



## CHEMICAL UPDATE WORKSHEET

<b>Chemical Name:</b>	<b>Aldrin</b>
<b>CAS #:</b>	<b>309-00-2</b>
<b>Revised By:</b>	RRD Toxicology Unit
<b>Revision Date:</b>	September 9, 2015

### (A) Chemical-Physical Properties

	Part 201 Value	Updated Value	Reference Source	Comments
<b>Molecular Weight (g/mol)</b>	364.9	364.92	EPI	EXP
<b>Physical State at ambient temp</b>	Solid	Solid	MDEQ	
<b>Melting Point (°C)</b>	377	104.00	EPI	EXP
<b>Boiling Point (°C)</b>	145	NA	NA	
<b>Solubility (ug/L)</b>	180	1.7E+01	EPI	EXP
<b>Vapor Pressure (mmHg at 25°C)</b>	0.00001672	1.20E-04	EPI	EXP
<b>HLC (atm-m<sup>3</sup>/mol at 25°C)</b>	1.70E-4	4.40E-05	EPI	EXP
<b>Log Kow (log P; octanol-water)</b>	6.5	6.50	EPI	EXP
<b>Koc (organic carbon; L/Kg)</b>	2.45E+6	8.202E+04	EPI	EST
<b>Ionizing Koc (L/kg)</b>		NR	NA	NA
<b>Diffusivity in Air (Di; cm<sup>2</sup>/s)</b>	0.0132	2.28E-02	W9	EST
<b>Diffusivity in Water (Dw; cm<sup>2</sup>/s)</b>	4.86E-6	5.8402E-06	W9	EST
<b>Soil Water Partition Coefficient (Kd; inorganics)</b>	NR	NR	NA	NA

	Part 201 Value	Updated Value	Reference Source	Comments
Flash Point (°C)	NA	NA	NA	NA
Lower Explosivity Level (LEL; unit less)	NA	NA	NA	NA
Critical Temperature (K)		8.39E+02	EPA2004	EXP
Enthalpy of Vaporization (cal/mol)		1.50E+04	EPA2004	EST
Density (g/mL, g/cm <sup>3</sup> )		1.6	PC	EXP
EMSOFT Flux Residential 2 m (mg/day/cm <sup>2</sup> )	7.11E-08	5.50E-07	EMSOFT	EST
EMSOFT Flux Residential 5 m (mg/day/cm <sup>2</sup> )	7.11E-08	5.50E-07	EMSOFT	EST
EMSOFT Flux Nonresidential 2 m (mg/day/cm <sup>2</sup> )	8.32E-08	6.93E-07	EMSOFT	EST
EMSOFT Flux Nonresidential 5 m (mg/day/cm <sup>2</sup> )	8.32E-08	6.93E-07	EMSOFT	EST

