United States Environmental Protection Agency

**Region 6 - Enforcement & Compliance Assurance Division**

# INSPECTION REPORT

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| Inspection Date(s): | October 23, 2023-October 27, 2023 | |
| Media Program: | Air | |
| Regulatory Program(s) | Clean Air Act (CAA) Section 112(r) and 40 C.F.R. Part 68 Chemical Accident Prevention Provisions - Risk Management Program (RMP) | |
| Company Name: | **Dow Chemical Company** | |
| Facility Name: | **Dow Chemical Company Louisiana Operations** | |
| Facility Physical Location: | 21225 Highway 1 | |
| (city, state, zip code) | Plaquemine, Louisiana 70765 | |
| Mailing address: | Same as facility address | |
| (city, state, zip code) | | |
| County/Parish: | Iberville | |
| Facility Phone Number | (225) 353-4374 | |
| Facility Contact: | Mary Meyer | Responsible Care Leader |
| | MCMeyer2@dow.com> | |
| FRS Number: | 110001244724 | |
| Programmatic ID/Permit Number: | LA0000002204700008 / LDEQ Air Operating Permit O2203-V11 | |
| Media Identifier Number: | RMP 1000 0013 6523 | |
| NAICS: | 325199 (All Other Basic Organic Chemical Manufacturing) | |
| SIC: | 2869 | |

| Personnel participating in inspection: | | |
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| EPA Lead Inspector Signature/Date | Howard Cole Digitally signed by Howard Cole Date: 2024.01.25 10:51:01 -06'00' | |
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| | Samuel Tates | Date |

## SECTION I – INTRODUCTION

### PURPOSE OF THE INSPECTION

United States Environmental Protection Agency (EPA) Region 6 inspector Howard Cole arrived at the Dow Chemical facility in Plaquemine, LA ("Dow", "Dow Chemical" or the "Facility") at 9:00 AM on Monday, October 23, 2023, for an announced inspection. The EPA and LDEQ inspectors met with Byron Braud (Environmental H&S Leader), and other Dow employees for an opening conference. I presented my EPA inspector credentials and informed Dow personnel that this was an EPA inspection to determine compliance with the federal Chemical Accident Prevention Program rule and standards. The scope of the inspection was a partial compliance evaluation, which included an evaluation of the facility's compliance with the Clean Air Act (CAA), Section 112(r)(7), the Chemical Accident Prevention Provisions in 40 Code of Federal Regulations (C.F.R.), Part 68, and the CAA Section 112(r)(1) General Duty Clause.

### FACILITY DESCRIPTION

Dow Chemical owns and operates the chemical plant located in Plaquemine, Louisiana. This facility manufacturers ethylene oxide, ethylene, propylene oxide, polyethylene, propylene, propylene glycol, amines and base aromatic hydrocarbons (benzene, xylene, toluene) for sale to other chemical companies. Dow's customers in turn transform these chemicals into consumer products ranging from plastics to building materials. Co-located chemical manufacturers present at the Dow Chemical site within the property boundaries, and which are adjacent to the Dow Chemical covered process units include Blue Cube Operations, LLC a subsidiary company of Olin Corporation, Nutrition & Biosciences USA 1, LLC, (IFF), TSRC Specialty Materials LLC, and INEOS Americas, LLC. Dow's Risk Management Plan (RMP) is listed as meeting the criteria of Program Level 3, Title V facility. Dow Chemical is a non-union facility. The facility operates 24 hours a day, 7 days a week and employs approximately 1,243 full time employees. EPA conducted the inspection as a follow up action to a reported accidental release incident that occurred on July 14, 2023.

#### Incident Description and Background

In May 2023, Dow completed a scheduled plant turnaround of the Glycol-II unit, where ethylene oxide is manufactured. A process vessel (D-87) underwent an internal inspection and cleaning during the turnaround. According to information Dow provided, the company believes portable electric lighting used inside the vessel during the inspection and clean out was inadvertently left inside the vessel after work was completed. When the vessel was returned to service and ethylene oxide was reintroduced into the vessel, the portable lighting components became exposed to the process. Dow surmised that the lighting components degraded over time to form transportable debris, some of which migrated during normal operation and subsequent liquid flow out of vessel D-87.

On July 14, 2023, at approximately 7:00 PM, a process unit pump (P-11A) tripped offline due to high vibration. Dow believes that debris from the portable lights remained inside the D-87 process vessel after inspection and cleaning; migrated and passed through process pumps P-11A/B/C, and then through a heat exchanger (E-19C). The debris physically contacted the heat exchanger's rupture disk (RD), causing mechanical damage. The damage to the rupture disk released ethylene oxide internally into a pipeline between the rupture disk and an atmospheric pressure safety valve (PSV). The size of the pipeline is approximately 50 feet and 4 inches in diameter. The ethylene oxide then ignited inside the pipeline. This series of events introduced combustion gas back into the process vessel (D-87), which ultimately caused overpressure of the vessel and surrounding equipment, and resulted in the release of

ethylene oxide to the atmosphere. The accidental release in turn caused a fire and multiple explosions. No hospitalizations or fatalities resulted from the fire and explosions.

**SECTION II – OBSERVATIONS**

**Subpart A – General**

**40 C.F.R. § 68.10 Applicability –** Dow Chemical is the owner/operator of a stationary source that has more than a threshold quantity of the following regulated substances: 1,3-Butadiene, 1-Butene, 1-Pentene, Butane, Chlorine, Epichlorohydrin, Ethane, Ethyl chloride, Ethylene, Ethylene oxide, Hydrogen, Isobutane, Isoprene, Methane, Methylamine, Pentane, Propane, Propylene, Propylene oxide, and Ammonia (anhydrous), as listed in 40 C.F.R. § 68.130; therefore, the facility is subject to the Chemical Accident Prevention Provisions of Part 68. Dow is classified under the North American Industrial Classification System (NAICS) code 325199 (All Other Basic Organic Chemical Manufacturing). The facility is also subject to the Occupational Safety and Health Administration (OSHA) process safety management (PSM) standard, 29 C.F.R. § 1910.119. The facility handles the listed RMP regulated toxic and flammable substances at or above the RMP threshold quantities.

**40 C.F.R. § 68.10 Program Eligibility –** Dow re-submitted an RMP registration for its 5-year updates under 40 C.F.R. § 68.190 on February 5, 2018, and then again on January 18, 2023. The next registration re-submittal is due on January 18, 2028, unless an update or correction is required by 40 C.F.R. § 68.190 or 40 C.F.R. § 68.195 prior to the five-year renewal date.

**40 C.F.R. § 68.12 General requirements –** The re-submitted RMP plan requires the facility to: develop and implement a management system; conduct a hazard assessment; implement the prevention requirements of 40 C.F.R. § 68.65 - § 68.87; develop and implement an emergency response program; and include the data elements from 40 C.F.R. § 68.175 in their RMP.

In August 2018, Dow provided a resubmission to update the Dow Chemical Louisiana Operations RMP to include a newly constructed Polyethylene plant (Poly D) and adjustments to inventories as a result of expansions in other units that came online in early 2018. The manufacturing process and chemistry of Poly D is comparable to the existing Poly A process at the facility; therefore, no new RMP regulated chemicals were brought on site. There was one RMP-reportable accidental release, as defined by the RMP rule, of regulated substances from this facility within the last 5 years. The incident occurred on November 3, 2019, when 28 pounds of ethylene oxide was released. The recent July 14, 2023, ethylene oxide release was submitted in a separate RMP correction, before the deadline of January 14, 2024.

**40 C.F.R. § 68.15 Management –** Dow has developed a management system to oversee the implementation of the risk management program elements and provided an organizational chart that satisfactorily documents the lines of authority and coverage of RMP program areas.

**Subpart B – Hazard Assessment**

**40 C.F.R. § 68.20 Applicability –**The facility is required to prepare an off-site consequence analysis and complete the five-year accident history. Dow has twenty (20) Program Level 3 processes subject to this subpart.

**40 C.F.R. § 68.22 Off-site Consequence Analysis (OCA) Parameters –** Dow uses RMP*Comp™ as the technique for modeling the release scenarios. For both the worst-case and alternative case scenarios involving flammables, the facility used the endpoints provided in Appendix A of 40 C.F.R. Part 68, including appropriate wind speeds and stability classes, ambient temperatures and humidity values, values for height of the release, and surface roughness values for the release scenario analyses.

**40 C.F.R. § 68.25 Worst-case Release Scenario Analysis –** Dow identified and analyzed at least one flammable worst-case release scenario for propane, estimated to create the greatest distance to endpoint, resulting from an accidental release of the regulated flammable substance from a covered process under worst-case conditions. Dow identified and analyzed at least one toxics worst-case release scenario for ethylene oxide, estimated to create the greatest distance to endpoint, resulting from an accidental release of the regulated toxic substance from a covered process under worst-case conditions. EPA notes that ethylene oxide is also a regulated flammable substance.

