



west virginia department of environmental protection

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ENGINEERING EVALUATION / FACT SHEET

BACKGROUND INFORMATION

Application No.: R13-2840
Plant ID No.: 039-00003
Applicant: Union Carbide Corporation
Facility Name: South Charleston Facility
Location: South Charleston, Kanawha County
SIC Code: 2869
Application Type: Modification
Received Date: April 21, 2010
Engineer Assigned: Steven R. Pursley, PE
Fee Amount: \$1,000.00
Date Received: April 22, 2010
Complete Date: May 10, 2010
Due Date: August 6, 2010
Applicant Ad Date: April 29, 2010
Newspaper: *The Daily Mail*
UTM's: Easting: 439.67 km Northing: 4,246.72 km Zone: 17
Description: Installation of a groundwater/soil remediation systems to remove and treat volatile organic compounds.

DESCRIPTION OF PROCESS

The following process description comes *nearly* verbatim from the permit application.

Contaminants will be extracted from the groundwater and soil through soil vapor extraction (SVE) wells using a vacuum blower. VOCs and non VOCs (i.e. methane) present in the process vapor stream will be vented to a regenerative thermal oxidizer (RTO). Thermal oxidation will destroy the VOCs through direct combustion at temperatures where organic compounds in the process vapor stream are thermodynamically unstable. The oxidation process will result in the formation of carbon dioxide, water vapor and inorganic acids. Oxidizer exhaust vent gas will be quenched and routed to a wet scrubber for removal of hydrogen chloride prior to venting to the air. A dilute caustic (sodium hydroxide) solution will be used as the scrubber liquor to enhance hydrogen chloride removal efficiency.

SITE INSPECTION

The facility is regularly inspected by DAQ personnel. Within the past 2 years the facility has been inspected twice. First by Robert Keatley as part of a targeted inspection on September 24, 2008. Then again by Rich Boehm as part of a RCRA inspection on June 16, 2009. Both times the facility was found to be in compliance.

To get to the facility take exit 56 of Interstate 64. Turn right on Montrose Drive and proceed approximately 1/4 mile. The facility is at the intersection of US Route 60.

ESTIMATE OF EMISSIONS BY REVIEWING ENGINEER

Controlled emissions of criteria pollutants from the remediation system will be as follows:

	lb/hr	tpy
NO _x	0.10	0.44
CO	0.44	1.92
SO ₂	0.01	0.02
PM	0.01	0.01
VOC	3.1	13.5

Controlled emissions of HAPs from the remediation system will be as follows:

	lb/hr	tpy
bis(2-Chloroethyl)ether	0.01	0.02
1,1,2,2,-Tetrachloroethane	0.02	0.06
1,1,2-Trichloroethane	0.20	0.84
1,1,-Dichloroethane	0.01	0.02
Vinylidene Chloride	0.15	0.65
Ethylene Dichloride	1.53	6.67
1,4-Dichlorobenzene	0.01	0.01
1,4-Dioxane	0.01	0.03
Benzene	0.01	0.01

Carbon Tetrachloride	0.01	0.03
Chlorobenzene	0.01	0.01
Chloroform	0.01	0.01
Hexachlorobutadiene	0.01	0.01
Hexachloroethane	0.01	0.01
Tetrachloroethene	0.02	0.05
Toluene	0.01	0.01
Trichloroethene	0.39	1.68
Vinyl Chloride	0.02	0.08
Hexane	0.01	0.04
HCl	0.35	1.51
Total HAPs	2.8	11.75

REGULATORY APPLICABILITY

The facility proposed to be permitted under this application R13-2426 is subject to the following state regulations:

STATE RULES

45CSR4 "To Prevent and Control the Discharge of Air Pollutants into the Open Air Which Causes or Contributes to an Objectionable Odor or Odors."

§45-4-3.1, states that no person shall cause, suffer, allow or permit the discharge of air pollutants which cause or contribute to an objectionable odor at any location occupied by the public.

45CSR6 "To Prevent and Control Air Pollution from Combustion of Refuse."

The regenerative thermal oxidizer is classified as an incinerator under the definitions of 45CSR6 and is required to comply with the emission standards of §45-6-4. Based on the applicants maximum VOC charging rate of 109 pounds per hour (0.055 ton/hr) , the allowable particulate emission rate per §45-6-4.1 is 0.296 lb/hr. The permitted particulate emission rate from the oxidizer will be 0.01 lb/hr.

