

Chemical	Acute Exposure (High Dose)	Chronic Exposure (Low Dose)	Cancer
<p><b>Glyphosate with surfactant (formulation)</b> (Roundup, Rodeo, Pondmaster) <b>Herbicide</b></p>	<p>When surfactant is mixed with glyphosate, it creates a synergistic effect (an effect that is caused by the interaction of two substances to produce a combined effect greater than the sum of their separate effects)<sup>1</sup>.</p>	<p>Endocrine disruption: testosterone can decrease by 35% (infertility for men is rising)<sup>6</sup>. Disrupts aromatase activity (synthesizes estrogen) especially on placental cells<sup>7</sup> (needed for pregnancy to maintain uterine health).</p>	<p>Probably Carcinogenic to humans (for both pure and formulations)<sup>12</sup></p>
<p>Ground and Aerial Spray</p>	<p><i>Ingestion:</i> Nausea, vomiting, abdominal pain, diarrhea, slight sedation, mouth and throat pain,<sup>2</sup> metabolic acidosis (too much acid in body fluids), tachycardia (abnormally rapid heart beat), renal failure (kidney failure), and electrolyte imbalances<sup>3</sup>.</p> <p><i>Inhalation:</i> Respiratory distress<sup>4</sup>.</p> <p><i>Dermal:</i> Skin burns, itching, erythema (reddening of the skin), piloerection (bristling of hairs/hairs standing up)<sup>5</sup>.</p>	<p>Causes DNA and chromosomal damage<sup>8</sup> (can create DNA mutations and lead to cancer).</p> <p>Exposed children living in areas close to spraying (500 m) suffered from chronic exposure had nose itching/bleeding, lacrimation (secretion of tears), eye and ear itching/burning, respiratory symptoms, skin itching<sup>9</sup>.</p> <p>Obesity, high blood pressure, acute kidney injury, diabetes, end stage renal (kidney) disease<sup>10</sup>.</p> <p>Ingesting contaminated drinking water causes kidney problems and reproductive difficulties<sup>11</sup>.</p>	<p>Breast cancer, non-Hodgkin lymphoma<sup>13</sup>, thyroid cancer, liver and bile duct cancer are linked with glyphosate formulations<sup>14</sup>.</p> <p>There is “limited” evidence of cancer in humans and “sufficient” evidence of cancer in experimental animals for both pure and formulations<sup>15</sup>.</p> <p>There is “strong” evidence for genotoxicity for both pure and formulations meaning that a property of a chemical has the ability to damage genetic information within a cell causing mutations. It doesn’t mean that all genotoxic substances lead to cancer, but it has the ability to<sup>16</sup>.</p>
<p><b>Glyphosate (pure) Herbicide</b></p>	<p>Glyphosate formulations such as Roundup are more toxic than pure glyphosate creating a synergistic effect. Pure glyphosate is to be considered low in toxicity<sup>17</sup>. Most herbicides used are the formulations of glyphosate.</p>		

