FORM EQP 5111 ATTACHMENT TEMPLATE B4
ENVIRONMENTAL ASSESSMENT

This document is an attachment to the Michigan Department of Environment, Great Lakes, and Energy's (EGLE) *Instructions for Completing Form EQP 5111, Operating License Application Form for Hazardous Waste Treatment, Storage, and Disposal Facilities.* See Form EQP 5111 for details on how to use this attachment.

The administrative rules promulgated pursuant to Part 111, Hazardous Waste Management, of Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451) §324.11118(3) and R 299.9504(1)(e) and R 299.9504(1)(b) establish requirements for conducting environmental assessments at hazardous waste management facilities. Before receiving an operating license, owners and operators of hazardous waste treatment, storage, or disposal facilities must evaluate the (proposed) facility's impact on air, water, or other natural resources of the state. The evaluation must also include a failure mode assessment. All references to 40 CFR citations specified herein are adopted by reference in R 299.11003.

This license application template addresses requirements for an environmental assessment for hazardous waste management units at the *Dow Silicones Corporation* facility.

📖 Guidance for this template can be found in EGLE's document titled "Contents of the Environmental Assessment."

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Appendix B4-1 Results of Computer Modeling of Facility Risk Scenarios

INTRODUCTION

This environmental assessment for *Dow Silicones Corporation facility* describes current conditions, environmental impacts, and applicable exposure information for landfills and surface impoundments. The goals of the environmental assessment are to describe and discuss (1) the probable impact of the facility on natural resources, human life, and all environmental elements that affect these values; (2) probable unavoidable adverse effects of the facility; (3) alternatives for accomplishing the same objective; and (4) possible modifications that would minimize adverse effects.

B4.A CURRENT CONDITIONS

B4.A.1 Facility Description

The Dow Silicones Corporation facility is located at 3901 South Saginaw Street, Midland County, Midland, Michigan (southern portion of the City of Midland in Section 26 of Midland Township: Township 14N, Range 2E). Figure B4-1 shows the general location of the site and shows the area immediately surrounding the site. Module B2 (Corrective Action) provides a detailed description of the facility and the wastes managed are discussed in Module A2 (Chemical and Physical Analyses).

B4.A.2 Description of Existing Environmental Conditions

A description of existing environmental conditions at the facility and any surrounding areas that may be affected by the facility is included in this section. Detailed information that is provided in other modules is not repeated here; however, references to appropriate modules are provided. Maps, photographs, and other relevant information that are not included in other modules are included in this section. Important ecological relationships, functions, and interdependence of physical environmental elements and social and economic elements are discussed. Factual information from publications, reports, or personal communications is documented, with sources cited.

B4.A.2(a) Climate

Table B4-1 presents annual and monthly mean temperatures, precipitation and snowfall for Midland, Michigan. The data was obtained from the Michigan State Climatologists Office and presents the average minimum and maximum temperatures and average precipitation and snow from 1981-2010. In general, precipitation is fairly well distributed throughout the year. The Midland area is characterized by a continental climate regime, with winter temperatures cold enough to sustain stable snow cover and relatively warm summer temperatures.

According to annual measurements recorded in Midland from 1981 - 2010, the average annual

snowfall between November and April for the year 2010 was 23.6 inches, the lowest since 2001 (22.8 inches). During the year 2010, Midland received 26.7 inches of precipitation, the lowest since 1989 (24.47 inches) (Michigan State Climatologist's Office, 2022).

Wind direction is generally from the west-southwest (that is, toward the east-northeast), regardless of season. Wind velocity peaks during February and March and is lowest during July. A wind rose is included as Figure B4-2.

B4.A.2(b) Topography

Figure B4-3 illustrates the topography of the area. The elevations of the ground surface in the Dow Silicones Corporation facility range from approximately 630 feet above sea level in the northeast corner to 617 feet in the southwest corner. Northeast of the facility the surface elevation increases to over 670 feet in 1.5 miles. The surface of the land; southwest of the facility slopes toward the Tittabawassee River, which is located approximately 1,000 feet away. The ground elevation between the facility and the northeastern bank of the Tittabawassee River is about 620 feet. The land elevation drops quickly at the riverbank to about 590 feet. Lingle Drain is the incised drainage ditch which runs through the eastern and southern portions of Dow Silicones manufacturing area and eventually empties into the Tittabawassee River. The drain is contained within steep banks on Dow Silicones Corporation property. The surface elevation of the water in Lingle Drain is approximately 615 feet above sea level at the northern border of the facility.

B4.A.2(c) Geology

Five distinct stratigraphic units can be distinguished beneath the Dow Silicones Corporation facility. These units are termed, from bottom to top, Bedrock, Regional Aquifer, Glacial Till, Lakebed Clay, and Surface Sand. The unit names are derived from the relative position and/or geologic genesis of each unit. These units can be divided into two groups: consolidated sedimentary rocks and unconsolidated glacial sediments. The consolidated sedimentary rocks will hereafter be referred to as "bedrock", and the unconsolidated sediments make up the other four units mentioned previously. Additional information on geology of the facility and surrounding area is presented in Module B3 (Hydrogeologic Report).

Mining

Mineral extraction (other than brine), sand or gravel mining, or hydrocarbon extraction has not occurred near the Dow Silicones Corporation facility to any significant degree. Coal was formerly mined in Bay County east of Dow Silicones Corporation, but not on the site.

B4.A.2(d) Soils

The Midland Plant lies in the Eastern Lowlands Physiographic Region of Michigan's Lower Peninsula. This region has very flat topography of lacustrine origin. Soil types in the area are typically derived from glacial and post-glacial fluvial processes and generally are composed of coarse-grained material deposited in ancient beach and near-shore environments and clay-rich lacustrine deposits. The *Soil Survey of Midland County, Michigan* (Department of Agriculture,

Soil Conservation Service 1979) identifies site soils. Most of the site has "urban land" soil, which is generally highly disturbed and developed. Lenawee silty clay loam and Wixom sandy loam soils occur in smaller areas of the site that are not developed.

B4.A.2(e) Hydrology

Groundwater is present in all four unconsolidated glacial deposited formations beneath the Dow Silicones Corporation facility. See Module B3 (Hydrogeologic Report) for additional information.

Surface Water Hydrology

Lingle Drain, originating as a discharge from the City of Midland wastewater treatment plant, flows across in the eastern edge of the facility. The landfill is located within 50 feet of Lingle Drain, a local drainage channel, and approximately one mile from the discharge of Lingle Drain to the Tittabawassee River. Lingle Drain originates at the Midland County Wastewater Treatment Plant. Much of the drain in enclosed in an underground pipe.

The primary natural surface water in this area is the Tittabawassee River (located approximately 0.6 mile from the active facility at its nearest point), which drains approximately 2,500 square miles of land in the Lower Peninsula of Michigan. The Tittabawassee River watershed is the fifth largest watershed in Michigan (Department of Natural Resources and Environment, Tittabawassee River Assessment, 2009).

The Tittabawassee River begins in Roscommon and Ogemaw counties, which are approximately 26 miles north of the city of Midland and Saginaw County. The Tittabawassee River flows south and southeast for approximately 80 miles to its confluence with the Saginaw River, located approximately 22 miles southeast of Midland. Most of the Tittabawassee River watershed upstream of Midland is forested or agricultural land. Tittabawassee River flow and water level fluctuated daily in response to releases from the Sanford Dam prior to its breach in 2020. The average discharge for Tittabawassee River based on data from 1937 to 2021 is approximately 1,815 cubic feet per second (USGS Surface Water Annual Statistics for Michigan). Discharge is typically highest in March and April during spring snow melt and runoff.

The maximum recorded historical crest of the Tittabawassee River occurred in 2020. On May 19 and 20, 2020, extensive rainfall and subsequent dam failures of both Wixom Lake and Sanford Lake resulted in flooding occurring along the Tittabawassee River. Flood waters crested at 35.05 feet (ft) which is equivalent to 615.1 ft (NGVD 29 datum). Flows greater than 20,000 cfs have occurred in 29 of the years between 1910 and 2021, with flows greater than 30,000 cfs occurring in 1912, 1916, 1946, 1948, 1986, 2017, and 2020. In May 2020, the river discharge reached approximately 51,800 cfs.

Surface Water Quality

Lingle Drain has been monitored quarterly and has not shown any evidence of impact resulting from activities at this facility. The primary source of water to Lingle Drain is the Midland Wastewater Treatment Plant.

There is a total maximum daily load for the Tittabawassee River near the Dow Silicones Corporation facility and further upstream (*Total Maximum Daily Load for E. coli for Tittabawassee River, Midland County. MDEQ Water Bureau, May, 2009*). A source or sources was not identified, but was upstream of, and not related to, the Dow Silicones Corporation Facility.

B4.A.2(f) Land Use and Zoning

Land adjacent to the Dow Silicones Corporation site on the west is the Dow Chemical Company Midland, Michigan facility, a chemical manufacturing facility; immediately to the south is Salzburg Landfill owned by The Dow Chemical Company; to the north is an undeveloped tract of land owned by The Dow Chemical Company that is adjacent to the railroad tracks. Further north are residential developments within the City of Midland (approximately 0.5 mile from the licensed portion of the facility). The land east of the facility is owned by Dow Silicones Corporation and is currently undeveloped. The Midland Cogeneration Venture (a gas-fired power plant) is located approximately one mile west of the facility. The schools nearby the facility are as follows: Longview Early Childhood Center, Kinder Kare Children's Center, and Midland High School.

The Dow Silicones Corporation site is zoned for Industrial B (intensive industrial operations) and is surrounded by other Industrial B zoning.

Figure B4-4 is a zoning map. Figure B4-5 is a land use map. Figure B4-6 is an aerial photograph.

B4.A.2(g) Historical or Archaeological Resources

The requirements of the National Historic Preservation Act of 1966, 16 U.S.C 470 *et seq.*, are not applicable to this facility as there are no structures or properties on or near the hazardous waste facility which are listed or eligible for listing in the National Register of Historic Places.

B4.A.2(h) Social Environment

The social environment, in terms of demographics and infrastructure of the area, is discussed in the following two subsections.

B4.A.2(h)(i) Demographics

The population of Midland in 2019 was 41,920 (U.S. Census Bureau, 2019), (see Table B4-2). Through the 1990's Midland's population has grown by about 10%. It is estimated that in the first 5 years of this decade the population of Midland has stayed about the same since 2000.

The employment statistics for the Saginaw Bay City-Midland, Michigan Metropolitan Statistical Area in 2019 was 167,635 employment positions (U.S. Bureau of Labor Statistics, 2019). The major employers of Midland County are The Dow Chemical Company, MidMichigan Medical Center, Midland Public Schools, Meijer, City of Midland and Quebecor Printing/Pendell Inc.

B4.A.2(h)(ii) Infrastructure

Support systems that may be affected by this facility are sewer and water service, police and fire protection, schools, roads, and solid waste disposal.

The schools within a mile radius of the facility are as follows: Longview Early Childhood Center, Kinder Kare Children's Center, and Midland High School.

Midland Fire Department employs 45 fire fighters and the Police Department has about 48 sworn officers.

Electric and gas are provided by Consumers Energy and telephone services are provided by AT&T. Drinking water for Midland residents is supplied from Lake Huron.

B4.A.2(i) Transportation

Dow Silicones Corporation receives raw materials via rail car. Occasionally loads of hazardous materials are also transferred via rail for off-site disposal.

Major highways near Dow Silicones Corporation include Highway M-20 (Isabella Road) approximately one mile to the north, US-10 approximately two miles to the north northeast, and Highway M-47 (Midland Road) approximately three miles to the east.

B4.A.2(j) Air Quality

All operations at the Dow Silicones Corporation facility are controlled such that there is an absence of dust, odors, and other inconveniences to the local residents. Most of the traffic areas are paved. The truck parking areas are surfaced with gravel for dust minimization.

No information on air quality for Midland County was available for review and hence specific surrounding sources of air pollution around the facility are not known. Following is the summary of the 2006 Annual Air Quality Report for Michigan prepared by Michigan Department of Environment, Great Lakes, and Energy (EGLE).

For the criteria pollutants carbon monoxide, lead, nitrogen dioxide, and sulfur dioxide all of Michigan has continued to stay in attainment with levels well below their NAAQS established by the U.S. EPA. For ozone and particulate matter, Michigan does have some non-attainment areas but for both pollutants, levels have continued to decline. Midland is not a non-attainment area.

The main contributing factors to Michigan's particulate matter levels are on-road and non-road emission sources (particulate matter: 18% and 32% respectively). In addition, area sources also contribute 37% of particulate emissions. Therefore, with the federal Clean Air rules, along with Michigan's continued reduction efforts, both of these criteria pollutant levels should continue to decline.

Ground level ozone is not emitted directly from any source but is created from photochemical reactions involving oxides of nitrogen and volatile organic compounds in the presence of sunlight. U.S. EPA states that the nationwide ozone levels have improved considerably.

