UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, ILLINOIS 60604

DATE: 6/7/2021

SUBJECT: CLEAN AIR ACT INSPECTION REPORT
Linde Inc. East Chicago, Indiana

FROM: Carlo Demma
AECAB (MN/OH)

THRU: Brian Dickens, Section Chief
AECAB (MN/OH)

TO: File

BASIC INFORMATION

Facility Name: Linde Inc.

Facility Location: 2551 Dickey Rd., East Chicago, Indiana 46312

Date of Inspection: April 13, 2021

EPA Inspector(s):
1. Carlo Demma, Physical Scientist (Env.)
2. Natalie Schulz, Environmental Engineer
3. Cody Yarbrough, Environmental Engineer

Other Attendees:
1. Sasa Dunovic, Environmental Engineer Indiana Department of Environmental Management (IDEM).
2. Heather McCormick, Linde Regional Environmental Manager.
3. Paul Piper, Linde Plant Manager.
4. David Moore, Linde Environmental Specialist Northwest Region.
5. Joseph Centanni, Linde Production Superintendent.

Contact Email Address: heather.mccormick@Linde.com

Purpose of Inspection: Clean Air Act partial compliance evaluation (PCE) to assess compliance with requirements of the Indiana State Implementation Plan (SIP) and Linde Inc's November 24,

2020 Permit (Operation Permit No.: T089-38226-00435), which establishes, nitrogen oxides (NO_x), carbon monoxide (CO), and particulate matter (PM) emission limits. EPA inspectors searched for process leaks using an Infrared Optical Gas Imaging camera.

Facility Type: Hydrogen Gas and Carbon Dioxide Manufacturing.

Regulations Central to Inspection: According to Permit No. T089-38226-00435, Linde Inc. is subject to the following limits:

- Annual CO limit on the burner system, process reformers, and CO_2 purification system.
- Annual NO_x limit on the burner system, process reformers, and CO_2 purification system.
- Low NO_x control device requirements under NESHAP VVVVVV.
- Opacity and PM from the process equipment stacks.

Virtual Conference Dates and Times:
Opening Conference: April 12, 2021 9:30 AM – 10:45 PM CT
Closing Conference: April 14, 2021 10:00 AM – 10:25 PM CT

On-Site Inspection Arrival Time and Date: 10:30AM, April 13, 2021
On-Site Inspection Departure Time and Date: 12:30PM, April 13, 2021

Inspection Type:
☐ Unannounced Inspection
☒ Announced Inspection

OPENING CONFERENCE

☒ Presented Credentials
☒ Stated authority and purpose of inspection
☐ Provided Small Business Resource Information Sheet
☒ Small Business Resource Information Sheet not provided. Reason: Not a small Business
☒ Provided CBI warning to facility

The following information was obtained verbally from Linde Inc personnel unless otherwise noted.

Company Ownership: Praxair, Inc. owned the facility prior to 2020; Praxair officially merged with Linde Inc. in September of 2020. No significant changes in employees were made during the "One-Linde merger." The company retained the name Linde Inc. (Linde). The name of the inspected facility changed from Praxair to Linde after the merger.

Process Description: Steam Methane Reformers (SMR) produce high purity hydrogen and beverage grade CO_2. Natural gas and steam are combined in the presence of a nickel catalyst to form nearly pure hydrogen gas (~99%). The process contains a carbon dioxide (CO_2) purification system, which is used to scrub the hydrogen of CO_2 in the gas stream. Steam Methane Reformer

#4 (SMR-4) is the largest of the SMRs at the Linde facility and currently the only one in operation. The natural gas for SMR-4 is provided by NIPSCO and is preheated and pretreated to remove sulfur before entering SMR-4. The raw water used in the process is from the adjacent BP Oil Refinery and is purified prior to use.

SMR-4 has approximately 16 low-NO_x burners used for emissions control. Steam generated by SMR-4 is run over a nickel catalyst to create syngas, an unpurified hydrogen gas containing CO_2 and CO. The combustion emissions from the SMR-4 burners are sent to stack S/V17, and the syngas is sent from SMR-4 to the CO_2 purification system and/or the Pressure Swing Adsorber (PSA) for purification and processing. About 70% of the syngas goes directly to the PSA to produce purified hydrogen gas while 30% of the syngas goes first to the CO_2 purification system before reaching the PSA.