- <sup>1</sup>"The Definition of Synergy." *Dictionary.com*. N.p., n.d. Web. <<http://www.dictionary.com/browse/synergy?s=t>>.
- <sup>2</sup>"Glyphosate." *TOXNET: Toxicology Data Network*. National Library of Medicine, 1986. Web. <<http://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs%2Bhsdb%3A%40term%2B%40DOCNO%2B3432>>.
- <sup>3</sup>Song HY, Kim YH, Seok SJ, Gil HW, Yang JO, Lee EY, Hong SY. **Cellular Toxicity of Surfactants Used as Herbicide Additives.** *J Korean Med Sci.* 2012 Jan;27(1):3-9. <http://dx.doi.org/10.3346/jkms.2012.27.1.3>
- <sup>4</sup>"Glyphosate." *TOXNET: Toxicology Data Network*. National Library of Medicine, 1986. Web. <<http://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs%2Bhsdb%3A%40term%2B%40DOCNO%2B3432>>.
- <sup>5</sup>"Glyphosate." *TOXNET: Toxicology Data Network*. National Library of Medicine, 1986. Web. <<http://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs%2Bhsdb%3A%40term%2B%40DOCNO%2B3432>>.
- <sup>6</sup>Clair, É, Mesnage, R, Travert, C, & Séralini, G 2012, 'A glyphosate-based herbicide induces necrosis and apoptosis in mature rat testicular cells in vitro, and testosterone decrease at lower levels', *Toxicology In Vitro*, 26, 2, pp. 269-279, Academic Search Premier, EBSCOhost, viewed 25 February 2016.
- <sup>7</sup>Richard, Sophie, et al. "Differential effects of glyphosate and roundup on human placental cells and aromatase." *Environmental health perspectives* (2005): 716-720.
- <sup>8</sup>"Biosafety Information Centre." *Biosafety Information Centre*. N.p., 31 Mar. 2015. Web. <<http://www.biosafety-info.net/article.php?aid=1145>>.
- <sup>9</sup>"Biosafety Information Centre." *Biosafety Information Centre*. N.p., 31 Mar. 2015. Web. <<http://www.biosafety-info.net/article.php?aid=1145>>.
- <sup>10</sup>"Glyphosate and Cancer." *Institute of Science in Society*. N.p., 26 Mar. 2014. Web. <[http://www.i-sis.org.uk/Glyphosate\\_and\\_Cancer.php](http://www.i-sis.org.uk/Glyphosate_and_Cancer.php)>.
- <sup>11</sup>"Table of Regulated Drinking Water Contaminants." *EPA*. Environmental Protection Agency, Feb. 2016. Web. <<https://www.epa.gov/your-drinking-water/table-regulated-drinking-water-contaminants#one>>.
- <sup>12</sup>"Q&A on Glyphosate." (2016): n. pag. *International Agency for Research on Cancer*. World Health Organization, 3 Mar. 2016. Web. <[https://www.iarc.fr/en/media-centre/iarcnews/pdf/Q&A\\_Glyphosate.pdf](https://www.iarc.fr/en/media-centre/iarcnews/pdf/Q&A_Glyphosate.pdf)>.
- <sup>13</sup>"Biosafety Information Centre." *Biosafety Information Centre*. N.p., 31 Mar. 2015. Web. <<http://www.biosafety-info.net/article.php?aid=1145>>.
- <sup>14</sup>"Glyphosate and Cancer." *Institute of Science in Society*. N.p., 26 Mar. 2014. Web. <[http://www.i-sis.org.uk/Glyphosate\\_and\\_Cancer.php](http://www.i-sis.org.uk/Glyphosate_and_Cancer.php)>.
- <sup>15</sup>"Q&A on Glyphosate." (2016): n. pag. *International Agency for Research on Cancer*. World Health Organization, 3 Mar. 2016. Web. <[https://www.iarc.fr/en/media-centre/iarcnews/pdf/Q&A\\_Glyphosate.pdf](https://www.iarc.fr/en/media-centre/iarcnews/pdf/Q&A_Glyphosate.pdf)>.
- <sup>16</sup>"Q&A on Glyphosate." (2016): n. pag. *International Agency for Research on Cancer*. World Health Organization, 3 Mar. 2016. Web. <[https://www.iarc.fr/en/media-centre/iarcnews/pdf/Q&A\\_Glyphosate.pdf](https://www.iarc.fr/en/media-centre/iarcnews/pdf/Q&A_Glyphosate.pdf)>.
- <sup>17</sup>Gasnier, Céline, et al. "Glyphosate-Based Herbicides Are Toxic And Endocrine Disruptors In Human Cell Lines." *Toxicology* 262.3 (2009): 184-191. *Academic Search Premier*. Web. 25 Feb. 2016.