B4.A.2(k) Noise

The Dow Silicones Corporation facility generates relatively low levels of noise. Truck/Rail traffic is probably the noisiest aspect of this facility, and this traffic and noise is consistent with industrial operations.

B4.A.2(l) Appearance and Aesthetics

The Dow Silicones Corporation facility is in an industrial area with no unique aesthetic value. There are no panoramic views and no special landscapes. To the north, south and west of the Dow Silicones Corporation facility is the Dow Chemical Manufacturing facility and to the east is a wooded vacant property owned by Dow Silicones Corporation. The Dow Silicones Corporation facility itself is kept neat and well maintained. The container and tank storage areas and the landfill are located greater than 1,000 feet from the nearest property line, thereby exceeding the minimum requirement of 150 meters (about 400 feet) of isolation distance for the landfill and 60 meters (about 200 feet) for the storage areas.

B4.A.2(m) Terrestrial Ecosystem

The characteristics of the terrestrial ecosystem, in terms of flora, fauna, rare or endangered species, and critical habitat are described in the following subsections. Figure B4-7 presents a vegetation map showing vegetative coverage in the area surrounding the Dow Silicones Corporation facility.

B4.A.2(m)(i) Flora

Since the Dow Silicones Corporation licensed portion of the facility is almost completely paved or covered with buildings, no significant vegetation grows. The flora of the entire site is typical of industrial locations. Trees and brush have been removed across the majority of the Facility property. Nuisance weeds are located throughout the site. Native forests in this area are a mixture of hardwoods (oak, maple and beech), white pine and hemlock. Small parts of the site, but not the regulated unit (800/1000 Block Landfill, 806 Tank Farm, 801 and 809 Container Storage Buildings) are undeveloped wooded areas dominated by oak trees. Vegetation on the site displayed no remarkable components in the species mix which would indicate the possible existence of endangered or threatened species. Those common species present on the site are also well represented in the forest and fields in the general area. Therefore, the continued operations and/or development of the site would not result in destruction or elimination of any unique botanical resource.

B4.A.2(m)(ii) Fauna

Wildlife on the facility and nearby is limited to species characteristic of suburban areas such as white tail deer, squirrel, raccoon, skunk, rabbit, and other small mammals. The site is frequented by several common species of birds. Pigeons, sparrows, and starlings represent the majority of the bird life. Throughout the site, bird numbers are low as a result of extensive human disruption. Overall, the fauna of the site is not unique and does not contain endangered or threatened species. Those species present on the site are common species and well represented in the forests and fields in the general area.

B4.A.2(m)(iii) Rare or Endangered Species

No rare, threatened, endangered, or special wildlife species or special plant species are known to occur in the area (Michigan Natural Features Inventory, 2009). However, there is the possibility of one threatened species (*Carex seorsa*, a vascular plant) that was last observed in 1934 may be present. (The Michigan Natural Features Inventory requests this report not be redistributed. The Michigan Natural Features Inventory report was provided separately to the MDEQ.) There are no endangered plants or animal species in the area or surrounding the Facility.

B4.A.2(m)(iv) Critical Habitat

There is no critical habitat located on or near the facility. The site is an established industrial complex encompassing 485 acres which shows evidence of the impacts of human activities. There are no endangered plants or animal species in the area or surrounding the Facility. There is no place on site that provides habitat critical to the survival of the local species. The plant and animal species observed either on-site or immediately off-site are common species found in populated areas.

B4.A.2(n) Aquatic Ecosystem

The characteristics of the aquatic ecosystem, in terms of flora, fauna, rare or endangered species, and critical habitat are described in the following subsections. Two surface water features or wetlands near the Dow Silicones Corporation facility are Lingle Drain and the Tittabawassee River. There is no direct discharge of leachate or other water which has been in contact with hazardous wastes to surface waters. All landfill leachate and storm water runoff are discharged to the wastewater sewer, which flows to The Dow Chemical Company's wastewater treatment plant for treatment prior to discharge under the terms of their NPDES permit.

The Tittabawassee River flows approximately 800 feet to the south of the Dow Sillicones Corporation facility. The river flows in a generally southerly direction until it joins the Shiawassee River to form the Saginaw River, which then flows north into the Saginaw Bay. The total length from headwaters to the Saginaw River junction is approximately 70 miles.

B4.A.2(n)(i) Flora

Lingle Drain, which is an excavated ditch, supports some aquatic vegetation. The flora of the Tittabawassee River is typical of waterways in this region. Industrial activity has resulted in tree and brush removal from riverbank areas. Flora consists of noxious weeds, quack grass, milkweed, cattails, willow, sumac, poison ivy, and other vegetation. The aquatic vegetation presents no remarkable components in the mix of species, which would indicate the possible existence of endangered or threatened species.

B4.A.2(n)(ii) Fauna

There is no aquatic fauna located on site. Areas adjacent to the Tittabawassee River provide suitable habitat for migratory birds, upland songbirds, scavengers, and other marsh species. Throughout the area, bird numbers are not high as a result of extensive human disruption. Fauna adjacent to the river include gulls, redwing blackbirds, gold finch, killdeer, wood ducks, mallards, starlings, baltimore orioles, white tail deer, and grackles. Reptiles and amphibians are represented by various frogs, toads, and small water snakes.

The fauna of the site does not contain endangered or threatened species and are well represented in the general area.

B4.A.2(n)(iii) Rare or Endangered Species

There are no known aquatic rare or endangered species located on site and/or near the facility.

B4.A.2(n)(iv) Critical Habitat

The site is an established industrial complex encompassing 485 acres which shows evidence of the impacts of human activities. There are no endangered plants or animal species in the area or surrounding the Facility. There is no place on site that provides habitat critical to the survival of the local species. The plant and animal species observed either on-site or immediately off-site are common species found in populated areas.

B4.B ENVIRONMENTAL IMPACTS OF THE FACILITY

The Dow Silicones Corporation operations do not have significant impacts on physiography, climate, terrestrial systems, aquatic systems, regional hydrology, aesthetics, air quality, land use, and zoning. There may be some minor impacts on solid wastes, energy demand, and non-renewable resources. Truck traffic is routed to avoid adverse impacts on residential areas and nearby schools.

This section provides an analysis of the potential for safe handling of hazardous wastes to fail at this facility during treatment, storage, and disposal. Included is information on the potential for public exposure to hazardous wastes and hazardous constituents through releases related to the landfill unit.

B4.B.1 Container Storage Units Failure Mode Assessment [MAC R 299.9504(1)(e)]

The potential major failure modes which may occur in the container storage areas are described in this section.

B4.B.1(a) Spills from Containers

The most likely causes of spills from containers are:

- Puncture or rupture of a container in storage or during movement of containers into or out of the container storage;
- Over pressurization of a container due to overfilling or reaction of incompatible wastes;
- Spillage during transfer of waste from one container to another; and
- Deterioration of a container due to corrosion.

Structures, equipment and management practices are in-place to minimize or eliminate the potential for such spills, or to minimize the impact of such spills. See Module A6 (Preparedness/Prevention Plan) for more information about these structures, equipment and procedures. See Module A7, (Contingency Plan), for more information about alarms and emergency response procedures.

In the event of failure or rupture of a container it is possible that the entire contents of the container may be released suddenly. The largest containers handled at the container storage areas of the facility are semi-bulk portable tanks with typical capacities of 300 to 400 gallons. This quantity of material released would be readily contained within the storage area secondary containment and would be prevented from migrating to soil and possibly contaminating groundwater; air emissions from such a release would be insignificant at the facility fence line. Potential impact to public health would therefore be negligible.

B4.B.1(b) Fire or Explosion

Fire or explosion may occur during the transfer or storage of hazardous wastes in containers if there is first a spill of the waste so that it is thereby exposed to air and to potential sources of ignition. Although this is highly unlikely because of the precautions taken at this facility to prevent hazards and minimize consequences by prompt response, this scenario was modeled using the RMP Comp risk management modeling software provided by U.S. EPA for use by facilities storing hazardous materials in evaluating potential risks to the surrounding community, as required by the Clean Air Act Risk Management Program. The results of the modeling are presented in Appendix B4-1.

Structures, equipment and management practices are in-place to minimize or eliminate the potential for fire or explosion. See Module A6 (Preparedness/Prevention Plan) for more information about these structures, equipment and procedures. See Module A7, (Contingency Plan), for more information about alarms and emergency response procedures.

B4.B.1(c) Failure of Container Storage Secondary Containment

The secondary containment systems in the container storage areas are constructed of reinforced concrete and sealed with an impervious coating (see Module C1 for details). Some components of the secondary containment system (flumes and spill pond) are located outdoors and are subjected to normal seasonal temperature variations and cycles of wetting and drying due to precipitation. The indoor portions of the secondary containment are also subjected to mechanical stress imparted by forklift travel. Although the concrete was designed to withstand these various stresses eventual deterioration is possible.

Dow Silicones Corporation inspects the integrity of the secondary containment daily and promptly reports any cracks or gaps in the concrete and any deterioration of the impervious coating to the site maintenance group assigned to these types of repairs, in accordance with established company procedures. All such instances are noted on the container storage area inspection log, as well as the date of the repair, see Module A5 (Inspection Schedules).

In the event of a failure of the secondary containment systems, two backups exist to protect groundwater and surface waters. First, the container storage areas are located on top of the inactive portion of the hazardous waste landfill, so any liquids migrating into the ground from spills in the container storage areas would most likely be collected in the leachate collection system installed in the landfill. Second, the entire Midland plant is surrounded by the Site Interceptor System (SIS), which collects shallow groundwater before the groundwater flows offsite. The geologic setting of this facility, on top of a layer of native clay at least 25 feet thick and of very low permeability, also ensures that shallow groundwater will not percolate downward to the regional aquifer. Therefore, impacts to offsite groundwater and surface waters is prevented.

B4.B.1(d) Accident During Transport to the Container Storage Area

All loading and unloading operations are located in areas with adequate secondary containment. In the event of a spill, hazardous waste or hazardous waste constituents will be contained by the secondary containment and will not reach surface waters or be discharged off-site.

Releases of hazardous wastes to the ground outside of the loading and unloading areas, storage areas during transportation, are cleaned up immediately. Such releases, if they occur, would also be collected either by the wastewater sewer system which flows to Dow Chemical's wastewater treatment plant, or by the Site Interceptor System, which is also treated at Dow Chemical's wastewater treatment plant.

B4.B.2 Tank Storage Unit Failure Mode Assessment [MAC R 299.9504(1)(e)]

The potential major failure modes which may occur in the tank storage area are described in this section.

B4.B.2(a) Spills from Tanks

Potential causes of spills from tank storage units and ancillary equipment are overfilling of a tank, failure of ancillary equipment such as a valve, pump, flange, or pipe, and uncontrolled reaction due to mixing of incompatible materials, which could cause an emergency venting of a tank.

Structures, equipment and management practices are in-place to minimize or eliminate the potential for spill from tanks. See Module A6 (Preparedness/Prevention Plan) for more information about these structures, equipment and procedures. See Module A7, (Contingency Plan), for more information about alarms and emergency response procedures.

Overfilling is prevented by the use of a high level sensor and overfill alarm, with automatic actuation of the tank fill line shutoff valve. Tank transfers are always attended by facility personnel. In case of failure of the high level alarm and shutoff system, the tank farm operator is present during transfers and can manually shutoff the transfer pump to prevent or minimize spillage due to overflow. The high level sensor, alarm, and automatic shutoff are tested quarterly to ensure their functioning.

It is possible for a spill to occur other than during transfer operations by failure of the bottom drain fitting or valve on a tank. In this case failure could occur during a time when no facility personnel are present in the tank farm area to respond immediately. Although less likely than the possibility of a spill during waste transfer; this scenario could result in the release of the entire contents of the tank into the tank farm secondary containment system.

Assuming the worst case, a full tank of 10,000 gallons could be released into the tank farm containment and flow into the spill pond, resulting in an exposed surface area of spilled material of approximately 6,800 square feet. The Air Force “AFTOX” release model, provided by the U.S. EPA for use in performing preliminary evaluations of hazardous materials releases, was used to model downwind concentration of the two major types of wastes stored in tanks at this facility. For solvent wastes, which are primarily composed of toluene and xylene, toluene was used in the model since it is the more volatile of the two compounds and of similar toxicity to xylene. For chlorosilane wastes, hydrochloric acid was used for the model, since chlorosilanes hydrolyze rapidly on exposure to the humidity in air, releasing hydrochloric acid. The results of the modeling are presented in Appendix B4-1.

