

**Occupational Cancers: Link to Fire Fighter Exposures**  
**Updated: February 2019**

Presumptive Disease	Likely Chemical Causes	Sources of Chemical and Exposure Source	Supporting Research
<b>Bladder Cancer</b>	Arsenic <sup>1</sup>	A heavy metal commonly found in smoke. Used to produce chromated copper arsenate, a wood preservative.	(Easter et al 2016) <sup>2</sup> (Fabian et al 2010) <sup>3</sup> (IARC Monograph) <sup>4</sup>
	Diesel exhaust <sup>1</sup>	Diesel exhaust comprises of a complex mixture of both particulate matter and gaseous substances including diesel particulate matter, polyaromatic hydrocarbons (PAH) and volatile organic compounds (VOCs).	(IARC Monograph) <sup>4</sup> (NIOSH) <sup>5</sup> (NIOSH HHE) <sup>6</sup>
	Soot <sup>1</sup>	Incomplete burning of organic matter. Typically, black or grey powdery substance.	(IARC Monograph) <sup>4</sup> (Hsu et al., 2011) <sup>7</sup>
	Tetrachloroethylene <sup>1</sup>	A manufactured chemical that is widely used for dry cleaning of fabrics and for metal-degreasing. It is also used to make other chemicals and is used in some consumer products.	(IARC Monograph) <sup>4</sup> (Edelman et al 2003) <sup>8</sup>
	Polycyclic aromatic hydrocarbons (PAHs) <sup>9,10,11</sup>	A group of over 100 chemicals formed during incomplete burning of coal, oil and gas, garbage or other organic substances like tobacco. Encountered on most fire grounds during fires and overhaul and cleaning of equipment, clothing, and skin.	(Easter et al 2016) <sup>2</sup> (Fabian et al 2010) <sup>3</sup> (IARC Monograph) <sup>4</sup> (Edelman et al 2003) <sup>8</sup> (Fent et al 2014) <sup>12</sup> (Fernando et al. 2016) <sup>13</sup> (Caux et al 2002) <sup>14</sup>
<b>Brain Cancer</b>	Benzene <sup>15</sup>	Found in crude oil, gasoline, motor vehicle exhaust, tobacco smoke and wood smoke. Used to make plastics, and primary component of PVC combustion. Present in 92% of samples in a study of 200 structural fires. <sup>16</sup>	(Fabian et al 2010) <sup>3</sup> (IARC Monograph) <sup>4</sup> (Fent et al 2014) <sup>12</sup> (Caux et al 2002) <sup>14</sup> (Fent et al. 2015) <sup>17</sup> (Austin et al 2001) <sup>18</sup> (Austin et al 2001) <sup>19</sup>
	1,3-butadiene <sup>20</sup>	Present in diesel exhaust.	(IARC Monograph) <sup>4</sup> (Austin et al 2001) <sup>18</sup>

	Polychlorinated biphenyls (PCBs) <sup>1</sup>	Used as a flame retardant in electronic equipment, insulation, oil-based paint, caulking, fluorescent light bulbs, plastics, floor finish. No longer produced, but still found in consumer products.	(IARC Monograph) <sup>4</sup> (Edelman et al 2003) <sup>8</sup> (Chernyak et al 2012) <sup>21</sup> (Kelly et al 2002) <sup>22</sup>
<b>Oral (Buccal Cavity)/ Pharynx</b>	Asbestos <sup>1</sup>	Naturally occurring minerals used in fireproofing and insulation. Primarily in buildings and building materials before 1989.	(IARC Monograph) <sup>4</sup> (Bolstad-Johnson et al 2000) <sup>23</sup> (Daniels et al 2014) <sup>24</sup> (Markowitz et al 1991) <sup>25</sup>
	Formaldehyde <sup>26</sup>	Used in resins, adhesives for pressed wood products, particle board, furniture. Preservative in some medical labs and consumer products.	(Fabian et al 2010) <sup>3</sup> (IARC Monograph) <sup>4</sup> (Bolstad-Johnson et al 2000) <sup>23</sup> (Driscoll et al 2016) <sup>27</sup>
	Benzene <sup>28</sup>	Found in crude oil, gasoline, motor vehicle exhaust, tobacco smoke and wood smoke. Used to make plastics, and primary component of PVC combustion.	(Fabian et al 2010) <sup>3</sup> (IARC Monograph) <sup>4</sup> (Fent et al 2014) <sup>12</sup> (Caux et al 2002) <sup>14</sup> (Fent et al. 2015) <sup>17</sup> (Austin et al 2001) <sup>18</sup> (Austin et al 2001) <sup>19</sup>
<b>Colorectal (colon and rectum)</b>	Asbestos <sup>1</sup>	Naturally occurring minerals used in fireproofing and insulation. Primarily in buildings and building materials before 1989.	(IARC Monograph) <sup>4</sup> (Bolstad-Johnson et al 2000) <sup>23</sup> (Daniels et al 2014) <sup>24</sup> (Markowitz et al 1991) <sup>25</sup>
<b>Esophageal Cancer</b>	Asbestos <sup>29, 30</sup>	Naturally occurring minerals used in fireproofing and insulation. Primarily in buildings and building materials before 1989.	(IARC Monograph) <sup>4</sup> (Bolstad-Johnson et al 2000) <sup>23</sup> (Daniels et al 2014) <sup>24</sup> (Markowitz et al 1991) <sup>25</sup>
	Carbon black <sup>29</sup>	Product of incomplete combustion that may be coated with polycyclic aromatic hydrocarbons (PAHs). <sup>31</sup>	(IARC Monograph) <sup>4</sup>
	Diesel exhaust <sup>32</sup>	Diesel exhaust comprises of a complex mixture of both particulate matter and gaseous substances including diesel particulate matter, polyaromatic hydrocarbons (PAH) and volatile organic compounds (VOCs).	(IARC Monograph) <sup>4</sup> (NIOSH) <sup>5</sup> (NIOSH HHE) <sup>6</sup>

