

FINDING OF NO SIGNIFICANT IMPACT

FOR THE PROPOSED

METHYL CHLORIDE VIA OXYHYDROCHLORINATION OF METHANE PROJECT

AGENCY: U.S. Department of Energy (DOE)

ACTION: Finding of No Significant Impact (FONSI)

SUMMARY: DOE has prepared an Environmental Assessment (EA) (DOE/EA-1157) for a project proposed by Dow Corning Corporation to demonstrate a novel method for producing methyl chloride (CH_3Cl). The project would involve design, construction, and operation of an engineering-scale oxyhydrochlorination (OHC) facility where methane, oxygen, and hydrogen chloride (HCl) would be reacted in a fixed-bed reactor in the presence of highly selective, stable catalysts. Unconverted methane, light hydrocarbons and HCl would be recovered and recycled back to the OHC reactor. The methyl chloride would be absorbed in a solvent, treated by solvent stripping and then purified by distillation. Testing of the proposed OHC process would be conducted at Dow Corning's production plant in Carrollton, Carroll County, Kentucky, over a 23-month period. Based on the analyses in the EA, the DOE has determined that the proposed action is not a major Federal action significantly affecting the quality of the human environment as defined by the National Environmental Policy Act (NEPA) of 1969. Therefore, preparation of an Environmental Impact Statement is not required, and DOE is issuing this FONSI.

COPIES OF THE EA ARE AVAILABLE FROM:

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BACKGROUND: Over the past five years, DOE's Pittsburgh Energy Technology Center (PETC) has supported a research program to determine the feasibility of producing methyl chloride (CH_3Cl), a key ingredient used in the silicone industry, directly from methane (the primary component of natural gas) via an oxyhydrochlorination (OHC) process. The concept originally began at PETC and patents were issued. Dow Corning approached PETC with a proposal to further develop the route. As a result of this research program, funded through cost-sharing by DOE, Dow Corning Corporation, the Gas Research Institute (GRI), and Texas Gas Transmission Company, the OHC process is now ready for further development. The proposed action, which would be funded by DOE, Dow Corning, and GRI, would advance the OHC natural gas conversion technology to an integrated engineering-scale process at the Dow Corning plant in Carrollton, Kentucky.

The benefits of developing such an economically viable natural gas conversion process are numerous. Successful development of the OHC technology would encourage economic growth, help to reduce the trade deficit resulting from methanol imports, enhance energy interests by increasing utilization of an abundant domestic resource, and improve environmental quality since the product separation process to be developed as part of the technology has the potential for more effectively capturing volatile organic compounds (VOCs).

While Dow Corning intends to use the CH_3Cl converted from natural gas for the manufacture of silicones, DOE's interest in the OHC process is to use the CH_3Cl to produce liquid transportation fuels. Because the OHC technology utilizes domestic natural gas as a feedstock and thereby provides a reliable, low cost source of CH_3Cl independent of methanol, considerable cost savings may be achievable.

DESCRIPTION OF THE PROPOSED PROJECT: The proposed action is the establishment of a cooperative agreement between DOE and Dow Corning to partially fund the engineering-scale development of the OHC process. The engineering-scale facility would be constructed on a one-quarter acre plot of land within Dow Corning's 1,400-acre industrial site at Carrollton, Carroll County, Kentucky. The proposed facility would be designed to process approximately 1,000 standard cubic feet per minute (scfm) of methane. It would involve the construction and installation of a fixed-bed reactor consisting of 1,600 one-inch diameter by 6-ft tubes, an absorber system (a glass-lined absorber column and phase separator), a stripper system (a stripper column and phase separator), and a distillation train to purify the CH_3Cl . Methane, oxygen, and HCl gases would be introduced into the reactor tubes, where chemical conversion would occur over a proprietary catalyst. Operational testing of the facility would occur over a 23-month period, during which time the proposed facility would be on-line approximately 50% of the time. Operational testing would be performed under a variety of conditions to establish

sufficient data for performing technical and economic viability assessments. Successful development of the OHC technology would enhance the commercial acceptability of this natural gas conversion process, and the product separation technology planned for use in capturing volatile organic compounds (VOCs) would be marketable to other chemical process industries.