Both instantaneous and continuous releases of toluene were modeled, to show the effects of both a catastrophic tank failure, releasing 10,000 gallons suddenly, and a continuing leak of 150 gallons per minute, such as from a ruptured three-inch pipe or hose. The maximum concentration of solvent vapor in the catastrophic release scenario is 156 ppm at a distance of 100 feet from the spill. The duration of the model was set at 20 minutes because, in the event of such an incident, the Dow Silicones Corporation onsite emergency responders would immediately apply firefighting foam to the spill to suppress vapor and prevent ignition. A response time of 20 minutes would be extremely long, since this group is located at the Midland plant and is on call 24 hours a day. The model shows that at no time would there be vapor concentrations exceeding the 100 ppm TLV for toluene outside the fence line. The distance to the nearest property line from the 806 tank farm is greater than 1,000 feet; the model shows a vapor concentration of 5 ppm at 972 feet. Therefore, there would be no significant danger to the public from even a catastrophic release of solvent from the storage tanks.

B4.B.2(b) Fire or Explosion at 806 Tank Farm

All wastes stored in the 806 tank farm are ignitable. The worst case scenario of a fire or explosion would involve loss of the entire contents of a tank, which then are entirely volatilized to form a vapor cloud, which then ignites in a vapor explosion. Although this is highly unlikely because of the precautions taken at this facility to prevent hazards and minimize consequences by prompt response, this scenario was modeled using the RMP Comp risk management modeling software provided by U.S. EPA for use by facilities storing hazardous materials in evaluating potential risks to the surrounding community, as required by the Clean Air Act Risk Management Program.

Assuming the worst case, a full tank of 10,000 gallons could be released into the tank farm containment and flow into the spill pond, resulting in an exposed surface area of spilled material of approximately 6,800 square feet. The Air Force "AFTOX" release model, provided by the U.S. EPA for use in performing preliminary evaluations of hazardous materials releases, was used to model downwind concentration of the two major types of wastes stored in tanks at this facility. For solvent wastes, which are primarily composed of toluene and xylene, toluene was used in the model since it is the more volatile of the two compounds and of similar toxicity to xylene. For chlorosilane wastes, hydrochloric acid was used for the model, since chlorosilanes hydrolyze rapidly on exposure to the humidity in air, releasing hydrochloric acid. The results of the modeling are presented in Appendix B4-1.

Trichlorosilane was chosen for modeling because the physical parameters for this compound are already loaded in the computer modeling program, while the parameters for toluene are not. However, the effects of a vapor cloud explosion of either compound should be similar since they are both volatile and ignitable. Scenarios for releases of a full tank and of a tank truck load were modeled and the distance to which an explosion overpressure of one pound per square inch would extend was calculated. This overpressure is considered the pressure at which injuries to bystanders are likely to occur. The maximum distance calculated for this zone of 1 psi overpressure was 0.2 km, or about 660 feet. Therefore, the worst case vapor explosion from a release of wastes at the facility would not be likely to cause injuries past the nearest property line 1,000 feet away.

B4.B.2(c) Failure of Tank Farm Secondary Containment

The secondary containment systems in the tank farm is constructed of reinforced concrete and sealed with an impervious coating (see Module C2, for details). Some components of the secondary containment system (flumes and spill pond) are located outdoors and are subjected to normal seasonal temperature variations and cycles of wetting and drying due to precipitation. The indoor portions of the secondary containment are also subjected to mechanical stress imparted by forklift travel. Although the concrete was designed to withstand these various stresses eventual deterioration is possible.

The integrity of the secondary containment is inspected daily and promptly reports any cracks or gaps in the concrete and any deterioration of the impervious coating to the site maintenance group assigned to these types of repairs, in accordance with established company procedures.

All such instances are noted on the container storage area inspection log, as well as the date of the repair, see Module A5 (Inspection Schedules).

In the event of a failure of the secondary containment systems, two backups exist to protect groundwater and surface waters. First, the tank farm is located on top of the inactive portion of the hazardous waste landfill, so any liquids migrating into the ground from spills in the tank farm area would most likely be collected in the leachate collection system installed in the landfill. Second, the entire Midland plant is surrounded by the Site Interceptor System, which collects shallow groundwater before the groundwater flows from the site. The geologic setting of this facility, on top of a layer of native clay at least 25 feet thick and of very low permeability, also ensures that shallow groundwater will not percolate downward to the regional aquifer. Therefore, impacts to offsite groundwater and surface waters is prevented.

B4.B.2(d) Accident During Transport to the 806 Tank Farm

Any accidents during transport to the 806 Tank Farm will be identified and managed as described for the container storage area (Section B4.B.1(d)).

B4.C EXPOSURE INFORMATION REPORT FOR LANDFILLS AND SURFACE IMPOUNDMENTS

B4.C.1 General Information

There is no available health or risk assessment information for the landfill.

Figure B4-4 is a zoning map, Figure B4-5 is a land use map and Figure B4-6 is an aerial photograph of the Dow Silicones Corporation facility. The available waste analysis information is provided in Module A2 (Chemical and Physical Analyses) and Module A3 (Waste Analysis Plans).

The landfill receives approximately 3,000 cubic yards of waste per year. None of this is listed or characteristically hazardous waste.

The facility is inspected by the EGLE. Dow Silicones Corporation facility structures and equipment are inspected routinely by plant personnel, to identify malfunctions, deterioration, operator errors, discharges and any other situations which may lead to the release of hazardous waste constituents into the environment or a threat to human health. See Module A5 (Inspection Schedules) for details on inspection procedures.

The inspection compliance reports are maintained at the facility in the EVS offices for three years and are then archived for the life of the facility plus 30 years.

B4.C.2 Potential Exposure Pathways

The primary failure mode likely in a hazardous waste landfill is the leakage of hazardous wastes

or hazardous constituents from the landfill into the surrounding groundwater, surface waters, or soil. These media are addressed individually below.

B4.C.2(a) Groundwater

The landfill is constructed of native clay with measured permeabilities less than 1.0×10^{-7} cm/sec. The facility also is provided with a leachate collection system and compacted clay side curtain walls to further limit migration of liquids. The geology of the area consists of lake bed clay over glacial till to a depth of approximately 60 feet. The regional aquifer is located at the 60-foot depth and extends to bedrock at a depth of 100 to 120 feet below surface.

Using the conservative estimate of 25 feet of clay thickness and 1.0×10^{-7} cm/sec the estimated time of travel to the regional aquifer by any possible contaminants is about 6,000 years. Water within the regional aquifer has an estimate travel rate of 6 feet per year, or nearly 900 years per mile, and is flowing to the northeast, toward the Saginaw Bay of Lake Huron. Groundwater use in the area is not extensive, with the major population center in the area being the city of Midland, located up gradient from this facility. Drinking water for Midland residents is supplied from Lake Huron by pipe.

The distance to the nearest down gradient drinking water wells is estimated to be three miles, for an estimated groundwater travel time of almost 2,700 years. Considering the rates of biotransformation and hydrolysis for the types of organic constituents found in the landfill leachate and their relatively low concentrations in the leachate, it is unlikely that this landfill would cause impact drinking water. The Site Interceptor System (SIS) was installed to capture shallow groundwater before it flows from the site. Groundwater monitoring confirms that, after nearly fifty years of operation of the landfill, during much of which time the operation was unregulated, there is no evidence the regional aquifer has been impacted by operations at this facility.

B4.C.2(b) Surface Water

The landfill is located within 50 feet of Lingle Drain, a local drainage channel, and approximately one mile from the discharge of Lingle Drain to the Tittabawassee River. The landfill was constructed with a compacted clay curtain wall and an internal leachate collection system to prevent migration of contaminants to these bodies. Additional sewer laterals have been installed outside the landfill directly to the north, west, and south to collect groundwater outside the landfill and thereby prevent the buildup of hydrostatic forces on the curtain wall from outside. This outside groundwater has also shown some localized impacts that predate installation of the curtain wall, and these sewers collect the shallow groundwater for disposal to the wastewater sewer. The shallow groundwater occurring between the landfill and Lingle Drain is perched and is seasonally sparse, limiting the potential for it to be an avenue for migration of hazardous constituents to Lingle Drain.

Lingle Drain is monitored and has not shown any evidence of impacts resulting from activities at this facility in approximately 20 years of monitoring. See Module B5 (Environmental Monitoring Programs), Section B5.D (Surface Water Monitoring Program) for details on surface water monitoring.

B4.C.2(c) Air

No hazardous wastes have been disposed in the landfill at this facility since 1984, hence ambient air monitoring is not required at this facility.

B4.C.2(d) Subsurface Gas

This subsection is not applicable for the facility. The landfilled wastes are not putrescible and are not listed or characteristic for volatile chemicals. Only the following non-RCRA regulated materials are disposed of in the landfill: RCRA-empty containers; containers of non-regulated gloves, rags, pieces of metal and glass and other debris; column packing; cleaned process equipment; asbestos; construction debris; solidified silicone sealants, rubber and gums; solidified polysiloxane gels; nonhazardous contaminated dirt; and used office furniture. No wastes containing free liquids are disposed in the landfill and no lead contaminated (D008) hazardous wastes have been placed in the landfill since 1985.

B4.C.2 (e) Soil

Currently no hazardous wastes are received at or disposed in the landfill and prior to resuming such disposal Dow Silicones Corporation will notify EGLE and request approval. At that time Dow Silicones Corporation will also submit a soil sampling plan.

The liner system of the landfill, including the native clay base and the compacted clay curtain walls, is designed to prevent migration of hazardous wastes and hazardous constituents from the landfill contents to the surrounding soil. The curtain walls are constructed of clay with a permeability of 1.8×10^{-8} cm/sec with a minimum thickness of six feet and were keyed into the native clay base to prevent migration of liquids through this joint. A final cover of compacted clay and geo-membrane will be installed upon closure of the landfill to further ensure that the contents remain isolated from surrounding soils. See Module A11 (Closure and Post-closure Plans) for information about the final cover system.

B4.C.3 Transportation Information

Wastes generated at the Midland plant are picked up from the generating locations and transferred to the licensed facility on pallets via industrial lift truck, flatbed trailer, or closed van trailer. Containerized hazardous wastes generated at other locations owned by Dow Silicones Corporation generally arrive by flatbed or van trailer. Types of containers used for transporting hazardous wastes include steel, plastic and fiber drums and pails, and portable tanks of various capacities. Liquid hazardous wastes are transported in bulk, via tank trailer and vacuum truck, and in containers, from various generating locations both in the Midland plant and at other locations in the U.S. owned by Dow Silicones Corporation. Wastes transferred to the landfill are delivered to the active cell by truck or by forklift. Entrance to the Midland plant is obtained at the North, South, and Main Clock Room gates on South Saginaw Road, and the Salzburg Road gate. Passenger vehicles, forklifts, and cargo hauling vehicles ranging in size from pickup trucks to tractor-trailer rigs access the 800 and 1000 block licensed facility areas. Vehicles are owned by Dow Silicones Corporation, waste transporters, and contractors; no personal vehicles

belonging to employees enter the licensed facility areas. See Module A7 (Contingency Plan) and Module A6 (Preparedness/Prevention Plan) for the facility.

B4.C.4 Management Practices

Dow Silicones Corporation maintains a data base (GIMS) of all injuries and accidents at the Midland facility. To date no injuries or accidents have occurred at the regulated units. Internal Health and Safety protocols and procedures are in place to ensure workers safety in case of injury/illness/accident. Each department at Dow Silicones Corporation Midland follows their own Health and Safety, plans, protocols and procedures. Each department's Health and Safety Plan as well as other Health and Safety resources for the facility are located on the Dow Silicones Corporation Midland intranet, either at their own department's Page or at the Employee Health Services Page. The Environmental Department's intranet has the Site Safety and Loss Prevention page (which includes safety meeting topics and videos, injury data history, material safety data sheets (MSDS) updates, site safety statistics, site standards, site safety plan, etc.) and the Emergency Plan.

B4.C.5 Known Release Information

There are no known releases from the landfill. A leak detection monitoring program is in place, as described in Module B5 (Environmental Monitoring Programs).

B4.C.6 Landfill Location and Potential to Cause Human Exposure

There is very low potential for human exposure related to the wastes in the landfill due to the construction and operation of the landfill.

B4.D EVALUATION OF ALTERNATE HAZARDOUS WASTE MANAGEMENT TECHNOLOGIES

Construction costs have already been incurred since this is an existing licensed facility. This section evaluates several operational alternatives:

- Alternative 1. Continue centralized operations at the existing facility
- Alternative 2. Management of wastes at sites of generation
- Alternative 3. Waste reduction

Alternative 1, Continuation of centralized operations at the existing facility, is the selected alternative.

Alternative 1. Continue Centralized operations at the existing facility.

The advantages of the existing facility are that facilities and procedures are in place, fewer workers are needed, and documentation is centralized and established. Releases and non-compliance with regulations are less likely due to the existence of suitable facilities, trained staff and established operating procedures.

The disadvantage of centralized operations is the costs and risks associated with additional transportation of wastes.

Alternative 2. Management of wastes at sites of generation.

The advantages of managing wastes at each site of generation are reduced costs and risks associated with transportation.

The disadvantages of managing wastes at each site of generation are the need for additional staff, additional training, new operating procedures for each site, and additional costs for licensing and construction of physical facilities.

Alternative 3. Waste reduction.