**(B) Toxicity Values/Benchmarks**

	Part 201 Value	Updated Value	Source*/Reference /Date	Comments/Notes /Issues
<b>Reference Dose (RfD) (mg/kg/day)</b>	2.5E-5	3.0E-5	ATSDR, 2002	
<b>RfD details</b>	Rat 2-year feeding study (Fitzhugh et al., 1964); NOAEL=None LOAEL=0.5 ppm diet adjusted to 0.025 mg/kd/day (assumed rats food consumption 1ppm=0.05 mg/kg/day; Critical effect = liver toxicity.	<p><b>Basis:</b> ATSDR (9/2002) chronic MRL = 0.00003 (or 3.0E-5) mg/kg-day for hepatic effect. The ATSDR value was selected over the PPRTV value since the Fitzhugh et al. study is a longer term study and a larger number of animals were used. ATSDR is more recent than IRIS.</p> <p><b>Critical Study:</b> Fitzhugh OG, Nelson AA, Quaife ML. 1964. Chronic oral toxicity of aldrin and dieldrin in rats and dogs. Food Cosmet Toxicol 2:551-562.</p> <p><b>Method(s):</b> Weanling Osborne-Mendel strain rats (24/dose, evenly divided by sex) were exposed to aldrin (recrystallized, #99% purity) in the diet at concentrations of 0, 0.5, 2, 10, 50, 100, or 150 ppm for 2 years.</p> <p><b>Critical effect:</b> enlarged hepatocyte, increased cytoplasmic eosinophilia with peripheral migration of basophilic granules, and possible increases in vacuolation and bile duct proliferation</p> <p><b>End point or Point of Departure (POD):</b> LOAEL = 0.5 ppm (0.025 mg/kg-day)</p> <p><b>Uncertainty Factors:</b> UF = 1,000 (10 each for intraspecies variability, interspecies extrapolation and use of a LOAEL)</p> <p><b>Source and date:</b> ATSDR, 9/2002</p> <p><b>Tier 1 and 2 Sources:</b></p> <p><b>IRIS:</b> Per IRIS (3/01/1988), RfD = 3.0E-5 mg/kg-day based on hepatotoxicity.</p> <p><b>Critical Study:</b> Fitzhugh, O.G., A.A. Nelson, and M.L. Quaife. 1964. Chronic oral toxicity of aldrin and dieldrin in rats and dogs. Food Cosmet. Toxicol. 2: 551-562.</p> <p><b>Method(s):</b> Male and female Osborne Mendel rats or mongrel dogs were exposed orally for two years. The dogs were orally exposed 6 days/week, but the method is unclear. Rats (12/dose/sex) were exposed daily via diet.</p> <p><b>Critical effect:</b> hepatotoxicity in rats.</p> <p><b>End point or Point of Departure (POD):</b> LOAEL = 0.025 mg/kg/day (converted from 0.5 ppm assuming 1 ppm = 0.05 mg/kg/day food consumption rate)</p> <p><b>Uncertainty Factors:</b> UF = 1,000; (10-fold each for extrapolation from animals to humans, the uncertainty in the range of human sensitivities, and an additional</p>	Complete	

	Part 201 Value	Updated Value	Source*/Reference /Date	Comments/Notes /Issues
		<p>uncertainty because the RfD is based on a LOAEL rather than a NOAEL)  <b>Source and date:</b> IRIS; 3/01/1988. IRIS conducted a literature review in 2002 and did not identify any critical new studies.</p> <p><b>PPRTV:</b> PPRTV (3/14/2005) refers to the IRIS RfD. A sub chronic pRfD = 4.0E-5 mg/kg-day is derived: The LOAEL of 0.043 mg/kg-day for renal lesions in the 16-month toxicity study in beagles (Treon and Cleveland, 1955) can serve as the basis for the sub chronic RfD for aldrin. Since developmental studies indicate that fetal effects of aldrin occur at maternally-toxic doses, an RfD based on this LOAEL should be protective against fetal effects (U.S. EPA, 2003b).</p> <p><b>Critical Study:</b> Treon, J.F. and F.P. Cleveland. 1955. Toxicity of certain chlorinated hydrocarbon insecticides for laboratory animals, with special reference to aldrin and dieldrin. Agric. Food Chem. 3: 402-408.</p> <p><b>Method(s):</b> Groups of beagle dogs (2-3 male and 2 female) were exposed to 1, 3, 10, 25 or 50 ppm aldrin (95% purity) in diets for 5 or 6 days per week for up to 15.6 months.</p> <p><b>Critical effect:</b> renal lesions</p> <p><b>End point or Point of Departure (POD):</b> LOAEL = 0.043 mg/kg-day</p> <p><b>Uncertainty Factors:</b> UF = 1,000 (10 to extrapolate from dogs to humans, 10 to protect sensitive individuals and 10 for the use of a LOAEL)</p> <p><b>Source and date:</b> PPRTV, 2005</p> <p><b>ATSDR:</b> ATSDR (9/2002) also derived an acute MRL = 0.002 (or 2.0E-3) mg/kg-day for hepatic effect.</p> <p><b>Critical Study:</b> Al-Hachim GM. 1971. Effect of aldrin on the condition avoidance response and electroshock seizure threshold of offspring from aldrin-treated mother. Psychopharmacologia 21:370-373.</p> <p><b>Method(s):</b> Pregnant albino mice (7/group) were exposed to 0, 2, or 4 mg/kg by gavage during the third trimester of pregnancy for 5-7 days. The 0 mg/kg/day group received only corn oil. Litters were weaned at 30 days of age. Three groups of 10 offspring were randomly selected from each group of maternal animals and were subsequently tested for effects of prenatal exposure to aldrin.</p>		

