



MISSOURI
DEPARTMENT OF
NATURAL RESOURCES

MISSOURI AIR CONSERVATION COMMISSION

PERMIT TO CONSTRUCT

Under the authority of RSMo 643 and the Federal Clean Air Act the applicant is authorized to construct the air contaminant source(s) described below, in accordance with the laws, rules and conditions as set forth herein.

Permit Number: **01 2017 - 002**

Project Number: 2016-08-051
Installation Number: 027-0019

Parent Company: ABB Inc.

Parent Company Address: 12040 Regency Pkwy, Cary, NC 27518

Installation Name: ABB Inc.

Installation Address: 500 W. Hwy 94, Jefferson City, MO 65101

Location Information: Callaway County, S10, T44N, R11W

Application for Authority to Construct was made for:

ABB Inc. Jefferson City has applied to construct four (4) paint booths for surface coating power transformers. Particulate and HAP emissions are expected from the spray booth's solid aromatic polyurea spray elastomer system. This review was conducted in accordance with Section (5), Missouri State Rule 10 CSR 10-6.060, *Construction Permits Required*.

Standard Conditions (on reverse) are applicable to this permit.

Standard Conditions (on reverse) and Special Conditions are applicable to this permit.

Hans Robinson

Prepared by
Hans Robinson
New Source Review Unit

Kyra L Moore

Director or Designee
Department of Natural Resources

JAN 03 2017

Effective Date

STANDARD CONDITIONS:

Permission to construct may be revoked if you fail to begin construction or modification within 18 months from the effective date of this permit. Permittee should notify the Enforcement and Compliance Section of the Air Pollution Control Program if construction or modification is not started within 18 months after the effective date of this permit, or if construction or modification is suspended for one year or more.

You will be in violation of 10 CSR 10-6.060 if you fail to adhere to the specifications and conditions listed in your application, this permit and the project review. In the event that there is a discrepancy between the permit application and this permit, the conditions of this permit shall take precedence. Specifically, all air contaminant control devices shall be operated and maintained as specified in the application, associated plans and specifications.

You must notify the Enforcement and Compliance Section of the Department's Air Pollution Control Program of the anticipated date of start up of this (these) air contaminant source(s). The information must be made available within 30 days of actual startup. Also, you must notify the Department's regional office responsible for the area within which you are located within 15 days after the actual start up of this (these) air contaminant source(s).

A copy of the permit application and this permit and permit review shall be kept at the installation address and shall be made available to Department's personnel upon request.

You may appeal this permit or any of the listed special conditions to the Administrative Hearing Commission (AHC), P.O. Box 1557, Jefferson City, MO 65102, as provided in RSMo 643.075.6 and 621.250.3. If you choose to appeal, you must file a petition with the AHC within 30 days after the date this decision was mailed or the date it was delivered, whichever date was earlier. If any such petition is sent by registered mail or certified mail, it will be deemed filed on the date it is mailed. If it is sent by any method other than registered mail or certified mail, it will be deemed filed on the date it is received by the AHC.

If you choose not to appeal, this certificate, the project review and your application and associated correspondence constitutes your permit to construct. The permit allows you to construct and operate your air contaminant source(s), but in no way relieves you of your obligation to comply with all applicable provisions of the Missouri Air Conservation Law, regulations of the Missouri Department of Natural Resources and other applicable federal, state and local laws and ordinances.

The Air Pollution Control Program invites your questions regarding this air pollution permit. Please contact the Construction Permit Unit using the contact information below.

Contact Information:
Missouri Department of Natural Resources
Air Pollution Control Program
P.O. Box 176
Jefferson City, MO 65102-0176
(573) 751-4817

The regional office information can be found at the following website:
<http://dnr.mo.gov/regions/>

SPECIAL CONDITIONS:

The permittee is authorized to construct and operate subject to the following special conditions:

The special conditions listed in this permit were included based on the authority granted the Missouri Air Pollution Control Program by the Missouri Air Conservation Law (specifically 643.075) and by the Missouri Rules listed in Title 10, Division 10 of the Code of State Regulations (specifically 10 CSR 10-6.060). For specific details regarding conditions, see 10 CSR 10-6.060 paragraph (12)(A)10. "Conditions required by permitting authority."

ABB Inc.