Waste reduction applies to either alternative and these efforts are on-going. Dow Silicones Corporation sustainability program has reduced the amount of waste generated per amount of product by 5% since 2003. Dow Silicones Corporation also participates in the Responsible Care ® program of the chemical industry that promotes continuous improvement in the environment. This program includes:

- Train other businesses and our customers on process safety.
- Help customers use, transport, and dispose of our products safely.
- Provide technical support and information for our customers.
- Help train community emergency responders.
- Teach communities about recycling.
- Work with community advisory panels.
- Improve manufacturing processes to reduce waste and energy consumption.
- Recycle manufacturing by-products.
- Strive to work safely and develop improved safety procedures.
- Create better ways to transport products.
- Find processes and products that reduce environmental impact.

Table B4-1

Average Temperature, Precipitation and Snowfall
for Midland, Michigan (1981-2010)
Dow Silicones, Midland, Michigan
(Michigan State Climatologists Office)

Month	Average Temperature Minimum (F)	Average Temperature Maximum (F)	Average Precipitation (inches)	Average Snowfall (inches)
January	16.5	30.2	1.65	10.37
February	18.2	33.4	1.57	7.75
March	25.4	44.1	2.07	3.83
April	36.3	58.1	3.15	2.10
May	46.8	69.6	3.88	0.0
June	56.7	79.2	3.29	0.0
July	61.0	83.3	2.52	0.0
August	59.7	80.9	3.20	0.0
September	51.8	73.6	3.73	0.0
October	41.5	60.7	2.73	0.2
November	32.2	46.8	2.76	2.33
December	22.3	34.4	1.87	8.61
Annual	39.0	57.9	32	32

https://climate.geo.msu.edu/climate_mi/stations/5434/1981-2010%20monthly%20summary.pdf
https://climate.geo.msu.edu/climate_mi/stations/5434/nprec.pdf
https://climate.geo.msu.edu/climate_mi/stations/5434/nsnow.pdf

Table B4-2

2019-2020 Census Summary for Midland

Dow Silicones, Midland, Michigan

	State of Michigan	Midland County	City of Midland
Total Population	10,077,331	83,494	41,920
Male	49.3%	49.0%	48%
Female	50.7%	51.0%	52%
Median Age	39.8	41.3	38.7
Population			
0 -5 years	574,408	4,592	9,083
5 – 19 years	1,592,218	13,359	
20 – 64 years	6,127,017	50,514	25,663
65 and older	1,783,688	15,029	7,174

https://data.census.gov/cedsci/profile?g=0400000US26

https://data.census.gov/cedsci/profile?g=0500000US26111

https://censusreporter.org/profiles/16000US2653780-midland-mi/

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FIGURE B4-1
DOW SILICONES
SITE LOCATION

CLIENT

THE DOW CHEMICAL COMPANY - MICHIGAN DIVISION
MIDLAND, MI

CONSULTANT

AECOM
MICHIGAN - DOW PROGRAM
25 BUILDING
MIDLAND, MICHIGAN 48667
989-636-0151 TEL 989-636-2700 FAX
www.aecom.com

CONSULTANTS

GIS SPECIALIST
Jack Saj
25 Building
Midland, MI 48667
989.423.3319 tel
www.aecom.com

LEGEND

- Facility Boundary
- Roadways

Midland/Bay City/Saginaw Wind Rose
2012–2022

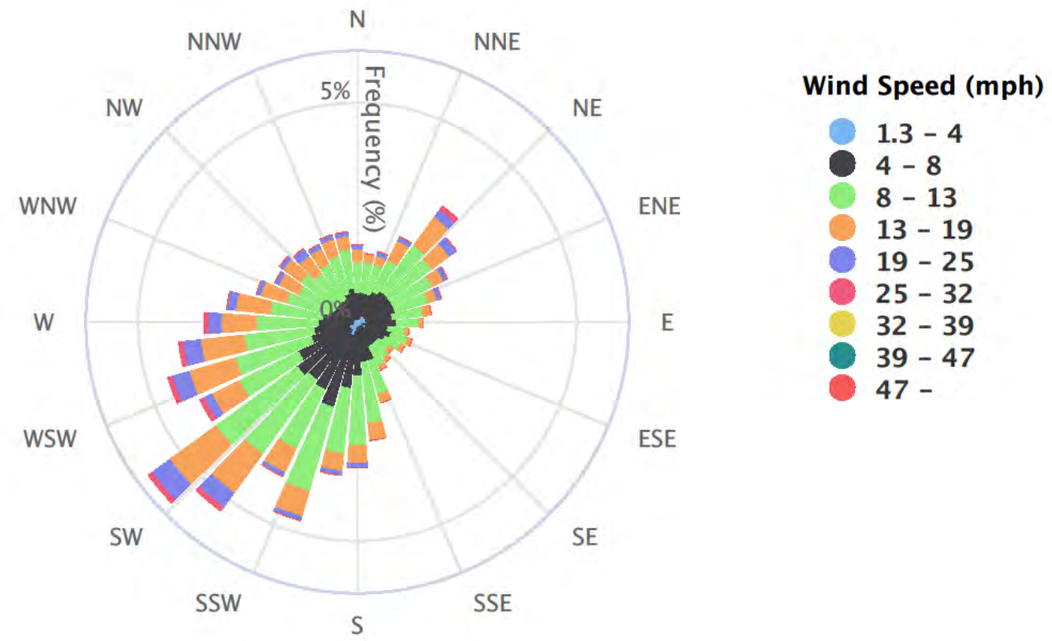

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Figure B4-2
Wind Rose Data
2012-2022

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FILE NAME:
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UPDATED: 3/18/2022
SAJ, J

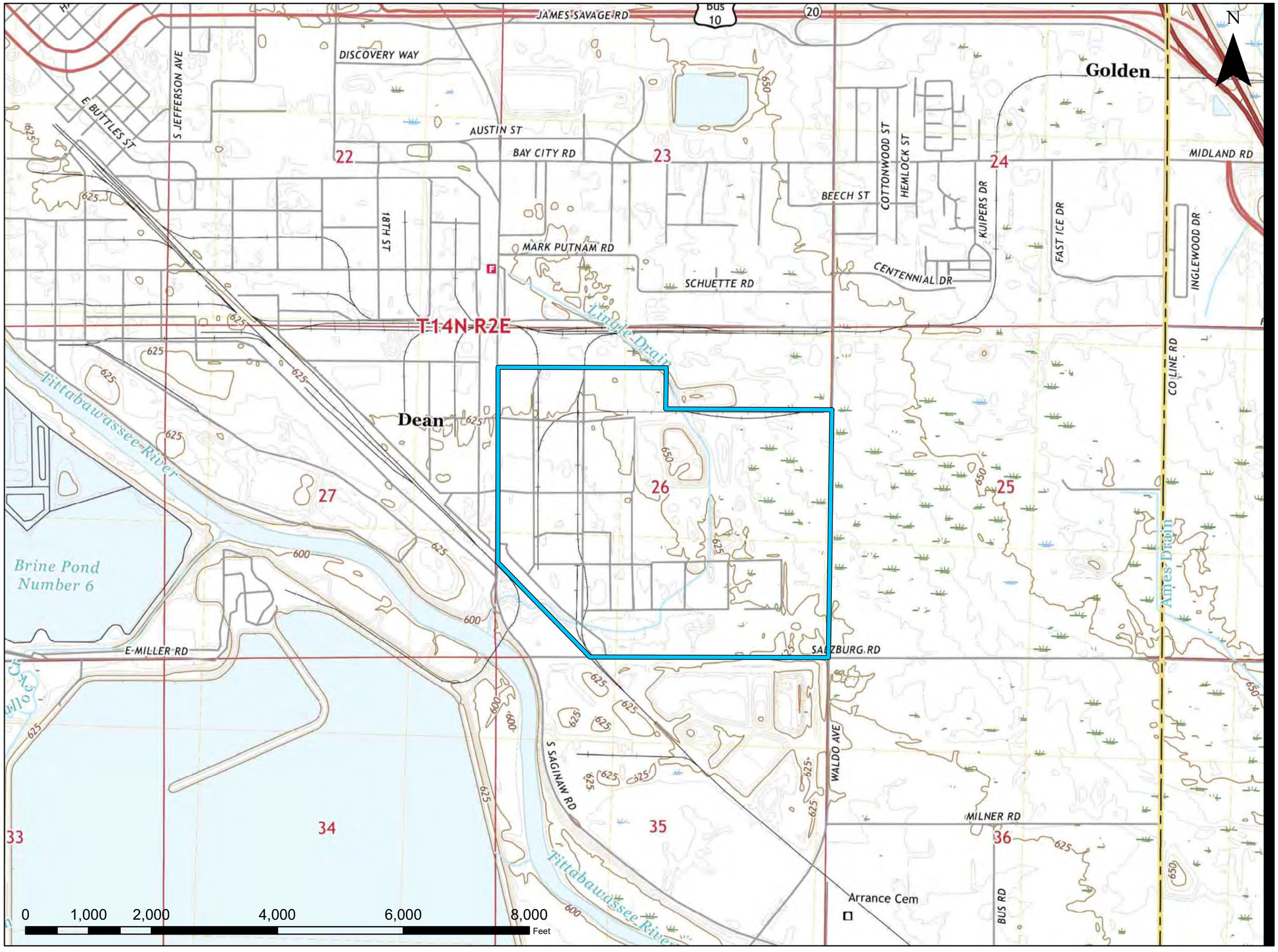

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FIGURE B4-3
DOW SILICONES
TOPOGRAPHY
AND SITE
LOCATION

CLIENT

THE DOW CHEMICAL COMPANY - MICHIGAN DIVISION
MIDLAND, MI

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MICHIGAN - DOW PROGRAM
25 BUILDING
MIDLAND, MICHIGAN 48667
989-636-0151 TEL 989-636-2700 FAX
www.aecom.com

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Jack Saj
25 Building
Midland, MI 48667
989.423.3319 tel
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LEGEND

Facility Boundary

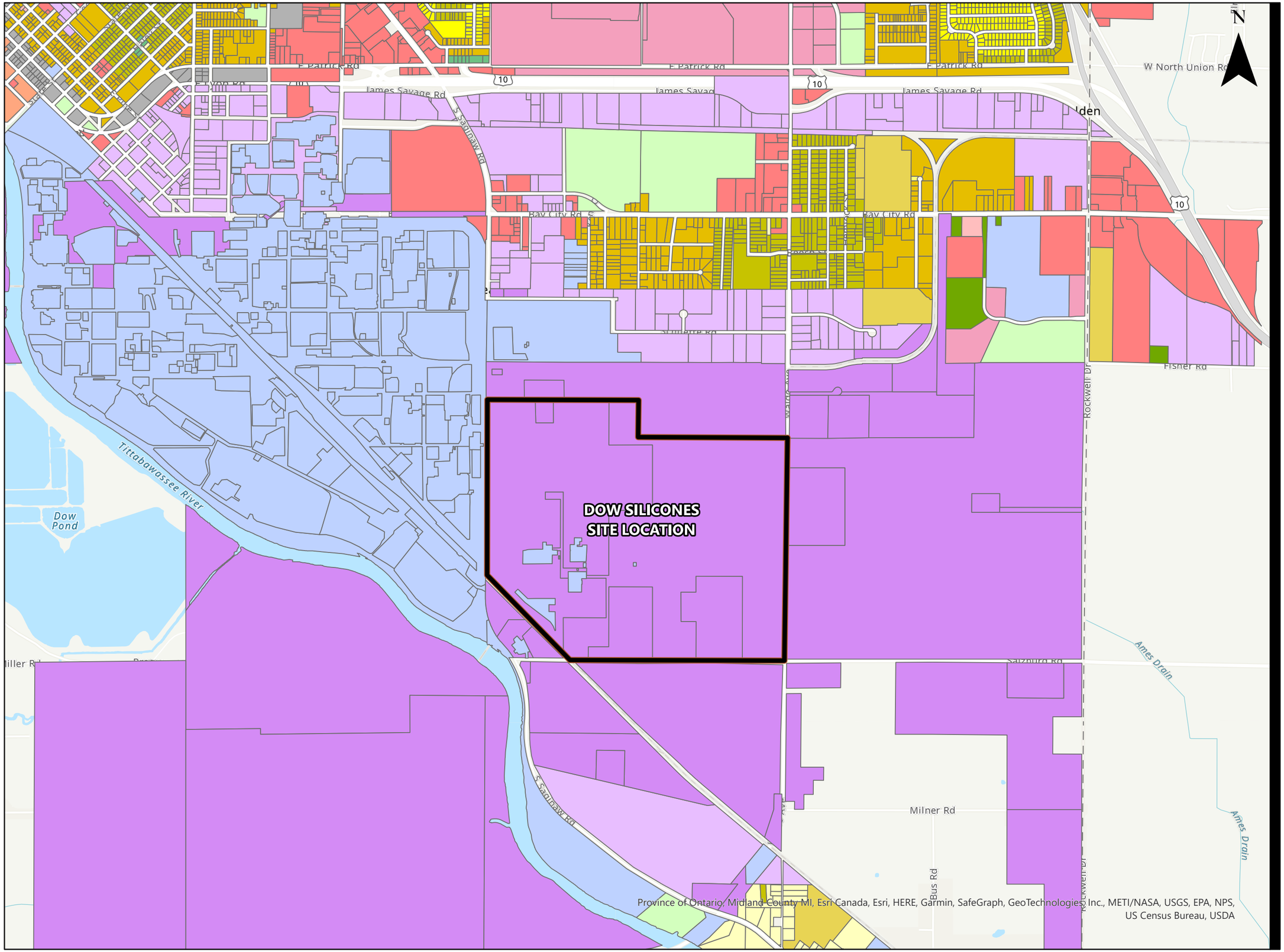

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FIGURE B4-4
DOW SILICONES
ZONING OVERVIEW