**40 C.F.R. § 68.28 Alternative Release Scenario Analysis –** Dow identified and analyzed at least one alternative release scenario for ethylene oxide to represent all flammable substances held in covered processes. Dow also identified and analyzed alternative release scenarios for chlorine, epichlorhydrin, propylene oxide, and ammonia to represent all toxic substances held in covered processes. The alternate release scenarios represent potential releases that are more likely to occur during the course of operation in the covered process areas.

**40 C.F.R. § 68.30 Defining Off site Impacts - Population**

*Public receptor* means off site residences, institutions (e.g., schools, hospitals), industrial, commercial, and office buildings, parks, or recreational areas inhabited or occupied by the public at any time without restriction by the stationary source where members of the public could be exposed to toxic concentrations, radiant heat, or overpressure, as a result of an accidental release.

*Stationary source* means any buildings, structures, equipment, installations, or substance emitting stationary activities which belong to the same industrial group, *which are located on one or more contiguous properties*, which are under the control of the same person (or persons under common control), and from which an accidental release may occur.

Dow defined the affected off-site population, based on a circle with the point of release at the center. The facility used the most recent Census data, estimated to two significant digits in the OCA documentation. However, Dow did not include the other chemical industrial facilities co-located within the property boundaries of the site, and adjacent to the Dow Chemical production units, in the off-site population totals. These industrial facilities include the Blue Cube Operations, LLC a subsidiary company of Olin Corporation, Nutrition & Biosciences USA 1, LLC, (IFF), TSRC Specialty Materials LLC, and INEOS Americas, LLC. operations identified in the Section I Facility Description. **AOC-1 [68.30(a)]**

**40 C.F.R. § 68.33 Defining Off site Impacts - Environment –** Dow has identified environmental receptors in the OCA, as determined by the distance to endpoint using methods such as local U.S. Geological Survey (U.S.G.S.) maps or any other data source containing U.S.G.S. data to identify environmental receptors.

**40 C.F.R. § 68.36 Review and Update –** Dow has reviewed and updated the off-site consequence analyses at least once every five years.

**40 C.F.R. § 68.39 Documentation –** For the worst-case and alternative release scenarios, a description of the vessel or pipeline and substance selected, assumptions and parameters used, the rationale for selection, the anticipated effect of the administrative controls and passive mitigation on the release quantity, and the release rate was completed and provided for EPA's review.

**40 C.F.R. § 68.42 Five-year accident history –** Dow had two (2) RMP-reportable accidental releases of regulated substances identified in their five-year accident history. The incidents occurred on November 3, 2019, and April 25, 2020.

**Subpart C - Program 2 Prevention Program (Not Applicable)**

**Subpart D – Program 3 Prevention Program**

**40 CFR § 68.65 Process Safety Information –** Dow maintains a detailed record of process safety information that describes the chemical hazards, operating parameters, and equipment designs associated with all covered processes. Some of this documentation includes safety data sheets for all hazardous chemicals used in the covered processes, equipment design specification sheets, and reactive chemicals testing. This information is maintained and updated regularly, and is available to all operating personnel. Dow compiled written process safety information, which includes information pertaining to the hazards of the regulated substances used or produced by the covered processes, information pertaining to the technology of the processes, and information pertaining to the equipment in the processes. The EPA inspector reviewed the Safety Data Sheets (SDSs) for the RMP regulated process chemicals. The SDSs contain the following data for the hazards of each substance: toxicity information, permissible exposure limits, physical data, reactivity data, corrosivity data, thermal and chemical stability data, and the hazardous effects of inadvertent mixing of materials that could foreseeably occur.

EPA reviewed documentation concerning the technology of the covered processes, which included block flow diagrams, process chemistry, maximum intended inventory, safe upper and lower limits for such items as temperatures, pressures, flows, or compositions, and an evaluation of the consequences of deviation. EPA also reviewed documentation pertaining to the equipment of each process, including, piping and instrumentation diagrams (P&IDs), electrical classification, process safety valve (PSV), pressure relief valve (PRV) and relief system design, the design bases, design codes and standards employed, and other safety systems.

Dow has in place over fifteen pressure vessels at the facility that have atmospheric relief valves and pressure relief devices which have the potential to release ethylene oxide into the environment if an overpressure condition occurs inside the associated pressure vessel. Since ethylene oxide is both flammable and highly reactive, acute exposures to ethylene oxide gas may result in respiratory irritation and lung injury, headache, nausea, vomiting, diarrhea, shortness of breath, and cyanosis. Chronic exposure also has been associated with the occurrence of neurotoxicity, and sensitization. The OSHA standard for ethylene oxide is 1910.1047, which sets permissible exposure limits for workers at (1) part per million (ppm) as an 8-hour time weighted average (TWA), and (5) ppm as an acute fifteen-minute excursion limit. Based on available information Dow provided, if a relief device on a pressure vessel activates, ethylene oxide will vent at concentrations potentially exceeding the OSHA exposure limits immediately at the relief source and up to a certain distance. Based on their proximities within the covered process areas, EPA believes that the relief devices do not vent to safe locations in accordance with American Petroleum Institute (API) Standard 521, the Center for Chemical Process Safety (CCPS)

Guidelines for Pressure Relief and Effluent Handling Systems, and recommendations of the Chemical Safety Board (CSB)'s March 6, 2023 Safety Alert: *"Hazards Posed by Discharges from Emergency Pressure-Relief Systems"*. **AOC-2 [68.65(d)(2)]** Under some, the potential also exists for release of ethylene oxide in areas where a fire may have already occurred, thus creating the potential risk of additional catastrophic fires and explosions at the facility during an accidental release incident.

Additionally, Dow has over forty atmospheric pressure relief valves that upon activation during an overpressure event may release other hazardous hydrocarbon compounds to the atmosphere if an overpressure condition occurs inside an associated pressure vessel. EPA believes that there are accidental release situations under which a release to the environment would include potential chemical exposures to the public at hazardous levels. Vessel over-pressurization is one of these scenarios, in which emergency relief devices function as designed, to vent hazardous gas streams away from the covered process and into the ambient air, where they are carried downwind. EPA imagines that all facilities should routinely consider sources of chemical releases and address such possibilities; integrating the protection of the public and the environment into their design of safety systems.

**40 C.F.R. § 68.67 Process hazard analysis (PHA) –** Dow conducts periodic comprehensive studies to ensure that hazards associated with the covered processes are identified, evaluated, and controlled effectively. The methodology used to carry out these analyses may include: Checklists, Hazard and Operability Studies (HAZOP), Layers of Protection Analysis (LOPA), Risk Assessment Screening, and Reactive Chemicals/Process Hazards Analysis. The studies are undertaken by a team of qualified personnel with expertise in engineering and process operations and are revalidated at a regular interval of five years. Dow's PHA process requires that findings related to a hazard analysis must be addressed in a timely manner. Dow performed the initial PHAs and completed subsequent PHAs based on a five-year cycle, divided among the covered process units. During the inspection, EPA reviewed the Glycol II unit 2020 and 2023 PHAs.

Dow contracted with Baker Engineering and Risk Consultants, Inc. to conduct two Occupied Building Impact (OBI) Studies in 2012 and 2022. Dow had these facility stationary source siting studies conducted in support of Dow's corporate and Plaquemine site efforts to comply with the requirements of Dow's Loss Prevention Principle (LPP) 12.2 "Occupied Plant Buildings Subject to Process Hazards" (revised November 2006), and API RP-752. Dow's LPP 12.2 Implementation Project was designed to support Dow's sites and business units in their efforts to comply with LPP 12.2, benchmarking against studies conducted at other similar companies covered under OSHA PSM and EPA RMP requirements. The objectives of the studies included provisions of Dow's LPP 12.2 guidance to protect building occupants from process hazards associated with explosions external to an occupied building or room, including: vapor cloud explosion, condensed phase detonable material explosion, vessel bursting, building explosion impact from another building, explosion inside a room in a building affecting other occupied rooms, thermal radiation from pool or jet fires, and toxic releases. The study results presented in the reports identified Occupied Buildings subject to toxic impact, flammable impact, fire impact, and explosion impact, as well as plant locations exceeding Dow's risk elevation criteria, and occupied buildings exceeding Dow's risk elevation criteria. The studies made recommendations to address the potential impacts and comply with LPP 12.2. EPA requested both the 2012 and 2022 studies and upon review determined that the two studies were exactly the same, except for the newly constructed PEG/SURF process, which was included in the 2022 study.