Callaway County, S10, T44N, R11W

1. Superseding Condition

A. The conditions of this permit supersede the following conditions found in permit #112001-018 issued by the Air Pollution Control Program:

- 1) Special Condition 1.A
- 2) Special Condition 1.C
- 3) Special Condition 1.D
- 4) Special Condition 2

2. VOC Emissions Limitation

A. ABB Inc. shall emit less than 249.0 tons of VOCs in any consecutive 12-month period from the entire installation. This limit applies to the VOC emissions from all the equipment/processes installed at ABB Inc. as of the issuance date of this permit.

3. Record Keeping and Reporting Requirements

A. ABB Inc. must develop and keep monthly and annual records of VOC emissions to show compliance with Special Condition 2.A. These records shall include, at minimum, the following information:

- 1) Installation name
- 2) Installation ID
- 3) Permit number
- 4) Current month
- 5) Current 12-month date range
- 6) To calculate actual emissions for all other emission points that emits VOC at the facility:
 - a) Monthly throughput of each material where applicable used for each emission point
 - b) Approved emission factors and emission factor sources (i.e. emission factors used to calculate potential to emit for previously issued permits) including those listed in the most current operating permit.
 - c) Cleaning solvent (DYNASOLVE and Isopropyl Alcohol) evaporation is the only source of VOC emissions that will occur from the application of Line-X and UV-Coat. Emission

SPECIAL CONDITIONS:

The permittee is authorized to construct and operate subject to the following special conditions:

factors for solvent evaporation shall be calculated as the mass percent (%) VOC multiplied by the mass of solvent used (i.e. $VOC_{\text{mass_solvent}} = (\%VOC_{\text{mass}}) * (\text{mass used})$). If VOC mass percent varies for individual solvents, use the largest VOC concentration.

- 7) Plant wide Monthly VOC Emissions (tons) shall be the sum of all Monthly VOC Emissions (tons) of all emission points (units).
 - 8) Plant wide 12-Month rolling Total VOC Emissions (tons) = The sum of the 12 most recent Plant wide Monthly VOC Emissions (tons) + the sum of all start-up, shutdown, and malfunction VOC emissions as reported to the Air Pollution Control Program's Compliance/Enforcement Section during the most recent 12 month period. Plant wide 12-Month Rolling Total VOC Emissions of less than 249.0 tons combined of VOCs per year indicates compliance with Special Condition 2.A.
4. Control Device Requirement - Filter
- A. ABB Inc. shall control PM, PM₁₀, and PM_{2.5} emissions from the Line-X Paint Booths (four total) using a filter. The filter shall be attached to the input of the exhaust ventilation duct.
 - B. Replacement filters shall be kept on hand at all times. The filters shall be made of fibers appropriate for operating conditions expected to occur (i.e. temperature limits, acidic and alkali resistance, and abrasion resistance). ABB shall regenerate/replace the filters before breakthrough.
 - C. The filters shall be operated and maintained in accordance with the manufacturer's specifications.
 - D. ABB Inc. shall maintain a copy of the filter manufacturer's performance warranty on site. The operating pressure drop shall be maintained within the design conditions specified by the manufacturer's performance warranty.
 - E. ABB Inc. shall maintain an operating and maintenance log for the filters which shall include the following:
 - 1) Incidents of malfunction, with impact on emissions, duration of event, probable cause, and corrective actions; and
 - 2) Maintenance activities, with inspection schedule, repair actions, and replacements, etc.

SPECIAL CONDITIONS:

The permittee is authorized to construct and operate subject to the following special conditions:

5. Capture Device Requirement – Booth

- A. All PM, PM₁₀, and PM_{2.5} emissions associated with the application of Line -X and UV-Coat must occur within a total permanent enclosure spray booth as defined by EPA method 204. This includes all controls, monitoring, and spray booth design specifications listed in EPA method 204. The 3 foot by 2 foot horizontal overhead crane opening will not affect the status of a total permanent enclosure so long as the spray booth satisfies the following conditions:
- 1) ABB Inc. shall keep all spray booth doors closed at all times except during personnel or equipment entrance or egress.
 - 2) ABB Inc. shall operate and maintain the ventilation system of the spray booth such that negative pressure is maintained at all spray booth openings and all internal air passes through the filter.
 - 3) ABB Inc. shall demonstrate negative pressure once a quarter as required. This demonstration may be done by using streamers or puff tests on booth openings or an alternative method. The results shall be documented.