Chemical	Acute Exposure (High Dose)	Chronic Exposure (Low Dose)	Cancer
<p data-bbox="163 175 323 240"><b>Atrazine (Herbicide)</b></p> <p data-bbox="121 266 365 500">Ground and Aerial Spray  (Not sprayed in Jetty Creek, but a very common herbicide applied in Oregon).</p>	<p data-bbox="443 175 989 240"><i>Ingestion:</i> Causes abdominal pain, diarrhea, vomiting<sup>18</sup>.</p> <p data-bbox="443 282 989 347"><i>Inhalation:</i> Irritation of mucous membrane, difficulty breathing.</p> <p data-bbox="443 386 989 451"><i>Dermal:</i> Causes rashes on skin. Causes eye irritation.</p> <p data-bbox="422 490 1010 587">After consuming high doses, <b>rats</b> were found to have slowed breathing, incoordination, muscle spasms, depression, and muscular weakness<sup>19</sup>.</p>	<p data-bbox="1045 175 1654 376">Reproductive effects: At risk of gestational diabetes mellitus (GDM), menstrual cycle changes<sup>20</sup>, decreased sperm counts of about 40% and reduced semen quality<sup>21</sup>, increased risk of miscarriage, low birth weight, and increased birth defects<sup>22</sup>.</p> <p data-bbox="1056 415 1644 480">Ingesting drinking water causes cardiovascular system or reproductive problems<sup>23</sup>.</p> <p data-bbox="1045 519 1654 786">Endocrine disruption- In <b>rats</b>, it can alter key hormones and delay puberty. In male <b>frogs</b> atrazine converts testosterone to estrogen (more than usual) using the enzyme aromatase (also found in humans) and causes feminization<sup>24</sup>. In humans, the increase of aromatase activity leads to increased estrogen production, which has the potential to cause breast cancer<sup>25</sup>.</p> <p data-bbox="1052 824 1648 922">Found to decrease dopamine levels in mice, so it could be considered to be contributory to cause Parkinson's disease in humans<sup>26</sup>.</p> <p data-bbox="1062 961 1638 1058">In <b>rats</b>, long-term exposure contributed to a development of insulin resistance and obesity especially when fats are high in diets<sup>27</sup>.</p>	<p data-bbox="1688 175 1999 513">Studies with human cell lines indicate an association between atrazine and certain cancers (stomach, prostate, ovarian, breast, non-Hodgkin's lymphoma<sup>28</sup>, and increased risk of thyroid cancer<sup>29</sup>).</p>

<sup>18</sup> "Atrazine." *Atrazine*. Cornell University, Sept. 1993. Web. <<http://pmep.cce.cornell.edu/profiles/extoxnet/24d-captan/atrazine-ext.html#1>>.

<sup>19</sup> "Atrazine." *Atrazine*. Cornell University, Sept. 1993. Web. <<http://pmep.cce.cornell.edu/profiles/extoxnet/24d-captan/atrazine-ext.html#1>>.

<sup>20</sup> Brusick, David J. "An Assessment of the Genetic Toxicity of Atrazine: Relevance to Human Health and Environmental Effects." *Mutation Research/Reviews in Genetic Toxicology* 317.2 (1994): 133-44. Minnesota Department of Health. Web. <<http://www.health.state.mn.us/divs/eh/risk/studies/atrazinaldoc.pdf>>.

<sup>21</sup> Swan, Shanna H. et al. "Semen Quality in Relation to Biomarkers of Pesticide Exposure". *Environmental Health Perspectives* 111.12 (2003): 1478-1484. Web.

<sup>22</sup> "Atrazine." *Pesticide Action Network*. N.p., n.d. Web. <<http://www.panna.org/resources/atrazine>>.

<sup>23</sup> "Table of Regulated Drinking Water Contaminants." *EPA*. Environmental Protection Agency, Feb. 2016. Web. <<https://www.epa.gov/your-drinking-water/table-regulated-drinking-water-contaminants#one>>.

<sup>24</sup> "Atrazine." *Pesticide Action Network*. N.p., n.d. Web. <<http://www.panna.org/resources/atrazine>>.

<sup>25</sup> WuQiang Fan et al. "Atrazine-Induced Aromatase Expression Is SF-1 Dependent: Implications for Endocrine Disruption in Wildlife and Reproductive Cancers in Humans". *Environmental Health Perspectives* 115.5 (2007): 720-727. Web.

<sup>26</sup> Coban, A. and Filipov, N. M. (2007), Dopaminergic toxicity associated with oral exposure to the herbicide atrazine in juvenile male C57BL/6 mice. *Journal of Neurochemistry*, 100: 1177-1187.

<sup>27</sup> Soo, Lim, et al. "Chronic Exposure To The Herbicide, Atrazine, Causes Mitochondrial Dysfunction And Insulin Resistance." *Plos ONE* 4.4 (2009): 1-11. *Academic Search Premier*. Web. 25 Feb. 2016.