EPA believes that Dow's 2020 and 2023 Glycol II unit PHAs were not appropriate to the complexity of the process in that they did not effectively evaluate and control the hazards of the process, as outlined

in the 2012 and 2022 Baker Risk studies. The process safety information presented in the 2012 and 2022 Baker Risk studies indicated that certain buildings required mitigation, or their occupancy be discontinued, in locations where an unacceptable toxic or explosion risk to building occupants was identified to exist. EPA determined that none of the findings and recommendations from the 2012 and 2022 Baker Risk OBI studies have been documented or resolved. EPA also determined that the PHAs reviewed were not appropriate for the complexity of the process in that they failed to evaluate and recommend control of the hazards related to the release of ethylene oxide and other toxic and flammable chemicals from atmospheric pressure relief devices to the ambient environment.

The EPA believes that the PHA facility siting checklists are not used in a manner consistent with API Standard 752 (Management of Hazards Associated with Location of Process Plant Permanent Buildings), and are not appropriate for the complexity of the process. The facility siting PHA checklists did not reference action closure documents or address the recommendations of the 2012 and 2022 Baker Risk OBI studies for the hazards posed by toxic releases, fire, explosion or overpressure scenarios outlined in the studies, and the potential risks to building occupants, or the effect of pressure relief device discharges of toxic chemicals within the facility. **AOC-3 [68.67(a)].**

The RMP rule requires the owner or operator to complete a compilation of written process safety information before conducting any process hazard analysis. The compilation of written process safety information is needed to enable the owner/operator and the employees involved in operating the process to identify and understand the hazards posed by the regulated substances in a covered process. The EPA believes that the 2020 and 2023 Process Hazard Analyses failed to incorporate the hazards of the process identified in the 2012 and 2022 Baker Risk OBI studies. **AOC-4 [68.67(c)(1) and (c)(6)]**. EPA also determined that Dow failed to promptly address the findings and recommendations from the Baker Risk OBI studies to ensure and document that the recommendations were resolved in a timely manner. **AOC-5 [68.67(e)]**.

**40 C.F.R. § 68.69 Operating Procedures –** Dow has developed written operating procedures for safely conducting most activities involved in each covered process, consistent with the process safety information. The procedures consisted of steps for each operating phase: initial startup; normal operations; temporary operations; emergency shutdown, including the conditions under which emergency shutdown is required.

In the Dow-Glycol II Unit operating procedures, no direct reference is made to the requirements of 68.69(a)(3) for safety and health considerations of the properties and hazards presented by the chemicals used in the process, precautions necessary to prevent exposure (including engineering controls, administrative controls, and personal protective equipment), control measures to be taken if physical contact or airborne exposure occurs, or special or unique hazards posed by the regulated chemicals. Operating procedure “Clearing and Recommissioning D-341” did not indicate what safety data sheet(s) (e.g., ethylene, ethylene oxide, benzene, nitrogen) were applicable to the covered process, or where these safety data sheets could be accessed for review. The operating procedure addresses maintenance and re-commissioning, but does not include or reference Dow’s internal policies for confined space entry, lock-out/tag-out, or opening process equipment. The Procedure Implementation Analysis document that is referenced within various operating procedures to identify hazards was provided; however, this document does not identify the hazards of the chemicals used in the covered process. Operating procedure “Clearing EO Spool Pieces at DH-1B, C and E” also did not include a reference to safety data sheets (e.g., ethylene oxide, nitrogen) which were applicable to the process or

where these safety data sheets could be accessed for review. The operating procedure does not address or reference the Dow internal policy for lock-out/tag-out. **AOC-6 [68.69(a)(3)]**

Dow provided the document "Annual Validation of Procedure Management System", as representing their annual operating procedure certification requirement for 2020. However, the first page of the document (Purpose Section) indicates the following: *"This checklist is not designed to be used for the annual certification of procedures that is required by OSHA PSM or EPA RMP…Use this checklist to spot check the facility's procedure management system to check that the work processes for updating and maintaining procedures are current and accurate and are actually working to keep procedures current and accurate…The checklist is not designed to require all procedures to be reviewed as part of this validation."*

Page four in the document further states, -"*Revision January 26, 2017: Updated to separate this form from the PSM/RMP requirement. Removed the validation and signature blocks and replace with follow up actions…"* EPA noted that *n*owhere in the 2020 annual validation document does it include a reference to the Glycol II Operating Procedures. Therefore, the annual validation document furnished does not meet the RMP requirement that operating procedures be reviewed and certified annually to ensure that they are current and accurate. Dow has provided the Annual Validation of Procedure Management System to represent the annual review and certification of the Glycol 2 Unit operating procedures certification. In addition to the concerns stated above, this document was certified on February 11, 2020. The document provided, 05.03.04 L3 Annual Certification of Procedures, which represents the annual certification requirement for 2021 is dated October 21, 2021. Therefore, the 2021 annual operating procedure certification was eight months late. **AOC-7 [68.69(c)]**

Dow failed to develop and implement written safe work practices for employees and contractors to provide for the control of hazards during operations such as lockout/tagout, confined space entry, and opening process equipment. Dow (or its contractors) did not develop or implement a safe work practice to identify and ensure removal of all equipment (e.g. portable lighting) used to conduct inspection and cleaning inside process vessels following the May 2023 turnaround. The failure to develop or implement an appropriate work practice contributed to the circumstances that caused equipment to be left in and remain inside pressure vessel D-87 prior to putting the vessel back into service, resulting in the July 2023 fire and explosion incident. These operating procedures do not reference industry standard safe work practices or Dow's internal safe work procedures and requirements.

The Dow-Glycol 2 operating procedures, failed to address safe work practices which are both regulatory and now industry standards, such as but not limited to, the requirements of OSHA standard 1910.1047; which includes provisions for employee and contractor exposure monitoring when opening process equipment, establishing regulated areas, work practices and precautions including engineering controls, administrative controls to minimize exposure. **AOC-8 [68.69(d)]**

**40 C.F.R. § 68.71 Training –** Dow has a comprehensive written training program in place to ensure that employees who operate covered processes are competent in the operating procedures associated with these processes. All new employees are provided the applicable training, consisting of initial classroom training and on-the-job mentoring, depending on the nature and location of their assignments, before they are allowed to perform their duties independently. Refresher training is provided on a continuing basis.

Dow Chemical provided information regarding their written operator training program. The facility provides new operators initial training, which includes an overview of the covered process and the specific aspects of applicable operating procedures as outlined in § 68.69(a). Refresher training is required at least every three years for each employee involved in operating a covered process to assure that the employee understands and adheres to the current operating procedures. Dow also has an annual training requirement for some of the process safety training courses. EPA requested training records for nine (9) operators in the Glycol II Unit, including initial training and the most recent two (2) refresher trainings through October 24, 2023. Based on the information provided, EPA determined that five operators had not completed refresher training at the required intervals. **AOC-9 [68.71(c)]**

**40 C.F.R. § 68.73 Mechanical Integrity (MI)**

During this inspection EPA requested for review the following inspection and testing records for twenty-four (24) pressure vessels (including heat exchangers, towers, reactors, knockout-drum, etc.) and sixteen (16) piping circuits in the Glycol II Unit:

- internal inspections;
- external inspections;
- the written inspection and test plan; and,
- ultrasonic testing (non-destructive examination).

EPA also requested a list of current active pipe and pressure vessel leak repair devices (clamp, engineered clamp, wrap, or other type) in place, and a list of leak repair devices that had been removed in 2021, 2022, and 2023. Based on review of the inspection and test records, EPA determined that many external and internal inspections, and ultrasonic testing dates, were late or had been missed (i.e. no inspection record was furnished). Specifically, Dow failed to perform internal inspections for pressure vessels D-14, D-15A, and E19-C. **AOC-10 [68.73(d)(1)].** There was also a failure to perform external and internal inspections in accordance with API 510, a recognized and generally accepted good engineering practice that is included and referenced in Dow's written MI program. Dow failed to perform ultrasonic thickness measurement testing on several pressure vessels at specific condition monitoring locations (CML) by the calculated due dates, in accordance with API 510. **AOC-11 [68.73(d)(2)].**Dow also failed to perform ultrasonic thickness measurement testing at specific CMLs on several pressure vessels by the calculated projected minimum thickness target date. **AOC-12 [68.73(d)(3)].** The API standard 510 states the following under *Section 5.6.2 CML Examinations: "5.6.2.1. Each pressure vessel shall be monitored by conducting a representative number of examinations at CMLs to satisfy the requirements for an internal and/or on-stream inspection. For example, the thickness for all major components (shells, heads, cone sections) and a representative sample of vessel nozzles should be measured and recorded. Corrosion rates, the remaining life, and next inspection intervals should be calculated to determine the limiting component. CMLs with the highest corrosion rates and least remaining life shall be part of those included in next planned examinations."*

Finally, based on information provided for EPA's review, fire pumps and fire-fighting foam distribution and delivery system equipment in several areas are not being properly maintained and have failed inspections and testing. **AOC-13 [68.73(e)].**

**40 C.F.R. § 68.75 Management of Change (MOC) -** Written procedures are in place at Dow to manage changes in process chemicals, technology, equipment, and procedures. Process operators, maintenance personnel or any other employee whose job tasks are affected by a modification in process conditions are to be promptly made aware of the availability of training prior to interacting with the modification.