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The RTO should easily comply with the visible emission limitations in §45-6-4.3 and 4.4.

45CSR10 “To Prevent and Control Air Pollution from the Emission of Sulfur Oxides.”

Because the heat input of the regenerative thermal oxidizer is low (less than 10 MMBTU/hr) and has an SO₂ potential to emit of less than 500 pounds per year, the source is exempt from all parts of 45CSR10 except §45-10-5. §45-10-5.1 limits the hydrogen sulfide concentration of any process gas stream being combusted to 50 grains per 100 cubic feet of gas. Based on results from preliminary testing the applicant expects no H₂S in the gas stream.

45CSR13 Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, and Procedures for Evaluation)

The modification is subject to 45CSR13 because uncontrolled VOC emissions would be well over 6 pounds per hour and 10 tons per year. Additionally, uncontrolled HAP emissions would be well over 2 pounds per hour and 5 tons per year. This is a minor modification to a major source.

45CSR30 Requirements for Operating Permits

The facility is an existing Title V major source.

NONAPPLICABILITY DETERMINATIONS

The modification is **not** subject to the following rules:

45CSR21 Regulation To Prevent and Control Air Pollution From The Emission of Volatile Organic Compounds

§45-21-40.1.d exempts incinerators having a destruction efficiency of 95% or greater.

45CSR27 To Prevent and Control Emissions of Toxic Air Pollutants

The modification does not meet the definition of Chemical Processing Facility under §45-27-2.4. However, it should be noted that the main requirement of 45CSR27 is the employment of Best Available Technology (BAT). The controls proposed by UCC almost

certainly meets this requirement anyway.

40 CFR 61 Subpart V National Emission Standards for Equipment Leaks

Although vinyl chloride and benzene are defined as VHAPs under the rule, §61.245(d)(1) states that when it can be determined that the percent VHAP concentration can be reasonably expected to never exceed 10% by weight, the equipment is considered to be “not if VHAP service”. Testing performed by the applicant indicates that this is the case.

40 CFR 61 Subpart FF National Emission Standard for Benzene Waste Operations

§61.340(c)(1) exempts waste that is in the form of gases or vapors that is emitted from process fluids.

40 CFR 63 Subpart GGGGG National Emission Standards for Hazardous Air Pollutants: Site Remediation

§61.340(c)(1) exempts site remediation that will be performed under the Resource Conservation and Recovery Act (RCRA) corrective action and is required by a permit. The applicant has indicated that this is the case.

TOXICITY OF NON-CRITERIA REGULATED POLLUTANTS

The following information was obtained from USEPA’s Air Toxic Website.

111-44-4 bis(2-chloroethyl)ether - HAP

Dichloroethyl ether is mainly used as a chemical intermediate in industry. Limited health effects information is available on this chemical. The major effect from acute (short-term) inhalation exposure to dichloroethyl ether in humans is extreme irritation of the respiratory tract and skin. Dichloroethyl ether has been shown to be carcinogenic in animal studies; an increased incidence of liver tumors in mice has been reported. EPA has classified dichloroethyl ether as a Group B2, probable human carcinogen.

79-34-5 1,1,2,2-Tetrachloroethane - HAP

As 1,1,2,2-tetrachloroethane is no longer used much in the United States, current air emissions predominantly result from its use as a chemical intermediate during the manufacture of other chemicals. Low levels have been detected in air. The main effects of 1,1,2,2-tetrachloroethane are liver and neurological effects. Acute (short-term) 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 (long-term) inhalation exposure to 1,1,2,2-tetrachloroethane in humans results in jaundice and an enlarged liver, headaches, tremors, dizziness, numbness, and drowsiness. Animal studies have shown a significantly increased incidence of liver tumors in mice orally exposed to 1,1,2,2-tetrachloroethane. EPA has classified 1,1,2,2-tetrachloroethane as a Group C possible human carcinogen.

79-00-5 1,1,2-Trichloroethane - HAP

1,1,2-Trichloroethane is used as a chemical intermediate and a solvent. No information is available on the acute (short-term), chronic (long-term), developmental, reproductive, or carcinogenic effects of 1,1,2-trichloroethane in humans. The only effect that has been noted in humans is stinging and burning sensations of the skin upon dermal exposure to the chemical. Acute animal studies have reported effects on the liver, kidney, and central nervous system (CNS) from inhalation and oral exposure to 1,1,2-trichloroethane, while chronic animal studies have reported effects on the liver and immune system from oral exposure. An animal study reported liver tumors and adrenal tumors in mice, but no tumors in rats, exposed to 1,1,2-trichloroethane by gavage (experimentally placing the chemical in the stomach). EPA has classified 1,1,2-trichloroethane as a Group C, possible human carcinogen.