	Part 201 Value	Updated Value	Source*/Reference /Date	Comments/Notes /Issues
		<p><b>Critical effect:</b> decreased body weight and electroconvulsive shock threshold in offspring</p> <p><b>End point or Point of Departure (POD):</b> LOAEL = 2 mg/kg-day</p> <p><b>Uncertainty Factors:</b> UF = 1,000 (10 each for intraspecies variability, interspecies extrapolation and use of a LOAEL)</p> <p><b>Tier 3 Source:</b></p> <p><b>MDEQ:</b> Per DEQ-CCD, IRIS value is modified to 2.5E-3 mg/kg/day to report in two significant figures.</p>		
<b>Oral Cancer Slope Factor (CSF) (mg/kg-day)<sup>-1</sup></b>	8.7E+0	1.7E+1	IRIS, 1993	
<b>CSF details</b>	<p>SF is the geometric mean of three in-feed bioassays: male mice (Davis, 1965), female mice (Davis, 1965), and male mice (NCI, 1978). Tumor type = liver carcinoma. IRIS SF updated with revised species scaling factor: (70/.03) rose to the 0.25 power.</p>	<p><b>Tier 1 Sources:</b></p> <p><b>Basis:</b> IRIS (7/01/1993) CSF = 1.7E+1 (mg/kg-day)<sup>-1</sup> IRIS is a Tier 1 source.</p> <p><b>Critical Studies:</b></p> <p>1) Davis, K.J. 1965. Pathology report on mice fed dieldrin, aldrin, heptachlor, or heptachlor epoxide for two years. Internal FDA memorandum to Dr. A.J. Lehrman, July 19.</p> <p>2) NCI (National Cancer Institute). 1978. Bioassays of aldrin and dieldrin for possible carcinogenicity. DHEW Publication No. (NIH) 78-821. NCI Carcinogenesis Tech. Rep. Ser. No. 21. NCI-C6-TR-21.</p> <p><b>Method(s):</b></p> <p>1) <i>Dose response data:</i> Tumor Type - liver carcinoma; <i>Test Species</i> - C3H mouse and B6C3F1 mouse; <i>Route</i> - diet</p> <p>2) <i>Extrapolation method:</i> Linearized multistage procedure, extra risk</p> <p><b>Carcinogen Weight-of-Evidence (WOE) Class:</b> B2; probable human carcinogen</p> <p><b>IRIS WOE Basis:</b> Increases in tumor responses in three different strains of mice in both males and females. Tumor induction has been observed for structurally related chemicals, including dieldrin, a metabolite.</p> <p><b>Source and Date:</b> IRIS; Last revision date - 7/01/1993. . An IRIS literature review in September 2002 identified one or more significant new studies.</p>		Complete

