

Appendix 13.02 TAP Carcinogenic Effect and Classification

Item	Chemical	Species	Carcinogenic Risk IUR (µg/m3) ⁻¹	Characteristics	Consequence	IARC Group
1	Sulphur dioxide	Criteria air pollutants	-	Sulphur dioxide is a highly toxic, colorless with a choking or suffocating odour, nonflammable gas. It is used as a pharmaceutical aid and antioxidant. It is also an environmental air pollutant	Acute exposure of sulphur dioxide would resulting in irritation and lacrimation to eyes. Chronic exposure of Sulphur dioxide can result in an altered sense of smell (including increased tolerance to low levels of sulphur dioxide), increased susceptibility to respiratory infections, symptoms of chronic bronchitis, and accelerated decline in pulmonary function.	Group 3
2	Nitrogen dioxide	Criteria air pollutants	-	Nitrogen dioxide is part of a group of gaseous air pollutants produced as a result of road traffic and other fossil fuel combustion processes.	Acute exposure of nitrogen dioxide could result in eye, throat and lung irritation and triggers asthma in asthmatics. Chronic exposure of Nitrogen dioxide may decrease lung fuction and increase the risk of respiratory symptoms such as acute bronchitis and cough and phlegm, particularly in children.	-
3	Carbon monoxide	Criteria air pollutants	-	Carbon Monoxide is an odorless, tasteless, poisonous gas, CO, that results from the incomplete combustion of carbon. Inhalation causes central nervous system damage and asphyxiation. It is found in both outdoor and indoor air.	Acute effects of carbon monoxide would have symptoms in order of increasing severity of CO poisoning are headache, dizziness on exertion, fatigue, palpitations, nausea, vomiting, difficulty breathing on exertion, mental confusion, rapid heartbeat, visual disturbance, and muscle twitch. Chronic exposure to low levels of CO can lead to a cluster of symptoms resembling the flu: headache, fatigue, muscle aches, nausea, vomiting, and a change in sensitivity to light, odor, and taste.	-
4	Hydrogen sulphide	Inorganic compound	-	Hydrogen sulphide is a flammable, poisonous gas with a characteristic odor of rotten eggs. Hydrogen sulphide (H ₂ S) occurs naturally in crude petroleum, natural gas, volcanic gases, and hot springs.	Acute and chronic exposure of Hydrogen sulphide may result in may result in effects on the respiratory, neurological, ocular and cardiovascular systems.	-
5	Ammonia	Inorganic compound	-	Ammonia is a colorless inorganic compound of nitrogen and hydrogen with the formula NH ₃ , usually in gaseous form with a characteristic pungent odor	Acute exposure of Ammonia to humans can initially cause upper respiratory tract irritation and chronic inhalation is associated with increased cough, phlegm, wheeze and asthma.	-
6	Dimethyl sulphide	Organosulfur compounds	-	Dimethyl sulfide is a clear colorless to straw colored liquid with a disagreeable odor. Flash point less than 0 °F. Less dense than water and slightly soluble in water. Vapors are heavier than air.	Acute exposure of humans to the vapors of dimethyl sulfate may cause severe inflammation and necrosis of the eyes, mouth, and respiratory tract; severe damage to the lungs may result. No information is available on the chronic effects of dimethyl sulfate in humans.	-
7	Diethyl sulphide	Organosulfur compounds	-	Diethyl sulfide is a colorless oily liquid with a garlic-like odor. Less dense than water. Vapors heavier than air. May irritate skin and eyes.	May cause toxic effects if inhaled or absorbed through skin. Inhalation or contact with material may irritate or burn skin and eyes. Fire will produce irritating, corrosive and/or toxic gases. Vapors may cause dizziness or suffocation. Runoff from fire control or dilution water may cause pollution.	-
8	Acetone	Ketone	-	Acetone is a colorless, volatile, flammable organic solvent. Acetone occurs naturally in plants, trees, forest fires, vehicle exhaust and as a breakdown product of animal fat metabolism. This agent may be normally present in very small quantities in urine and blood; larger amounts may be found in the urine and blood of diabetics. Acetone is toxic in high doses.	Acute exposure to acetone can cause eye irritation, dryness of the mouth and throat, nausea, vomiting, headache, sleepiness, dizziness, light-headedness, weakness, incoordination, loss of energy, fainting, and unconsciousness. Chronic exposure to acetone can cause dizziness and sleepiness.	-