75-34-3 1,1-Dichloroethane - HAP

Ethylidene dichloride is primarily used as an intermediate in chemical synthesis. Acute (short-term) inhalation exposure to high levels of ethylidene dichloride in humans results in central nervous system (CNS) depression and a cardiostimulating effect resulting in cardiac arrhythmias. Studies in animals have reported effects on the kidney. No information is available on the chronic (long-term), reproductive, developmental, or carcinogenic effects of ethylidene dichloride in humans. An oral animal study reported a significantly positive dose-related trend in hemangiosarcomas, mammary tumors, liver tumors, and endometrial stromal polyps. EPA has classified ethylidene dichloride as a Group C, possible human carcinogen.

75-35-4 1,1-Dichloroethene (Vinylidene Chloride) - HAP, TAP

Vinylidene chloride is used as an intermediate in chemical synthesis and to produce polyvinylidene chloride copolymers. The primary acute (short-term) effects in humans from vinylidene chloride exposure are on the central nervous system (CNS), including CNS depression and symptoms of inebriation, convulsions, spasms, and unconsciousness at high concentrations. Low-level, chronic (long-term) inhalation exposure of vinylidene chloride in humans may affect the liver. Animal studies indicate that chronic exposure to vinylidene chloride can affect the liver, kidneys, CNS and lungs. Human data are

considered inadequate in providing evidence of cancer from exposure to vinylidene chloride. The most recent cancer classification for vinylidene chloride can be found on IRIS.

107-06-2 1,2-Dichloroethane (Ethylene Dichloride) - HAP, TAP

Exposure to low levels of ethylene dichloride can occur from breathing ambient or workplace air. Inhalation of concentrated ethylene dichloride vapor can induce effects on the human nervous system, liver, and kidneys, as well as respiratory distress, cardiac arrhythmia, nausea, and vomiting. Chronic (long-term) inhalation exposure to ethylene dichloride produced effects on the liver and kidneys in animals. No information is available on the reproductive or developmental effects of ethylene dichloride in humans. Decreased fertility and increased embryo mortality have been observed in inhalation studies of rats. Epidemiological studies are not conclusive regarding the carcinogenic effects of ethylene dichloride, due to concomitant exposure to other chemicals. Following treatment by gavage (experimentally placing the chemical in the stomach), several tumor types were induced in rats and mice. EPA has classified ethylene dichloride as a Group B2, probable human carcinogen.

106-46-7 1,4-Dichlorobenzene - HAP

The primary exposure to 1,4-dichlorobenzene is from breathing contaminated indoor air. Acute (short-term) exposure to 1,4-dichlorobenzene, via inhalation in humans, results in irritation of the skin, throat, and eyes. Chronic (long-term) 1,4-dichlorobenzene inhalation exposure in humans results in effects on the liver, skin, and central nervous system (CNS). No information is available on the reproductive, developmental, or carcinogenic effects of 1,4-dichlorobenzene in humans. A National Toxicology Program (NTP) study reported that 1,4-dichlorobenzene caused kidney tumors in male rats and liver tumors in both sexes of mice by gavage (experimentally placing the chemical in their stomachs). EPA has classified 1,4-dichlorobenzene as a Group C, possible human carcinogen.

123-91-1 1,4-Dioxane - HAP

1,4-Dioxane is used as a solvent. Acute (short-term) inhalation exposure to high levels of 1,4-dioxane has caused vertigo, drowsiness, headache, anorexia and irritation of the eyes, nose, throat, and lungs in humans. It may also irritate the skin. Damage to the liver and kidneys has been observed in rats chronically (long-term) exposed in their drinking water. In three epidemiologic studies on workers exposed to 1,4-dioxane, the observed number of cancer cases did not differ from the expected cancer deaths. Tumors have been observed in orally exposed animals. EPA has classified 1,4-dioxane as a Group B2, probable human carcinogen.