The facility provided the Management of Change and Pre-Start-Up Safety Review Procedures with supporting appendices.

The RMP standard requires that employees involved in operating a process whose job tasks will be affected by a change in the process shall be informed of, and trained in, the change prior to start-up of the process or affected part of the process. The Dow MOC policy requires that affected personnel must be notified of completion of a change and receive training before operating modified portions of a process associated with a change. Each employee must sign off to acknowledge that the change has been implemented. At the beginning of each workday and shift all Glycol II personnel must review any MOCs which have occurred in the covered process during their absence. Written sign off in the MOC *EATool* online database must be completed by end of the workday or shift. The facility allows a fourteen day grace period for employees to acknowledge implemented MOCs, after which it becomes overdue. An action item will be entered into the *EATool* database if an employee is unable to acknowledge a MOC due to an extended absence. At the time of the EPA inspection, seven (7) MOCs were identified in which the employees had not acknowledged that they had completed the required training prior to process start-up or within the fourteen day window for sign off in the *EATool* database. **AOC-14 [68.75(c)]**

**40 C.F.R. § 68.77 Pre-startup Safety Review (PSSR) –** Dow performs pre-startup safety reviews related to new processes and to modifications in established covered processes, and conducts PSSRs as a regular practice. These reviews are conducted to confirm that construction, equipment, instrumentation, and operating and maintenance procedures are suitable for safe startup prior to placing affected equipment into operation. Dow documented that, when the facility installed a new stationary source, or significantly modified an existing source, a PSSR was conducted prior to the introduction of RMP regulated substances, including the appropriate communication elements and training.

**40 C.F.R. § 68.79 Compliance Audits –** The Dow compliance audits which EPA reviewed during the inspection were conducted by at least one person knowledgeable in the process. EPA reviewed the two most recent audit reports conducted on July 9, 2018-July 13, 2018, and June 28-July 2, 2021. The objective of the compliance audits is to assure that employers evaluate the effectiveness of their process safety management system, as required by the rule. An effective means of achieving this objective is for employers to conduct audits to assure that the applicable provisions of the RMP rule are being met. Compliance audits are also used to ascertain whether the procedures and practices that are required to be developed to implement the RMP program are adequate, reflect current operation of the covered processes, and are being followed. The format should be designed to provide the lead auditor with a procedure or checklist which details the requirements of each section of the RMP rule. Dow Chemical failed to fully evaluate compliance with the applicable provisions of this subpart at least every three years to verify that procedures and practices developed are adequate, current, and are being followed. EPA determined that the Dow Chemical 2018 and 2021 compliance audits did not address each applicable element and section of RMP Program Level 3 requirements. Some RMP requirements were not included in one or both of the audits and did not address each element-section of the RMP standard every three (3) years and in some cases every six years. **AOC-15 [68.79(a)]**

**40 C.F.R. § 68.81 Incident Investigation –** Dow provided an incident investigation procedure (PSM-SOP-0002) for EPA's review. The facility has investigated incidents which resulted in, or could reasonably have resulted in, a catastrophic release. The EPA inspector reviewed selected incidents, and determined that each of these incidents had investigations initiated no later than 48 hours following the incident. For each investigation reviewed, the investigation team consisted of at least one person knowledgeable

in the process involved and other persons with appropriate knowledge and experience, who thoroughly investigated and analyzed each incident.

**40 C.F.R. § 68.83 Employee Participation –** Dow has developed a written plan of action regarding the implementation of employee participation required by this section, and provided the plan for EPA's review. EPA did not identify any areas of concern regarding employee participation.

**40 C.F.R. § 68.85 Hot Work Permit –** Dow has developed an internal written procedure that requires the facility to issue general work permits for hot work operations conducted on or near a covered process. The written Dow Environmental Health and Safety (EH&S) Global Hot Work Standard includes the following language: *"Low energy & high energy hot work conducted in a flammable area must conduct atmospheric monitoring…The safety attendant must stay at least an additional 30 minutes after the Hot Work is completed."* EPA reviewed selected hot work permits and identified deficiencies in eight (8) permits that had not been completed as required by the Dow internal written procedure and had not documented all required hot work elements on the completion form. **AOC-16 [68.85(a)]**

**40 C.F.R. § 68.87 Contractors –** Dow hires contractors to conduct specialized maintenance, construction, and various other activities. Prior to selecting a contractor, Dow performs a thorough evaluation of safety performance of the contractor. Dow has a strict policy of informing contractors of known potential hazards related to the contractor's work and the processes individuals may encounter while on site. Contractors are also informed of all the procedures for emergency response should an accidental release of a regulated substance occur. Additionally, contractors are required to inform Dow of any hazards they may introduce at the site. Dow provided the written contractor program documents for EPA's review, and EPA did not identify any findings under this RMP rule section.

**Subpart E – Emergency Response**

**40 C.F.R. § 68.90 Applicability –** Dow Chemical is designated as a responding stationary source and is subject to the requirements of 68.93 to 68.95.

**40 C.F.R. § 68.93 Emergency Response Coordination Activities**

The emergency response program provides the essential planning and training for effectively protecting workers, the public, and the environment during emergency situations. Detailed emergency response plans must be developed and coordinated with the Local Emergency Planning Committee (LEPC) and the community's local response organization (typically the fire department). Dow maintains a written emergency response plan to handle and manage accidental releases of hazardous materials. The plan includes all aspects of emergency response, including adequate first aid and medical treatment, evacuations, notification to local emergency response agencies and the public, as well as post-incident decontamination of affected areas. In addition, the plan is promptly updated to reflect any pertinent changes taking place within the covered processes that would require a modified emergency response. Emergency drills are routinely conducted to enhance skills and tactics for responding to an accidental chemical release. Iberville and West Baton Rouge Parish Offices of Emergency Preparedness (OEPs) are the LEPCs with which Dow's emergency plan has been coordinated and verified. Dow also has coordinated its emergency response plan with the co-located Blue Cube Operations, LLC a subsidiary company of Olin Corporation, Nutrition & Biosciences USA 1, LLC, (IFF), TSRC Specialty Materials LLC, and INEOS Americas, LLC.  facilities through a contractual agreement.

Dow Chemical provided its Emergency Response Plan document, and the inspection and tests performed on its emergency response equipment for EPA's review. Dow's Emergency Response Team members are trained in firefighting, hazardous materials response, first aid, and rescue. Team members receive annual training for industrial firefighting, hazardous waste operations (HAZWOPER), emergency response equipment, confined space rescue, and medical skills. Iberville Parish OEP operates the Community Alert Broadcast System (CABS). This system includes warning sirens, cable television and AM radio station emergency broadcast notifications, and a telephone notification system. Community Awareness Emergency Response (CAER) sirens are located throughout Iberville Parish and the southern end of West Baton Rouge Parish.

Dow also provided their Emergency Procedure Plan-Shelter in Place reference for EPA's review, which contains the following instructions: "*If the Immediate Response Leader (IRL) determines that it is necessary to shelter in place, the IRL would direct the personnel assembled in the maintenance warehouse to report to the 5301 large conference room. In the event of overflow from 5301 large conference room, personnel are to line up in the north/south hallway. All PEG/Surf loaders and truck drivers will assemble in B-5313 load building located in the PEG/Surf plan, unless the IRL directs otherwise.*" The steps necessary to switch the office building 5301 air conditioners off and the PEG/Surf loaders building 5313 high vacuum air conditioning vents fans off are also provided in the written procedure.

Section 68.95(a)(2) requires the facility to establish procedures for the use of emergency response equipment and for its inspection, testing, and maintenance to ensure proper functioning. EPA requested and received documents addressing the inspection and testing of emergency response equipment. Based on EPA's review, in some instances Dow failed to implement its emergency response program inspection and testing program by not conducting inspection and tests at the required scheduled intervals for Level A responder personal protection equipment suits, fire monitors, sprinklers, and fire trucks. Also, the fire pumps and firefighting foam distribution and delivery system equipment were not properly maintained in one building. **AOC-17 [68.95(a)(2)]**

EPA reviewed the training records for Dow emergency response personnel. Dow failed to provide the required Plaquemine Hazwoper 365 course annually for all employees. A few employees failed to complete the required training on an annual basis as required by the Dow training plan. **AOC-18 [68.95(a)(3)]**

**40 C.F.R. § 68.96 Emergency Response Exercises –** Dow indicated that the facility has conducted emergency response drills in coordination with local emergency planning and response organizations. These drills have included an emergency response accountability drill, annual evacuation drills, and marine spill drills.