9	Butanone (Methyl ethyl ketone)	Ketone	-	Butanone is a colorless fairly volatile liquid with a pleasant pungent odor. Flash point 20 °F. Vapors heavier than air. Does not react with water or many common materials. Stable in normal transportation.	Acute inhalation exposure to methyl ethyl ketone in humans results in irritation to the eyes, nose, and throat. Limited information is available on the chronic effects of butanone in humans.	-
10	Acetaldehyde	VOCs	2.2E-06	Acetaldehyde is a colorless, flammable liquid used in the manufacture of acetic acid, perfumes, and flavors. It is also an intermediate in the metabolism of alcohol. It has a general narcotic action and also causes irritation of mucous membranes. Large doses may cause death from respiratory paralysis.	Acute exposure to acetaldehyde results in effects including irritation of the eyes, skin, and respiratory tract. Symptoms of chronic intoxication of acetaldehyde resemble those of alcoholism.	Group 2B
11	Benzene	VOCs	6.0E-06	Benzene is a clear, colorless, highly flammable and volatile, liquid aromatic hydrocarbon with a gasoline-like odor. Benzene is found in crude oils and as a by-product of oil-refining processes. In industry benzene is used as a solvent, as a chemical intermediate, and is used in the synthesis of numerous chemicals	Acute inhalation exposure of humans to benzene may cause drowsiness, dizziness, headaches, as well as eye, skin, and respiratory tract irritation, and, at high levels, unconsciousness. Chronic inhalation exposure has caused various disorders in the blood, including reduced numbers of red blood cells and aplastic anemia, in occupational settings.	Group 1
12	Carbon disulphide	VOCs	-	Carbon disulphide is a colorless, flammable, poisonous liquid, CS ₂ . It is used as a solvent, and is a counterirritant and has local anesthetic properties but is not used as such. It is highly toxic with pronounced CNS, hematologic, and dermatologic effects.	Acute inhalation exposure of humans to carbon disulfide has caused changes in breathing and chest pains. Nausea, vomiting, dizziness, fatigue, headache, mood changes, lethargy, blurred vision, delirium, and convulsions have also been reported in humans acutely exposed by inhalation. Neurologic effects, including behavioral and neurophysiological changes, have been observed in chronic human and animal inhalation studies. Reproductive effects, such as decreased sperm count and menstrual disturbances, have been observed in humans exposed to carbon disulfide by inhalation.	-
13	Carbon tetrachloride	VOCs	6.0E-06	Carbon Tetrachloride is a clear, colorless, volatile and very stable chlorinated hydrocarbon. Carbon Tetrachloride is used as a solvent for oils and fats, as a refrigerant and as a dry-cleaning agent. Inhalation of its vapors can depress central nervous system activity and cause degeneration of the liver and kidneys. Carbon Tetrachloride is reasonably anticipated to be a human carcinogen based on evidence of carcinogenicity in experimental animals.	Human symptoms of acute inhalation to carbon tetrachloride include headache, weakness, lethargy, nausea, and vomiting. Acute exposures to higher levels and chronic inhalation exposure to carbon tetrachloride produces liver and kidney damage in humans.	Group 2B
14	Chlorobenzene	VOCs	-	Chlorobenzene is a colorless to clear, yellowish liquid with a sweet almond-like odor. Chlorobenzene is used primarily as a solvent, a degreasing agent, and a chemical intermediate.	Acute exposure to chlorobenzene produced narcosis, restlessness, tremors, and muscle spasms. Chronic exposure of humans to chlorobenzene affects the central nervous system (CNS). Signs of neurotoxicity in humans include numbness, cyanosis, hyperesthesia (increased sensation), and muscle spasms.	-

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15	Chloroform	VOCs	2.3E-05	Chloroform is a colorless, volatile, liquid derivative of trichloromethane with an ether-like odor. Formerly used as an inhaled anesthetic during surgery, the primary use of chloroform today is in industry, where it is used as a solvent and in the production of the refrigerant Freon.	The major effect from acute (short-term) inhalation exposure to chloroform is central nervous system depression. Chronic (long-term) exposure to chloroform by inhalation in humans has resulted in effects on the liver, including hepatitis and jaundice, and central nervous system effects, such as depression and irritability.	Group 2B