71-43-2 Benzene - HAP, TAP

Benzene is found in the air from emissions from burning coal and oil, gasoline service stations, and motor vehicle exhaust. Acute (short-term) 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 (long-term) inhalation exposure has caused various disorders in the blood, including reduced numbers of red blood cells and aplastic anemia, in occupational settings. Reproductive effects have been reported for women exposed by inhalation to high levels, and adverse effects on the developing fetus have been observed in animal tests. Increased incidence of leukemia (cancer of the tissues that form white blood cells) have been observed in humans occupationally exposed to benzene. EPA has classified benzene as a Group A, human carcinogen.

56-23-5 Carbon Tetrachloride (Tetrachloromethane) - HAP, TAP

Carbon tetrachloride may be found in both ambient outdoor and indoor air. The primary effects of carbon tetrachloride in humans are on the liver, kidneys, and central nervous system (CNS). Human symptoms of acute (short-term) inhalation and oral exposures to carbon tetrachloride include headache, weakness, lethargy, nausea, and vomiting. Acute exposures to higher levels and chronic (long-term) inhalation or oral exposure to carbon tetrachloride produces liver and kidney damage in humans. Human data on the carcinogenic effects of carbon tetrachloride are limited. Studies in animals have shown that ingestion of carbon tetrachloride increases the risk of liver cancer. EPA has classified carbon tetrachloride as a Group B2, probable human carcinogen.

108-90-7 Chlorobenzene - HAP

Chlorobenzene is used primarily as a solvent, a degreasing agent, and a chemical intermediate. Limited information is available on the acute (short-term) effects of chlorobenzene. Acute inhalation exposure of animals to chlorobenzene produced narcosis, restlessness, tremors, and muscle spasms. Chronic (long-term) 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. No information is available on the carcinogenic effects of chlorobenzene in humans. EPA has classified chlorobenzene as a Group D, not classifiable as to human carcinogenicity.

67-66-3 Chloroform (Trichloromethane) - HAP, TAP

Chloroform may be released to the air as a result of its formation in the chlorination of drinking water, wastewater and swimming pools. Other sources include pulp and paper mills, hazardous waste sites, and sanitary landfills. 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. Chloroform has been shown to be carcinogenic in animals after oral exposure, resulting in an increase in kidney and liver tumors. EPA has classified chloroform as a Group B2, probable human carcinogen.

87-68-3 Hexachlorobutadiene - HAP

Hexachlorobutadiene is used mainly as an intermediate in the manufacture of rubber compounds. No information is available on the health effects of hexachlorobutadiene in humans. Animal studies have reported effects on the kidney and respiratory system from acute inhalation exposure, and effects on the kidney from chronic oral exposure to hexachlorobutadiene. Animal studies have not reported developmental or reproductive effects, other than a reduction in fetal body weights, from inhalation exposure to hexachlorobutadiene. One study reported kidney tumors in rats exposed to hexachlorobutadiene orally. EPA has classified hexachlorobutadiene as a Group C, possible human carcinogen.

67-72-1 Hexachloroethane - HAP

Hexachloroethane is used by the military for smoke-producing devices, in metal and alloy production, and as an ingredient in insecticides. Hexachloroethane acts primarily as a central nervous system (CNS) depressant in humans acutely (short-term) exposed to it. Hexachloroethane is also moderately irritating to the skin, mucous membranes, and liver in humans. Neurological, liver, and kidney effects have been observed in animals exposed to hexachloroethane. No information is available on the chronic (long-term), reproductive, developmental, or carcinogenic effects of hexachloroethane in humans. Hepatocellular carcinomas (liver tumors) were observed in mice following oral exposure to hexachloroethane. EPA has classified hexachloroethane as a Group C, possible human carcinogen.

127-18-4 Tetrachloroethylene (Perchloroethylene) - HAP

Tetrachloroethylene is widely used for dry-cleaning fabrics and metal degreasing operations. The main effects of tetrachloroethylene in humans are neurological, liver, and kidney effects following acute (short-term) and chronic (long-term) inhalation exposure. Adverse reproductive effects, such as spontaneous abortions, have been reported from occupational exposure to tetrachloroethylene; however, no definite conclusions can be made because of the limitations of the studies. Results from epidemiological studies of dry-cleaners occupationally exposed to tetrachloroethylene suggest increased risks for several types of cancer. Animal studies have reported an increased incidence of liver cancer in mice, via inhalation and gavage (experimentally placing the chemical in the stomach), and kidney and mononuclear cell leukemia in rats. In the mid-1980s, EPA considered the epidemiological and animal evidence on tetrachloroethylene as intermediate between a probable and possible human carcinogen (Group B/C). The Agency is currently reassessing its potential carcinogenicity.

10-88-3 Toluene - HAP

Toluene is added to gasoline, used to produce benzene, and used as a solvent. Exposed to toluene may occur from breathing ambient or indoor air. The central nervous system (CNS) is the primary target organ for toluene toxicity in both humans and animals for acute (short-term) and chronic (long-term) exposures. CNS dysfunction and narcosis have been frequently observed in humans acutely exposed to toluene by inhalation; 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. Human studies have reported developmental effects, such as CNS dysfunction, attention deficits, and minor craniofacial and limb anomalies, in the children of pregnant women exposed to toluene or mixed solvents by inhalation. Reproductive effects, including an association between exposure to toluene and an increased incidence of spontaneous abortions, have also been noted. However, these studies are not conclusive due to many confounding variables. EPA has classified toluene as a Group D, not classifiable as to human carcinogenicity.

79-01-6 Trichloroethene (Trichloroethylene) - HAP, TAP

Most of the trichloroethylene used in the United States is released into the atmosphere from industrial degreasing operations. Acute (short-term) and chronic (long-term) 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 have also been reported in humans. A recent analysis of available epidemiological studies reports trichloroethylene exposure to be associated with several types of cancers in humans, especially kidney, liver, cervix, and lymphatic system. Animal studies have reported increases in lung, liver, kidney, and testicular tumors and lymphoma. The Agency is currently reassessing the cancer classification of trichloroethylene.

75-01-4 Vinyl Chloride - HAP, TAP

Most vinyl chloride is used to make polyvinyl chloride (PVC) plastic and vinyl products. Acute (short-term) exposure to high levels of vinyl chloride in air has resulted in central nervous system effects (CNS), such as dizziness, drowsiness, and headaches in humans. Chronic (long-term) exposure to vinyl chloride through inhalation and oral exposure in humans has resulted in liver damage. Cancer is a major concern from exposure to vinyl chloride via inhalation, as vinyl chloride exposure has been shown to increase the risk of a rare form of liver cancer in humans. EPA has classified vinyl chloride as a Group A, human carcinogen.

110-54-3 Hexane - HAP

Hexane is used to extract edible oils from seeds and vegetables, as a special-use solvent, and as a cleaning agent. Acute (short-term) inhalation exposure of humans to high levels of hexane causes mild central nervous system (CNS) effects, including dizziness, giddiness, slight nausea, and headache. Chronic (long-term) exposure to hexane in air is associated with polyneuropathy in humans, with numbness in the extremities, muscular weakness, blurred vision, headache, and fatigue observed. Neurotoxic effects have also been exhibited in rats. No information is available on the carcinogenic effects of hexane in humans or animals. EPA has classified hexane as a Group D, not classifiable as to human carcinogenicity.

7647-01-0 Hydrochloric Acid - HAP

Hydrochloric acid has many uses. It is used in the production of chlorides, fertilizers, and dyes, in electroplating, and in the photographic, textile, and rubber industries. Hydrochloric acid is corrosive to the eyes, skin, and mucous membranes. Acute (short-term) inhalation exposure may cause eye, nose, and respiratory tract irritation and inflammation and pulmonary edema in humans. Acute oral exposure may cause corrosion of the mucous membranes, esophagus, and stomach and dermal contact may produce severe burns, ulceration, and scarring in humans. Chronic (long-term) occupational exposure to hydrochloric acid has been reported to cause gastritis, chronic bronchitis, dermatitis, and photosensitization in workers. Prolonged exposure to low concentrations may also cause dental discoloration and erosion. EPA has not classified hydrochloric acid for carcinogenicity.

AIR QUALITY IMPACT ANALYSIS

Because this is a minor modification to a major stationary source no modeling was performed.

MONITORING OF OPERATIONS

The permittee shall monitor and record the following:

- * Monthly visual emissions checks of the packed bed scrubber exhaust stack.
- * The RTO firebox temperature.
- * Scrubber liquor flow rate (daily average) and pH (at least once daily).

RECOMMENDATION TO DIRECTOR

Information supplied in the application indicates that compliance with all applicable regulations will be achieved. Therefore it is the recommendation of the writer that permit R13-2840 for the modification of a installation of a Soil Vapor Extraction/Groundwater Remediation System in South Charleston, Kanawha County, be granted to Union Carbide Corporation.

Steven R. Pursley, PE
Engineer

Date