<sup>28</sup> "Decision Documents for Atrazine." (2006): 4-5. US EPA. Web. <[http://archive.epa.gov/pesticides/reregistration/web/pdf/atrazine\\_combined\\_docs.pdf](http://archive.epa.gov/pesticides/reregistration/web/pdf/atrazine_combined_docs.pdf)>.

<sup>29</sup> Freeman, Laura E. Beane et al. "Atrazine and Cancer Incidence Among Pesticide Applicators in the Agricultural Health Study (1994-2007)". *Environmental Health Perspectives* 119.9 (2011): 1253-1259. Web.

Chemical	Acute Exposure (High Dose)	Chronic Exposure (Low Dose)	Cancer
<b>2,4 D with acid (Herbicide)</b>	<i>Ingestion:</i> fatigue, weakness, nausea <sup>30</sup> .	Weakness, dizziness, nausea, abdominal pain, myotonia (unable to relax muscles), hypotension (abnormally low blood pressure), renal (kidney) and hepatic (liver) injury, delayed neuropathy (weakness or numbness caused by the killing of neurons in the central nervous system) <sup>33</sup> .	Possibly carcinogenic to humans <sup>36</sup>
Ground	<i>Inhalation:</i> Coughing, burning, dizziness, and temporary loss of muscle coordination <sup>31</sup> .  <i>Dermal:</i> Serious eye and skin irritation <sup>32</sup> .	Incoordination, weak reflexes, and urinary incontinence, liver dysfunction <sup>34</sup> .  Ingesting drinking water causes kidney, liver, or adrenal gland problems <sup>35</sup> .	This is due to inadequate evidence in humans and limited evidence in experimental animals. Moderate evidence that it causes immunosuppression (reduction of efficiency of the immune system). Studies found no consistent increase in risks for Non-Hodgkin's lymphoma, it but needs more testing <sup>37</sup> .

<sup>30</sup> "2,4-D." *Pesticide Management Education Program*. Cornell University, Sept. 1993. Web. <<http://pmep.cce.cornell.edu/profiles/extoxnet/24d-captan/24d-ext.html>>.

<sup>31</sup> "2,4-D." *Pesticide Management Education Program*. Cornell University, Sept. 1993. Web. <<http://pmep.cce.cornell.edu/profiles/extoxnet/24d-captan/24d-ext.html>>.

<sup>32</sup> "2,4-D." *Pesticide Management Education Program*. Cornell University, Sept. 1993. Web. <<http://pmep.cce.cornell.edu/profiles/extoxnet/24d-captan/24d-ext.html>>.

<sup>33</sup> "Biomonitoring Summary: 2,4-Dichlorophenoxyacetic Acid." *Centers for Disease Control and Prevention*. Centers for Disease Control and Prevention, 04 Dec. 2013. Web. <[http://www.cdc.gov/biomonitoring/2,4-DichlorophenoxyaceticAcid\\_BiomonitoringSummary.html](http://www.cdc.gov/biomonitoring/2,4-DichlorophenoxyaceticAcid_BiomonitoringSummary.html)>.

<sup>34</sup> "2,4-D." *Pesticide Management Education Program*. Cornell University, Sept. 1993. Web. <<http://pmep.cce.cornell.edu/profiles/extoxnet/24d-captan/24d-ext.html>>.

<sup>35</sup> "Table of Regulated Drinking Water Contaminants." *EPA*. Environmental Protection Agency, Feb. 2016. Web. <<https://www.epa.gov/your-drinking-water/table-regulated-drinking-water-contaminants#one>>.

<sup>36</sup> Gillam, Carey, and Steve Orlofsky. "WHO Unit Finds 2,4-D Herbicide 'possibly' Causes Cancer in Humans." *Reuters*. Thomson Reuters, 22 June 2015. Web. <<http://www.reuters.com/article/un-herbicides-2-4-d-idUSL1N0Z815P20150622>>.

<sup>37</sup> Iarc. "IARC Monographs Evaluate DDT, Lindane, and 2,4-D." (2015): n. pag. *International Agency for Research on Cancer*. World Health Organization, 23 June 2015. Web. <[https://www.iarc.fr/en/media-centre/pr/2015/pdfs/pr236\\_E.pdf](https://www.iarc.fr/en/media-centre/pr/2015/pdfs/pr236_E.pdf)>.