**Clean Air Act (CAA) § 112(r)(1) – The CAA General Duty Clause**

The failure to design and maintain a safe facility subsequently resulted in a catastrophic ethylene oxide release from the Glycol II Unit which caused a fire and multiple explosions on July 14, 2023. **AOC-19**

**Subpart G – Risk Management Plan**

**40 C.F.R. § 68.190 Updates –**Dow re-submitted an RMP registration (5-year update) under 40 C.F.R. § 68.190 on February 2018, and then again on February 6, 2023.

**40 C.F.R. § 68.195 Required corrections –** Dow's next registration re-submittal is due on February 6, 2028, unless an update or correction is required by 40 C.F.R. § 68.190 or 40 C.F.R. § 68.195 prior to the five-year renewal date.

**SECTION III – AREAS OF CONCERN**

**Closing Meeting-** On the last day of the inspection, October 27, 2023, the EPA inspector conducted a closing conference, during which he presented selected Areas of Concern (AOC) identified during the inspection. The inspector indicated that there may be additional Areas of Concern identified after all the documents EPA requested are received and reviewed.

**AOC 1 – 40 Code of Federal Regulations (CFR) §68.30(a) Defining Off-site Impacts**

*The owner or operator shall estimate in the RMP the population within a circle with its center at the point of the release and a radius determined by the distance to the endpoint defined in § 68.22(a).*

Dow did not include the Blue Cube Operations, LLC a subsidiary company of Olin Corporation, Nutrition & Biosciences USA 1, LLC, (IFF), TSRC Specialty Materials LLC, and INEOS Americas, LLC. co-located industrial facilities within Dow's property boundaries in their off-site population analysis.

**AOC 2 – 40 CFR §68.65(d)(2) Process Safety Information**

*The owner or operator shall document that equipment complies with recognized and generally accepted good engineering practices.*

Dow failed to document that atmospheric pressure relief devices, which may activate during an overpressure event, release ethylene oxide and other hazardous chemicals to a safe location, in accordance with API Standard 521, *Pressure-Relieving and Depressuring Systems*, Section 5.8.

**AOC 3 – 40 CFR §68.67(a) Process Hazard Analysis (PHA)**

*The process hazard analysis shall be appropriate to the complexity of the process and shall identify, evaluate, and control the hazards involved in the process.*

Dow's 2020 and 2023 Glycol II PHAs were not appropriate to the complexity of the process in that they did not evaluate and assess controls for all potential hazards of the covered process. The process safety information included in the 2012 and 2022 Baker Risk studies indicated that certain buildings required mitigation and recommended that this be implemented or that use of the buildings be discontinued in locations where an unacceptable toxic exposure or explosion risk to building occupants existed.

Dow's PHAs also failed to evaluate and assess controls for hazards related to the release of ethylene oxide and other toxic and flammable chemicals to the ambient air from the following pressure vessels with atmospheric pressure relief devices: T-2, D-3, T-8-1, D-87, D-32, T-8-2A, T-7, E-15B (TS), E-17A (TS), KO-3, D-60, D-448, E-13-C and E-603. In addition to ethylene oxide, the following flammable and/or toxic chemicals may vent to atmosphere at non-safe locations from these vessels: methane, ethane, ethyl chloride, triethanolamine, ethylene, propylene oxide, methyl amine, and methyl-diethanol amine.

The PHA facility siting checklists are not used in a manner consistent with API Standard 752, *Management of Hazards Associated with Location of Process Plant Permanent Buildings,* and are not appropriate for the complexity of the process.

**AOC 4 – 40 CFR §68.67(c) Process Hazard Analysis**

*The process hazard analysis shall address the hazards of the process, which includes stationary source siting.*

The facility siting PHA checklists do not include or address the recommendations of the 2012 and 2022 Baker Risk studies for toxic release, fire, explosion, and process vessel overpressure scenarios, and the potential risks to building occupants. Both the 2012 and 2022 Baker Risk studies indicate that approximately 162 occupied buildings on site are potentially subject to toxic exposure impact from over fifteen highly hazardous chemicals, including chlorine, hydrogen chloride, ethylene oxide, butadiene, styrene, ammonia, and carbon tetrachloride. These occupied buildings may also be subject to the risk of flammable impact. The scenarios modeled indicate that fires involving concentrations of flammable chemicals at their lower flammable limits could reach the affected buildings. Both studies also indicate that approximately six occupied buildings are subject to risk from a fire impact generally, and 120 buildings are subject to risk from a process vessel overpressure impact which could result in building damage.

**AOC 5 – 40 CFR §68.67(e) Process Hazard Analysis**

*The owner or operator shall establish a system to promptly address the team's findings and recommendations; assure that the recommendations are resolved in a timely manner and that the resolution is documented; document what actions are to be taken; complete actions as soon as possible; develop a written schedule of when these actions are to be completed; communicate the actions to operating, maintenance and other employees whose work assignments are in the process and who may be affected by the recommendations or actions.*

Dow failed to promptly address the findings and recommendations of the 2012 and 2022 Baker Risk "Occupied Building Impact Studies to document what actions were to be taken, develop a written schedule of when these actions were to be completed, assure that the recommendations were resolved in a timely manner, and the communication of the recommendations and actions to be taken to operating, maintenance and other affected employees whose work assignments are in the covered process. The 2012 and 2022 Baker Risk studies were the same with only minor exceptions. Hence, there was no documentation or indication that any of the findings and recommendations from the 2012 had been implemented.

**AOC 6 - 40 CFR §68.69(a)(3)- Operating Procedures-Safety and Health Considerations**

*The owner or operator shall develop and implement written operating procedures that…shall address at least the following elements. (3) Safety and health considerations.*

The Dow-Glycol II operating procedures make no reference of the requirements of safety and health considerations of the properties and hazards presented by the chemicals used in the process, precautions necessary to prevent exposure (including engineering controls, administrative controls, and

personal protective equipment), control measures to be taken if physical contact or airborne exposure occurs, or special or unique hazards posed by the regulated chemicals. The Dow-Glycol II operating procedure, "*Clearing and Recommissioning D-341*", did not indicate what safety data sheet(s) (e.g., ethylene, ethylene oxide, benzene, nitrogen) were applicable to the covered process or where these safety data sheets could be accessed for review. The operating procedure addresses maintenance and re-commissioning but does not include or reference Dow policies for confined space entry, lock-out/tag-out, or opening process equipment. The Procedure Implementation Analysis document that is referenced within the operating procedures to identify hazards was provided; however, the document does not identify the hazards of the chemicals used in the process. The Dow-Glycol II operating procedure, "*Clearing EO Spool Pieces at DH-1B, C and E*", did not include a reference to safety data sheets (e.g., ethylene oxide, nitrogen) which were applicable to the covered process or where these safety data sheets could be accessed for review. The operating procedure does not address or reference the Dow policy for lock-out/tag-out.

**AOC 7 - 40 CFR §68.69(c)- Operating Procedures**

*The owner or operator shall certify annually that these operating procedures are current and accurate.*

Dow failed to certify annually for 2020 and 2021 that the operating procedures for the Glycol II Unit were current and accurate. The operating procedures and certification for 2020 did not specify they were for the Glycol II unit. The operating procedures for 2021 were certified on October 20, 2021, approximately eight months after their due date, based on the certification date in 2020.

**AOC 8 - 40 CFR §68.69(d)- Operating Procedures**

*The owner or operator to develop and implement safe work practices to provide for the control of hazards during operations such as lockout/tagout; confined space entry; opening process equipment or piping; and control over entrance into a stationary source by maintenance, contractor, laboratory, or other support personnel. These safe work practices shall apply to employees and contractor employees.*

Dow failed to develop and implement safe work practices for employees and contractors to provide for the control of hazards such as lockout/tagout and opening process equipment. Following a turnaround, Dow (or its contractor) failed to conduct an inspection to identify all equipment (e.g., portable lighting) that remained inside pressure vessel D-87 prior to returning the vessel to service. This was a direct contributing factor to the July 2023 fire and explosion incident.

The Dow-Glycol 2 operating procedures, failed to develop safe work practices which are both regulatory and now industry standards, such as but not limited to, the requirements of OSHA standard 1910.1047; which includes provisions for employee and contractor exposure monitoring when opening process equipment, establishing regulated areas, work practices and precautions including engineering controls, administrative controls to minimize exposure.

