* Not a calculated value, no mortality was observed in the highest loading rate/concentration tested.</p> <p>CNC = Could Not Calculate a confidence interval</p> <p>The maximum actual loading rate causing no immobilization after 48-hours was <0.22 mg/L, one daphnid was immobilized at 0.22 mg/L, the lowest loading rate tested. The minimum actual loading rate causing 100% immobilization after 48-hours was 4.9 mg/L.</p> <p>The maximum measured concentration causing no immobilization after 48-hours was <0.19 mg/L, one daphnid was immobilized at 0.19 mg/L, the lowest measured concentration tested. The minimum measured concentration causing 100% immobilization after 48-hours was 4.6 mg/L.</p> <p>The method of analysis was automated static headspace gas chromatography with flame ionization detection (HS GC-FID).</p> <table border="0"> <tr> <td>Loading Rate (mg/L)</td> <td>Measured Conc. (mg/L)</td> <td colspan="2">% Immobilization</td> </tr> <tr> <td></td> <td></td> <td>24 hour</td> <td>48 hour</td> </tr> <tr> <td>Control</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>0.22</td> <td>0.19</td> <td>0</td> <td>5</td> </tr> <tr> <td>0.43</td> <td>0.35</td> <td>0</td> <td>0</td> </tr> <tr> <td>1.0</td> <td>0.85</td> <td>0</td> <td>0</td> </tr> <tr> <td>2.3</td> <td>2.0</td> <td>0</td> <td>5</td> </tr> <tr> <td>4.9</td> <td>4.6</td> <td>0</td> <td>100</td> </tr> </table>		EL ₅₀	EC ₅₀	24 hours	>4.9*	>4.6*	48 hours	3.2 (CNC)	2.9 (CNC)	Loading Rate (mg/L)	Measured Conc. (mg/L)	% Immobilization				24 hour	48 hour	Control	0	0	0	0.22	0.19	0	5	0.43	0.35	0	0	1.0	0.85	0	0	2.3	2.0	0	5	4.9	4.6	0	100
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<p>Conclusion:</p>	<p>After <i>Daphnia magna</i> were exposed to WAFs prepared from Low Dicyclopentadiene Resin Oil for 48-hours, the EL₅₀ was 3.2 mg/L and the EC₅₀ was 2.9 mg/L.</p>																																									
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<p>Reference:</p>	<p>ExxonMobil Biomedical Sciences, Inc. 2003. <i>Daphnia sp.</i>, ACUTE IMMOBILIZATION TEST on LOW DICYCLOPENTADIENE RESIN OIL. Study # 163042</p>																																									
<p>Other (source):</p>	<p>Olefins Panel, American Chemistry Council</p>																																									

Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Fish Acute Toxicity

Test Substance:	<p>Low Dicyclopentadiene Resin Oil (Low DCPD Resin Oil) CAS No. 68477-54-3. Distillates, petroleum, steam-cracked, C8-12 fraction. This stream can also be described by CAS No. 68516-20-1. Naphtha, petroleum, steam-cracked middle arom.</p> <p>Low DCPD Resin Oil is a C8 to C10 distillate obtained from a pyrolysis gasoline stream produced by an ethylene production process (steam cracking process). The sample tested consisted of vinyltoluenes (17%), trimethylbenzenes (9%), styrene and methylstyrenes (3%), indene (14%), methylindene (8%), and naphthalene (1%). The balance of the composition is expected to consist of other hydrocarbons with carbon range primarily 8 to 10, mainly aromatics and olefins, with some paraffins.</p>
Method/Guideline:	OECD Guideline 203
Year (guideline):	1992
Type (test type):	Fish Acute Toxicity Test
GLP (Y/N):	Yes
Year (study performed):	2003
Species:	<i>Oncorhynchus mykiss</i>
Analytical Monitoring:	Yes
Exposure Period:	96 hours
Statistical Method:	<p>The 6 hour, 24 hour, 48 hour and 72 hour LL₅₀ and LC₅₀ values were determined using a Binomial Method (Stephan, 1977), a Trimmed Spearman-Kärber Method (Hamilton et al., 1977). was used to determine the 96 hour LL₅₀ and LC₅₀ values.</p> <p>Stephan, C. E., Methods for Calculating an LC₅₀, <i>Aquatic Toxicology and Hazard Evaluation, ASTM STP 634</i>, F. L. Mayer and J. L. Hamelink, Eds., American Society for Testing and Materials, 1977, pp. 65-84.</p> <p>Hamilton, M., R. Russo, R. Thurston, 1977. Trimmed Spearman-Kärber Method for Estimating Median Lethal Concentrations in Toxicity Bioassays. <i>Environmental Science and Technology</i>, Vol. 11, No. 7, p.714-719.</p>
Test Conditions: <ul style="list-style-type: none"> • Note: Concentration preparation, vessel type, volume, replication, environmental conditions, organisms supplier, loading, deviations from guideline or protocol. 	<p>Individual Water Accommodated Fractions (WAF's) were prepared for each treatment. The test substance was added to 19 L of reconstituted water in glass aspirator bottles (capacity 22 L). The solutions were mixed for 24 hours using a 3% vortex (of the static liquid depth). The test solutions were removed through the outlet at the bottom of each mixing vessel into three replicates of 4.5 L in 4 L size aspirator bottles (no headspace). Four fish were added to each replicate and the replicates sealed. Daily renewals were performed by removing ~90% of the test solution through the outlet at the bottom of the aspirator bottle and refilling with fresh solution. The fish were received from Thomas Fish Company, Anderson, CA. The fish were not fed during the study. They were held for 13 days in study dilution water prior to use and were 36 days old at the start of the study. Fish mean weight = 0.226 g, mean total length = 3.4 cm, test loading = 0.201 g of fish/L.</p> <p>Mean test temperature: 13.6°C (S.D. = 0.2), diurnal light: approximately 16 hours light and 8 hours dark with 627 to 635 Lux during full daylight periods.</p>