ENVIRONMENTAL IMPACTS: The proposed engineering-scale facility would be constructed on a one-quarter acre plot of land within Dow Corning's 1,400-acre industrial site. Construction of the facility would not be expected to result in significant impacts to the human environment. Minimal air emissions would be expected as a result of vehicular exhausts and fugitive dust from site excavation. There are no concerns with groundwater contamination since construction would not reach groundwater levels. Construction would not encroach upon any floodplains. In addition, all construction-related waste would be non-hazardous (e.g., wood, concrete, and paper). A material control system would be used to ensure that documentation of all construction materials is received and meets design specifications and requirements. Increased noise levels would result from machinery used in the installation of process equipment, and vehicle operations during construction.

During operation of the engineering-scale facility, no substantial change in air emissions would be expected to occur. All wastewater discharges from operation of the facility would be handled and treated within existing facilities and would add less than one percent to current process water output. Primary safety and health hazards would be fire and chemical exposure, created by handling of the methyl chloride gas and methylene chloride, chloroform and carbon tetrachloride liquids; Dow Corning has performed methane-oxygen flammability studies and would operate outside flammability limits.

AIR EMISSIONS: A temporary increase in air emissions would be expected during the construction phase of the project due to vehicular exhaust emissions from construction equipment and "fugitive" particulate emissions from wind erosion during site excavation. The latter would be controlled by watering, to eliminate dust generation. During operation of the facility, there would be a slight increase in the production hazardous air pollutants. Because the increase in air emissions would be minimal, no complications with CAAA compliance would be anticipated. On the contrary, if the operation of the facility is successful, a proprietary absorber-stripper technology developed by Dow Corning would be demonstrated for reducing VOCs by up to 98%. A purge stream on the absorber effluent would still be necessary since oxygenates would accumulate in the recycle loop. However, this purge stream would be incinerated in a steam generating boiler, recovering the heat value of the unconverted methane.

WATER QUALITY: Construction of the proposed engineering-scale facility would not be expected to impact existing surface water or groundwater, nor would any new liquid waste streams be generated. However, during operation of the facility, the components and quantities of the wastewater anticipated would be: process water (710,000 gallons or 95,140 cubic feet), hydrochloric acid, methyl chloride, and methylene chloride. The Kentucky Pollutant Discharge Elimination System (KPDES) permit for the existing Dow Corning plant imposes monthly average and daily maximum discharge limitations for methyl chloride (0.655 lbs/day and 1.446 lbs/day) and methylene chloride (0.304 lbs/day and 0.677 lbs/day). Waste discharges from operation of the facility would be combined with discharges from existing operations and handled and treated within existing facilities. These discharges would add less than one percent to current process water output. Due to the existing treatment system and very low wastewater output from the proposed project, neither violations of existing KPDES standards nor adverse water quality impacts from the proposed project would be expected.

SOIL/GROUNDWATER: Prior study has documented that heavy groundwater withdrawal by industries in the Carrollton area actually induces infiltration from the Ohio River. Pumping by Dow Corning to support current operations induces such flow from the Ohio River. Further, Dow Corning has developed Spill Prevention Control and Countermeasure, Groundwater Protection, and Best Management Practice Plans that would also apply to the construction and operation of the proposed engineering-scale facility. There are no concerns about groundwater contamination impacts of the proposed action because construction activities would not reach groundwater levels, and the chance of an accidental chemical release would be small due to the existing environmental protection plans.

WETLANDS: Consultation with the U.S. Fish and Wildlife Service and consideration of soil types comprising the Dow Corning property indicates a very low likelihood of wetland encroachment by the proposed action.

FLOODPLAINS: The 100-year flood elevation near the project site is approximately 469.6 feet above sea level. The approximate top of ground site elevation is around 485.0 feet above sea level. All plant construction would be above this elevation and should not be affected by reasonable flood elevation such as the 100-year flood.

SOLID WASTE: Over the duration of the proposed action, approximately 170 cubic feet of solid waste would be generated. Miscellaneous construction waste debris would consist of wood, concrete, paper, and other garbage. During process operations, office waste, which would also be non-hazardous, would be generated. All of this solid waste would be aggregated with other non-hazardous waste from

Dow Corning's Carrollton plant, collected by the municipal waste hauler for Carrollton County, and transported to the Colerain landfill in Cincinnati, Ohio.