6. Operational Requirement - Solvent/Coating Cloths

- A. ABB Inc. shall keep all solvents and cleaning solutions that emit VOC and/or HAPs in sealed containers whenever the materials are not in use. ABB Inc. shall provide and maintain suitable, easily read, permanent markings on all solvent and cleaning solution containers used with this equipment.

7. Record Keeping and Reporting Requirements

- A. ABB shall maintain all records required by this permit for not less than five years and shall make them available immediately to any Missouri Department of Natural Resources' personnel upon request. These records shall include MSDS for all materials used.
- B. ABB shall report to the Air Pollution Control Program's Compliance/Enforcement Section, P.O. Box 176, Jefferson City, MO 65102, no later than 10 days after the end of the month during which any record required by this permit shows an exceedance of a limitation imposed by this permit.

REVIEW OF APPLICATION FOR AUTHORITY TO CONSTRUCT AND OPERATE
SECTION (5) REVIEW

Project Number: 2016-08-051

Installation ID Number: 027-0019

Permit Number: **012017-002**

Installation Address:

ABB Inc.
500 W. Highway 94
Jefferson City, MO 65101

Parent Company:

ABB Inc.
12040 Regency Pkwy
Cary, NC 27518

Callaway County, S10, T44N, R11W

REVIEW SUMMARY

- ABB Inc. has applied for authority to construct four (4) paint booths for coating power transformers. Particulate and HAP emissions are expected from the booths' solid aromatic polyurea spray elastomer system.
- The application was deemed complete on September 6, 2016.
- HAP emissions are expected from the proposed equipment. HAPs of concern from this process are diphenylmethane-4,4'-diisocyanate (MDI). Unconditioned MDI emissions will be below the SMAL.
- None of the New Source Performance Standards (NSPS) apply to the installation.
- None of the NESHAPs apply to this installation. None of the currently promulgated MACT regulations apply to the proposed equipment.
- A fiberglass paint arrestor (or a similarly effective filter) must be used to control emissions. A ventilation system will be in place to remove HAP, PM, PM₁₀, and PM_{2.5} to outside the facility.
- This review was conducted in accordance with Section (5) of Missouri State Rule 10 CSR 10-6.060, *Construction Permits Required*. Potential emissions of all pollutants are below de minimis levels.
- This installation is located in Callaway County, an attainment area for all criteria pollutants.
- This installation is not on the List of Named Installations found in 10 CSR 10-6.020(3)(B), Table 2. The installation's major source level is 250 tons per year and fugitive emissions are not counted toward major source applicability.

- Ambient air quality modeling was not performed since potential emissions of the application are below de minimis levels.
- Emission testing is not required for the elastomer spray booth as a part of this permit.
- A Part 70 operating permit is required for this installation.
- Approval of this permit is recommended with special conditions.

INSTALLATION DESCRIPTION

ABB Inc. – Jefferson City manufactures pad mounted, distribution transformers for use in subdivisions and small industries. ABB has estimated that their facility in Jefferson City, MO can produce 40 large three phase transformers, 60 small three phase transformers, and 227 single phase transformers per day. Transformer cases are washed and sent through a primer coating process, after which they are dried in natural gas fired dryers. The facility is a synthetic minor source, with a 249 ton per year cap for VOC and a major source for HAPs. With the issuance of this permit, ABB will install four (4) aromatic polyurea spray elastomer systems and spray booths with emissions below de minimis. ABB was issued a Part 70 Operating Permit No. 2010-008A. The following table lists the construction permits issued to ABB by Air Pollution Control Program.

The following New Source Review permits have been issued to ABB Inc. from the Air Pollution Control Program.