<b>Kidney Cancer</b>	Trichloroethylene <sup>1</sup>	It is used mainly as a solvent to remove grease from metal parts, but it is also an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers.	(IARC Monograph) <sup>4</sup> (Edelman et al 2003) <sup>8</sup>
	Arsenic <sup>1</sup>	A heavy metal commonly found in smoke. Used to produce chromated copper arsenate, a wood preservative.	(Easter et al 2016) <sup>2</sup> (Fabian et al 2010) <sup>3</sup> (IARC Monograph) <sup>4</sup>
	Perfluorooctanoic acid (PFOA) <sup>1</sup>	Used as a water, stain and grease repellent in consumer products; ingredients in some firefighting foams (AFFF) applied to liquid fuel fires.	(Dobraca et al 2015) <sup>33</sup>
	1,3-butadiene <sup>34</sup>	Present in diesel exhaust.	(IARC Monograph) <sup>4</sup> (Austin et al 2001) <sup>18</sup>
	Cadmium <sup>1</sup>	A type of metal used in the production of batteries, plastics, and other industrial processes. Can be found in diesel exhaust.	(Fabian et al 2010) <sup>3</sup> (IARC Monograph) <sup>4</sup> (Edelman et al 2003) <sup>8</sup>
<b>Leukemia/and or Lymphoma</b>	Ethylene oxide <sup>1</sup>	Used in Polyurethane foams, textiles, solvents; found in auto exhaust.	(IARC Monograph) <sup>4</sup> (Figueredo et al 2003) <sup>35</sup>
	Formaldehyde <sup>1</sup>	Used in resins, adhesives for pressed wood products, particle board, furniture. Preservative in some medical labs and consumer products.	(Fabian et al 2010) <sup>3</sup> (IARC Monograph) <sup>4</sup> (Bolstad-Johnson et al 2000) <sup>23</sup> (Driscoll et al 2016) <sup>27</sup>
	1,3 butadiene <sup>1</sup>	Present in diesel exhaust.	(IARC Monograph) <sup>4</sup> (Austin et al., 2001) <sup>18</sup>
	Polychlorinated biphenyls (PCBs) <sup>1</sup>	Used as a flame retardant in electronic equipment (capacitors, transformers), insulation, oil-based paint, caulking, fluorescent light bulbs, plastics, floor finish. No longer produced, but still found in consumer products.	(IARC Monograph) <sup>4</sup> (Edelman et al 2003) <sup>8</sup> (Chernyak et al 2012) <sup>21</sup>
	Trichloroethylene <sup>1</sup>	It is used mainly as a solvent to remove grease from metal parts, but it is also an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers.	(IARC Monograph) <sup>4</sup> (Edelman et al 2003) <sup>8</sup>
	Dioxins/TCDD <sup>1,36</sup>	Formed during combustion processes: waste incineration, fuels (wood, coal, oil) plastic materials containing PBDEs.	(IARC Monograph) <sup>4</sup> (Chernyak et al 2012) <sup>21</sup>