Chemical	Acute Exposure (High Dose)	Chronic Exposure (Low Dose)	Cancer
<b>Chlorophacinone (Rodenticide)</b>	<i>Ingestion:</i> Reduced ability of blood clots, nosebleeds, bleeding gums, blood in urine and stool <sup>38</sup> , gastrointestinal bleeding (stomach and intestines), bruising, and abdominal pain <sup>39</sup> .	Anemia could result from severe or repeated bleeding <sup>42</sup> .	Has not been tested for its ability to cause cancer in animals <sup>43</sup> . No human studies on the possibility of carcinogenicity were found <sup>44</sup> .
Ground	<i>Inhalation:</i> Reduced ability of blood clots, nose bleeds <sup>40</sup> .  <i>Dermal:</i> Skin breakdown, pain, and irritation. Eye irritation <sup>41</sup> .		

<sup>38</sup> "Hazardous Substance Fact Sheet: Chlorophacinone." *The Physiological Ecology of Woody Plants* (1991): 613-26. New Jersey Department of Health and Senior Services. Web.

<<http://nj.gov/health/eoh/rtkweb/documents/fs/0400.pdf>>

<sup>39</sup> "Chlorophacinone." *TOXNET: Toxicology Data Network*. National Library of Medicine, 2003. Web. <<http://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs+hsdb:@term+@DOCNO+6432>>.

<sup>40</sup> "Hazardous Substance Fact Sheet: Chlorophacinone." *The Physiological Ecology of Woody Plants* (1991): 613-26. New Jersey Department of Health and Senior Services. Web.

<<http://nj.gov/health/eoh/rtkweb/documents/fs/0400.pdf>>

<sup>41</sup> "Chlorophacinone." *TOXNET: Toxicology Data Network*. National Library of Medicine, 2003. Web. <<http://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs+hsdb:@term+@DOCNO+6432>>.

<sup>42</sup> "Pesticide Info Sheet - Chlorophacinone." *Pesticide Info Sheet - Chlorophacinone*. British Columbia Ministry of Agriculture, Food and Fisheries, n.d. Web.

<sup>43</sup> "Hazardous Substance Fact Sheet: Chlorophacinone." *The Physiological Ecology of Woody Plants* (1991): 613-26. New Jersey Department of Health and Senior Services. Web.

<<http://nj.gov/health/eoh/rtkweb/documents/fs/0400.pdf>>

<sup>44</sup> "Chlorophacinone." *TOXNET: Toxicology Data Network*. National Library of Medicine, 2003. Web. <<http://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs+hsdb:@term+@DOCNO+6432>>.

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<b>Metsulfuron Methyl (Herbicide)</b>	<i>Ingestion:</i> Nausea, vomiting, abdominal pain, and diarrhea, headache, fatigue, weakness <sup>45</sup> .	Can cause slight changes in body and organ weight body weight when fed to <b>rats</b> at moderate to high doses for two years <sup>48</sup> . No documentation for humans.	Not Likely to Be Carcinogenic <sup>49</sup> .
Ground and Aerial Spray	<i>Inhalation:</i> cough, difficulty breathing, respiratory distress, irritation of respiratory mucous membranes, bronchitis, pneumonitis <sup>46</sup> .		Rats showed no increase in number of tumors when tested <sup>50</sup> . "The EPA has not evaluated this substance of its ability to cause cancer in humans <sup>51</sup> ."
	<i>Dermal:</i> Causes skin and eye irritation <sup>47</sup> .		

<sup>45</sup> "Metsulfuron Methyl." *TOXNET: Toxicology Data Network*. National Library of Medicine, 1993. Web. <<http://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs%2Bhsdb%3A%40term%2B%40DOCNO%2B6849>>.

<sup>46</sup> "Metsulfuron Methyl." *TOXNET: Toxicology Data Network*. National Library of Medicine, 1993. Web. <<http://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs%2Bhsdb%3A%40term%2B%40DOCNO%2B6849>>.

<sup>47</sup> Metsulfuron Methyl - Human Health and Ecological Risk Assessment - Final Report." (2004): n. pag. *U.S. Forest Service - United States Department of Agriculture*. 9 Dec. 2004. Web.