**AOC 9 - 40 CFR §68.71(b) Refresher Training**

*Refresher training shall be provided at least every three years, and more often, if necessary, to each employee involved in operating a process to assure that the employee understands and adheres to the current operating procedures of the process.*

At the time of EPA's inspection, the following operators had not completed the necessary refresher training at the required 1-year or 3-year intervals:

- Operator #1 (EE1) - Initial training (F619-1095 Glycol II T-11 Recovery) conducted 3/6/2017. Next refresher training was completed on 2/2/2020. The next refresher training was due on 2/20/2023, and has not been completed.
- Operator #2 (EE2) - Initial training (F619-1095 Glycol II T-11 Recovery) conducted on 5/1/2020. Next refresher training was due on 5/1/2023, and has not been completed.
- Operator #3 (EE3) - Training has not been completed as often as necessary. Initial training (Dow-806433 Glycol II Process Safety & Reactive Chemicals) conducted on 8/12/2022. Next refresher training was due on 8/12/2023, and has not been completed.
- Operator #4 (EE4) - Training has not been completed as often as necessary. Initial training (Dow-806433 Glycol II Process Safety & Reactive Chemicals) was conducted on 7/12/2021. Annual refresher training was due 7/12/2022, and was not completed until 1/16/2023.
- Operator #5 (EE5) - Training has not been completed as often as necessary. Initial training (Dow-270337-365 Glycol II Emergency Procedure) conducted 4/30/2021. Annual refresher training was due 4/30/2022, and was not completed until 7/3/2023.

**AOC 10 - 40 CFR §68.73(d)(1) Mechanical Integrity (MI)**

*Inspection and testing. Inspections and tests shall be performed on process equipment.*

Dow failed to perform internal inspections for pressure vessels D-14, D-15A, and E19-C in accordance with published API standards and requirements of Dow's internal written MI program.

**AOC 11 - 40 CFR §68.73(d)(2) Mechanical Integrity**

*Inspection and testing. Inspection and testing procedures shall follow recognized and generally accepted good engineering practices.*

Inspections of pressure vessels did not follow recognized and generally accepted good engineering practices, such as API 510 Section 6.5.1, *"Internal, On-stream, and Thickness Measurement Inspections/Inspection Interval"*, which requires that the period between external inspections shall not exceed five-years, and the period between internal inspections shall not exceed ten years. Dow did not provide sufficient data to support an analysis and justification for a Risk Based Inspection schedule to extend the external and/or internal inspection due dates for the following pressure vessels.
a. The required inspections had not been completed at the time of the EPA inspection.

- Pressure vessel DF-5B - the most recent previous external inspection was conducted on 5/31/2017, and the next external inspection was not performed by the due date of 5/31/2022.
- Pressure vessel T-7A – the most recent previous external inspection was conducted on 1/30/2018, and the next external inspection was not performed by the due date of 1/30/2023.
- Pressure vessel T-8-1 - the most recent previous external inspection was conducted on 4/19/2016, and the next external inspection was not performed by the due date of 4/19/2021.
- Pressure vessel E-24A - the most recent previous external inspection was conducted on 2/11/2016, and the next external inspection was not performed by the due date of 2/11/2021.
- Pressure vessel E-25A - the most recent previous external inspection was conducted on 2/11/2016, and the next internal inspection was not performed by the due date of 2/11/2021.

- Pressure vessel E-19-C - the most recent previous external inspection was conducted on 2/28/2017, and the next internal inspection was not performed by the due date of 2/28/2022.
- Pressure vessel D-32 – the most recent previous external inspection was conducted on 1/25/2018, and the next internal inspection was not performed by the due date of 1/25/2023.
- Pressure vessel T-7A - the most recent previous internal inspection was conducted on 5/15/2008, and the next internal inspection was not performed by the due date of 5/15/2018, but was conducted on 11/16/2023.
- Pressure vessel T-8-1 - the most recent previous internal inspection was conducted on 3/19/2011, and the next internal inspection was not performed by the due date of 3/19/2021.
- Pressure vessel D-87 - there is no record of an internal inspection prior to 5/21/2023, which should have been performed between 5/21/2018 and 5/20/2023.

b. Dow failed to perform ultrasonic thickness measurement testing inspections by the calculated due dates at the following condition monitoring locations (CMLs) on the following process vessels:

- T-7A
  - CML 082-D-3”-W – the next inspection due date for ultrasonic testing was 6/4/2019.
- D-14A
  - CML 043-SHELL 1 - the next inspection due date for ultrasonic testing was 3/10/2023.
  - CML 044-SHELL 1-S - the next inspection due date for ultrasonic testing was 4/22/2023.
  - CML 046-BTM-HEAD-N – the next inspection due date for ultrasonic testing was 5/9/2022.
- D-15A
  - CML 007-B-14”-S – the next inspection due date for ultrasonic testing was 5/8/2023.
  - CML 008-B-14"-W – the next inspection due date for ultrasonic testing was 10/28/2023.
  - CML 010-S-2-2”-S – the next inspection due date for ultrasonic testing was 9/14/2021.
  - CML 014-M2-18”-W – the next inspection due date for ultrasonic testing was 3/3/2021.
  - CML 015-SHELL2-N – the next inspection due date for ultrasonic testing was 6/24/2023.
  - CML 018-SHELL2-W – the next inspection due date for ultrasonic testing was 6/1/2021.
  - CML 021-A-26”-T – the next inspection due date for ultrasonic testing was 7/19/2023.
  - CML 023-A-26”-B – the next inspection due date for ultrasonic testing was 4/30/2021.
  - CML 024-A-26”-W – the next inspection due date for ultrasonic testing was 12/1/2020.
  - CML 027-L5-2”-T – the next inspection due date for ultrasonic testing was 12/20/2022.
  - CML 028-L5-2”-B – the next inspection due date for ultrasonic testing was 3/26/2021.
  - CML 033-L3-2”-T – the next inspection due date for ultrasonic testing was 3/18/2022.
  - CML 034-L3-2”-B – the next inspection due date for ultrasonic testing was 2/7/2022.
  - CML 043-SHELL1-S – the next inspection due date for ultrasonic testing was 11/25/2020.
- T-8-1
  - CML 018-K5-1.5"-B – the next inspection due date for ultrasonic testing was 6/24/2023.
- E-24A
  - CML 001 STH-HEAD-T – the next inspection due date for ultrasonic testing was 11/6/2021.
  - CML 002 STH-HEAD-E – the next inspection due date for ultrasonic testing was 3/3/2023.
  - CML 004 STH-HEAD-T – the next inspection due date for ultrasonic testing was 8/16/2023.
  - CML 005 CHANNEL-T – the next inspection due date for ultrasonic testing was 1/8/2021.
  - CML 006 CHANNEL-E – the next inspection due date for ultrasonic testing was 1/15/2022.
  - CML 007 CHANNEL-B – the next inspection due date for ultrasonic testing was 7/2/2021.
  - CML 008 CHANNEL-W – the next inspection due date for ultrasonic testing was 4/4/2020.
  - CML 015-C-6”-S - the next inspection due date for ultrasonic testing was 12/17/2022.

- CML 031- F-1”-N – the next inspection due date for ultrasonic testing was 12/30/2020.

**AOC 12 - 40 CFR §68.73(d)(3) Mechanical Integrity**

*The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.*

Dow failed to perform ultrasonic testing inspections by the due date at the following condition monitoring locations (CMLs) on affected process vessels, and the CML projected minimum thickness date has passed:

- T-7A
  - CML 085-D-ELL-C was due for ultrasonic testing on 2/20/2013, and the projected minimum thickness date (2/20/2013) has been exceeded.
- D-15A
  - CML 022-A-26”-E was due for ultrasonic testing on 7/1/2019, and the projected minimum thickness date (9/25/2022) has been exceeded.
  - CML 036-L1-2”-B was due for ultrasonic testing on 8/27/2019, and the projected minimum thickness date (1/17/2023) has been exceeded.
  - CML 042-SHELL1-E was due for ultrasonic testing on 11/3/2018, and the projected minimum thickness date (6/1/2021) has been exceeded.
  - CML 052-C-3”-W was due for ultrasonic testing on 3/22/2018, and the projected minimum thickness date (3/6/2020) has been exceeded.
  - D-14A
  - CML 016-SHELL2-N was due for ultrasonic testing on 7/24/2017, and the projected minimum thickness date (11/11/2018) has been exceeded.
  - CML 017-SHELL2-E was due for ultrasonic testing on 9/4/2017, and the projected minimum thickness date (2/4/2019) has been exceeded.
  - CML 018-SHELL2-S was due for ultrasonic testing on 6/25/2017, and the projected minimum thickness date (9/4/2018) has been exceeded.
  - CML 019-SHELL2-S was due for ultrasonic testing on 5/18/2017, and the projected minimum thickness date (6/30/2018) has been exceeded.
  - E19-C
  - CML 019-NTH-CHNL-T was due for ultrasonic testing on 3/31/2012, and the projected minimum thickness date (5/150/2015) has been exceeded.
  - D-13
  - CML 007-B_18”-S was due for ultrasonic testing on 8/22/2017, and the projected minimum thickness date (1/9/2019) has been exceeded.
  - CML 030-M1-24”-T was due for ultrasonic testing on 9/24/2019, and the projected minimum thickness date (3/15/2023) has been exceeded.