Table 1: Permit History

Permit	Project Description
0186-002	Paint Spray booth
0189-011A	Rebuild a complete water chamber to the 3-phase final spray paint booth
0792-002	Replacement of electric heating elements with natural gas fired burners
0494-013	Increase the paint usage to 4,500 gallons per year in the 1-phase final prime paint booth
1194-014	Modification to existing exhaust stacks and core annealing furnace atmosphere.
1295-018	Installation of paint booth that added to the 3-phase final assembly area to increase the capacity
042001-008	Installation of 8-zone gas-fired oven for cure/bake of 1-phase transformer core/coil assemblies and 16-zone gas-fired oven for cure/bake of 3-phase transformer core/coil assemblies
112001-018	Expanded 3-phase transformer line by permitting paint booths and accepting various facility wide emission limits

PROJECT DESCRIPTION

ABB Inc. has applied to construct four (4) aromatic polyurea spray elastomer system spray booths that will have the capability of coating transformers with Line-X XS-350 and UV-Coat. Line-X will be applied as a solid powder through a high pressure impingement spray gun. The coating will be applied by ABB personnel that will physically hold the spray gun and coat the entire outer surface of each designated transformer. The spray booth is required to be completely enclosed with four walls and a roof, an airtight door, an air filter, and an exhaust system that can generate enough negative pressure to pull all potential particulate matter to a filter. Line-X is formed from a reaction of two solid components, thus overspray from the transformer will primarily be in the form of particulate matter. The air impingement coating gun will spray an "A" component and a "B" component separately but simultaneously. The Iso "A" material will contain diphenylmethane-4,4'-diisocyanate (MDI) which is a regulated HAP. The "B" side material will be a resin. When the "A" side and "B" simultaneously contact the transformer, they will immediately begin a polymer reaction and harden. In addition, a UV protection coat will be applied on top of the Line-X coat in the same manner. Although both coats are expected to set in a manner of minutes, coating is an intensive process that is expected to take 45 minutes for each large three phase transformer. Emission considerations were estimated on a much more conservative time line of 15 minutes to account for the fact that it may take less time to coat smaller transformers.

It is expected that usage will be 184 lbs/transformer of Line-X (82 gallons/hour) and 63 lbs/transformer of UV coat (27 gallons/hour). MHDR for spraying transformers are projected to be 1.67 large three phase transformers per hour, 2.5 small three phase transformers per hour, and 9.46 large single phase transformers per hour. For a full description of throughput and emission estimates, see Table 2.

EMISSIONS/CONTROLS EVALUATION

There are two types of expected emissions, particulate (PM, PM₁₀, PM_{2.5}) and hazardous air pollutants (HAPs). The only expected HAP will be methylene diphenyl diisocyanate (MDI) which has a SMAL of 0.1 tons per year. Calculation methods for MDI emissions are based on guidelines from the American Chemistry Council (ACC). Specifically, the ACC has provided a detailed spreadsheet titled "MDI / PMDI Calculator." Under the option *M10 Spray Coating* within the spreadsheet is a method for calculating MDI based upon MDI's ability to saturate the air. This is important because it is not based on the maximum hourly design rate of Line-X and UV coat application. This method takes into account the vapor pressure and temperature of the MDI as well as the temperature and exhaust flow rate of the spray booth. It assumes the air within the spray booth is constantly saturated with MDI. It was determined that MDI will not exceed the SMAL even if Line-X and UV coat is applied 8,760 hours per year.

Although the UV coat will contain a HAP, Hexamethylene,-1,6-Diisocyanate (HDI), emissions will be below the SMAL. HDI only exists in the "A" side of the UV-coat mixture, so only half of the mass of the UV Coat will contribute HDI. Additionally, HDI

content is very small (between 0.1 and 1% of the UV coat by weight) and most of the HDI will remain bonded within the UV coat on the transformer. UV coat is applied at one third (1/3) the rate as Line-X which emits the other isocyanate, MDI, at 0.055 tons per year. In addition, a study produced by Bayer Material Science titled, "An Evaluation of Airborne 1,6-Hexamethylene Diisocyanate (HDI), HDI Polyisocyanate, and Polyaspartic Ester at Line-X Santa Ana, California" showed that HDI was either undetectable or in the range of 0.1 to 0.6 ppb during a common truck bed coating process. For safety purposes, the study suggested that operators should probably still use protective equipment (ie. respirator). ABB Inc. will be working with OSHA to assure that no employee is exposed to elevated MDI or HDI concentrations.