<sup>48</sup> Hershberger, L.w., and D.e. Brennan. "Metsulfuron Methyl." *Specific Applications* (1988): 83-103. Washington State Department of Transportation. Web. <<http://www.wsdot.wa.gov/NR/rdonlyres/2A7ABA10-EDC5-481A-88BD-B9C559DB7449/0/Metsulfuron.pdf>>.

<sup>49</sup> "Chemicals Evaluated for Carcinogenic Potential Office of Pesticide Programs U.S. Environmental Protection Agency Annual Cancer Report 2015." (n.d.): n. pag. U.S. EPA. Web. <[http://npic.orst.edu/chemicals\\_evaluated.pdf](http://npic.orst.edu/chemicals_evaluated.pdf)>.

<sup>50</sup> Hershberger, L.w., and D.e. Brennan. "Metsulfuron Methyl." *Specific Applications* (1988): 83-103. Washington State Department of Transportation. Web. <<http://www.wsdot.wa.gov/NR/rdonlyres/2A7ABA10-EDC5-481A-88BD-B9C559DB7449/0/Metsulfuron.pdf>>.

<sup>51</sup> Hershberger, L.w., and D.e. Brennan. "Metsulfuron Methyl." *Specific Applications* (1988): 83-103. Washington State Department of Transportation. Web. <<http://www.wsdot.wa.gov/NR/rdonlyres/2A7ABA10-EDC5-481A-88BD-B9C559DB7449/0/Metsulfuron.pdf>>.

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<b>Clopyralid (Transline, Stinger, Reclaim, Curtail, Lontrel) (Herbicide)</b>	<i>Ingestion:</i> esophagus or gastrointestinal tract irritation or burning <sup>52</sup> .	Changes in stomach tissue structure, body, liver, and kidney weight when fed to <b>rats</b> for 2 years <sup>55</sup> . Hyperplasia (enlargement of an organ or tissue) and thickening of the gastric epithelium (lining of the stomach) in rats <sup>56</sup> .	Not likely to be carcinogenic to Humans <sup>57</sup> .
Ground and Aerial Spray	<i>Inhalation:</i> Labored breathing, red stains around nares (nostrils) <sup>53</sup> .		Rats showed no increase in number of tumors when tested <sup>58</sup> .
	<i>Dermal:</i> Causes eye irritation, poor absorption in skin <sup>54</sup> .		

<sup>52</sup> "Clopyralid." *TOXNET: Toxicology Data Network*. National Library of Medicine, 1993. Web. <<http://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs+hsdb:@term+@DOCNO+6593>>.

<sup>53</sup> "Clopyralid - Human Health and Ecological Risk Assessment - Final Report." (1994): n. pag. *U.S. Forest Service - United States Department of Agriculture*. 5 Dec. 2004. Web. <[http://www.fs.fed.us/foresthealth/pesticide/pdfs/120504\\_clopyralid.pdf](http://www.fs.fed.us/foresthealth/pesticide/pdfs/120504_clopyralid.pdf)>.

<sup>54</sup> "Clopyralid - Human Health and Ecological Risk Assessment - Final Report." (1994): n. pag. *U.S. Forest Service - United States Department of Agriculture*. 5 Dec. 2004. Web. <[http://www.fs.fed.us/foresthealth/pesticide/pdfs/120504\\_clopyralid.pdf](http://www.fs.fed.us/foresthealth/pesticide/pdfs/120504_clopyralid.pdf)>.

<sup>55</sup> "Clopyralid." *Hawley's Condensed Chemical Dictionary* (2007): n. pag. Washington State Department of Transportation. Web. <<http://www.wsdot.wa.gov/NR/rdonlyres/C3ECE3F9-BFCF-432D-ACB2-6C716BB8FADC/0/Clopyralid.pdf>>

<sup>56</sup> "Clopyralid - Human Health and Ecological Risk Assessment - Final Report." (1994): n. pag. *U.S. Forest Service - United States Department of Agriculture*. 5 Dec. 2004. Web. <[http://www.fs.fed.us/foresthealth/pesticide/pdfs/120504\\_clopyralid.pdf](http://www.fs.fed.us/foresthealth/pesticide/pdfs/120504_clopyralid.pdf)>.