	Benzene <sup>1</sup>	Found in crude oil, gasoline, motor vehicle exhaust, tobacco smoke and wood smoke. Used to make plastics, and primary component of PVC combustion.	(Fabian et al 2010) <sup>3</sup> (IARC Monograph) <sup>4</sup> (Fent et al 2014) <sup>12</sup> (Caux et al 2002) <sup>14</sup> (Fent et al. 2015) <sup>17</sup> (Austin et al 2001) <sup>18</sup> (Austin et al 2001) <sup>19</sup>
<b>Lung Cancer</b>	Asbestos <sup>1</sup>	Naturally occurring minerals used in fireproofing and insulation. Primarily in buildings and building materials before 1989.	(IARC Monograph) <sup>4</sup> (Bolstad-Johnson et al 2000) <sup>23</sup> (Daniels et al 2014) <sup>24</sup> (Markowitz et al 1991) <sup>25</sup>
	Silica (crystalline) <sup>1, 37</sup>	Common materials like sand, stone, concrete, and mortar contain crystalline silica. Also used to make glass, pottery, ceramics, bricks, and artificial stone. Exposure to Silica occurs when activities make it airborne.	(IARC Monograph) <sup>4</sup> (Reinhardt et al 2018) <sup>38</sup>
	Diesel Exhaust <sup>1</sup>	Diesel exhaust comprises of a complex mixture of both particulate matter and gaseous substances including diesel particulate matter, polyaromatic hydrocarbons (PAH) and volatile organic compounds (VOCs).	(IARC Monograph) <sup>4</sup> (NIOSH) <sup>5</sup> (NIOSH HHE) <sup>6</sup>
	Arsenic <sup>1</sup>	A heavy metal commonly found in smoke. Used to produce chromated copper arsenate, a wood preservative.	(Easter et al 2016) <sup>2</sup> (Fabian et al 2010) <sup>3</sup> (IARC Monograph) <sup>4</sup>
	Cadmium <sup>1</sup>	A type of metal used in the production of batteries, plastics, and other industrial processes. Can be found in diesel exhaust.	(Fabian et al 2010) <sup>3</sup> (IARC Monograph) <sup>4</sup> (Edelman et al 2003) <sup>8</sup>
	Polycyclic aromatic hydrocarbons (PAHs) <sup>39</sup>	A group of over 100 chemicals formed during incomplete burning of coal, oil and gas, garbage or other organic substances like tobacco. Encountered on most fire grounds during fires and overhaul and cleaning of equipment, clothing, and skin.	(Easter et al 2016) <sup>2</sup> (Fabian et al 2010) <sup>3</sup> (IARC Monograph) <sup>4</sup> (Edelman et al 2003) <sup>8</sup> (Fent et al 2014) <sup>12</sup> (Fernando et al. 2016) <sup>13</sup> (Caux et al 2002) <sup>14</sup>
	Dioxins/TCDD <sup>1,40</sup>	Formed during combustion processes: waste incineration, fuels (wood, coal, oil) plastic materials containing PBDEs.	(IARC Monograph) <sup>4</sup> (Chernyak et al 2012) <sup>21</sup>

<b>Melanoma (skin cancer)</b>	Polychlorinated biphenyls (PCBs) <sup>1</sup>	Used as a flame retardant in electronic equipment, insulation, oil-based paint, caulking, fluorescent light bulbs, plastics, floor finish. No longer produced, but still found in consumer products.	(IARC Monograph) <sup>4</sup> (Edelman et al 2003) <sup>8</sup> (Chernyak et al 2012) <sup>21</sup>
	Arsenic <sup>41</sup>	A heavy metal commonly found in smoke. Used to produce chromated copper arsenate, a wood preservative.	(Easter et al 2016) <sup>2</sup> (Fabian et al 2010) <sup>3</sup> (IARC Monograph) <sup>4</sup>
	Polycyclic aromatic hydrocarbons (PAHs) <sup>42</sup>	A group of over 100 chemicals formed during incomplete burning of coal, oil and gas, garbage or other organic substances like tobacco. Encountered on most fire grounds during fires and overhaul and cleaning of equipment, clothing, and skin.	(Easter et al 2016) <sup>2</sup> (Fabian et al 2010) <sup>3</sup> (IARC Monograph) <sup>4</sup> (Edelman et al 2003) <sup>8</sup> (Fent et al 2014) <sup>12</sup> (Fernando et al. 2016) <sup>13</sup> (Caux et al 2002) <sup>14</sup>
<b>Mesothelioma</b>	Asbestos <sup>1</sup>	Naturally occurring minerals used in fireproofing and insulation. Primarily in buildings and building materials before 1989.	(IARC Monograph) <sup>4</sup> (Bolstad-Johnson et al 2000) <sup>23</sup> (Daniels et al 2014) <sup>24</sup> (Markowitz et al 1991) <sup>25</sup>
<b>Multiple Myeloma</b>	Benzene <sup>1, 43</sup>	Found in crude oil, gasoline, motor vehicle exhaust, tobacco smoke and wood smoke. Used to make plastics, and primary component of PVC combustion.	(Fabian et al 2010) <sup>3</sup> (IARC Monograph) <sup>4</sup> (Fent et al 2014) <sup>12</sup> (Caux et al 2002) <sup>14</sup> (Fent et al. 2015) <sup>17</sup> (Austin et al 2001) <sup>18</sup> (Austin et al 2001) <sup>19</sup>
<b>Nasopharyngeal Cancer</b>	Formaldehyde <sup>1</sup>	Used in resins, adhesives for pressed wood products, particle board, furniture. Preservative in some medical labs and consumer products.	(Fabian et al 2010) <sup>3</sup> (IARC Monograph) <sup>4</sup> (Bolstad-Johnson et al 2000) <sup>23</sup> (Driscoll et al 2016) <sup>27</sup>
<b>Non-Hodgkin's Lymphoma</b>	Benzene <sup>1, 44</sup>	Found in crude oil, gasoline, motor vehicle exhaust, tobacco smoke and wood smoke. Used to make plastics, and primary component of PVC combustion.	(Fabian et al 2010) <sup>3</sup> (IARC Monograph) <sup>4</sup> (Fent et al 2014) <sup>12</sup> (Caux et al 2002) <sup>14</sup> (Fent et al. 2015) <sup>17</sup>