16	Formaldehyde	VOCs	1.3E-05	Formaldehyde is a colorless, flammable gas at room temperature and has a strong odor. Exposure to formaldehyde may cause adverse health effects.	The major toxic effects caused by acute formaldehyde exposure via inhalation are eye, nose, and throat irritation and effects on the nasal cavity. Other effects seen from exposure to high levels of formaldehyde in humans are coughing, wheezing, chest pains, and bronchitis. Chronic exposure to formaldehyde by inhalation in humans has been associated with respiratory symptoms and eye, nose, and throat irritation.	Group 1
17	Hexane (or n-hexane)	VOCs	-	N-hexane is a clear colorless liquids with a petroleum-like odor. Flash points -9 °F. Less dense than water and insoluble in water. Vapors heavier than air. Used as a solvent, paint thinner, and chemical reaction medium.	Acute inhalation exposure of humans to high levels of hexane causes mild central nervous system (CNS) effects, including dizziness, giddiness, slight nausea, and headache. Chronic exposure to hexane in air is associated with polyneuropathy in humans, with numbness in the extremities, muscular weakness, blurred vision, headache, and fatigue observed.	-
18	Methanol	VOCs	-	A colorless, flammable liquid used in the manufacture of formaldehyde and acetic acid, in chemical synthesis, antifreeze, and as a solvent. Ingestion of methanol is toxic and may cause blindness.	Acute or chronic exposure of humans to methanol by inhalation or ingestion may result in blurred vision, headache, dizziness, and nausea	-
19	Methyl chloride (Chloromethane)	VOCs	-	Methyl chloride is a colorless gas with a faint sweet odor. Shipped as a liquid under its vapor pressure. A leak may either be liquid or vapor. Contact with the liquid may cause frostbite by evaporative cooling. Easily ignited. Vapors heavier than air. Can asphyxiate by the displacement of air. Under prolonged exposure to fire or intense heat the containers may rupture violently and rocket. Used to make other chemicals and as a herbicide.	Acute exposure to high concentrations of methyl chloride in humans has caused severe neurological effects. Methyl chloride has also caused effects on the heart rate, blood pressure, liver, and kidneys in humans. Chronic exposure have shown liver, kidney, spleen, and central nervous system (CNS) effects.	Group 3
20	Methyl chloroform (1,1,1-Trichloroethane)	VOCs	-	Methyl chloroform is a colorless liquid with a sweet, pleasant odor. May irritate skin, eyes and mucous membranes. In high concentrations the vapors may have a narcotic effect. Nonflammable, but may decompose and emit toxic chloride fumes if exposed to high temperatures. Used as a solvent.	Symptoms of acute inhalation exposure include dizziness, nausea, vomiting, diarrhea, loss of consciousness, and decreased blood pressure in humans. After chronic inhalation exposure to methyl chloroform, some liver damage was observed in mice and ventricular arrhythmias in humans.	Group 3
21	Methylene chloride (Dichloromethane)	VOCs	1.0E-08	Methylene Chloride is a clear, colorless, nonflammable, volatile liquid chlorinated hydrocarbon with a sweet, pleasant smell and emits highly toxic fumes of phosgene when heated to decomposition. Methylene chloride is primarily used as a solvent in paint removers, but is also used in aerosol formulations, as a solvent in the manufacture of pharmaceuticals, as a degreasing agent, in electronics manufacturing and as an ethane foam blowing agent.	The acute effects of methylene chloride inhalation in humans consist mainly of nervous system effects including decreased visual, auditory, and motor functions, but these effects are reversible once exposure ceases. The effects of chronic exposure to methylene chloride suggest that the central nervous system (CNS) is a potential target in humans and animals.	Group 2A
22	Styrene	VOCs	-	Styrene is a colorless, toxic liquid with a strong aromatic odor. It is used to make rubbers, polymers and copolymers, and polystyrene plastics.	Acute exposure to styrene in humans results in mucous membrane and eye irritation, and gastrointestinal effects. Chronic exposure to styrene in humans results in effects on the central nervous system (CNS), such as headache, fatigue, weakness, and depression, CNS dysfunction, hearing loss, and peripheral neuropathy.	Group 2B