Dow Corning routinely recycles a variety of solid waste materials, including mixed office paper, cardboard, scrap steel, containers, aluminum, glass, motor oil, plastics, and wood pallets. All such waste materials produced during construction and operation of the proposed unit would be recycled.

HAZARDOUS WASTE: The materials to be used as process inputs would be methane, oxygen, and hydrogen chloride gases, while process outputs would be methyl chloride, and byproducts consisting of: methylene chloride, chloroform, and trace amounts of carbon tetrachloride. A commercially marketed catalyst consisting of metals on an alumina support would be used to promote chemical reaction of methane, oxygen, and hydrogen chloride to produce methyl chloride.

All hazardous materials that may pose disposal problems would be handled through the use of closed loop systems. These include the heat transfer fluids used in the OHC process, as well as the absorbent hydrocarbon solvent used to recover the chlorinated products and byproducts. In the latter case, the solvent would subsequently be stripped of the chlorinated products and recycled to the separation stage in a closed loop operation.

In addition, chemical reaction of the feed gases (methane, oxygen, and hydrogen chloride) over the process catalyst would be performed in a closed system. After separation of the products and byproducts, unreacted gases would be recycled for subsequent processing over the catalyst. Methyl chloride product (at a maximum production rate approximately 900 lbs/hr) would be separated from the three other chlorinated byproducts (methylene chloride, chloroform, and carbon tetrachloride which would have maximum production rates of 322.5, 26.6, and 3.1 lbs/hr, respectively) through distillation, temporarily stored, and pumped for use in other chemical manufacturing operations at the Carrollton plant.

Over the life of the proposed project, approximately 5,000 pounds of spent catalyst would be produced. It would be characterized for its composition and then transported to a commercial organization specializing in catalyst processing for reclamation of metal values.

SAFETY AND HEALTH: Primary safety and health hazards would be fire and chemical exposure hazards associated with the raw material feeds (methane, oxygen, and hydrogen chloride gases) and reaction products (methyl chloride gas and methylene chloride, chloroform, and carbon tetrachloride liquids). Since handling and processing of these materials represent activities that have been historically and safely employed in Dow Corning's chemical manufacturing plant at Carrollton,

existing approaches for averting risk would be utilized and are deemed adequate for risk control at the engineering-scale development unit.

At the construction stage, a material control system would be used to ensure that documentation for all construction materials is received, that the supplied documentation appropriately demonstrates consistency of construction materials with design specifications for manufacturing, and that construction materials meet process design requirements.

Dow Corning maintains an on-site emergency response program and capability that precludes the need for responders from off-site emergency management organizations; this capability has been recognized by local planning and emergency response officials and sufficiently coordinated with local organizations such that the Carrollton plant's capabilities have been used for off-site safety response efforts.

ACCIDENTAL RELEASES: Natural gas would be supplied to the development unit from an existing pipeline supply to the Carrollton plant and purified on-site to separate methane for process feed. Non-methane components separated from the natural gas would be sent to an existing boiler house for steam generation. The methane would be stored as liquid in a 15,000 gallon cryogenic storage tank.

Hydrogen chloride gas would be delivered to the development unit by tube trailer.

Industrial grade liquid oxygen would be delivered to the development unit and stored in a 15,000 gallon cryogenic storage tank.

Methyl chloride produced from the development unit would be pumped directly into existing storage tanks for use in chemical manufacturing operations at the Carrollton plant. The by-product stream (91.6% methylene chloride, 7.5% chloroform, and 0.9% carbon tetrachloride) would be pumped directly into a rail car storage tank for market delivery.

Based on the similarities between development unit materials and materials currently handled at the Carrollton plant, and the small sizes of storage operations, procedures for handling accidental releases would be similar to those that currently exist at the Carrollton plant and would be adequate for risk control for the proposed project. The development unit would be constructed in an open environment and not enclosed within a building structure, thus providing a method for natural ventilation to dissipate any fugitive releases of process gases that might occur. In-plant monitors would be used to detect such releases, and procedures for evacuation and emergency response in the event of a release of methane, hydrogen chloride, or chlorinated reaction product would be employed.