	Part 201 Value	Updated Value	Source*/Reference /Date	Comments/Notes /Issues
		<p><b>Tier 2 Sources:</b>  <b>PPRTV:</b> PPRTV (3/14/2005) refers to the IRIS value.  <b>MRL:</b> NA; MRLs are for non-cancer effects only.</p> <p><b>Tier 3 Source:</b>  <b>MDEQ:</b> MDEQ/WRD derived a CSF = 4.7E+0 (mg/kg-day)<sup>-1</sup>  <b>Critical Studies:</b> (Davis et al., 1965; NCI, 1978).                      1) Davis, K.J. 1965. Pathology report on mice fed dieldrin, aldrin, heptachlor, or heptachlor epoxide for two years. Internal FDA memorandum to Dr. A.J. Lehrman, July 19.                      2) NCI (National Cancer Institute). 1978. Bioassays of aldrin and dieldrin for possible carcinogenicity. DHEW Publication No. (NIH) 78-821. NCI Carcinogenesis Tech. Rep. Ser. No. 21. NCI-C6-TR-21.  <b>Method(s):</b>                      1) <i>Dose response data:</i> Tumor Type - liver carcinoma; Test Species - C3H mouse and B6C3F1 mouse; Route - diet                      2) <i>Extrapolation method:</i> Linearized multistage procedure, extra risk  <b>Note: SWQD did a more thorough and recent evaluation of the cancer data in 2000 even though they did not appear to adjust for species scaling.</b></p>		
<p><b>Reference Concentration (RfC) or Initial Threshold Screening Level (ITSL) (µg/m³)</b></p>	<p>--</p>	<p>NA</p>	<p>MDEQ, 2015</p>	
<p><b>RfC/ITSL details</b></p>	<p>NA</p>	<p><b>Tier 1 and 2 Sources:</b>  <b>IRIS:</b> Per IRIS (7/01/1993), no value at this time.  <b>PPRTV:</b> Per PPRTV (3/14/2005), no value at this time.  <b>MRL:</b> Per ATSDR (07/2013), no value at this time.</p> <p><b>Tier 3 Source:</b>  <b>MDEQ:</b> Per DEQ-CCD, no value at this time.</p>		<p>Complete.</p>

	Part 201 Value	Updated Value	Source*/Reference /Date	Comments/Notes /Issues
<b>Inhalation Unit Risk Factor (IURF) ((<math>\mu\text{g}/\text{m}^3</math>)<sup>-1</sup>)</b>	4.9E-3	4.9E-3	IRIS, 1993	
<b>IURF details</b>	Based on geometric mean of potency for liver carcinomas found in mouse studies by Davis 1965 and NCI 1978, as reported in IRIS. CCD/AQD date: 10/15/1992.	<p><b>Tier 1 Source:</b>  <b>Basis:</b> IRIS (7/01/1993) IURF = 4.9E-3 (<math>\mu\text{g}/\text{kg}\cdot\text{day}</math>)<sup>-1</sup> IRIS is the only available value.  <b>Critical Study (ies):</b> Davis et al. and 1965; NCI, 1978. (Refer to Updated Value RfD details)  <b>Method(s):</b>            3) <i>Dose response data:</i> oral mouse data. (Refer to RfD details)            4) <i>Extrapolation method:</i> Linearized multistage procedure, extra risk  <b>Carcinogen Weight-of-Evidence (WOE) Class and WOE Basis:</b> Refer to Updated Value RfD details.  <b>Source and Date:</b> IRIS; Last revision date - 7/01/1993. An IRIS literature review in 2002 identified one or more significant new studies</p> <p><b>Tier 2 Sources:</b>  <b>PPRTV:</b> PPRTV (3/14/2005) refers to the IRIS value.  <b>MRL:</b> NA; MRLs are for non-cancer effects only.</p> <p><b>Tier 3 Source:</b>  <b>MDEQ:</b> Per DEQ-CCD, AQD adopted the IRIS IURF.</p>		Complete
<b>Mutagenic Mode of Action (MMOA)? (Y/N)</b>	--	NO	USEPA, 2015	
<b>MMOA Details</b>	--	NA Not listed as a carcinogen with mutagenic MOA in the USEPA OSWER List.		
<b>Developmental or Reproductive Effector? (Y/N)</b>	No	No, the RfD is not based on a reproductive-developmental effect.	MDEQ, 2014	
<b>Developmental or Reproductive Toxicity Details</b>	NA	NA		
<b>State Drinking Water Standard</b>	--	NO	SDWA, 1976	