23	1,1,2,2-Tetrachloroethane	VOCs	5.8E-05	1,1,2,2-tetrachloroethane is a colorless to pale yellow liquid with a sweet odor. Sinks in water.	Acute inhalation exposure to very high levels of 1,1,2,2-tetrachloroethane has resulted in effects on the liver and respiratory, central nervous, and gastrointestinal systems in humans. Chronic inhalation exposure to 1,1,2,2-tetrachloroethane in humans results in jaundice and an enlarged liver, headaches, tremors, dizziness, numbness, and drowsiness.	Group 2B
24	Tetrachloroethylene (Perchloroethylene)	VOCs	2.6E-07	Tetrachloroethylene is a colorless, volatile, nonflammable, liquid, chlorinated hydrocarbon with an ether-like odor that may emit toxic fumes of phosgene when exposed to sunlight or flames. Tetrachloroethylene is mainly used as a cleaning solvent in dry cleaning and textile processing and in the manufacture of fluorocarbons.	Effects resulting from acute high-level inhalation exposure of humans to tetrachloroethylene include irritation of the upper respiratory tract and eyes, kidney dysfunction, and neurological effects such as reversible mood and behavioral changes, impairment of coordination, dizziness, headache, sleepiness, and unconsciousness. The primary effects from chronic inhalation exposure are neurological, including impaired cognitive and motor neurobehavioral performance. The IARC has classified trichloroethylene as Group 2A.	Group 2A
25	Toluene	VOCs	-	Toluene is a clear colorless liquid with a characteristic aromatic odor. Flash point 40 °F. Less dense than water (7.2 lb / gal) and insoluble in water. Hence floats on water. Vapors heavier than air. May be toxic by inhalation, ingestion or skin contact. Used in aviation and automotive fuels, as a solvent, and to make other chemicals.	The central nervous system (CNS) is the primary target organ for toluene toxicity in humans for acute and chronic exposures. CNS dysfunction and narcosis have been frequently observed in humans acutely exposed to elevated airborne levels of toluene; symptoms include fatigue, sleepiness, headaches, and nausea. CNS depression has been reported to occur in chronic abusers exposed to high levels of toluene. Chronic inhalation exposure of humans to toluene also causes irritation of the upper respiratory tract and eyes, sore throat, dizziness, and headache.	Group 3
26	1,2,4-Trichlorobenzene	VOCs	-	1,2,4-trichlorobenzene is a colorless liquid or white solid with a sharp chlorobenzene odor. Melting point 16.95 °C (62.5 °F) .	Acute exposure of 1,2,4-Trichlorobenzene can irritate the nose and throat. Chronic exposure of 1,2,4-Trichlorobenzene can cause damage to liver and kidneys.	-
27	1,1,2-Trichloroethane	VOCs	1.6E-05	1,1,2-Trichloroethane is a colourless, sweet-smelling liquid that does not dissolve in water, but is soluble in most organic solvents. It is an isomer of 1,1,1-trichloroethane.	Acute exposure to very high levels of 1,1,2-tetrachloroethane has caused severe liver destruction in humans. Respiratory and eye irritation, dizziness, nausea, and vomiting have been noted in humans exposed to fumes at high levels in the workplace. Chronic exposure of humans to high levels of 1,1,2-tetrachloroethane results in effects on the liver (jaundice and an enlarged liver), central and peripheral nervous system (headaches, tremors, dizziness, and drowsiness), and gastrointestinal effects (pain, nausea, vomiting, and loss of appetite).	Group 3
28	Trichloroethylene	VOCs	4.3E-07	Trichloroethylene is a synthetic, light sensitive, volatile, colorless, liquid that is miscible with many non-polar organic solvents. Trichloroethylene is used mainly as a degreaser for metal parts.	Acute and chronic inhalation exposure to trichloroethylene can affect the human central nervous system (CNS), with symptoms such as dizziness, headaches, confusion, euphoria, facial numbness, and weakness. Liver, kidney, immunological, endocrine, and developmental effects.	Group 1

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29	Xylenes (isomers and mixture)	VOCs	-	It is a colorless, sweet-smelling liquid or gas occurring naturally in petroleum, coal and wood tar, and is so named because it is found in crude wood spirit Xylenes are released into the atmosphere as fugitive emissions from industrial sources, from auto exhaust, and through volatilization from their use as solvents.	Acute inhalation exposure to mixed xylenes in humans results in irritation of the eyes, nose, and throat, gastrointestinal effects, eye irritation, and neurological effects. Chronic inhalation exposure of humans to mixed xylenes results primarily in central nervous system (CNS) effects, such as headache, dizziness, fatigue, tremors, and incoordination; respiratory, cardiovascular, and kidney effects.	Group 3