ENVIRONMENTAL JUSTICE: The proposed action would take place in an area currently zoned for industrial activity. No disproportionately high or adverse impact on minority or low-income communities would be expected from this proposed project.

THREATENED AND ENDANGERED SPECIES: The U.S. Fish and Wildlife Service has been consulted to ensure compliance with the Endangered Species Act and the Fish and Wildlife Coordination Act. This project would not impound, divert, deepen, control, or otherwise modify any stream or other body of water; adverse impacts to fish, plant, or wildlife species would not be anticipated. Endangered species collection records do not indicate that any federally listed or proposed endangered or threatened species occur within the impact area of the project.

CULTURAL RESOURCES: Consultation with the State of Kentucky's Historic Preservation Office under the National Historic Preservation Act has concluded that there would be no effect on cultural resources or historic properties listed in or eligible for listing in the National Register of Historic Places.

NOISE: Increased noise levels would be expected from the machinery used for installation of process equipment and vehicle operations during construction, but these increases would be localized and sporadic. The equipment used during operation of the engineering-scale facility would be typical of that used for chemical processing units. Any additional noise load relative to Dow Corning's existing production plant would be very small. However, industrial hygiene personnel monitor the processes and procedures regularly for possible noise concerns, and employee exposure is limited.

POLLUTION PREVENTION: Dow Corning set a goal to reduce its toxic releases within the U.S. by 75% in the year 2000 compared to 1988 levels, with voluntary commitments to the U.S. Environmental Protection Agency under the 33/50 Voluntary Reduction Program and the Clean Air Act Early Reduction Credit Program. Compared to 1988 baseline levels, Dow Corning has exceeded its goal of 75% reduction of toxic air pollutants, having achieved 90% reduction as of 1994. In addition to these initiatives, the proposed OHC facility would avoid the bulk transportation of methanol, a flammable liquid, by using domestic supplies of methane. Finally, the absorber/stripper technology developed as part of the OHC process would be expected to reduce VOCs from other industrial processes by up to 98%.

SOCIOECONOMICS: During construction, between 20 and 50 jobs would be created in the Carrollton community. The construction positions would be filled by local laborers. These temporary jobs would have a minimal, but positive impact on the local employment and economy. Once constructed, the unit would be operated by trained operators and qualified engineers drawn from Dow Corning's existing workforce, and no impact on the local employment and economy would be expected.

LONG-TERM AND CUMULATIVE IMPACTS: The proposed Department of Energy action would result in testing of the Oxyhydrochlorination (OHC) process for a period of 23 months, during which time the proposed facility would be on-line approximately 50% of the time. If the project is successfully completed, the engineering-scale facility would be maintained in an operational condition, producing methyl chloride for use at Dow Corning plant. No other large-scale projects are proposed at the Carrollton plant that, in conjunction with the OHC project, would create adverse cumulative impacts.

ALTERNATIVES CONSIDERED: In addition to the proposed action, the no-action alternative was considered. Under the no-action alternative, DOE would not provide funding for the development of the OHC process. There are no other practical alternatives to the proposed demonstration project because an existing, developed site within a commercial production plant employing comparable operations and capable of easily handling products and discharges would be used. Constructing the facility at another site would involve unnecessary monetary expenditures and would probably result in greater impacts to the natural and human environment.

PUBLIC AVAILABILITY: This FONSI, and the EA on which it is based, will be distributed to all persons and agencies known to be interested in or potentially affected by the proposed action. Additional copies of the FONSI and EA may be obtained from the Pittsburgh Energy Technology Center.

DETERMINATION: The proposed Federal action, to provide cost-shared financial assistance for demonstration of the OHC process in an engineering scale facility, does not constitute a major Federal action that would significantly affect the quality of the human environment as defined by NEPA. This conclusion is based on the analyses contained in the EA. Therefore, an Environmental Impact Statement is not required and DOE is issuing this FONSI.

ISSUED IN PITTSBURGH, PA, this 27th day of September, 1996



Sun W. Chun

Director

Pittsburgh Energy Technology Center