The CO_2 purification system recovers and purifies the gaseous CO_2 generated by SMR-4. The gaseous CO_2 is compressed and then liquefied into a liquid CO_2 product. The remaining gases are sent to the PSA. Once the gas stream reaches the PSA, impurities are adsorbed, and the purified hydrogen gas is recovered and sent to be sold. The "tail gas" containing the impurities from the PSA is recirculated to the methane reformer furnace where it is burned as fuel in the reformer burners. There is no flare or other control device at the facility.

Staff Interview: Linde personnel explained to EPA that the facility idled SMR Units 1, 2, and 3. The units have not been turned on in the past five years, but the units would not require modifications before being brought back into use. During startup or shutdown, or when operational conditions are upset, process stack S/V16 on reformer #4 can vent unpurified gas to the atmosphere. SV/16 does not have a control device. EPA discussed and reviewed Linde's records for the emission limits and requirements under its Permit. Linde explained to EPA that there are six pressure relief valves on the PSA that are inspected and replaced according to the preventative maintenance program. Currently, Linde is not implementing a leak detection and repair program on the valves. The low-NO_X burners for combustion stack S/V 17 are serviced every 4 years or during a planned outage. Linde's last stack test was on January 28, 2020.

TOUR INFORMATION

EPA Tour of the Facility: Yes
Photos and/or Videos: were taken during the inspection.
EPA took photographs of the facility on April 13, 2021. These included photos of the process stack/vent, combustion stack/vent, NO_X burners, CO_2 purification building and associated ductwork.
EPA took videos of the facility using an Infrared Optical Gas Imaging camera on April 13, 2021. These videos were taken of the process stack/vent, combustion stack/vent, NO_X burners, CO_2 purification building and associated ductwork.

RECORDS REVIEW

1. Air permit.

2. Site map and overview.
3. Process flow diagrams.
4. Production and material usage records.
5. Air emission calculations.

CLOSING CONFERENCE

☒ Provided U.S. EPA point of contact to the facility

Requested documents:

1. Most recent CAA facility-wide permit and construction permits for each unit.
2. List of all emission units and their associated air pollution control equipment.
3. Site map.
4. Process description(s) and process flow diagram(s).
5. Detailed description of the carbon dioxide purification system.
6. State emission inventory report summary for the last three years.
7. Production data, material usage, purchase, and composition records since January 1, 2018.
8. Air emission calculations since January 1, 2018 with supporting documentation and narrative descriptions.
9. Copies of all determinations regarding NESHAP and/or NSPS applicability.
10. Test reports for any emissions testing performed since January 1, 2015 or for most recent air emissions stack test.

DIGITAL SIGNATURES

Report Author: CARLO DEMMA

Digitally signed by CARLO DEMMA
Date: 2021.06.07 11:12:19 -05'00'

Section Chief: BRIAN DICKENS

Digitally signed by BRIAN DICKENS
Date: 2021.06.07 11:52:40 -05'00'

APPENDICES AND ATTACHMENTS

1. Appendix A: Digital Image Log
2. Appendix B: Infrared Optical Gas Imaging Log

APPENDIX A: DIGITAL IMAGE LOG

1. Inspector Name: Cody Yarbrough	**2. Date of Inspection:** April 13, 2021
3. Company/Facility Name: Linde Inc	**4. Street Address, City, State:** 2551 Dickey Rd., East Chicago, Indiana 46312
5. Number of Images: 12	**6. Archival Record Location:** *All photos are located in EPA Region 5's Electronic Record Center under the folder "Enf_LindeInc_IN_21_InspectionReport"*

Photos containing confidential business information are marked (CBI).