Particulate emissions will exist primarily as particulate smaller than 2.5 microns based on information supplied by the Line-X and UV-Coat manufacturer. It was assumed that there would be 20% overspray (80% of the solid material would stick to the transformer's surface), the spray booth's filter efficiency would be able to remove 99% of particulate, and that the spray booth would be completely enclosed. The transformers will be hoisted into the booth by a crane and will hover about 2 feet off of the ground so the bottom may be coated. Doors will open to the spray booth that will allow the crane system to move the transformer into the booth and the spray guns will not be able to operate without closing the doors first. However, even with the door closed there will be a small horizontal gap, about 3 feet wide and 2 feet tall, at the very top of the spray booth that accommodates the track for the conveyor. The four (4) spray booths will be constructed to meet all the criteria for a full enclosure so 100% capture efficiency was used for emission calculations despite the small opening. In addition, the exhaust system will be able to generate sufficient negative pressure that a decrease in capture efficiency is not expected. Except for the small opening for the crane, each booth will fit the EPA method 204 criteria for a total enclosure. In addition, a quarterly negative pressure or puff test will be required to verify that the exhaust system control efficiency is sufficient to pull all particulate to the filter.

Particulate calculations were based on the typical transformer output of ABB Inc. per year. Below, in Table 2, can be found the breakdown of how maximum PM_{2.5} emissions were calculated and an estimate for how many transformers may be produced in a year. All calculations were done on an 8760 hour basis. Thus, the estimates below suggest that coating every transformer produced by ABB Inc. per year would result in a total of 9.01 tpy of PM_{2.5}. Line-X coating will be a specialty coating that buyers will need to opt for, so it is expected that far fewer transformers will be coated than ABB Inc.'s entire transformer output. This means actual PM_{2.5} emissions are expected to be much lower than 9.01 tpy.

Table 2: Potential Transformer Output per Year

Transformer Type	Estimated Yearly Output of Transformers ¹	PM _{2.5} (lbs/unit) ²	Tons/year PM _{2.5}
Large Three Phase	14600	0.4529	3.306
Small Three Phase	21900	0.0750	0.821
Large Single Phase	82855	0.1179	4.884

¹Estimated Transformers produced on a yearly basis assuming continuous operation (8760 hours per year)

²Emission factor in lbs/transformer of PM_{2.5}. These are the controlled emission factors and the ones that should be used for calculating emissions.

There will be a solvent used for cleaning the spray gun, but usage is expected to be fairly limited due to the fact that cleaning only needs to be performed once a day. This is because the spray gun and elastomer spray system contain heating elements. This constant heat, when on, keeps the Line-X and UV coat materials from setting or bonding to the gun surface. Therefore, solvent cleaning only needs to occur when the spray gun is no longer in use potentially allowing the spray gun to go days on end without cleaning. When the spray gun is cleaned, DYNASOLVE (produced by Partsmaster, Div of NCH Corp.) will be used which is primarily composed of petroleum distillates that are not listed as a HAP but are designated as VOC. Before Line-X and UV coat is applied, each transformer must be wiped down with a 50/50 solution of isopropyl alcohol and water. Both DYNASOLVE and isopropyl alcohol solvent emissions will be tracked as a part of Special Condition 3.

Negative pressure within the spray booth will be measured once per quarter to ensure compliance with OSHA regulations for crossflow as well as Special Condition 5.A.3 of this permit—there will not be a permanently mounted anemometer for the entire spray booth. A smoke/puff test may also suffice to assure that the spray booth has adequate negative pressure to pull all of the air within the booth to the filter. In addition, a permanently installed pressure gauge will measure pressure drop across the filter. These measurements will be in place to ensure that all PM, PM₁₀, PM_{2.5}, and HAPs make it to the filter and exhaust system. The booth will be vented to outside the facility.

The following table provides an emissions summary for this project. Estimates for Existing Potential Emissions using EIQ emission factors were sufficient to judge that criteria pollutants will be emitted below major sources levels after the issuance of this permit. ABB Inc. is a major source of HAPs. Existing actual emissions were taken from the installation's 2016 EIQ. Potential emissions of the application represent the potential of the spray booth, assuming continuous operation (8760 hours per year).