30	Methyl mercaptan (Methanethiol)	VOCs	-	Methyl mercaptan is a colorless gas with a smell like rotten cabbage. It is a natural substance found in the blood, brain, and other tissues of people and animals. It is released from animal feces. It occurs naturally in certain foods, such as some nuts and cheese. Methyl mercaptan is released from decaying organic matter in marshes and is present in the natural gas of certain regions in the United States, in coal tar, and in some crude oils. It is manufactured for use in the plastics industry, in pesticides, and as a jet fuel additive. It is also released as a decay product of wood in pulp mills.	Acute health effects of Methyl mercaptan can irritate the nose and throat. Breathing Methyl mercaptan can irritate the lungs causing coughing and/or shortness of breath. Higher exposures can cause a build-up of fluid in the lungs, a medical emergency, with severe shortness of breath. Exposure to methyl mercaptan can cause headache, nausea, vomiting, dizziness, muscle weakness and loss of coordination. Higher levels can cause loss of consciousness and death. No information is currently available for the chronic human health effect for methyl mercaptan.	-
31	Ethyl mercaptan (Ethanethiol)	VOCs	-	Ethyl mercaptan is a clear colorless low-boiling liquid (boiling point 97 °F) with an overpowering, garlic-like/skunk-like odor. Flash point -55 °F. Less dense than water and very slightly soluble in water. Vapors are heavier than air. Vapors may irritate nose and throat. May be toxic if swallowed, by inhalation or by contact. Added to natural gas as an odorant. Used as a stabilizer for adhesives.	Inhalation of vapor causes muscular weakness, convulsions, respiratory paralysis. High concentrations may cause pulmonary irritation. Liquid irritates eyes and skin. Ingestion causes nausea and irritation of mouth and stomach.	-
32	1,2-Dichloroethane	VOCs	2.6E-05	1,2-Dichloroethane is a clear, colorless, oily, synthetic, flammable liquid chlorinated hydrocarbon with a pleasant chloroform-like smell that emits toxic fumes of hydrochloric acid when heated to decomposition.	Acute and chronic exposure to 1,2-Dichloroethane by inhalation has resulted in a variety of effects in humans, including effects on the central nervous system, liver, kidney, lung, and cardiovascular system	Group 2B
33	Ethylbenzene	VOCs	2.5E-06	Ethylbenzene is a clear colorless liquid with an aromatic odor. Flash point 59 °F. Less dense than water (at 7.2 lb / gal) and insoluble in water. Hence floats on water. Vapors heavier than air. Used as a solvent and to make other chemicals.	Acute exposure to ethylbenzene in humans results in respiratory effects, such as throat irritation and chest constriction, irritation of the eyes, and neurological effects such as dizziness. Chronic exposure to ethylbenzene by inhalation in humans has shown conflicting results regarding its effects on the blood. Animal studies have reported effects on the blood, liver, and kidneys from chronic inhalation exposure to ethylbenzene.	Group 2B
34	a-Pinene	VOCs	-	Alpha-pinene is a clear colorless liquid with a turpentine odor. Flash point 91 °F. Less dense than water and insoluble in water. Vapors are heavier than air. Used as a solvent.	Acute exposure to a-Pinene can irritate the nose and throat causing coughing and wheezing. Exposure to a-Pinene can cause headache, nausea and vomiting. Chronic exposure to a-Pinene can irritate the lungs. Repeated exposure may cause bronchitis to develop with coughing, phlegm, and/or shortness of breath. a-Pinene may also damage the kidneys.	-
35	n-Decane	VOCs	-	n-decane is a colorless liquid. Flash point 115 °F. Less dense than water and insoluble in water. Vapors heavier than air. In high concentrations its vapors may be narcotic. Used as a solvent and to make other chemicals.	Contact with eyes may produce mild irritation. Contact with skin may cause defatting, redness, scaling, and hair loss. Ingestion may cause diarrhea, slight central nervous system depression, difficulty in breathing and fatigue. Inhalation of high concentrations may cause rapid breathing, fatigue, headache, dizziness, and other CNS effects.	-