CLIENT

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MIDLAND, MI

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MIDLAND, MICHIGAN 48667
989-636-0151 TEL 989-636-2700 FAX
www.aecom.com

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GIS SPECIALIST
Jack Saj
25 Building
Midland, MI 48667
989.423.3319 tel
www.aecom.com

LEGEND

- Facility Boundary
- AG - Agriculture
- NC - Rural Neighborhood Conservation
- COM - Community
- CC - Community Commercial
- LCMR - Limited Commercial
- RC - Regional Commercial
- D - Downtown District
- IA - Industrial A
- IB - Industrial B
- MULT - Mixed Use
- OS - Open Space
- RA1 - Residential
- RA2 - Residential
- RA3 - Residential
- RA4 - Residential
- RB - Rural Business
- RD - Mobile Home Park

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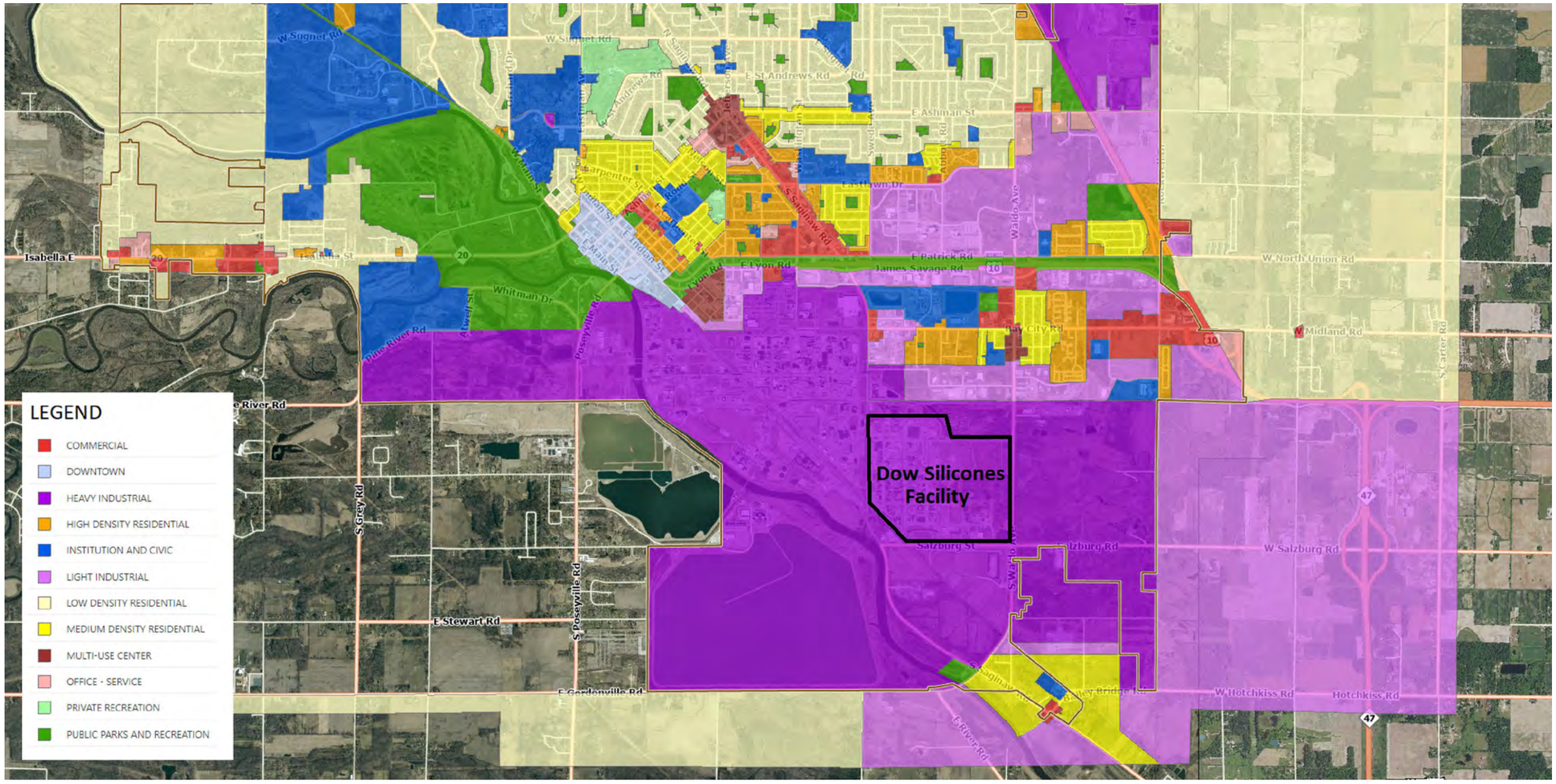

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Figure B4-5
Future Land Use

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MICHIGAN - DOW PROGRAM
25 BUILDING
MIDLAND, MI 48667
(989) 636-0151

FILE NAME:
Z/Dow Silicones/Projects/Future Land Use.mxd

UPDATED: 3/18/2022
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FIGURE B4-6
DOW SILICONES
SITE LOCATION

CLIENT

THE DOW CHEMICAL
COMPANY -
MICHIGAN DIVISION
MIDLAND, MI

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25 BUILDING
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989-636-0151 TEL 989-636-2700 FAX
www.aecom.com

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GIS SPECIALIST
Jack Saj
25 Building
Midland, MI 48667
989.423.3319 tel
www.aecom.com

LEGEND

Facility Boundary
Roadways

Filename: Z:\Dow Silicones\GIS\Projects\DCS License Renewal\DCS License Renewal.aprx

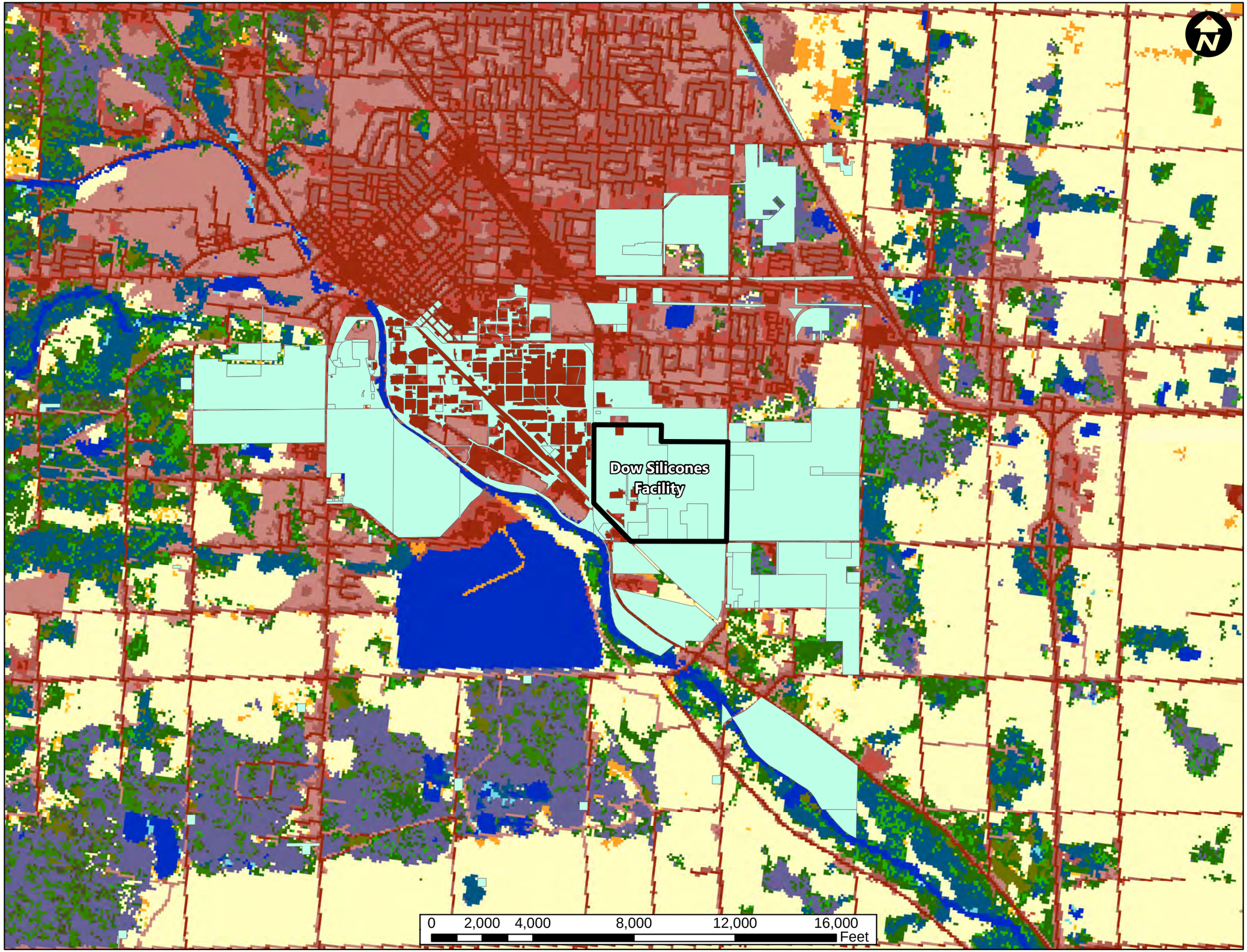

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Figure B4-7 Vegetation & General Habitat Area Dow Silicones Facility

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MICHIGAN - DOW PROGRAM
25 BUILDING
MIDLAND, MI 48667
(989) 636-0151

LEGEND

- Dow Silicones Site Boundary
- Dow Owned Parcels

- 73 - North-Central Interior Dry Oak Forest and Woodland
- 74 - North-Central Interior Dry-Mesic Oak Forest and Woodland
- 90 - Managed Tree Plantation
- 91 - Ruderal forest
- 98 - Laurentian-Acadian Northern Hardwoods Forest
- 99 - Laurentian-Acadian Northern Pine-(Oak) Forest
- 124 - North-Central Interior Maple-Basswood Forest
- 132 - Laurentian Pine-Oak Barrens
- 197 - Central Interior and Appalachian Floodplain Systems
- 199 - Laurentian-Acadian Floodplain Systems
- 204 - North-Central Interior and Appalachian Rich Swamp
- 207 - Laurentian-Acadian Swamp Systems
- 285 - Boreal Aspen-Birch Forest
- 287 - Boreal White Spruce-Fir-Hardwood Forest
- 288 - Boreal-Laurentian Conifer Acidic Swamp and Treed Poor Fen
- 416 - Central Interior and Appalachian Shrub-Herbaceous Wetland Systems
- 555 - Orchards Vineyards and Other High Structure Agriculture
- 556 - Cultivated Cropland
- 557 - Pasture/Hay
- 565 - Disturbed, Non-specific
- 567 - Harvested Forest - Grass/Forb Regeneration
- 579 - Open Water (Fresh)
- 581 - Developed, Open Space
- 582 - Developed, Low Intensity
- 583 - Developed, Medium Intensity
- 584 - Developed, High Intensity

FILE NAME:
Z/Dow Silicones/Projects/DSC Vegetation.mxd

UPDATED: 3/18/2022
SAJ, J

Appendix B4-1

Results of Computer Modeling of Facility Risk Scenarios

Catastrophic Release of Toluene from 806 Tank Farm

USAF TOXIC CHEMICAL DISPERSION MODEL

AFTOX

806 Tank Farm

DATE: 03-20-1999
TIME: 1303 LST

INSTANTANEOUS RELEASE

TOLUENE
SHORT TERM EXPOSURE LIMIT (STEL) IS 150 PPM (565 MG M-3)
TIME WEIGHTED AVERAGE (TWA) IS 100 PPM (377 MG M-3)

TEMPERATURE = 80 F
WIND DIRECTION = 270
WIND SPEED = 3 KNOTS
SUN ELEVATION ANGLE IS 45 DEGREES
CLOUD COVER IS 6 EIGHTHS
CLOUD TYPE IS MIDDLE (Ac, As, Sc, Cu)
GROUND IS DRY
THERE IS NO INVERSION
ATMOSPHERIC STABILITY PARAMETER IS 3.4
SPILL SITE ROUGHNESS LENGTH IS 100 CM