	<p>Dissolved oxygen ranged from 6.6 to 8.7 mg/L and pH ranged from 7.2 to 8.1 during the study. Water hardness was 104 mg/L as CaCO₃.</p> <p>Due to the complex nature and limited water solubility of the test substance, the following exceptions to the guideline apply for this study: The concentration of the test substance in solution was not determined prior to use. It was deemed more appropriate to prepare individual treatment solutions by adding the test substance to dilution water and removing the WAF of each mixture for testing than to prepare dilutions of a stock solution.</p>																																															
<p>Results: Units/Value: Note: Analytical method, biological observations, control survival.</p>	<p>The maximum actual loading rate causing no mortality after 96-hours was 2.1 mg/L. The maximum measured concentration causing no mortality after 96-hours was 1.8 mg/L. The minimum actual loading rate causing 100% mortality after 96-hours was 10 mg/L. The minimum measured concentration causing 100% mortality after 96-hours was 9.8 mg/L.</p> <p>Lethal Loading (LL₅₀) / Lethal Concentration (LC₅₀) Values (mg/L)</p> <table> <thead> <tr> <th></th> <th>LL₅₀</th> <th>LC₅₀</th> </tr> </thead> <tbody> <tr> <td>3 hours</td> <td>>10*</td> <td>>9.8*</td> </tr> <tr> <td>6 - 72 hours</td> <td>6.7 (4.5-10†)</td> <td>6.6 (4.4-9.8†)</td> </tr> <tr> <td>96 hours</td> <td>6.3 (5.5-7.1‡)</td> <td>6.1 (5.3-7.0‡)</td> </tr> </tbody> </table> <p>* Not a calculated value, 42% mortality was observed in the highest loading rate/concentration tested. Values in parentheses are 95% confidence intervals unless otherwise noted. † 99% confidence interval ‡ 95% confidence interval</p> <p>The method of analysis was automated static headspace gas chromatography with flame ionization detection (HS GC-FID).</p> <p>Summary of In-Life observations - % Mortality</p> <table> <thead> <tr> <th>Loading Rate (mg/L)</th> <th>Control</th> <th>0.43</th> <th>0.92</th> <th>2.1</th> <th>4.5</th> <th>10</th> </tr> </thead> <tbody> <tr> <td>Meas. Conc. (mg/L)</td> <td>0</td> <td>0.41</td> <td>0.84</td> <td>1.8</td> <td>4.4</td> <td>9.8</td> </tr> <tr> <td>3 hours</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>42</td> </tr> <tr> <td>6 - 72 hours</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>100</td> </tr> <tr> <td>96 hours</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>8</td> <td>100</td> </tr> </tbody> </table>		LL ₅₀	LC ₅₀	3 hours	>10*	>9.8*	6 - 72 hours	6.7 (4.5-10†)	6.6 (4.4-9.8†)	96 hours	6.3 (5.5-7.1‡)	6.1 (5.3-7.0‡)	Loading Rate (mg/L)	Control	0.43	0.92	2.1	4.5	10	Meas. Conc. (mg/L)	0	0.41	0.84	1.8	4.4	9.8	3 hours	0	0	0	0	0	42	6 - 72 hours	0	0	0	0	0	100	96 hours	0	0	0	0	8	100
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Conclusion:	After <i>Oncorhynchus mykiss</i> were exposed to WAFs prepared from Low Dicyclopentadiene Resin Oil for 96-hours, the LL ₅₀ was 6.3 mg/L and the LC ₅₀ was 6.1 mg/L.																																															
Reliability:	1-Reliable without restrictions.																																															
Reference:	ExxonMobil Biomedical Sciences, Inc. 2003. FISH, ACUTE TOXICITY TEST on LOW DICYCLOPENTADIENE RESIN OIL. Study # 163058																																															
Other (source):	Olefins Panel, American Chemistry Council																																															