36	d-Limonene	VOCs	-	D-limonene is a clear colorless mobile liquid with a pleasant lemon-like odor.	Symptoms of exposure to this compound may include irritation and sensitization of the skin. It may also cause eye irritation and damage. Ingestion of large doses may lead to albuminuria and hematuria. This type of compound irritates all tissues intensely and may cause circulatory collapse. Ingestion of this type of compound may cause abdominal burning, nausea, vomiting, diarrhea, dysuria, hematuria, unconsciousness, shallow respiration, and convulsions. Inhalation of this type of compound may cause dizziness, rapid and shallow breathing, tachycardia, bronchial irritation, unconsciousness and convulsions. Anuria, pulmonary edema and bronchia pneumonia may complicate recovery after either type of exposure.	Group 3
37	Terpenes	VOCs	-	Terpenes (/ 'tɜ:pi:n/) are a large and diverse class of organic compounds, produced by a variety of plants, particularly conifers, though also by some insects such as termites or swallowtail butterflies, which emit terpenes from their osmeteria.	They are often strong-smelling. They may protect the plants that produce them by deterring herbivores and by attracting predators and parasites of herbivores. Many terpenes are aromatic hydrocarbons and thus may have had a protective function.	-
38	o-Dichlorobenzene (1,2-Dichlorobenzene)	VOCs	-	o-Dichlorobenzene is an organic compound with the formula C6H4Cl2. This colourless liquid is poorly soluble in water but miscible with most organic solvents. It is a derivative of benzene, consisting of two adjacent chlorine centers.	The acute effects of o-Dichlorobenzene by inhalation are reported to be headache, nausea, vomiting, vertigo, malaise and unconsciousness.	Group 3
39	m-Dichlorobenzene(1,3-Dichlorobenzene)	VOCs	-	m- Dichlorobenzene is a colorless liquid that is insoluble to water in which is used to make herbicides, insecticides, medicine, and dyes.	Acute exposure to m- Dichlorobenzene can irritate the nose and throat causing coughing and wheezing but also headache, drowsiness, nausea, vomiting diarrhea and abdominal cramps. It may also damage the red blood cells leading to low blood count (anemia). No information is currently available for the chronic human health effect for m- Dichlorobenzene.	Group 3
40	p-Dichlorobenzene (1,4-Dichlorobenzene)	VOCs	1.1E-05	1 4-Dichlorobenzene is a synthetic, white crystalline solid that is practically insoluble in water and soluble in ether, chloroform,carbon disulfide, benzene, alcohol and acetone. It is used primarily as a space deodorant in products such as room deodorizers, urinal and toilet bowl blocks, and as an insecticide fumigant for moth control.	When 1,4-dichlorobenzene is heated to decomposition, toxic gases and vapors (such as hydrochloric acid and carbon monoxide) are released. The primary route of potential human exposure to this compound is inhalation. Acute inhalation exposure to 1,4-dichlorobenzene can result in coughing and breathing difficulties. Breathing high levels of this chemical can cause headaches, dizziness and liver damage. Contact with 1,4-dichlorobenzene can irritate the eyes, leading to burning and tearing. It is reasonably anticipated to be a human carcinogen.	Group 2B
41	Naphthalene	PAHs	3.4E-05	Naphthalene is a white, volatile, solid polycyclic hydrocarbon with a strong mothball odor. Naphthalene is obtained from either coal tar or petroleum distillation and is primarily used to manufacture phthalic anhydride, but is also used in moth repellents.	Acute exposure of humans to naphthalene by inhalation, ingestion, and dermal contact is associated with hemolytic anemia, damage to the liver, and neurological damage. Chronic exposure of workers and rodents to naphthalene would cause cataracts and damage to the retina.	Group 2B

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42	Benzo (a) Pyrene	PAHs	8.7E-02	Benzo (a) Pyrene is a pale yellow, crystalline solid or powder with a faint aromatic odor. In its pure form it is used as a laboratory reagent. It also forms as a gaseous by-product when certain carbon substances burn, such as coal tar chemicals, and is found in cigarette smoke.	Acute exposure to Benzo (a) Pyrene can irritate the skin causing a rash or burning feeling on contact. Exposure to a combination of sunlight and this chemical can increase these effects. Chronic exposure may cause stomach, skin, lung, blood, spleen, pancreas, and mammary cancer.	Group 1