THIS IS A LIQUID RELEASE
TOTAL AMOUNT SPILLED IS 10000 GAL
AREA OF SPILL IS 6800 SQ FT
EVAPORATION RATE IS 71.73 LBS/MIN
THE CHEMICAL WILL EVAPORATE IN 1007.8 MIN
CONCENTRATION AVERAGING TIME IS 15 MIN
ELAPSED TIME SINCE START OF SPILL IS 20 MIN
HEIGHT ABOVE GROUND IS 6 FT

THE MAXIMUM CONCENTRATION IS WITHIN 30 M(100 FT) OF THE SOURCE
AT 30M THE CONCENTRATION IS 156.19 PPM (572.03 MG M-3)

Catastrophic Release of Toluene from 806 Tank Farm

USAF TOXIC CHEMICAL DISPERSION MODEL

AFTOX

806 Tank Farm

DATE: 03-20-1999
TIME: 1314 LST

INSTANTANEOUS RELEASE

TOLUENE
SHORT TERM EXPOSURE LIMIT (STEL) IS 150 PPM (565 MG M-3)
TIME WEIGHTED AVERAGE (TWA) IS 100 PPM (377 MG M-3)

TEMPERATURE = 80 F
WIND DIRECTION = 270
WIND SPEED = 3 KNOTS
SUN ELEVATION ANGLE IS 45 DEGREES
CLOUD COVER IS 6 EIGHTHS
CLOUD TYPE IS MIDDLE (Ac, As, Sc, Cu)
GROUND IS DRY
THERE IS NO INVERSION
ATMOSPHERIC STABILITY PARAMETER IS 3.4
SPILL SITE ROUGHNESS LENGTH IS 100 CM

THIS IS A LIQUID RELEASE
TOTAL AMOUNT SPILLED IS 10000 GAL
AREA OF SPILL IS 6800 SQ FT
EVAPORATION RATE IS 71.76 LBS/MIN
THE CHEMICAL WILL EVAPORATE IN 1007.4 MIN
CONCENTRATION AVERAGING TIME IS 15 MIN
ELAPSED TIME SINCE START OF SPILL IS 20 MIN
HEIGHT OF INTEREST IS 6 FT

AT 20 MIN, THE MAXIMUM DISTANCE FOR 1 PPM IS 2488 FT
MAXIMUM TOXIC CORRIDOR LENGTH = 5221 FT AT 1007 MIN
DIRECTION & WIDTH 90 +/- 180 DEG

AT 20 MIN, THE MAXIMUM DISTANCE FOR 5 PPM IS 972 FT
AT 20 MIN, THE MAXIMUM DISTANCE FOR 25 PPM IS 397 FT

THE MAXIMUM CONCENTRATION IS WITHIN 30 M(100 FT) OF THE SOURCE
AT 30M THE CONCENTRATION IS 156.28 PPM (572.36 MG M-3)

Catastrophic Release of Toluene from 806 Tank Farm

USAF TOXIC CHEMICAL DISPERSION MODEL

AFTOX

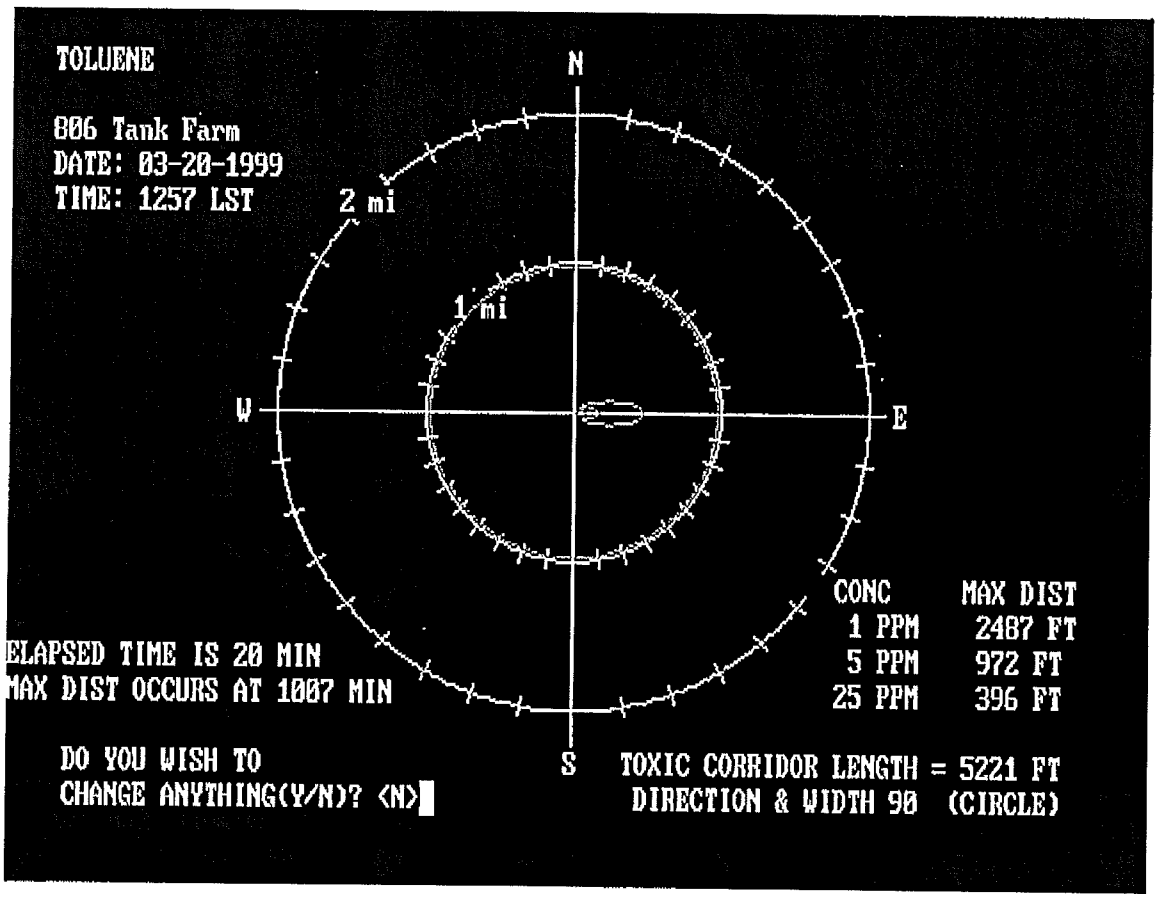
806 Tank Farm

DATE: 03-20-1999
TIME: 1446 LST

INSTANTANEOUS RELEASE of 10,000 gallons

TOLUENE

Exposure contour plot after 20 minutes:



Continuous Release of Toluene from 806 Tank Farm

USAF TOXIC CHEMICAL DISPERSION MODEL

AFTOX

806 Tank Farm

DATE: 03-02-1999
TIME: 1511 LST

CONTINUOUS RELEASE

TOLUENE
 SHORT TERM EXPOSURE LIMIT (STEL) IS 150 PPM (565 MG M-3)
 TIME WEIGHTED AVERAGE (TWA) IS 100 PPM (377 MG M-3)

TEMPERATURE = 80 F
WIND DIRECTION = 270
WIND SPEED = 4 KNOTS
SUN ELEVATION ANGLE IS 29 DEGREES
CLOUD COVER IS 1 EIGHTHS
CLOUD TYPE IS HIGH (Ci, Cc, Cs)
GROUND IS DRY
THERE IS NO INVERSION
ATMOSPHERIC STABILITY PARAMETER IS 3.46
SPILL SITE ROUGHNESS LENGTH IS 100 CM

THIS IS A LIQUID RELEASE
SPILL RATE IS 150 GAL/MIN
CHEMICAL IS STILL LEAKING
AREA OF SPILL IS 6109 SQ FT
EVAPORATION RATE IS 83.21 LBS/MIN
CONCENTRATION AVERAGING TIME IS 15 MIN
HEIGHT OF INTEREST IS 6 FT

THE MAXIMUM DISTANCE FOR 1 PPM IS 2393 FT
MAXIMUM TOXIC CORRIDOR LENGTH = 5024 FT
 DIRECTION & WIDTH 90 +/- 30 DEG

THE MAXIMUM DISTANCE FOR 10 PPM IS 635 FT
THE MAXIMUM DISTANCE FOR 100 PPM IS 132 FT

Continuous Release of Toluene from 806 Tank Farm

USAF TOXIC CHEMICAL DISPERSION MODEL

AFTOX

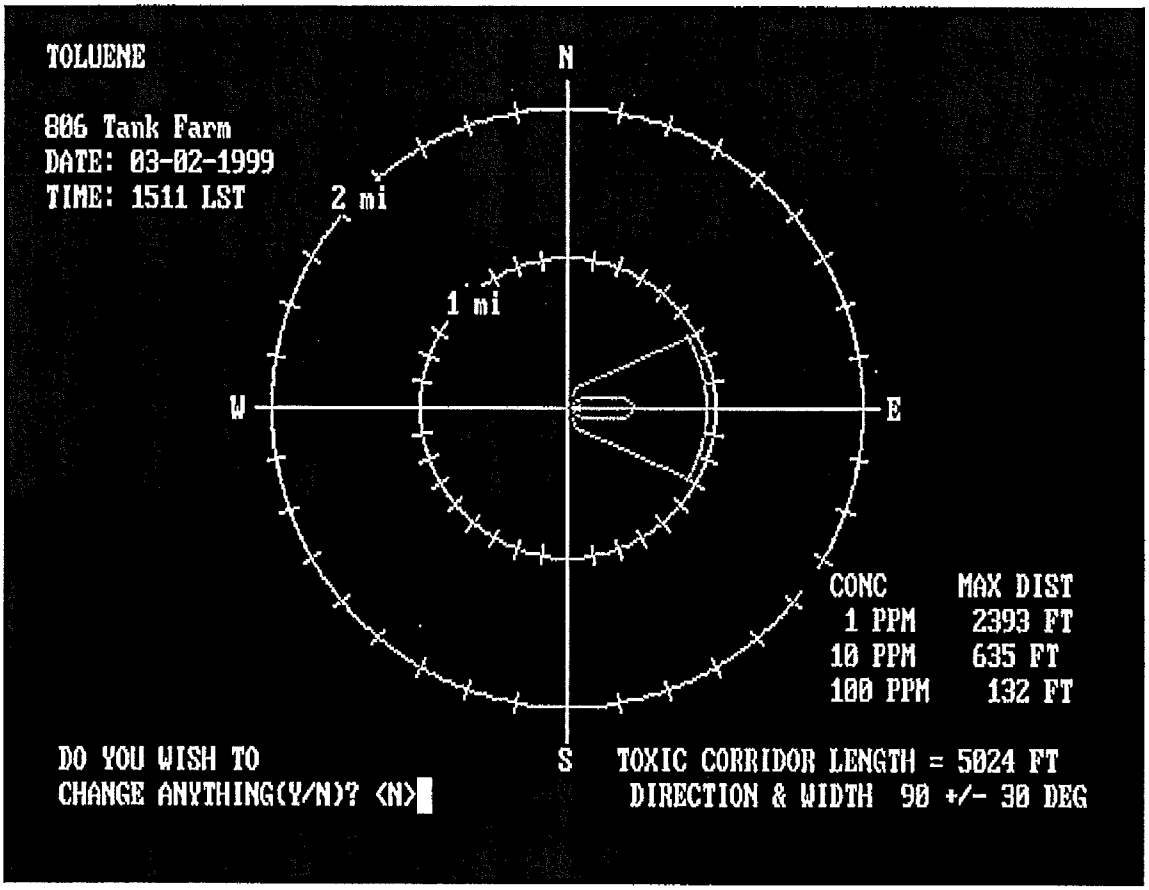
806 Tank Farm

DATE: 03-02-1999
TIME: 1511 LST

CONTINUOUS RELEASE

TOLUENE

Exposure contour plot



Toluene Release

Study

Description	Toluene Release
Notes	w/TRB
Created On	2/24/99 9:30:34 AM
Revised On	2/24/99 9:30:34 AM
Scenario selected for this study	Toluene Release w/TRB
Meteorology selected for this study	ARS Meteorology for Midland Area
Isopleth limits selected for this study	Toluene Concentrations
Simulation time	Let the program decide (Automatic)
Model flash fire	Yes
Model vapor cloud explosion	Yes

Release scenario

General

Description	Toluene Release w/TRB
Chemical	TOLUENE
Notes	
Created On	2/24/99 9:28:06 AM
Revised On	2/24/99 9:37:25 AM

Tank Info.

Tank geometry && dimensions	Vertical cylinder
Tank height	20.0 (ft)
Tank diameter	9.0 (ft)
Tank contents	Liquid level
Liquid level	15.0 (ft)

Leak Info.

Tank leak type	Orifice - Circular
Hole diameter	3.0 (in)
Hole elevation	0.0 (ft)
Mitigation time	10.0 (min)

Pool Info.