Table 3: Emissions Summary (tpy)

Pollutant	Regulatory De Minimis Levels	Existing Potential Emissions	Existing Actual Emissions (2015 EIQ)	Potential Emissions of the Project (without filter)	Potential Emissions of the Project (with filter)	New Installation Conditioned Potential
PM	25.0	<Major	N/A	488.8	9.01	N/A
PM10	15.0	<Major	1.04	488.8	9.01	N/A
PM2.5	10.0	<Major	1.04	488.8	9.01	N/A
SOx	40.0	<Major	0.04	N/A	N/A	N/A
NOx	40.0	<Major	6.52	N/A	N/A	N/A
VOC	40.0	<249.0	95.77	N/A	N/A	<249.0
CO	40.0	<Major	5.47	N/A	N/A	N/A
HAPs ²	10.0/25.0	Major	1.88	0.055	0.055	<10.0/25.0
MDI	N/A	<Major	N/A	0.055	0.055	N/A

N/A = Not Applicable; N/D = Not Determined

¹Information provided by the manufacturer suggests 99+% of particulate emissions will be smaller than 2.5 microns in diameter. PM2.5 emissions are based on typical yearly transformer output. See Table 2 for estimating particulate emissions

²HDI is not listed or calculated towards total HAPs because HDI will primarily remain bonded within the UV coat.

PERMIT RULE APPLICABILITY

This review was conducted in accordance with Section (5) of Missouri State Rule 10 CSR 10-6.060, *Construction Permits Required*. Potential emissions of all pollutants are below de minimis levels.

APPLICABLE REQUIREMENTS

ABB Inc. shall comply with the following applicable requirements. The Missouri Air Conservation Laws and Regulations should be consulted for specific record keeping, monitoring, and reporting requirements. Compliance with these emission standards, based on information submitted in the application, has been verified at the time this application was approved. For a complete list of applicable requirements for your installation, please consult your operating permit.

GENERAL REQUIREMENTS

- *Operating Permits*, 10 CSR 10-6.065
- *Restriction of Particulate Matter to the Ambient Air Beyond the Premises of Origin*, 10 CSR 10-6.170

- *Restriction of Emission of Visible Air Contaminants*, 10 CSR 10-6.220
- *Restriction of Emission of Odors*, 10 CSR 10-6.165

SPECIFIC REQUIREMENTS

- *Restriction of Emission of Particulate Matter From Industrial Processes*, 10 CSR 10-6.400

STAFF RECOMMENDATION

On the basis of this review conducted in accordance with Section (5), Missouri State Rule 10 CSR 10-6.060, *Construction Permits Required*, it is recommended that this permit be granted with filters that have a minimum removal efficiency of 99% of PM, PM₁₀, and PM_{2.5} emissions and a totally enclosed spray booth.

PERMIT DOCUMENTS

The following documents are incorporated by reference into this permit:

- The Application for Authority to Construct form, dated August 25, 2016, received August 30, 2016, designating ABB Inc. as the owner and operator of the installation.
-

OTHER RELIED UPON DOCUMENTS

- "MDI / PMDI Calculator" spreadsheet created by the American Chemistry Council, specifically the M10 spray coating section.
- "An Evaluation of Airborne 1,6-Hexamethylene Diisocyanate (HDI), HDI Polyisocyanate, and Polyaspartic Ester at Line-X Santa Ana, California" Bayer Material Science, May 28, 2013.
- EPA Method 204 – "Criteria for and Verification of a Permanent or Temporary Total Enclosure"