			(Austin et al 2001) <sup>18</sup> (Austin et al 2001) <sup>19</sup>
	Dioxins/TCDD <sup>1,45</sup>	Formed during combustion processes: waste incineration, fuels (wood, coal, oil) plastic materials containing PBDEs.	(IARC Monograph) <sup>4</sup> (Chernyak et al 2012) <sup>21</sup>
<b>Prostate Cancer</b>	Cadmium <sup>1</sup>	A type of metal used in the production of batteries, plastics, and other industrial processes. Can be found in diesel exhaust.	(Fabian et al 2010) <sup>3</sup> (IARC Monograph) <sup>4</sup> (Edelman et al 2003) <sup>8</sup>
	Polycyclic aromatic hydrocarbons (PAHs) <sup>46, 47</sup>	A group of over 100 chemicals formed during incomplete burning of coal, oil and gas, garbage or other organic substances like tobacco. Encountered on most fire grounds during fires and overhaul and cleaning of equipment, clothing, and skin.	(Easter et al 2016) <sup>2</sup> (Fabian et al 2010) <sup>3</sup> (IARC Monograph) <sup>4</sup> (Edelman et al 2003) <sup>8</sup> (Fent et al 2014) <sup>12</sup> (Fernando et al. 2016) <sup>13</sup> (Caux et al 2002) <sup>14</sup>
	Arsenic <sup>1, 47</sup>	A heavy metal commonly found in smoke. Used to produce chromated copper arsenate, a wood preservative.	(Easter et al 2016) <sup>2</sup> (Fabian et al 2010) <sup>3</sup> (IARC Monograph) <sup>4</sup>
	Diesel exhaust <sup>48,49, 50</sup>	Diesel exhaust comprises of a complex mixture of both particulate matter and gaseous substances including diesel particulate matter, polyaromatic hydrocarbons (PAH) and volatile organic compounds (VOCs).	(IARC Monograph) <sup>4</sup> (NIOSH) <sup>5</sup> (NIOSH HHE) <sup>6</sup>
	Polychlorinated biphenyls (PCBs) <sup>51, 47</sup>	Used as a flame retardant in electronic equipment, insulation, oil-based paint, caulking, fluorescent light bulbs, plastics, floor finish. No longer produced, but still found in consumer products.	(IARC Monograph) <sup>4</sup> (Edelman et al 2003) <sup>8</sup> (Chernyak et al 2012) <sup>21</sup>
<b>Gastric Cancer (Stomach)</b>	Asbestos <sup>1</sup>	naturally occurring minerals used in fireproofing and insulation. Primarily in buildings and building materials before 1989.	(IARC Monograph) <sup>4</sup> (Bolstad-Johnson et al 2000) <sup>23</sup> (Daniels et al 2014) <sup>24</sup> (Markowitz et al 1991) <sup>25</sup>
<b>Testicular Cancer</b>	Perfluorooctanoic Acid (PFOA) <sup>1</sup>	Used as a water, stain and grease repellent in consumer products; ingredients in some firefighting foams (AFFF) applied to liquid fuel fires.	(Dobraca et al 2015) <sup>33</sup>

<sup>1</sup> International Agency for Research on Cancer. <https://monographs.iarc.fr/wp-content/uploads/2018/07/Table4.pdf>.

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