<sup>57</sup> "Chemicals Evaluated for Carcinogenic Potential Office of Pesticide Programs U.S. Environmental Protection Agency Annual Cancer Report 2015." (n.d.): n. pag. U.S. EPA. Web. <[http://npic.orst.edu/chemicals\\_evaluated.pdf](http://npic.orst.edu/chemicals_evaluated.pdf)>.

<sup>58</sup> "Clopyralid." *Hawley's Condensed Chemical Dictionary* (2007): n. pag. Washington State Department of Transportation. Web. <<http://www.wsdot.wa.gov/NR/rdonlyres/C3ECE3F9-BFCF-432D-ACB2-6C716BB8FADC/0/Clopyralid.pdf>>

Chemical	Acute Exposure (High Dose)	Chronic Exposure (Low Dose)	Cancer
<p><b>Imazapyr</b> (Arsenal, Chopper, Stalker, Assault, Contain) <b>Herbicide</b></p> <p>Ground and Aerial Spray</p>	<p><i>Ingestion:</i> Hypotension (abnormally low blood pressure), pulmonary dysfunction (lung muscle weakness), oral mucosal (mucous membrane lining the mouth) and gastrointestinal (stomach and intestines) irritation, transient liver and renal dysfunction (short term liver and kidney failure), severe vomiting, altered consciousness<sup>59</sup>.</p> <p>Impaired consciousness, respiratory distress, diarrhea, abdominal pain, metabolic acidosis (if poisoned or intentional ingestion)<sup>60</sup>.</p> <p><i>Inhalation:</i> Respiratory distress<sup>61</sup>.</p> <p><i>Dermal:</i> mild or slight irritation to the skin<sup>62</sup>. Irreversible eye damage.</p>	<p>For two years, <b>mice</b> were fed imazapyr and developed accumulation of fluid in the lungs and an increased incidence of kidney cysts. <b>Rats</b> fed for two years developed an increase in thyroid cysts and increased blood pooling in the liver. (Study was not considered significant by the US EPA)<sup>63</sup>.</p>	<p>Not likely to be a human carcinogen<sup>64</sup></p>

<sup>59</sup> "Imazapyr." *TOXNET: Toxicology Data Network*. National Library of Medicine, 2002. Web. <<http://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs%2Bhsdb%3A%40term%2B%40DOCNO%2B6676>>.

<sup>60</sup> "HUMAN HEALTH AND ECOLOGICAL EFFECTS RISK ASSESSMENT: Imazapyr Risk Assessment." (2009): n. pag. AMEC Geomatrix, Inc. Web. <[http://www.ecy.wa.gov/programs/wq/pesticides/enviroReview/riskAssess/HHRA&ERA\\_063009.pdf](http://www.ecy.wa.gov/programs/wq/pesticides/enviroReview/riskAssess/HHRA&ERA_063009.pdf)>.

<sup>61</sup> "Imazapyr." *TOXNET: Toxicology Data Network*. National Library of Medicine, 2002. Web. <<http://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs%2Bhsdb%3A%40term%2B%40DOCNO%2B6676>>.

<sup>62</sup> Unger, Thomas A. "Imazapyr." *Pesticide Synthesis Handbook* (1996): 444. Washington State Department of Transportation, Feb. 2006. Web. <<http://www.wsdot.wa.gov/NR/rdonlyres/C8EB1611-2699-48FB-B5B8-161D1223BC92/0/imazapyr.pdf>>.

<sup>63</sup> Unger, Thomas A. "Imazapyr." *Pesticide Synthesis Handbook* (1996): 444. Washington State Department of Transportation, Feb. 2006. Web. <<http://www.wsdot.wa.gov/NR/rdonlyres/C8EB1611-2699-48FB-B5B8-161D1223BC92/0/imazapyr.pdf>>.

<sup>64</sup> Unger, Thomas A. "Imazapyr." *Pesticide Synthesis Handbook* (1996): 444. Washington State Department of Transportation, Feb. 2006. Web. <<http://www.wsdot.wa.gov/NR/rdonlyres/C8EB1611-2699-48FB-B5B8-161D1223BC92/0/imazapyr.pdf>>.

Chemical	Acute Exposure (High Dose)	Chronic Exposure (Low Dose)	Cancer
<b>Sulfometuron Methyl (Oust Extra) Herbicide</b>	<i>Ingestion:</i> Nausea, vomiting, abdominal pain, and diarrhea, fatigue, weakness, dizziness (intentional ingestion) <sup>65</sup> .	Fed with low doses for a year, rats had reduced red blood cell counts and an increased liver weight <sup>68</sup> .	Not classifiable as a human carcinogen <sup>69</sup>
Ground and Aerial Spray	<i>Inhalation:</i> Coughing, difficulty breathing, irritation of the respiratory mucous membrane <sup>66</sup> .  <i>Dermal:</i> Skin irritation. Irritation to eye <sup>67</sup> .		When mice and rats were fed high doses, there was a slight increase in urinary bladder tumors. Multiple studies show that this is not a mutagen (does not cause mutation of cells) <sup>70</sup> .

<sup>65</sup> "Sulfometuron-methyl." *TOXNET: Toxicology Data Network*. National Library of Medicine, 2010. Web. <<http://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs%2Bhsdb%3A%40term%2B%40DOCNO%2B6849>>.

<sup>66</sup> "Sulfometuron-methyl." *TOXNET: Toxicology Data Network*. National Library of Medicine, 2010. Web. <<http://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs%2Bhsdb%3A%40term%2B%40DOCNO%2B6849>>.

<sup>67</sup> "Sulfometuron-methyl." *TOXNET: Toxicology Data Network*. National Library of Medicine, 2010. Web. <<http://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs%2Bhsdb%3A%40term%2B%40DOCNO%2B6849>>.

<sup>68</sup> "Sulfometuron-methyl." *Pesticide Management Education Program*. Cornell University, 1993. Web. <<http://pmep.cce.cornell.edu/profiles/extoxnet/pyrethrins-ziram/sulfometuron-methyl-ext.html>>.

<sup>69</sup> "Sulfometuron-methyl." *TOXNET: Toxicology Data Network*. National Library of Medicine, 2010. Web. <<http://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs%2Bhsdb%3A%40term%2B%40DOCNO%2B6849>>.

<sup>70</sup> Zahnaw, E.w., and T.j. Waeghe. "Sulfometuron Methyl." (1988): 105-16. Washington State Department of Transportation, Feb. 2006. Web. <<http://www.wsdot.wa.gov/NR/rdonlyres/EA6DE6F7-696B-4DF9-8BF4-1D85582B3D77/0/Sulfometuron.pdf>>.

Chemical	Acute Exposure (High Dose)	Chronic Exposure (Low Dose)	Cancer
<b>Triclopyr (Herbicide)</b>	<i>Ingestion:</i> Hypotension (abnormally low blood pressure), metabolic acidosis (too much acid in body fluids), coma, and cardiovascular impairment (after intentional ingestion). Usual symptoms are vomiting and diarrhea <sup>71</sup> .	<b>Rat</b> studies have shown at high doses, there has been decreased liver and body weight and an increase in kidney weight <sup>73</sup> .	Not Classifiable as to Human Carcinogenicity <sup>74</sup>
Ground	<i>Inhalation:</i> Unknown symptoms.  <i>Dermal:</i> there is some absorption that is detectable in urine. Eye irritant <sup>72</sup> .		

<sup>71</sup> "Triclopyr." *TOXNET: Toxicology Data Network*. National Library of Medicine, July 2003. Web. <<http://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs+hsdb:@term+@DOCNO+7060>>.

<sup>72</sup> "Triclopyr." *TOXNET: Toxicology Data Network*. National Library of Medicine, July 2003. Web. <<http://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs+hsdb:@term+@DOCNO+7060>>.

<sup>73</sup> "Triclopyr." *Pesticide Management Education Program*. Cornell University, Sept. 1993. Web. <<http://pmep.cce.cornell.edu/profiles/extoxnet/pyrethrins-ziram/triclopyr-ext.html>>.

<sup>74</sup> "Chemicals Evaluated for Carcinogenic Potential Office of Pesticide Programs U.S. Environmental Protection Agency Annual Cancer Report 2015." (n.d.): n. pag. U.S. EPA. Web. <[http://npic.orst.edu/chemicals\\_evaluated.pdf](http://npic.orst.edu/chemicals_evaluated.pdf)>.