43	Acenaphthylene	PAHs	-	Acenaphthylene is a colorless crystalline solid. Insoluble in water. Used in dye synthesis, insecticides, fungicides, and in the manufacture of plastics.	Acute exposure may irritate the eyes, nose and throat. Very high levels can cause headache, restlessness, lethargy, nausea, vomiting, anorexia and anemia. Acenaphthylene may cause headaches, fatigue, and nausea with chronic exposure. Acenaphthylene may cause a skin allergy. Chronic exposure to some polycyclic aromatic hydrocarbons (PAHs) may result in optic neuritis, lens opacities, and chorioretinitis.	-
44	Acenaphthene	PAHs	-	Acenaphthene is a white needles. Melting point 93.6 °C. Soluble in hot alcohol. Denser than water and insoluble in water. Hence sinks in water. May irritate skin and mucous membranes. Emits acrid smoke and irritating fumes when heated to decomposition. Derived from coal tar and used to make dyes, pharmaceuticals, insecticides, fungicides, and plastics.	Acute exposure may irritate the eyes, nose and throat. Very high levels can cause headache, restlessness, lethargy, nausea, vomiting, anorexia and anemia. Acenaphthene may cause headaches, fatigue, and nausea with chronic exposure. Acenaphthylene may cause a skin allergy. Chronic exposure to some polycyclic aromatic hydrocarbons (PAHs) may result in optic neuritis, lens opacities, and chorioretinitis.	Group 3
45	Fluorene	PAHs	-	Fluorene is white crystalline plates. It is used in resinous products, dyestuffs, and as a chemical intermediate	Fluorene can irritate and burn the eyes and skin for acute health effects. For chronic exposure, fluorene has been tested but further studies are required to determine its ability to cause cancer.	Group 3
46	Phenanthrene	PAHs	-	Phenanthrene is a colorless monoclinic crystals with a faint aromatic odor. Solutions exhibit a blue fluorescence.	Acute exposure to Phenanthrene can irritate the nose and throat. While chronic human effects of Phenanthrene has been tested, it is not classifiable as to its potential to cause cancer.	Group 3
47	Anthracene	PAHs	-	Anthracene, also called paranaphthalene or green oil, a solid polycyclic aromatic hydrocarbon (PAH) consisting of three benzene rings derived from coal-tar, is the simplest tricyclic aromatic hydrocarbon. It is on the EPA's priority pollutant list. It is ubiquitous in the environment as a product of incomplete combustion of fossil fuels. It has been identified in surface and drinking water, ambient air, exhaust emissions, smoke of cigarettes and cigars, and in smoked foods and edible aquatic organisms. It is primarily used as an intermediate in the production of dyes, smoke screens, scintillation counter crystals, and in organic semiconductor research.	Inhalation of dust irritates nose and throat. Contact with eyes causes irritation.	Group 3
48	Fluoranthene	PAHs	-	Fluoranthene is a light yellow fine crystals.	Toxic by all routes (ie, inhalation, ingestion, dermal contact), exposure to this pale yellow, crystalline substance may occur from its presence in coal tar products used in coatings for pipes and storage tanks, in roofing materials, and asphalt. Effects from exposure (based on analogy to phenol) may include contact burns to the skin and eyes, nausea, tachycardia, cardiac arrhythmias, liver injury, pulmonary edema, and respiratory arrest. In addition, NIOSH recommends that fluoranthene be regulated as an occupational carcinogen. In activities and situations where over-exposure via coal tar products may occur, wear a self-contained breathing apparatus, and personal protective clothing to prevent skin contact. All such equipment and clothing should be removed in change rooms at the end of the workday, and maintained in a clean condition. Also workers should wash thoroughly at the end of the workday. While fluoranthene's fire hazard is only slight when exposed to heat and flame, it may be decomposed by heat, emitting acrid smoke and fumes. Spills of hot coal tar products may be covered with sand. Fluoranthene is a good candidate for disposal by rotary kiln or fluidized bed forms of incineration.	Group 3
49	Pyrene	PAHs	-	Pyrene is a colorless solid, solid and solutions have a slight blue fluorescence.	Pyrene is a carcinogenic agent and is absorbed by the skin. It is a skin irritant, a suspected mutagen, and an equivocal tumor-causing agent. Workers exposed to 3 to 5 mg/m3 of pyrene exhibited some teratogenic effects. Pyrene is a polycyclic aromatic hydrocarbon (PAH). The acute toxicity of pure PAHs appears low when administered orally or dermally to rats or mice. Human exposure to PAHs is almost exclusively via the gastrointestinal and respiratory tracts, and approximately 99 percent is ingested in the diet. Despite the high concentrations of pyrene to which humans may be exposed through food, there is currently little information available to implicate diet-derived PAHs as the cause of serious health effects.	Group 3