	Part 201 Value	Updated Value	Source*/Reference /Date	Comments/Notes /Issues
(SDWS) (ug/L)				
<b>SDWS details</b>	NA	MI Safe Drinking Water Act (SDWA) 1976 PA 399		
<b>Secondary Maximum Contaminant Level (SMCL) (ug/L)</b>	--	NO	SDWA, 1976 and USEPA SMCL List	
<b>SMCL details</b>	NA	MI Safe Drinking Water Act (SDWA) 1976 PA 399 and USEPA SMCL List, 2015		
<b>Aesthetic value (ug/L)</b>	--	NA	NA	
<b>Aesthetic value details</b>	NA	NA		
<b>Is there an aesthetic value for drinking water? (Y/N)</b>	NO	Not evaluated.	NA	
<b>Aesthetic Value details</b>	NA	NA		
<b>Phytotoxicity Value? (Y/N)</b>	NO	Not evaluated.	NA	
<b>Phytotoxicity details</b>	NA	NA	NA	
<b>Others</b>				

**(C) Chemical-specific Absorption Factors**

	Part 201 Value	Update	Source/Reference/ Dates	Comments/Notes /Issues
Gastrointestinal absorption efficiency value (ABS <sub>gi</sub> )	---	1.0	MDEQ, 2015/USEPA RAGS-E, 2004	
ABS <sub>gi</sub> details		RAGS E (EPA, 2004) Default Value		
Skin absorption efficiency value (AE <sub>d</sub> )	---	0.1	MDEQ, 2015	
AE <sub>d</sub> details				
Ingestion Absorption Efficiency (AE <sub>i</sub> )		0.5	MDEQ, 2015	
AE <sub>i</sub> Details				
Relative Source Contribution for Water (RSC <sub>w</sub> )		0.2	MDEQ, 2015	
Relative Source Contribution for Soil (RSC <sub>s</sub> )		1.0	MDEQ, 2015	
Relative Source Contribution for Air (RSC <sub>A</sub> )		1.0	MDEQ, 2015	
Others				

**(D) Rule 57 Water Quality Values and GSI Criteria**

<b>Current GSI value (µg/L)</b>	0.01 (M); 8.7E-6
<b>Updated GSI value (µg/L)</b>	0.01 (M,X); 8.7E-6
<b>Rule 57 Drinking Water Value (µg/L)</b>	0.01 (M,X); 8.7E-6

	<b>Rule 57 Value (µg/L)</b>	<b>Verification Date</b>
<b>Human Non-cancer Values- Drinking water source (HNV-drink)</b>	0.00012	11/2000
<b>Human Non-Cancer Values- Non-drinking water sources (HNV-Non-drink)</b>	0.00012	11/2000
<b>Wildlife Value (WV)</b>	NA	NA
<b>Human Cancer Values for Drinking Water Source (HCV-drink)</b>	0.0000087	11/2000
<b>Human Cancer values for non-drinking water source (HCV-Non-drink)</b>	0.0000087	11/2000
<b>Final Chronic Value (FCV)</b>	0.017	11/2000
<b>Aquatic maximum value (AMV)</b>	0.15	11/2000
<b>Final Acute Value (FAV)</b>	0.3	11/2000

Sources:

1. MDEQ Surface Water Assessment Section Rule 57 [website](#)
2. MDEQ Rule 57 [table](#)

**(E) Target Detection Limits (TDL)**

	<b>Value</b>	<b>Source</b>
<b>Target Detection Limit – Soil (<math>\mu\text{g}/\text{kg}</math>)</b>	20	MDEQ, 2015
<b>Target Detection Limit – Water (<math>\mu\text{g}/\text{L}</math>)</b>	0.01	MDEQ, 2015
<b>Target Detection Limit – Air (ppbv)</b>	3.50E-04	MDEQ, 2015
<b>Target Detection Limit – Soil Gas (ppbv)</b>	1.20E-02	MDEQ, 2015

**CHEMICAL UPDATE WORKSHEET ABBREVIATIONS:**

CAS # - Chemical Abstract Service Number.

**Section (A) Chemical-Physical Properties****Reference Source(s):**

CRC	Chemical Rubber Company Handbook of Chemistry and Physics, 95th edition, 2014-2015
EMSOFT	USEPA Exposure Model for Soil-Organic Fate and Transport (EMSOFT) (EPA, 2002)
EPA2001	USEPA (2001) Fact Sheet, Correcting the Henry's Law Constant for Soil Temperature. Office of Solid Waste and Emergency Response, Washington, D.C.
EPA4	USEPA (2004) User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings. February 22, 2004.
EPI	USEPA's Estimation Programs Interface SUITE 4.1, Copyright 2000-2012
HSDB	Hazardous Substances Data Bank
MDEQ	Michigan Department of Environmental Quality
NPG	National Institute for Occupational Safety and Health Pocket Guide to Chemical Hazards
PC	National Center for Biotechnology Information's PubChem database
PP	Syracuse Research Corporation's PhysProp database
SCDM	USEPA's Superfund Chemical Data Matrix
SSG	USEPA's Soil Screening Guidance: Technical Background Document, Second Edition, 1996
USEPA/EPA	United States environmental protection agency's Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). July, 2004.

W9 USEPA's User Guide for Water9 Software, Version 2.0.0, 2001

**Basis/Comments:**

EST	estimated
EXP	experimental
EXT	extrapolated
NA	not available or not applicable
NR	not relevant

**Section (B) Toxicity Values/Benchmarks****Sources/References:**

ATSDR	Agency for Toxic Substances and Disease Registry
CALEPA	California Environmental Protection Agency
CAL DTSC	California Department of Toxic Substances Control
CAL OEHHA	CAEPA Office of Environmental Health Hazard Assessment
CCD	MDEQ Chemical Criteria Database
ECHA	European Chemicals Agency (REACH)
OECD HPV	Organization for Economic Cooperation and Development HPV Database
HEAST	USEPA's Health Effects Assessment Summary Tables
IRIS	USEPA's Integrated Risk Information System
MADEP	Massachusetts Department of Environmental Protection
MDEQ/DEQ	Michigan Department of Environmental Quality
DEQ-CCD/AQD	MDEQ Air Quality Division
DEQ-CCD/RRD	MDEQ Remediation and Redevelopment Division
DEQ-CCD/WRD	MDEQ Water Resources Division
MNDOH	Minnesota Department of Health

NJDEP	New Jersey Department of Environmental Protection
NYDEC	New York State Department of Environmental Conservation
OPP/OPPT	USEPA's Office of Pesticide Programs
PPRTV	USEPA's Provisional Peer Reviewed Toxicity Values
RIVM	The Netherlands National Institute of Public Health and the Environment
TCEQ	Texas Commission on Environmental Quality
USEPA	United States Environmental Protection Agency
USEPA OSWER	USEPA Office of Solid Waste and Emergency Response
USEPA MCL	USEPA Maximum Contaminant Level
WHO	World Health Organization
WHO IPCS	International Programme on Chemical Safety (IPCS/INCHEM)
WHO IARC	International Agency for Research on Cancers
NA	Not Available.
NR	Not Relevant.

**Toxicity terms:**

BMC	Benchmark concentration
BMCL	Lower bound confidence limit on the BMC
BMD	benchmark dose
BMDL	Lower bound confidence limit on the BMD
CSF	Cancer slope Factor
CNS	Central nervous system
IURF or IUR	Inhalation unit risk factor
LOAEL	Lowest observed adverse effect level
LOEL	Lowest observed effect level
MRL	Minimal risk level (ATSDR)
NOAEL	No observed adverse effect level
NOEL	No observed effect level

RfC	Reference concentration
RfD	Reference dose
p-RfD	Provisional RfD
aRfD	Acute RfD
UF	Uncertainty factor
WOE	Weight of evidence

**Section (C) Chemical-specific Absorption Factors**

MDEQ	Michigan Department of Environmental Quality
USEPA RAGS-E	United States Environmental Protection Agency's Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). July, 2004.

**Section (D) Rule 57 Water Quality Values and GSI Criteria**

GSI	Groundwater-surface water interface
NA	A value is not available or not applicable.
ID	Insufficient data to derive value
NLS	No literature search has been conducted