APPENDIX A

Abbreviations and Acronyms

%	percent	m/s	meters per second
°F	degrees Fahrenheit	Mgal	1,000 gallons
acfm	actual cubic feet per minute	MW	megawatt
BACT	Best Available Control Technology	MHDR	maximum hourly design rate
BMPs	Best Management Practices	MMBtu ...	Million British thermal units
Btu	British thermal unit	MMCF	million cubic feet
CAM	Compliance Assurance Monitoring	MSDS	Material Safety Data Sheet
CAS	Chemical Abstracts Service	NAAQS ..	National Ambient Air Quality Standards
CEMS	Continuous Emission Monitor System	NESHAPs	National Emissions Standards for Hazardous Air Pollutants
CFR	Code of Federal Regulations	NO_x	nitrogen oxides
CO	carbon monoxide	NSPS	New Source Performance Standards
CO₂	carbon dioxide	NSR	New Source Review
CO_{2e}	carbon dioxide equivalent	PM	particulate matter
COMS	Continuous Opacity Monitoring System	PM_{2.5}	particulate matter less than 2.5 microns in aerodynamic diameter
CSR	Code of State Regulations	PM₁₀	particulate matter less than 10 microns in aerodynamic diameter
dscf	dry standard cubic feet	ppm	parts per million
EIQ	Emission Inventory Questionnaire	PSD	Prevention of Significant Deterioration
EP	Emission Point	PTE	potential to emit
EPA	Environmental Protection Agency	RACT	Reasonable Available Control Technology
EU	Emission Unit	RAL	Risk Assessment Level
fps	feet per second	SCC	Source Classification Code
ft	feet	scfm	standard cubic feet per minute
GACT	Generally Available Control Technology	SDS	Safety Data Sheet
GHG	Greenhouse Gas	SIC	Standard Industrial Classification
gpm	gallons per minute	SIP	State Implementation Plan
gr	grains	SMAL	Screening Model Action Levels
GWP	Global Warming Potential	SO_x	sulfur oxides
HAP	Hazardous Air Pollutant	SO₂	sulfur dioxide
hr	hour	tph	tons per hour
hp	horsepower	tpy	tons per year
lb	pound	VMT	vehicle miles traveled
lbs/hr	pounds per hour	VOC	Volatile Organic Compound
MACT	Maximum Achievable Control Technology		
µg/m³	micrograms per cubic meter		

(Line-X, UV-Coat Emission Factor Calculations)

Transformer Type (Line-X)	lbs/unit	MHDR (lb/hr)	lbs/yr	Gal/yr	Tons/year Total Used	Particulate	Cont. Particulate
Large Three Phase	169	169	1480440	165412	740	148	1.5
Small Single Phase	28	28	245280	27406	123	25	0.2
Large Single Phase	44	44	385440	43066	193	39	0.4

Transformer Type (UV coat)	lbs/unit	MHDR (lb/hr)	lbs/yr	Gal/yr	Tons/year Total Used	Particulate	Cont. Particulate
Large Three Phase	57	57	503405	55137	252	50	0.5
Small Single Phase	10	10	83404	9135	42	8	0.1
Large Single Phase	15	15	131064	14355	66	13	0.1

Line-X Density (Average)	8.95	lbs/gal
UV Coat Density (Average)	9.13	lbs/gal
Line-X total coat weight	74.62	%
UV total coat weight	25.38	%

Time to coat (Line-X + UV)	60	minutes
Units per hour	1.00	
Coating Transfer Efficiency %	80.0	%
Filter Efficiency %	99.0	%
Capture Efficiency	100.0	%
Actual Capture Efficiency	99.0	%

Controlled Total UV Coat + Line-X used (PM emissions)			(EF)	Projected	Potential
Transformer Type	Gal/year	Tons/year	lbs./unit	Transformers	PM2.5 (tpy)
Large Three Phase	220550	2.0	0.4529	14600	3.3
Small Three Phase	36541	0.3	0.0750	21900	0.8
Large Single Phase	57421	0.5	0.1179	82855	4.9
					9.013

(Time to coat is set at 8760, but this is only to illustrate how many many lbs of PM2.5 will be emitted per unit. Take tons/year emitted in the table above, multiply by 2000 lbs/ton, and divide by 8760 hours/year. This will yeild a tons/unit emission factor (EF))

Spray Coating

Calculation of emissions from spray coating

Calculating Emissions from a Spray Booth Operation
 The emissions associated with a spray booth operation will be governed by the exhaust air flow rate and the temperature at which the spray coating is carried out. If the concentration of the exit gas is not known, the worst-case scenario is to assume that the air is saturated with MDI/PMDI at the exit temperature.

The emissions from spray coating operations can be estimated from the following expression:

$$L_{sp} = (V_{air}/359) * (273.15/T_{sp}) * 60 * (C_{mdi}/1000000) * M_{W} * K_{MDI} * t_{sp}$$

Where:

- L_{sp} = the emissions in lb/year for spray coating operations.
- V_{air} = the exhaust air flow rate in ft³/min.
- T_{sp} = the exhaust temperature in K.
- C_{mdi} = the MDI concentration, in ppmv, in the exhaust air.
- M_{W} = the molecular weight of MDI (250.26).
- K_{MDI} = the adjustment factor to the vapor pressure.
- t_{sp} = the total time in hours/year that spray coating is occurring.
- 359 = the molar volume of an ideal gas in ft³/lb-mole @ 0°C and 1-atmosphere.
- $C_{mdi} = (VP_{MDI}/760) * 10^6$
- VP_{MDI} = MDI vapor pressure at exhaust temperature.