Substrate type	Concrete
Pool area	1000.0 (ft^2)
Minimum pool depth	1.0 (cm)
Aerosol formation	Let model decide
Aerosol formation	1.0
Initial air entrainment	Evaporate all aerosol at source
Initial air entrainment	1.0

Isopleth limits

General

Description:	Toluene Concentrations
Notes:	
Chemical	TOLUENE
Created On	2/24/99 9:30:28 AM
Revised On	2/24/99 9:30:28 AM
Averaging time	1800.0 (s)
Evaluate dispersion isopleths at height	0.0 (ft)

Concentration

Label	Concentration
Low	50.0 (ppm)
Medium	300.0 (ppm)
High	1000.0 (ppm)

SOURCE CHARACTERISTICS

Dispersion Source - Tank Dynamics

Time (min)	Tank temperature (deg F)	Tank pressure (psi)	Mass in the tank (lb)	Liquid (lb/min)	Vapor (lb/min)
0.0	67.73	14.7	51587.6	3214.3	0.0
0.2	67.73	14.7	51146.7	3201.1	0.0
0.3	67.73	14.7	50485.3	3187.9	0.0
0.5	67.73	14.7	50044.4	3174.7	0.0
0.7	67.73	14.7	49603.5	3148.2	0.0
0.8	67.73	14.7	48942.1	3135.0	0.0
1.0	67.73	14.7	48501.2	3121.7	0.0
1.2	67.73	14.7	48060.3	3108.5	0.0
1.3	67.73	14.7	47398.9	3082.1	0.0
1.5	67.73	14.7	46958.0	3068.8	0.0
1.7	67.73	14.7	46296.6	3055.6	0.0
1.9	67.73	14.7	45855.7	3029.2	0.0
2.0	67.73	14.7	45414.8	3015.9	0.0
2.2	67.73	14.7	44753.4	3002.7	0.0
2.4	67.73	14.7	44312.5	2976.2	0.0
2.5	67.73	14.7	43651.1	2963.0	0.0
2.7	67.73	14.7	43210.2	2949.8	0.0
2.9	67.73	14.7	42769.2	2923.3	0.0
3.1	67.73	14.7	42107.9	2910.1	0.0
3.3	67.73	14.7	41666.9	2896.9	0.0
3.5	67.73	14.7	41005.6	2870.4	0.0
3.6	67.73	14.7	40564.6	2857.2	0.0
3.8	67.73	14.7	40123.7	2830.7	0.0
4.0	67.73	14.7	39462.3	2817.5	0.0
4.2	67.73	14.7	39021.4	2791.1	0.0
4.4	67.73	14.7	38360.0	2777.8	0.0
4.6	67.73	14.7	37919.1	2764.6	0.0
4.8	67.73	14.7	37478.2	2738.1	0.0
5.0	67.73	14.7	36816.8	2724.9	0.0
5.2	67.73	14.7	36375.9	2698.5	0.0
5.3	67.73	14.7	35935.0	2685.2	0.0

Time (min)	Tank temperature (deg F)	Tank pressure (psi)	Mass in the tank (lb)	Liquid (lb/min)	Vapor (lb/min)
5.5	67.73	14.7	35273.6	2658.8	0.0
5.7	67.73	14.7	34832.7	2645.5	0.0
5.9	67.73	14.7	34171.3	2619.1	0.0
6.1	67.73	14.7	33730.4	2605.9	0.0
6.3	67.73	14.7	33289.5	2579.4	0.0
6.5	67.73	14.7	32628.1	2566.2	0.0
6.8	67.73	14.7	32187.2	2539.7	0.0
7.0	67.73	14.7	31525.8	2513.3	0.0
7.2	67.73	14.7	31084.9	2500.0	0.0
7.4	67.73	14.7	30643.9	2473.6	0.0
7.6	67.73	14.7	29982.6	2460.4	0.0
7.8	67.73	14.7	29541.6	2433.9	0.0
8.0	67.73	14.7	28880.3	2407.4	0.0
8.2	67.73	14.7	28439.3	2394.2	0.0
8.5	67.73	14.7	27998.4	2367.8	0.0
8.7	67.73	14.7	27337.0	2341.3	0.0
8.9	67.73	14.7	26896.1	2328.1	0.0
9.1	67.73	14.7	26455.2	2301.6	0.0
9.4	67.73	14.7	25793.8	2275.2	0.0
9.6	67.73	14.7	25352.9	2248.7	0.0
9.8	67.73	14.7	24691.5	2235.5	0.0
10.0	67.73	14.7	24471.1	0.0	0.0

Dispersion Source - Pool Dynamics

Time (min)	Pool Evaporation Rate (lb/min)	Pool Temperature (deg F)	Pool Radius (ft)	Pool Volume (ft^3)	Pool Height (ft)
0.0	3.4	68.00	0.3	0.0991853	0.3
0.3	9.1	67.55	13.9	19.8636	0.03
0.7	10.3	67.16	17.8	39.6302	0.04
1.0	10.3	66.98	17.8	59.283	0.1
1.3	10.2	66.89	17.8	78.9367	0.1
1.7	10.2	66.84	17.8	98.5908	0.1
3.3	10.2	66.73	17.8	196.88	0.2
5.0	10.2	66.66	17.8	289.165	0.3
6.7	10.2	66.60	17.8	374.958	0.4
8.3	10.1	66.54	17.8	454.293	0.5
10.0	10.1	66.48	17.8	527.285	0.5
11.7	10.0	66.22	17.8	526.955	0.5
13.3	10.0	65.97	17.8	526.569	0.5
15.0	9.6	65.72	17.8	526.186	0.5
31.7	9.0	63.35	17.8	523.157	0.5
48.3	8.5	61.17	17.8	519.675	0.5
65.0	8.0	59.16	17.8	516.424	0.5
81.7	7.6	57.30	17.8	513.372	0.5
98.3	7.2	55.58	17.8	510.497	0.5
115.0	6.9	53.98	17.8	507.781	0.5
131.7	6.6	52.50	17.8	505.204	0.5
148.3	6.4	51.11	17.8	502.754	0.5
165.0	6.1	49.82	17.8	500.416	0.5

Time (min)	Pool Evaporation Rate (lb/min)	Pool Temperature (deg F)	Pool Radius (ft)	Pool Volume (ft^3)	Pool Height (ft)
181.7	5.9	48.61	17.8	498.18	0.5
198.3	5.7	47.48	17.8	496.039	0.5
215.0	5.0	46.42	17.8	493.979	0.5
381.7	4.4	39.91	17.8	478.432	0.5
548.3	4.1	37.14	17.8	463.428	0.5
715.0	4.0	35.77	17.8	450.33	0.5
881.7	3.9	34.98	17.8	437.997	0.4
1048.3	3.8	34.43	17.8	426.088	0.4
1215.0	3.8	33.88	17.8	414.423	0.4
1381.7	3.7	33.64	17.8	402.976	0.4
1548.3	3.7	33.44	17.8	391.603	0.4
1715.0	3.7	33.27	17.8	380.243	0.4
1881.7	3.7	33.11	17.8	368.889	0.4
2048.3	3.7	32.97	17.8	357.867	0.4
2215.0	3.6	32.84	17.8	346.914	0.3
3881.7	3.5	31.95	17.8	238.499	0.2
5548.3	3.5	31.41	17.8	132.376	0.1
7215.0	1.6	30.87	16.6	28.2944	0.03

Dispersion Source - Release Stream and Flash

Time (min)	Liquid (lb/min)	Vapor (lb/min)	Air (lb/min)	Temperature (deg F)
0.0	3219.2	0.0	0.0	68.00
0.2	3202.7	0.0	0.0	68.00
4.2	2797.3	0.0	0.0	67.96
7.2	2497.8	0.0	0.0	67.93
9.1	2299.4	0.0	0.0	67.90
9.6	2253.0	0.0	0.0	67.90
9.8	2235.9	0.0	0.0	67.90
10.0	0.0	0.0	0.0	67.89

Dispersion Source - Release Stream and Flash

Time (min)	Aerosol (lb/min)	Flash (lb/min)	Liquid to Pool (lb/min)
0.0	0.0	0.0	3219.2
0.2	0.0	0.0	3202.7
4.2	0.0	0.0	2797.3
7.2	0.0	0.0	2497.8
9.1	0.0	0.0	2299.4
9.6	0.0	0.0	2253.0
9.8	0.0	0.0	2235.9
10.0	0.0	0.0	0.0

Dispersion Source - Vapor cloud at the source

Time (min)	Liquid (lb/min)	Vapor (lb/min)	Air (lb/min)	Temperature (deg F)	Cloud Radius (ft)
0.0	0.0	3.4	0.0	68.00	0.3
0.3	0.0	9.1	0.0	67.55	13.9
0.7	0.0	10.3	0.0	67.16	17.8
7215.0	0.0	0.0	0.0	80.33	0.0

ISOPLETHS

Evaluate dispersion isopleths at 0.0 (ft) height
Averaging time 1800.0 (s)
Meander time 1800.0 (s)

Concentration

Isopleth limit (ppm)	Maximum isopleth distance (ft)	Maximum isopleth width (ft)
50.0	122.3	36.4
300.0	36.7	32.0
1000.0	24.5	28.7

RECEPTOR IMPACT

Default Receptor

Downwind distance (ft)	Peak meander concentration (ppm)	Dose (ppm-min)	Exposure time (min)
45.9	206.4	1478590.0	7215.1
59.1	144.4	1021154.0	7215.1
72.2	105.4	738476.2	7215.1
85.3	82.1	586858.2	7215.2
98.4	65.9	460876.4	7215.1
111.5	54.3	379493.8	7215.1
124.7	45.9	324569.8	7215.2
137.8	17.3	2493.5	7214.8
150.9	14.6	2107.6	7214.8
164.0	6.7	8369.4	7214.7

TCS Release

Study

Description	TCS Release
Notes	With TRB
Created On	2/24/99 9:18:27 AM
Revised On	2/24/99 9:18:27 AM
Scenario selected for this study	TCS Release w/TRB
Meteorology selected for this study	ARS Meteorology for Midland Area
Isopleth limits selected for this study	TCS - ERPG 1,3,25
Simulation time	Let the program decide (Automatic)
Model flash fire	Yes
Model vapor cloud explosion	Yes

Release scenario

General

Description	TCS Release w/TRB
Chemical	Trichlorosilane (PHYPROP)
Notes	
Created On	2/24/99 9:17:53 AM
Revised On	2/24/99 9:17:53 AM

Tank Info.

Tank geometry && dimensions	Horizontal cylinder
Tank length	40.0 (ft)
Tank diameter	8.0 (ft)
Tank contents	Liquid level
Liquid level	8.0 (ft)

Leak Info.

Tank leak type	Orifice - Circular
Hole diameter	4.0 (in)
Hole elevation	0.0 (ft)
Mitigation time	10.0 (min)

Pool Info.

Substrate type	Concrete
Pool area	1000.0 (ft^2)
Minimum pool depth	1.0 (cm)
Aerosol formation	Let model decide
Aerosol formation	1.0
Initial air entrainment	Evaporate all aerosol at source
Initial air entrainment	1.0

Isopleth limits

General

Description:	TCS - ERPG 1,3,25
Notes:	
Chemical	Trichlorosilane (PHYPROP)
Created On	11/3/98 2:01:24 PM
Revised On	11/3/98 2:01:24 PM
Averaging time	3600.0 (s)
Evaluate dispersion isopleths at height	0.0 (ft)

Concentration

Label	Concentration
Low	1.0 (ppm)
Medium	3.0 (ppm)
High	25.0 (ppm)

SOURCE CHARACTERISTICS

Dispersion Source - Tank Dynamics

Time (min)	Tank temperature (deg F)	Tank pressure (psi)	Mass in the tank (lb)	Liquid (lb/min)	Vapor (lb/min)
0.0	67.73	14.7	168651.9	6455.1	0.0
0.3	67.73	14.7	166888.2	6362.5	0.0
0.5	67.73	14.7	165124.5	6296.4	0.0
0.8	67.73	14.7	163360.9	6243.5	0.0
1.1	67.73	14.7	161597.2	6190.6	0.0
1.4	67.73	14.7	160054.0	6150.9	0.0
1.6	67.73	14.7	158290.3	6111.2	0.0
1.9	67.73	14.7	156526.6	6058.3	0.0
2.2	67.73	14.7	154762.9	6018.6	0.0
2.5	67.73	14.7	152999.2	5978.9	0.0
2.8	67.73	14.7	151456.0	5939.3	0.0
3.1	67.73	14.7	149692.3	5899.6	0.0
3.4	67.73	14.7	147928.7	5873.1	0.0
3.6	67.73	14.7	146165.0	5833.4	0.0
4.0	67.73	14.7	144401.3	5793.7	0.0
4.3	67.73	14.7	142858.1	5754.1	0.0
4.5	67.73	14.7	141094.4	5727.6	0.0
4.8	67.73	14.7	139330.7	5687.9	0.0
5.2	67.73	14.7	137567.0	5648.2	0.0
5.5	67.73	14.7	135803.4	5621.8	0.0
5.8	67.73	14.7	134260.1	5582.1	0.0
6.1	67.73	14.7	132496.5	5542.4	0.0
6.4	67.73	14.7	130732.8	5516.0	0.0
6.7	67.73	14.7	128969.1	5476.3	0.0
7.0	67.73	14.7	127205.4	5449.8	0.0
7.3	67.73	14.7	125662.2	5410.1	0.0
7.6	67.73	14.7	123898.5	5383.7	0.0
8.0	67.73	14.7	122134.8	5344.0	0.0
8.3	67.73	14.7	120371.2	5317.5	0.0
8.6	67.73	14.7	118607.5	5277.9	0.0
8.9	67.73	14.7	117064.3	5238.2	0.0

Time (min)	Tank temperature (deg F)	Tank pressure (psi)	Mass in the tank (lb)	Liquid (lb/min)	Vapor (lb/min)
9.3	67.73	14.7	115300.6	5211.7	0.0
9.6	67.73	14.7	113536.9	5172.0	0.0
9.9	67.73	14.7	111773.2	5172.0	0.0
10.0	67.73	14.7	111332.3	0.0	0.0

Dispersion Source - Pool Dynamics

Time (min)	Pool Evaporation Rate (lb/min)	Pool Temperature (deg F)	Pool Radius (ft)	Pool Volume (ft^3)	Pool Height (ft)
0.0	131.7	68.00	0.3	0.128074	0.3
0.3	311.8	62.42	15.6	25.1494	0.03
0.7	323.7	62.42	17.8	48.9738	0.05
1.0	323.7	62.42	17.8	72.4691	0.1
1.3	323.7	62.42	17.8	95.7258	0.1
1.7	323.6	62.42	17.8	118.763	0.1
3.3	323.7	62.42	17.8	231.627	0.2
5.0	323.7	62.42	17.8	340.422	0.3
6.7	323.7	62.42	17.8	446.385	0.4
8.3	323.7	62.42	17.8	548.939	0.5
10.0	323.7	62.42	17.8	649.883	0.6
11.7	323.7	62.42	17.8	643.488	0.6
13.3	323.7	62.42	17.8	637.093	0.6
15.0	323.7	62.42	17.8	630.698	0.6
31.7	323.7	62.42	17.8	566.744	0.6
48.3	323.6	62.42	17.8	502.791	0.5
65.0	323.6	62.42	17.8	438.838	0.4
81.7	323.6	62.42	17.8	374.906	0.4
98.3	323.6	62.42	17.8	310.979	0.3
115.0	323.7	62.42	17.8	247.051	0.2
131.7	323.7	62.42	17.8	183.117	0.2
148.3	323.7	62.42	17.8	119.177	0.1
165.0	234.9	62.42	17.8	55.2365	0.1
181.7	84.5	62.42	9.3	8.82749	0.03

Dispersion Source - Release Stream and Flash

Time (min)	Liquid (lb/min)	Vapor (lb/min)	Air (lb/min)	Temperature (deg F)
0.0	6453.1	0.0	0.0	68.00
0.3	6364.9	0.0	0.0	68.00
0.5	6301.7	0.0	0.0	68.00
0.8	6246.9	0.0	0.0	68.00
1.1	6196.9	0.0	0.0	67.99
1.4	6150.2	0.0	0.0	67.99
1.9	6063.3	0.0	0.0	67.98
2.5	5982.1	0.0	0.0	67.98
3.4	5867.4	0.0	0.0	67.97
4.5	5722.6	0.0	0.0	67.96
6.4	5514.8	0.0	0.0	67.94

Time (min)	Liquid (lb/min)	Vapor (lb/min)	Air (lb/min)	Temperature (deg F)
9.6	5176.9	0.0	0.0	67.90
9.9	5168.5	0.0	0.0	67.90
10.0	0.0	0.0	0.0	67.90

Dispersion Source - Release Stream and Flash

Time (min)	Aerosol (lb/min)	Flash (lb/min)	Liquid to Pool (lb/min)
0.0	0.0	0.0	6453.1
0.3	0.0	0.0	6364.9
0.5	0.0	0.0	6301.7
0.8	0.0	0.0	6246.9
1.1	0.0	0.0	6196.9
1.4	0.0	0.0	6150.2
1.9	0.0	0.0	6063.3
2.5	0.0	0.0	5982.1
3.4	0.0	0.0	5867.4
4.5	0.0	0.0	5722.6
6.4	0.0	0.0	5514.8
9.6	0.0	0.0	5176.9
9.9	0.0	0.0	5168.5
10.0	0.0	0.0	0.0

Dispersion Source - Vapor cloud at the source

Time (min)	Liquid (lb/min)	Vapor (lb/min)	Air (lb/min)	Temperature (deg F)	Cloud Radius (ft)
0.0	0.0	131.7	0.0	68.00	0.3
0.3	0.0	323.6	0.0	62.42	15.6
165.0	0.0	234.9	0.0	62.42	17.8
181.7	0.0	0.0	0.0	80.33	0.0

ISOPLETHS

Evaluate dispersion isopleths at 0.0 (ft) height
Averaging time 3600.0 (s)
Meander time 3600.0 (s)

Concentration

Isopleth limit (ppm)	Maximum isopleth distance (mile)	Maximum isopleth width (mile)
1.0	5.2	0.2
3.0	1.4	0.1
25.0	0.5	0.03

RECEPTOR IMPACT

Default Receptor

Downwind distance (mile)	Peak meander concentration (ppm)	Dose (ppm-min)	Exposure time (min)
0.2	101.7	7458.4	182.5
0.5	10.5	1732.6	183.1
1.9	2.0	337.4	181.8
4.7	1.1	172.4	165.6
4.8	1.0	169.8	165.5
4.9	1.0	167.3	165.3
5.0	1.0	164.8	165.1
5.1	1.0	162.6	165.1
5.2	1.0	160.5	165.1
5.3	1.0	158.4	165.1

TCS Release

Study

Description	TCS Release
Notes	With TRB
Created On	2/24/99 9:18:27 AM
Revised On	2/24/99 9:18:27 AM
Scenario selected for this study	TCS Release w/TRB
Meteorology selected for this study	ARS Meteorology for Midland Area
Isopleth limits selected for this study	TCS - ERPG 1,3,25
Simulation time	Let the program decide (Automatic)
Model flash fire	Yes
Model vapor cloud explosion	Yes

Release scenario

General

Description	TCS Release w/TRB
Chemical	Trichlorosilane (PHYPROP)
Notes	
Created On	2/24/99 9:17:53 AM
Revised On	2/24/99 9:40:32 AM

Tank Info.

Tank geometry && dimensions	Horizontal cylinder
Tank length	40.0 (ft)
Tank diameter	8.0 (ft)
Tank contents	Liquid level
Liquid level	8.0 (ft)

Leak Info.

Tank leak type	Orifice - Circular
Hole diameter	2.0 (in)
Hole elevation	0.0 (ft)
Mitigation time	10.0 (min)

Pool Info.

Substrate type	Concrete
Pool area	1000.0 (ft^2)
Minimum pool depth	1.0 (cm)
Aerosol formation	Let model decide
Aerosol formation	1.0
Initial air entrainment	Evaporate all aerosol at source
Initial air entrainment	1.0

Isopleth limits

General

Description:	TCS - ERPG 1,3,25
Notes:	
Chemical	Trichlorosilane (PHYPROP)
Created On	11/3/98 2:01:24 PM
Revised On	11/3/98 2:01:24 PM
Averaging time	3600.0 (s)
Evaluate dispersion isopleths at height	0.0 (ft)

Concentration

Label	Concentration
Low	1.0 (ppm)
Medium	3.0 (ppm)
High	25.0 (ppm)

SOURCE CHARACTERISTICS

Dispersion Source - Tank Dynamics

Time (min)	Tank temperature (deg F)	Tank pressure (psi)	Mass in the tank (lb)	Liquid (lb/min)	Vapor (lb/min)
0.0	67.73	14.7	168651.9	1613.8	0.0
1.1	67.73	14.7	166888.2	1587.3	0.0
2.1	67.73	14.7	165124.5	1574.1	0.0
3.2	67.73	14.7	163360.9	1560.9	0.0
4.3	67.73	14.7	161597.2	1547.6	0.0
5.5	67.73	14.7	160054.0	1534.4	0.0
6.6	67.73	14.7	158290.3	1521.2	0.0
7.7	67.73	14.7	156526.6	1521.2	0.0
8.8	67.73	14.7	154762.9	1508.0	0.0
10.0	67.73	14.7	152999.2	1508.0	0.0
10.0	67.73	14.7	152999.2	0.0	0.0

Dispersion Source - Pool Dynamics

Time (min)	Pool Evaporation Rate (lb/min)	Pool Temperature (deg F)	Pool Radius (ft)	Pool Volume (ft^3)	Pool Height (ft)
0.0	35.6	68.00	0.2	0.0320185	0.2
0.3	98.0	62.42	7.8	6.2942	0.03
0.7	156.0	62.42	10.9	12.2824	0.03
1.0	210.3	62.42	13.2	18.0401	0.03
1.3	261.1	62.42	15.1	23.5136	0.03
1.7	320.5	62.42	16.7	28.769	0.03
3.3	323.7	62.42	17.8	53.6385	0.1
5.0	323.7	62.42	17.8	78.0015	0.1
6.7	323.7	62.42	17.8	102.035	0.1
8.3	323.7	62.42	17.8	125.718	0.1
10.0	323.7	62.42	17.8	149.128	0.1
11.7	323.7	62.42	17.8	142.734	0.1

Time (min)	Pool Evaporation Rate (lb/min)	Pool Temperature (deg F)	Pool Radius (ft)	Pool Volume (ft^3)	Pool Height (ft)
13.3	323.7	62.42	17.8	136.34	0.1
15.0	323.7	62.42	17.8	129.946	0.1
31.7	270.7	62.42	17.8	66.0055	0.1
48.3	61.8	62.42	11.0	12.5241	0.03

Dispersion Source - Release Stream and Flash

Time (min)	Liquid (lb/min)	Vapor (lb/min)	Air (lb/min)	Temperature (deg F)
0.0	1613.3	0.0	0.0	68.00
1.1	1591.2	0.0	0.0	67.99
2.1	1575.4	0.0	0.0	67.98
3.2	1561.7	0.0	0.0	67.97
4.3	1549.2	0.0	0.0	67.96
5.5	1537.6	0.0	0.0	67.94
6.6	1526.5	0.0	0.0	67.93
7.7	1515.8	0.0	0.0	67.92
8.8	1505.6	0.0	0.0	67.91
10.0	1505.3	0.0	0.0	67.90
10.0	0.0	0.0	0.0	67.90

Dispersion Source - Release Stream and Flash

Time (min)	Aerosol (lb/min)	Flash (lb/min)	Liquid to Pool (lb/min)
0.0	0.0	0.0	1613.3
1.1	0.0	0.0	1591.2
2.1	0.0	0.0	1575.4
3.2	0.0	0.0	1561.7
4.3	0.0	0.0	1549.2
5.5	0.0	0.0	1537.6
6.6	0.0	0.0	1526.5
7.7	0.0	0.0	1515.8
8.8	0.0	0.0	1505.6
10.0	0.0	0.0	1505.3
10.0	0.0	0.0	0.0

Dispersion Source - Vapor cloud at the source

Time (min)	Liquid (lb/min)	Vapor (lb/min)	Air (lb/min)	Temperature (deg F)	Cloud Radius (ft)
0.0	0.0	66.9	0.0	68.00	0.2
0.7	0.0	183.2	0.0	62.42	10.9
1.3	0.0	261.1	0.0	62.42	15.1
1.7	0.0	323.5	0.0	62.42	16.7
31.7	0.0	270.7	0.0	62.42	17.8
48.3	0.0	0.0	0.0	80.33	0.0

ISOPLETHS

Evaluate dispersion isopleths at 0.0 (ft) height
Averaging time 3600.0 (s)
Meander time 2900.1 (s)

Concentration

Isopleth limit (ppm)	Maximum isopleth distance (ft)	Maximum isopleth width (ft)
1.0	26898.6	1262.4
3.0	6113.3	576.4
25.0	1630.2	177.3

RECEPTOR IMPACT

Default Receptor

Downwind distance (ft)	Peak meander concentration (ppm)	Dose (ppm-min)	Exposure time (min)
1066.3	44.8	1786.6	49.4
2542.7	11.1	458.1	49.7
9924.5	1.9	80.2	48.4
24688.3	1.1	30.1	32.2
25269.0	1.0	29.5	32.1
25849.7	1.0	28.9	32.0
26430.4	1.0	28.4	31.8
27011.2	1.0	28.0	31.8
27591.9	1.0	27.6	31.8
28172.6	1.0	27.2	31.8