**AOC 13– 40 CFR §68.73(e) Mechanical Integrity**

*(e) Equipment deficiencies. The owner or operator shall correct deficiencies in equipment that are outside acceptable limits (defined by the process safety information in §68.65) before further use or in a safe and timely manner, when necessary, means are taken to assure safe operation.*

The following fire pumps and fire-fighting foam distribution and delivery system equipment are not being properly maintained in accordance with Dow's internal requirements and safety standards and have failed inspections and testing.

- Dow Fire Pump P-1107A – Inspections conducted in 2020-2023 revealed the following:
  - Excessive leaking is present on outboarding packing;
  - Heavy corrosion and metal defoliation are present on the pump frame and components;
  - Main block valve handle and header valve H-18 have failed;
  - Deficiencies reported in 2018-2021 have not been addressed;
  - Operational reliability was determined to be questionable in 2020, 2021,and 2022;
  - Compared to 2021 results, there was a loss of pressure performance in 2022;
  - The pump and driver appear to be in fair to poor condition;
  - A pressure relief valve or air release valves are not installed;
  - Gland drains are not installed; and,
  - Since the Dow fire water and pressure tests are evaluated on the actual flow and pump discharge, corrections for speed and flow have not been performed.

- Dow Fire Pump P-1107B – Inspections conducted in 2020-2023 revealed the following:
  - Excessive leaking is present on outboarding packing;
  - Heavy corrosion and metal defoliation are present on the pump frame and components;
  - Main block valve handle and header valve H-18 have failed;
  - Deficiencies reported in 2018-2021 have not been addressed;
  - Operational reliability was determined to be questionable in 2020, 2021, and 2022;
  - Compared to 2021 results, there was a loss of pressure performance in 2022;
  - Corrections for speed and flow have not been performed based on actual flow and pump discharge;
  - The pump and driver appear to be in fair to poor condition;
  - A pressure relief valve or air release valves are not installed;
  - Gland drains are not installed; and,
  - Header valve has failed and is leaking water.

- Dow Fire Pump 2P-700 – Inspections conducted in 2020-2023 revealed the following:
  - Excessive leaking is present on inboard packing;
  - Heavy corrosion is present on the frame and pump components;
  - Deficiencies reported in 2018-2021 have not been addressed;
  - Operational reliability was determined to be marginal or questionable in 2020, 2021, 2022, and 2023;
  - The pump and driver appear to be in fair to poor condition; and,
  - Gland drains or air release valves are not installed.

  Additionally, since LHC-2 Unit personnel did not provide a Dow Fire Water and Pressure Requirement document for the 2P-700 Diesel Fire Pump, the pump cannot be evaluated for compliance with internal Dow fire water delivery and pressure requirements.

- The following table summarizes fire pump flow test and inspection results by date and unit for operational reliability:

| Date of Test/Inspection | A174166/6LR-18 Operational Reliability Results | 0397-6334/6LR-18A Operational Reliability Results | Y642218A/6LR-18 Operational Reliability Results |
|---|---|---|---|
| 4/15/2020 | Marginable | Questionable | Questionable;<br>Header valve failed |
| 3/22/2021 | Marginable | Questionable | Questionable;<br>Header valve failed |
| 3/15/2022 | Questionable | Questionable;<br>Pump & Driver are in very poor condition;<br>Operational instructions are not legible | Questionable;<br>Header valve failed;<br>Engine air engagement knob failed |
| 3/13/2023 | Questionable;<br>Engine difficult to start;<br>Engine required starter fluid | Questionable;<br>Pump & Driver are in very poor condition;<br>Operational instructions are not legible | Questionable;<br>Header valve failed |

- The following firefighting foam distribution equipment and delivery system components were not properly maintained:
  - Failure (258) List – for any broken pipe found while performing flow test, Equipment numbers 35675 (tested 1/27/2021) and 31296 (tested 2/15/2022).
  - Failed standard CTT.QF1 - Visually inspect and maintain foam-water discharge devices to ensure that they are in place, continue to be aimed or pointed in the direction intended in the design, and are free from external loading and corrosion.

| Equipment Number | Inspection/Test Date |
|---|---|
| 35675 | 7/26/2021 |
| 31319 | 7/13/2021 |
| 31296 | 4/26/2021, 7/26/2021 |
| 26713 | 7/13/2021 |
| 25394 | 4/26/2021, 7/26/2021 |

  - Failed standard CTT.Q3 - All water-flow alarms shall be tested in accordance with the manufacturer's instructions - Equipment number 25394 (tested 2/15//2022)
  - Failed standard CTT.A12 - System piping, fittings, hangers and supports shall be inspected and repaired as necessary:

| Equipment number | Inspection Dates |
|---|---|
| 35675 | 4/26/2021 and 7/26/2021 |
| 32418 | 10/1/2020, 1/4/2021), 7/12/2021 |
| 32143 | 10/1/2020, 1/4/2021, 7/12/2021 |
| 31332 | 1//4/2021, 7/13/2021 |
| 31319 | 1/4/2021, 7/13/2021 |
| 31342 | 1/4/2021, 7/13/2021 |
| 31296 | 4/26/2021 |
| 26713 | 10/1/2020, 1/4/2021, 7/13/2021 |
| 25394 | 4/26/2021, 7/26/2021 |

  - Failed standard 48 - Condition of valve

| Equipment number | Inspection/Test Date |
|---|---|
| 31332 | 10/18/2021 |
| 31319 | 1/5/2022 |
| 31342 | 1/5/2022 |

**AOC 14 - 40 CFR §68.75(c) Management of Change**

*Employees involved in operating a process and maintenance and contract employees whose job tasks will be affected by a change in the process shall be informed of, and trained in, the change prior to start-up of the process or affected part of the process.*

Dow failed to ensure that the following employees had been trained in a change prior to start-up of the process or affected part of the process, and prior to the fourteen-day grace period permitted in Dow's MOC procedure:

- MOC (00007562023010002) - Adding condensate to C-3 intercooler inlets for formaldehyde management; Effective date - start of the process 1/6/2023; Dates of employee MOC review and training - Operator #1 (EE6) - 2/27/2023, Operator #2 (EE7) - 2/24/2023, Operator #3 (EE8) - 2/27/2023, Operator #4 (EE9) - 2/24/2023, Operator #5 (EE10) - 2/13/2023.
- MOC (00007562023010004) - Automation to close D-60 vent EBV on T-60 loss of absorber water flow (EAT Action 242853); Effective date - start of the process 2/6/2023; Dates of employee MOC review and training: Operator #1 (EE11) - 3/20/2023, Operator #2 (EE12) - 4/4/2023, Operator #3 (EE13) - 3/15/2023, Operator #4 (EE14) - 3/11/2023, Operator #5 (EE8) - 3/28/2023, Operator #6 (EE15) - 3/16/2023.
- MOC (00007562023020012) Remove T-6 low level trip for P-8; Effective date - start of the process 3/13/2023; Date of employee MOC review and training - Operator #1 (EE1) - 4/17/2023.
- MOC (00007562023030011) - CRTICIAL-T-58A PSV E-582 removal procedure; Effective date - start of the process 4/17/2023; Dates of employee MOC review and training: Operator #1 (EE5) - 5/29/2023, Operator #2 (EE17) - 5/6/2023.
- MOC (00007562023050004) - PSV-35A/B temporary retrofit for new PSV-36A/B; Effective date - start of the process 6/8/2023; Dates of employee review and training - Operator #1 (EE18) - 7/24/2023, Operator #2 (EE12) - 7/28/2023, Operator #3 (EE19) - 7/11/2023, Operator #4 (EE20) - 7/28/2023.
  MOC (00007562023050012) - Update data sheets for PSV-8A/8B to 170 PSIG; Effective date - start of the process 6/13/2023; Dates of employee MOC review and training - Operator #1 (EE18) - 7/24/2023, Operator #2 (EE12) - 7/28/2023, Operator #3 (EE20) - 7/31/2023, Operator #4 (EE21) - 10/9/2023.
- MOC (00007562023050016) - Replacing T-8-2 bottom bed packing with Duplex/316 SS mix; Effective date - start of the process 5/31/2023; Dates of employee review and training - Operator #1 (EE18) - 7/24/2023, Operator #2 (EE19) - 7/11/2023.

**AOC 15 - 40 CFR §68.79(a) Compliance Audit**

*The owner or operator shall certify that they have evaluated compliance with the provisions of this subpart at least every three years to verify that procedures and practices developed under this subpart are adequate and are being followed.*

Dow Chemical failed to fully evaluate compliance with the applicable provisions of this subpart at least every three years to verify that procedures and practices developed are adequate, current, and are being followed. EPA determined that the Dow Chemical 2018 and 2021 compliance audits did not address each applicable element and section of the RMP Program Level 3 requirements. Some RMP requirements were not included in one or both audits. The following RMP elements were not included in the 2018 compliance audit: Process Management, Process Safety Information, Mechanical Integrity, Pre-start-up Safety Review, Process Hazard Analysis, Hot Work Permits, and Contractors. The following RMP elements were not included in the 2021 compliance audit: Process Management, Mechanical Integrity, Pre-start-up Safety Review, Process Hazard Analysis, Management of Change, Hot Work Permits, and Contractors.

**AOC 16 - 40 CFR §68.85(a) Hot Work Permits**

*The owner or operator shall issue a hot work permit for hot work operations conducted on or near a covered process.*

The internal Dow EH&S Global Hot Work Standard requires the completion of a work permit for hot work operations when conducted on or near a covered process. EPA reviewed selected hot work permits and identified the following deficiencies, as outlined in the following tables:

- Glycol II Unit

| Hot Work Permit Number | Description | Date and Time | Permit Deficiency |
|---|---|---|---|
| LaGlyc2023070292 | Installing insulation & metal on T-320 and D-87 piping; Installing insulation & metal on D-7 piping; | 07/14/2023, 06:22 – 16:00 | No atmospheric monitoring performed, and permit was not signed at close out |
| LaGlyc2023070296 | Sand blasting & spray painting on T-360 | 07/14/2023, 07:22 – 17:00 | Permit has not been signed at close out and no fire watch safety attendant was identified |
| LaGlyc2023011502 | T-5/Stripper (E042-EOFINI-T5); column/tower (101207669); cut out/repair nozzle per vscr/welding using hand tools, grinder, welding machine | 05/21/2023, 07:00 – 21:00 | Permit was not signed at close out and contractor Total Safety did not identify the name of the fire watch safety attendant |
| LaGlyc2023021750 | 1058 R-1F-2 Tube Leak Repair | 5/25/2023, 13:00 – 18:00 | Total Safety did not identify the name of the person performing the atmospheric monitoring and the permit was not signed at close out. |
| LaGlyc2023102487 | Install spools and EBV-1013-14 on discharge side of P-607; Install check valve upstream of PO triplet | 10/18/2023, 06:32 – 17:00 | Permit was not signed at close out |

| | | | |
|---|---|---|---|
| LaGlyc2023103330 | GMISS repair on NH2 Header 2'' pipe. Fit and weld pipe spools | 10-23-2023, 06:33 – 18:00 | Permit has not been signed at close out |

- Glycol I Unit

| Hot Work Permit Number | Description | Date and Time | Permit Deficiency |
|---|---|---|---|
| LaGlyc2023102741 | Cut, grind, weld on all nozzles on T-801 tank | 10/19/2023 05:56 – 17:00 | Total Safety did not identify the name of the fire watch safety attendant and the permit was not signed at close out |
| LaGlyc2023102840 | Cut, weld, grind on all nozzles on T-801 tank | 10/20/2023 06:24 – 17:00 | No atmospheric monitoring performed - procedure notes monitoring is required for low and high energy hot work |

**AOC 17 - 40 CFR §68.95(a)(2) Emergency Response Program**

*The owner or operator shall develop and implement an emergency response program for the purpose of protecting public health and the environment. Such program shall include the following elements: (2) Procedures for the use of emergency response equipment and for its inspection, testing, and maintenance.*

i. Dow requires a weekly inspection of the facility's fire trucks. The following weekly inspections were not clearly documented for Fire Truck Unit 20: 8/26/2023 and 9/19/2023.

ii. For personal protection equipment, Dow requires that responder Level A protection suits be tested annually. The following table identifies Level A suits that were not consistently tested in accordance with Dow internal requirements:

| Level A Suit Number | 3/2020 Annual Test | 12/2020 Annual Test | 12/2021 Annual Test | 1/2022 Annual Test |
|---|---|---|---|---|
| 37059197 | Passed | Not tested | Not tested | Passed |
| 37059199 | Passed | Not tested | Not tested | Passed |
| 41352910 | Passed | Not tested | Not tested | Not tested |

iii. Dow requires that the sprinkler systems in the Poly A Warehouse be inspected quarterly. EPA determined that the following quarterly sprinkler system inspections were not completed: second and third quarters of 2021, first and second quarters of 2022, and third quarter of 2023.

iv. Dow conducts inspection and tests quarterly and annually on the fire hydrants and monitors in the Glycol II Unit. During inspections on 3/2/2022 and 9/8/2022, Equipment ID #H44 was noted as not operating as designed, with an additional comment that the valve was broken in the closed position. Dow did not include other fire hydrants and monitors and other emergency response equipment in the

September 2023 inspection and test report; therefore, EPA was unable to verify if equipment repairs had been completed.

**AOC 18 - 40 C.F.R §68.95(a)(3) Emergency Response Program**

The owner or operator shall develop and implement an emergency response program for the purpose of protecting public health and the environment. Such program shall include training for all employees in relevant procedures.

a. Dow failed to provide the required Plaquemine Hazwoper 365 course annually for all employees. Dow employees completed the course on 6/3/2021 and were not provided the refresher until 12/20/2022.

b. The following employees failed to complete the required training on an annual basis as required by the Dow training plan:

EE22: Industrial Fire Fighting: completed on 2/1/2021 and then again on 3/7/2022- 13+ months late. Foam Application Class: completed on 2/1/2021 and again on 12/13/2022-10+ months late.

EE23: Industrial Fire Fighting and Foam Application Class - missed the 2020 training.

EE24: EMT Recertification Training – last completed on 4/20/2021, required training every 2 years-has not been completed by 8/2023.

EE25: EMT Recertification Training – last completed on 4/20/2021, required training every 2 years-has not been completed by 8/2023.

EE26: EMT Recertification Training – last completed on 2/19/2021, required training every 2 years-has not been completed by 8/2023.

EE27: Confined Space and High Angle Rescue –last completed on 4/25/2022 and then again on 10/12/2023.

EE28: No training in 2023 for Confined Space and High Angle Rescue, Industrial Fire Fighting and Foam Application Class, and EMT Recertification Training.

EE29: No training in 2023 for Industrial Fire Fighting and Foam Application.

**AOC 19 – Clean Air Act (CAA) §112(r)(1) – The CAA General Duty Clause**

*Section 112(r)(1) states: (r) Prevention of Accidental Releases (1) Purpose and General Duty - It shall be the objective of the regulations and programs authorized under this subsection to prevent the accidental release and to minimize the consequences of any such release of any substance listed pursuant to paragraph (3) or any other extremely hazardous substance. The owners and operators of stationary sources producing, processing, handling or storing such substances have a general duty, in the same manner and to the same extent as section 654, title 29 of the United States Code, to identify hazards which may result from such releases using appropriate hazard assessment techniques, to design and maintain a safe facility taking such steps as are necessary to prevent releases, and to minimize the consequences of accidental releases which do occur.*

Dow failed to design and maintain a safe facility by not taking such steps as are necessary to conduct appropriate quality check inspections and authorizations following the completion of work in pressure vessel D-87 in the Glycol II Unit; to ensure that construction tools, equipment, and other portable components such as lighting, are not abandoned or inadvertently left inside a process vessel prior to placing the vessel back in service and operation.

Dow also failed to take steps necessary to ensure appropriate contractor oversight to confirm that the contractor's employees conducted and documented final inspection of an affected pressure vessel prior to the close-out of the work permit, to ensure that all construction tools, equipment, and other portable components such as lighting had been removed before placing the pressure vessel back into service. The failure to design and maintain a safe facility subsequently resulted in a catastrophic ethylene oxide release which caused a fire and multiple explosions.

**Section IV – FOLLOW UP**

The following information was received by EPA on November 8, and 17th,2023, after exiting the Facility on October 27, 2023: Confidential Business Information and additional supporting data and clarifications related to the Areas of Concern documented in this report.

**Section V – LIST OF APPENDICES**

There are no photos, videos, or other appendices in this report.