Robust Summary: Resin Oils and Cyclodiene Dimer Concentrates Category

Alga Toxicity

Test Substance:	<p><u>Low Dicyclopentadiene Resin Oil</u> (Low DCPD Resin Oil) CAS No. 68477-54-3. Distillates, petroleum, steam-cracked, C8-12 fraction. This stream can also be described by CAS No. 68516-20-1. Naphtha, petroleum, steam-cracked middle arom.</p> <p>Low DCPD Resin Oil is a C8 to C10 distillate obtained from a pyrolysis gasoline stream produced by an ethylene production process (steam cracking process). The sample tested consisted of vinyltoluenes (17%), trimethylbenzenes (9%), styrene and methylstyrenes (3%), indene (14%), methylindene (8%), and naphthalene (1%). The balance of the composition is expected to consist of other hydrocarbons with carbon range primarily 8 to 10, mainly aromatics and olefins, with some paraffins.</p>
Method/Guideline:	OECD Guideline 201
Year (guideline):	1984
Type (test type):	Alga Toxicity Test
GLP (Y/N):	Yes
Year (study performed):	2003
Species:	<i>Pseudokirchneriella subcapitata</i>
Analytical Monitoring:	Yes
Exposure Period:	96 hours
Statistical Method:	<p>The E_bC_{50}, E_rC_{50} and confidence intervals for inhibition of growth/growth rate slope were determined based on the linear regression Snedecor and Cochran (1989). Confidence intervals for the E_bC_{50} were calculated using the inverse interpolation equations from section 9.12 of Snedecor and Cochran (1989). Calculations were based on the PROC REGRESSION procedure and standard data manipulation methods in SAS (2002). The NOEC for the E_bC_{50} and E_rC_{50} was based on Duncan's (1975) Multiple Range test and Dunnett's (1964) test, determined from the GLM procedure of SAS (2002). The Shapiro-Wilk (1965) test for normality was used to test if the assumption of normality of the residuals was met; since the residuals were normally distributed the NOEC was based on the estimated values.</p> <p>Snedecor, G.W. and W.G. Cochran 1989, <i>Statistical Methods</i>, 8th Edition. Iowa State University Press / Ames.</p> <p>SAS Version 8, SAS Institute, Inc., Cary, NC. 2002.</p> <p>Duncan, D.B. 1975, "t-Tests and Intervals for Comparisons Suggested by the Data", <i>Biometrics</i>, 31, 339-359.</p> <p>Dunnett, C. 1964, "New Tables for Multiple Comparisons With A Control", <i>Biometrics</i>, Vol 20, No. 3, pg 482-491.</p> <p>Shapiro, S.S. and Wilk, M.B. 1965, "n analysis of variance test for normality (complete samples)" <i>Biometrika</i>, 52, pg 591-611.</p>

<p>Test Conditions:</p> <ul style="list-style-type: none"> Note: Concentration preparation, vessel type, volume, replication, environmental conditions, organisms supplier, loading, deviations from guideline or protocol. 	<p>Individual Water Accommodated Fractions (WAF's) were prepared for each treatment. The test substance was added to 4.3 L of algal nutrient medium augmented with sodium bicarbonate in glass aspirator bottles (capacity 4.5 L). The solutions were mixed for approximately 24 hours using a 9% vortex (of the static liquid depth). The test solutions were removed through the outlet at the bottom of each mixing vessel into 12 replicates of 140 mL in 125 mL Erlenmeyer flasks (no headspace) containing two 14 mm glass spheres to facilitate mixing. The test chambers were inoculated with algae (1.0×10^4 cells/mL) and were sealed with ground glass stoppers. Three replicates were sacrificed daily for cell density determination. The test chambers were placed on shaker tables (100 rpm) to keep the algae in suspension. The test was performed under static conditions with no aeration. The algae was cultured in-house from 5 day old stock cultures in log phase growth.</p> <p>Mean test temperature: 24.4°C (sd = 0.1). Continuous light: intensity was 8657 to 8813 Lux. The pH ranged from 7.5 to 7.6 in the test solutions at test initiation and ranged from 8.2 to 10.2 at test termination.</p> <p>Due to the complex nature and limited water solubility of the test substance, the following exceptions to the guideline apply for this study: The concentration of the test substance in solution was not determined prior to use. Test substance analysis was performed on samples of the WAFs at the start of the test (day 0) and at termination (day 4). The initial concentration of the test substance was not maintained at 80% in the three lower loading rates throughout the test (this may be due to biological activity or physical processes in the test chambers). It was appropriate to prepare individual treatment solutions by adding the test substance to dilution water and removing the WAF of each mixture for testing than to prepare dilutions of a stock solution. The test duration was 96 hours, instead of 72 hours. However, both 72 and 96-hour endpoints were determined.</p> <p>None of the above exceptions are believed to have affected the outcome, integrity, or quality of the study.</p>
<p>Results:</p> <p>Units/Value:</p> <p>Note: Analytical method, biological observations, control survival.</p>	<p>Effects on growth rate (r) based upon actual loading rates: 72 and 96 hr ErL50 = 1.5 mg/L (<0.23* - >7.3* mg/L) 72 hr NOELR = 0.46 mg/L 96 hr NOELR = 1.1 mg/L</p> <p>Effects on biomass (b) based upon actual loading rates: 72 hr EbL50 = 2.1 mg/L (<0.23* - >7.3* mg/L) 96 hr EbL50 = 1.9 mg/L (<0.23* - >7.3* mg/L) 72 hr NOELR = 0.23 mg/L 96 hr NOELR = <0.23 mg/L</p> <p>Effects on growth rate (r) based upon measured concentrations: 72 hr ErC50 = 1.4 mg/L (0.27 - >7.4* mg/L) 96 hr ErC50 = 1.4 mg/L (<0.27* - >7.4* mg/L) 72 hr NOEC = 0.37 mg/L 96 hr NOEC = 0.94 mg/L</p> <p>Effects on biomass (b) based upon measured concentrations: 72 hr EbC50 = 2.0 mg/L (<0.27* - >7.4* mg/L) 96 hr EbC50 = 1.9 mg/L (<0.27* - >7.4* mg/L) 72 hr NOEC = 0.27 mg/L 96 hr NOEC = <0.27 mg/L</p> <p>Values in parentheses are 95% confidence intervals. * Confidence interval exceeded the highest or lowest loading rate or concentration tested.</p>

	<p>The analytical method used was static headspace gas chromatography with flame ionization detection.</p> <p style="text-align: center;">Summary of In-Life observations - % Inhibition</p> <table border="1"> <tr> <td>Loading Rate (mg/L)</td> <td>Control</td> <td>0.23</td> <td>0.46</td> <td>1.1</td> <td>2.7</td> <td>7.3</td> </tr> <tr> <td>Meas. Conc. (mg/L)</td> <td>0</td> <td>0.27</td> <td>0.37</td> <td>0.94</td> <td>2.7</td> <td>7.4</td> </tr> </table> <p>Based on Growth Rate</p> <table border="1"> <tr> <td>72 hours</td> <td>n/a</td> <td>3.5</td> <td>4.3</td> <td>5.6</td> <td>85</td> <td>100</td> </tr> <tr> <td>96 hours</td> <td>n/a</td> <td>2.7</td> <td>2.0</td> <td>2.8</td> <td>93</td> <td>100</td> </tr> </table> <p>Based on Biomass</p> <table border="1"> <tr> <td>72 hours</td> <td>n/a</td> <td>8.9</td> <td>18</td> <td>23</td> <td>95</td> <td>98</td> </tr> <tr> <td>96 hours</td> <td>n/a</td> <td>9.2</td> <td>15</td> <td>19</td> <td>98</td> <td>100</td> </tr> </table>	Loading Rate (mg/L)	Control	0.23	0.46	1.1	2.7	7.3	Meas. Conc. (mg/L)	0	0.27	0.37	0.94	2.7	7.4	72 hours	n/a	3.5	4.3	5.6	85	100	96 hours	n/a	2.7	2.0	2.8	93	100	72 hours	n/a	8.9	18	23	95	98	96 hours	n/a	9.2	15	19	98	100
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