50	Benz(a)anthracene	PAHs	1.1E-04	Benz(a)anthracene is a crystalline, aromatic hydrocarbon consisting of four fused benzene rings, produced by incomplete combustion of organic matter. Benz(a)anthracene is primarily found in gasoline and diesel exhaust, tobacco and cigarette smoke, coal tar and coal tar pitch, coal combustion emissions, charcoal-broiled foods, amino acids, fatty acids and carbohydrate pyrolysis products, wood and soot smoke, and creosote, asphalt and mineral oils. This substance is used only for research purposes. Benz(a)anthracene is reasonably anticipated to be a human carcinogen.	When heated to decomposition this compound emits acrid smoke and irritating fumes.	Group 2B
51	Chrysene	PAHs	1.1E-05	Chrysene is an aromatic hydrocarbon in coal tar, allied to naphthalene and anthracene. It is a white crystalline substance, C18H12, of strong blue fluorescence, but generally colored yellow by impurities.	Toxic as chronic and acute hazard.	Group 2B
52	Benzo(b)fluoranthene	PAHs	1.1E-04	Benzo(b)fluoranthene is a colorless, aromatic hydrocarbon consisting of five fused rings and formed by the incomplete burning of organic matter. Benzo(b)fluoranthene is primarily found in gasoline exhaust, tobacco and cigarette smoke, coal tar, soot, amino acids and fatty acid pyrolysis products. This substance is used only for research purposes. Benzo(b)fluoranthene is reasonably anticipated to be a human carcinogen.	When heated to decomposition, this compound emits acrid smoke and irritating fumes	Group 2B

Appendix 13.02 TAP Carcinogenic Effect and Classification

Item	Chemical	Species	Carcinogenic Risk IUR (µg/m3) ⁻¹	Characteristics	Consequence	IARC Group
53	Benzo(k)fluoranthene	PAHs	1.1E-04	Benzo k fluoranthene is a pale yellow aromatic hydrocarbon consisting of five fused rings and is produced by the incomplete combustion of organic matter. Benzo(k)fluoranthene is primarily found in gasoline exhaust, cigarette smoke, coal tar, coal and oil combustion emissions, lubricating oils, used motor oils and crude oils. This substance is used only for research purposes. Benzo(k)fluoranthene is reasonably anticipated to be a human carcinogen.	hen heated to decomposition this compound emits acrid smoke and irritating fumes.	Group 2B
54	Indeno (1,2,3-cd)pyrene	PAHs	1.1E-04	Indeno 1 2 3-cd pyrene is a yellowish, aromatic hydrocarbon consisting of six fused rings and produced by the incomplete combustion of organic matter. Indene[1,2,3-cd]pyrene is primarily found in certain foods, gasoline and diesel exhaust, cigarette smoke, coal tar and coal tar pitch, soot and petroleum asphalt. This substance is used only for research purposes. Indene[1,2,3-cd]pyrene is reasonably anticipated to be a human carcinogen.	Toxic as chronic and actue hazard.	Group 2B
55	Dibenz(a,h)anthracene	PAHs	1.2E-03	Dibenzo a h Anthracene is a crystalline, carcinogenic aromatic hydrocarbon consisting of five fused benzene rings, produced by the incomplete combustion of organic matter. Dibenzo(a,h)anthracene is primarily found in gasoline exhaust, tobacco smoke, coal tar, soot and certain food products, especially smoked and barbecued foods. This substance is used only for research purposes to induce tumorigenesis. Dibenzo(a,h)anthracene is a mutagen and is reasonably anticipated to be a human carcinogen.	This compound is harmful if swallowed or inhaled. It may cause irritation. When heated to decomposition it emits acrid smoke, irritating fumes and toxic fumes of carbon monoxide and carbon dioxide.	Group 2A
56	Benzo(g,h,i)perylene	PAHs	-	Benzo[ghi]perylene is a colorless to white crystalline solid. Water insoluble. Large, pale yellow-green plates (recrystallized from xylene)	Inhalation of material may be harmful. Contact may cause burns to skin and eyes. Inhalation of Asbestos dust may have a damaging effect on the lungs. Fire may produce irritating, corrosive and/or toxic gases. Some liquids produce vapors that may cause dizziness or suffocation. Runoff from fire control may cause pollution.	Group 3

Notes:

- Group 1 Carcinogenic to humans
- Group 2A Probably carcinogenic to humans
- Group 2B Possibly carcinogenic to humans
- Group 3 Not classifiable as to its carcinogenicity to humans
- Group 4 Probably not carcinogenic to humans