Image Number	File Name	Date and Time (incl. Time zone)	Latitude and Longitude*	Description of Image
1	P4130008.JPG	4/13/2021 10:36 CST	Not Recorded	Process stack/vent (S/V 16). (CBI)
2	P4130009.JPG	4/13/2021 10:36 CST	Not Recorded	Process stack/vent (S/V 16). (CBI)
3	P4130010.JPG	4/13/2021 10:50 CST	Not Recorded	Combustion stack (S/V 17). (CBI)
4	P4130011.JPG	4/13/2021 10:54 CST	Not Recorded	Hydrotreater side. (CBI)
5	P4130012.JPG	4/13/2021 11:11 CST	Not Recorded	Natural gas tanks. (CBI)
6	P4130013.JPG	4/13/2021 11:11 CST	Not Recorded	Burner offtakes. (CBI)
7	P4130014.JPG	4/13/2021 11:29 CST	Not Recorded	Burner deck. (CBI)
8	P4130015.JPG	4/13/2021 11:30 CST	Not Recorded	Burners to PSA tubing. (CBI)
9	P4130016.JPG	4/13/2021 11:34 CST	Not Recorded	SMR-4 control room. (CBI)
10	P4130017.JPG	4/13/2021 11:42 CST	Not Recorded	Hydrogen feed to PSA. (CBI)
11	P4130018.JPG	4/13/2021 11:57 CST	Not Recorded	CO_2 purification building. (CBI)
12	P4130019.JPG	4/13/2021 12:03 CST	Not Recorded	Mono Ethanol Amine (MEA) control room. (CBI)

*The camera used by EPA did not record coordinates.

APPENDIX B: INFRARED OPTICAL GAS IMAGING LOG

1. Inspector Name: Carlo Demma	**2. Date of Inspection:** April 13, 2021
3. Company/Facility Name: Linde Inc	**4. Street Address, City, State:** 2551 Dickey Rd., East Chicago, Indiana 46312
5. Number of Videos: 21	**6. Archival Record Location:** *All videos are located in EPA Region 5's Electronic Record Center under the folder: "Enf_LindeInc_IN_21_InspectionReport"*

Video containing confidential business information are marked (CBI).

Image Number	File Name	Date and Time (incl. Time zone)	Description of Video
1	MOV_2522.mp4	4/13/2021 10:35 CST	Process stack/vent (S/V 16). (CBI)
2	MOV_2523.mp4	4/13/2021 10:36 CST	Process stack/vent (S/V 16). (CBI)
3	MOV_2524.mp4	4/13/2021 10:39 CST	Combustion stack (S/V 17). (CBI)
4	MOV_2525.mp4	4/13/2021 10:46 CST	Process Reformers Piping. (CBI)
5	MOV_2526.mp4	4/13/2021 10:48 CST	Process stack/vent (S/V 16). Looking west. (CBI)
6	MOV_2528.mp4	4/13/2021 10:58 CST	Process Reformers Piping facing south looking up at steam from burner stack. (CBI)
7	MOV_2529.mp4	4/13/2021 10:59 CST	Process Reformers Piping facing south looking up at steam from burner stack. (CBI)
8	MOV_2530.mp4	4/13/2021 11:08 CST	Syn gas piping. (CBI)
9	MOV_2531.mp4	4/13/2021 11:10 CST	Syn gas piping. (CBI)
10	MOV_2532.mp4	4/13/2021 11:23 (CST)	Burner deck. (CBI)
11	MOV_2533.mp4	4/13/2021 11:24 (CST)	Burner deck. (CBI)
12	MOV_2534.mp4	4/13/2021 11:26 (CST)	Burner deck. (CBI)
13	MOV_2535.mp4	4/13/2021 11:34 (CST)	SMR-4 control room. (CBI)
14	MOV_2536.mp4	4/13/2021 11:38 (CST)	PSA tubing hydrogen feed. (CBI)
15	MOV_2537.mp4	4/13/2021 11:39 (CST)	PSA Vent tubing. (CBI)
16	MOV_2538.mp4	4/13/2021 11:40 (CST)	PSA Vent tubing. (CBI)

17	MOV_2539.mp4	4/13/2021 11:43 (CST)	Waste gas to surge tank H2 to PSA. (CBI)
18	MOV_2540.mp4	4/13/2021 11:48 (CST)	Pressurized tail gas tubing. (CBI)
19	MOV_2541.mp4	4/13/2021 11:59 (CST)	Mono Ethanol Amine (MEA) building. (CBI)
20	MOV_2542.mp4	4/13/2021 12:00 (CST)	H2 piping to inside MEA. (CBI)
21	MOV_2543.mp4	4/13/2021 12:02 (CST)	H2 piping to inside MEA. (CBI)