How many sets of data do you have? Select

Clear Values

Term	Quantity	Unit	Comment	Data Set #
V_{air}	21498.0	ACFM	Enter actual exhaust air flow rate (ft ³ /min)	1
T_{sp} Exhaust Temperature	66.0	F	Enter temperature and select units: F, K, or C.	1
T_{sp} Exhaust Temperature	18.3	C	Exhaust temperature, in C	1
% MDI in MDI/PMDI	69	percent	Enter MDI percentage in MDI/PMDI.	1
t_{sp}	8760	hrs/yr	Enter time that spray coating is occurring.	1
VP_{MDI}	4.46E-06	mmHg	MDI vapor pressure based on temperature	1
M_{W}	250.26	g/mole	Molecular weight of MDI	1
K_{MDI}	0.64		Adjustment factor to the vapor pressure	1
C_{MDI}	0.01	ppmv	MDI concentration in the exhaust air	1
				1
L_{sp}	2.76E+01	lb/yr	Calculated emissions of diisocyanates	1
L_{sp}	2.76E+01	lb/yr	Calculated emissions of diisocyanates	GRAND TOTAL

Emission Rate above is based on one (1) spray booth. Multiply 2.76E+01 by four (4) in order to calculate MDI emissions from all permitted spray booths.

*Note: These calculations, using methods provided by the American Chemistry Council, use the assumption that MDI emissions are solely a function of MDI's ability to saturate the air.



Jeremiah W. (Jay) Nixon, Governor • Harry D. Bozoian, Director

DEPARTMENT OF NATURAL RESOURCES

dnr.mo.gov

JAN 03 2017

Mr. Dean Lamb
Senior Environmental Engineer
ABB Inc.
500 West Highway 94
Jefferson City, MO 65101

RE: New Source Review Permit - Project Number: 2016-08-051

Dear Mr. Lamb:

Enclosed with this letter is your permit to construct. Please study it carefully and refer to Appendix A for a list of common abbreviations and acronyms used in the permit. Also, note the special conditions, on the accompanying pages. The document entitled, "Review of Application for Authority to Construct," is part of the permit and should be kept with this permit in your files. Operation in accordance with these conditions, your new source review permit application and with your amended operating permit is necessary for continued compliance. The reverse side of your permit certificate has important information concerning standard permit conditions and your rights and obligations under the laws and regulations of the State of Missouri.

This permit may include requirements with which you may not be familiar. If you would like the department to meet with you to discuss how to understand and satisfy the requirements contained in this permit, an appointment referred to as a Compliance Assistance Visit (CAV) can be set up with you. To request a CAV, please contact your local regional office or fill out an online request. The regional office contact information can be found at the following website: <http://dnr.mo.gov/regions/>. The online CAV request can be found at <http://dnr.mo.gov/cav/compliance.htm>.

If you were adversely affected by this permit decision, you may be entitled to pursue an appeal before the administrative hearing commission pursuant to Sections 621.250 and 643.075.6 RSMo. To appeal, you must file a petition with the administrative hearing commission within thirty days after the date this decision was mailed or the date it was delivered, whichever date was earlier. If any such petition is sent by registered mail or certified mail, it will be deemed filed on the date it is mailed; if it is sent by any method other than registered mail or certified mail, it will be deemed filed on the date it is received by the administrative hearing commission, whose contact information is: Administrative Hearing Commission, United States Post Office Building, 131 West High Street, Third Floor, P.O. Box 1557, Jefferson City, Missouri 65102, phone: 573-751-2422, fax: 573-751-5018, website: www.oh.mo.gov/ahc.



Recycled paper

Mr. Dean Lamb
Page Two

If you have any questions regarding this permit, please do not hesitate to contact Hans Robinson at the Department of Natural Resources' Air Pollution Control Program, P.O. Box 176, Jefferson City, MO 65102 or at (573) 751-4817. Thank you for your attention to this matter.

Sincerely,

AIR POLLUTION CONTROL PROGRAM



Susan Heckenkamp
New Source Review Unit Chief

SH:hrj

Enclosures

c: Northeast Regional Office
PAMS File: 2016-08-051

Permit Number: