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From: Anu Jain
Date: May 10, 2022

Technical Support Document
ES America, LLC
Permit #C31387.000

1. Background

1.1 Applicant

Facility :	ES America Ironwood Drive & East Pecos Road Queen Creek, AZ 85140
Mailing Address:	ES America, LLC 1661 East Camelback Road, Suite 290 Phoenix, AZ 85016

1.2 Attainment Classification

The facility is situated in an area classified as non-attainment for ozone and PM10.

2. Process Description

The facility is proposing to construct and operate a manufacturing facility of lithium-ion batteries for use in electric vehicles. The manufacturing process involves the following:

2.1 Mixing Process

The raw materials for each electrode type are weighed and mixed with a solvent to obtain electrode suspensions/slurries. The primary solvent used for the cathode slurry is N-Methyl-3-Pyrrolidone (NMP) and the primary solvent for the anode slurry is purified water. The mixers are enclosed vessels which vent to the dust collectors to control PM10, and Absorption Column (A/C) towers to control VOCs.

2.2 Coating and Drying Process

Following mixing, the electrode slurries are pumped to slot dies for coating onto both sides of the current collector. There are six (6) coating lines in total, three (3) for the cathode and three (3) for the anode. The solvent is dried from the current collectors, resulting in VOC emissions from the cathode coating process. VOC emissions are controlled by the NMP Solvent Recovery Plant (SRP). The SRP consists of a capture device above the cathode coating lines which will capture NMP vapors, route them to a condenser, and store the recovered NMP solvent in tanks.

2.3 Finishing Process

After the coating processes, the finished electrodes are roll-pressed and slitted to fit the cell design. The anodes are first re-winded prior to roll pressing. There are no emissions from the roll-pressing and re-winding operations. Particulate emissions from the slitting process will be controlled by dust collectors and the scrap generated from this process will be controlled by scrap collectors.

2.4 Electric Drying Process

Moisture in the cathode or anode may result in corrosion and electrolyte damage inside a battery cell. To prevent this, an electric drying process (vacuum drying) is used to remove any residual moisture from the electrodes. The slit coated electrodes ("skids") are placed inside a closed chamber which contains an electric pump to remove residual moisture. The moisture then gets collected in a condensation trap. There are no air emissions associated with the vacuum drying process.

2.5 Assembly Operations

2.5.1 Winding Operations

The electrodes are wound in a cylindrical shape to form the internal structure of a battery cell. In this step, the polymer membrane (separator) is placed between the cathode and anode layers. The layers are placed inside a cylindrical can. There are no emissions expected from this process.

2.5.2 Electrolyte Filling

The next step in assembly operations is the filling of electrolyte into each cell. The electrolyte consists of a fluorinated lithium salt in solution, which promotes the movement of ions between the cathode and the anode during charging and discharging. The electrolyte solution is stored in tanks, resulting in VOC emissions. During the first filling step, each cell is filled with electrolyte solution and then capped. The cells are then charged for the first time. Following charging, the caps are removed, which results in a release of volatilized solvents from the electrolyte solution. The VOC emissions generated from this process are controlled by A/C Towers. The emitted solvent is replaced with additional electrolyte (second filling step).

2.5.3 Welding, Washing, and Marking

After the second filling step, the cells are sealed and welded via Resistance Spot Welding (RSW) to achieve the desired voltage for package application. Spot welding uses electricity, heat, and friction to fuse the stainless steel metal cover and the Nickel tab pieces together. RSW is preferred for battery welding operations instead due to the small welding area required. For the welding process, fume collectors will be used to control particulate emissions along with a dust collector. For the washing and marking of each cell, an A/C Tower will be used to control the VOC emissions.

2.5.4 Formation and EOL Marketing Operations

The electrolyte filled cells are activated and formed gasses which accumulate inside the cell from the cell are released and routed to A/C towers during the formation operations. The cells are aged and then charged and discharged. The final step in the manufacturing process is to mark the cells with Domino Ink during the EOL marking process. The emissions are routed to the A/C towers for VOC control and fume collectors for PM control.

2.6 Cell Waste Building

Waste cells are discharged by placing them in a dilute sodium chloride (NaCl) brine. Once placed in brine, the cells short circuit via an electrolysis reaction. The heat generated is absorbed by the brine. During the discharging process, the battery terminals may get corroded, resulting in the leaking and volatilization of electrolyte and accumulated gas release. By-products in the form of VOC and HAP may be formed from the reaction, which are controlled by A/C Towers.

2.7 Auxiliary Processes

The facility will be equipped with natural gas-fired boilers and a cooling tower to provide process heating and cooling water.

Parts painted in the touch-up area will have the paint applied by an employee using handheld spray cans and touch up paint pen. Emissions from this process are fugitive and include VOCs and HAPs only. No particulate matter (PM10) is emitted from this process.

3. Control Devices

Process	Control Device Description
Cathode and Anode Slurry Material Handling and Mixing	Dust Collectors & Adsorption Column (AC) Towers

Solvent Coating and Drying	Solvent Recovery Plant (SRP)
Slitting	Dust Collectors & Scrap Collectors
Vacuum Drying	N/A
Assembly – Electrolyte	Scrap Dust Collectors & Adsorption Column (AC) Towers
Assembly – Welding	Fume Collectors
Formation	N/A
EOL Marking	Fume Collector & Adsorption Column (AC) Tower
Cell Waste Building	Adsorption Column (AC) Tower
Cooling Tower	N/A
Auxiliary Processes	N/A

4. Emissions

4.1 Emission Factors Determination

Process	Pollutants	Emission Factors	Emission Factors Source
Cathode and Anode Slurry Material Handling and Mixing	PM10	0.5% loss/batch	Michigan Facility
	VOCs	0.0061 lb/hr	EPA's Emission Model for Material Loading (February 2005)
Solvent Coating and Drying	VOCs	0.00063 lb/lb solvent	Michigan Facility
Slitting	PM10	4.61e-6 ft^3 removed/ft coated	Michigan Facility
	HAP	21%, 11%, & 37% weight percent of coated electrode	Michigan Facility
Assembly - Electrolyte	VOCs	42.55% gas displaced during sealing	Michigan Facility
	VOCs	3.44 e-6 lb/lb charge	Michigan Facility
Electrolyte Raw Material Storage Tanks Emissions	VOCs	0.000029 lbs/gal	Michigan Facility
Electrolyte Filling Process	VOCs	60% & 40% weight percent	Manufacturing Recipe
	HAP	1% weight percent	Manufacturing Recipe
Assembly – Welding	PM10	20 mm^3 – Layer 1 Weld Volume Single Electrode 36 mm^3 – Layer 2 Weld Volume Single Electrode	Manufacturing Recipe
	HAPs	26%, 0.6% & 60.71%	Safety Data Sheets
Cell Degassing	VOCs	1.75e-1 g/cell	Michigan Facility
	CO	3.75e-2	Michigan Facility
EOL Marking	PM10	0.001 lb/lb	Paint and Allied Products Manufacturing Facility
	VOCs	Density lb/gal	Safety Data Sheets
NMP Tanks	VOCs	VOC losses lb/hr	AP-42, Chapter 7
Cell Waste Electrolyte Solution	VOCs & HAPs	Density lb/gal	Safety Data Sheets
Cell Waste Gas Formed	VOCs	Cell Composition g/cell	Manufacturing Recipe
Cell Waste Byproducts	HAPs	Reagent Amount lb/yr	Manufacturing Recipe
Miscellaneous Chemicals	VOCs & HAPs	Density lb/gal	Safety Data Sheets
Cooling Tower	PM10	3,640 TDS	Maricopa County Water Conductivity
Natural Gas Combustion – Boilers	NOX	100 lb/MMscf	AP-42, Tables 1.4-1 and 1.4-2

	CO	84 lb/MMscf	AP-42, Tables 1.4-1 and 1.4-2

4.2 Uncontrolled Potential Emissions

Process	PM10 (tpy)	CO (tpy)	NOX (tpy)	SOX (tpy)	VOCs (tpy)	Total HAPs (tpy)	Single HAP (tpy)
Cathode and Anode Slurry Material Handling and Mixing	13.69	-	-	-	6.29E-03	5.63	1.87
Solvent Coating and Drying	-	-	-	-	9,906	-	-
Slitting	111.46	-	-	-	-	77.34	22.92
Assembly – Electrolyte	-	-	-	-	5.6E-01	5.6E-03	-
Assembly – Welding	17.34	-	-	-	-	15.48	10.52
Formation	-	-	-	-	8.97	-	-
EOL Marking	2.18E-03	-	-	-	2.25	-	-
Cell Waste Building	-	1.04	-	-	1,537	45.11	-
NMP Tanks	-	-	-	-	0.30	-	-
Miscellaneous Chemical Use	-	-	-	-	11.97	-	-
Cooling Tower	1.00E-01	-	-	-	-	-	-
Natural Gas Combustion	4.27	47.23	56.23	0.34	3.09	1.06	-
Total Emissions (tpy)	**146.86**	**50.11**	**56.23**	**0.34**	**11,470**	**144.63**	**35.31**

4.3 Controlled Potential Emissions

Process	PM10 (tpy)	CO (tpy)	NOX (tpy)	SOX (tpy)	VOCs (tpy)	Total HAPs (tpy)	Single HAP (tpy)
Cathode and Anode Slurry Material Handling and Mixing	0.14	-	-	-	1.26E-04	0.056	0.02
Solvent Coating and Drying	-	-	-	-	6.22	-	-
Slitting	0.1	-	-	-	-	0.07	0.02
Assembly – Electrolyte	-	-	-	-	4.04E-03	4.04E-05	-
Assembly – Welding	5.82	-	-	-	-	5.20	3.53
Formation	-	-	-	-	8.97	-	-
EOL Marking	7.32E-04	-	-	-	0.02	-	-
Cell Waste Building	-	0.01	-	-	15.37	0.45	-
NMP Tanks	-	-	-	-	0.30	-	-
Miscellaneous Chemical Use	-	-	-	-	11.97	-	-
Cooling Tower	1.00E-01	-	-	-	-	-	-
Natural Gas Combustion	4.27	47.23	56.23	0.34	3.09	1.06	-
Total Emissions (tpy)	**10.43**	**49.08**	**56.23**	**0.34**	**45.95**	**6.84**	**3.57**

5. Regulatory Requirements and Monitoring

5.1 Synthetic Minor Status

The facility is a major source of Volatile Organic compounds (VOCs), Hazardous Air Pollutants (HAPs), and Particulate Matter (PM10), with a potential to emit more than 100 tons of each of these pollutants. However, at the source's request the permit includes proposed "federally enforceable provision(s)" ("FEP"), designated pursuant to Code §3-1-084 which will keep the source’s status to synthetic minor with respect to major source

5.2 Applicable Requirements

5.2.1 The New Source Performance Standard (NSPS), General Provisions, 40 CFR Part 60, Subpart A [40 CFR §§60.1-60.19]

5.2.2 New Source Performance Standards: Small Industrial-Commercial-Institutional Steam Generating Units, 40 CFR 60, Subpart Dc [40 CFR §§60.40c-60.48c]

Affected Source: Natural gas fired boilers

5.2.3 National Emission Standards for Hazardous Air Pollutants for Area Sources: Paints and Allied Products Manufacturing, 40 CFR 63, Subpart CCCCCCC

Affected Sources: Cathode and anode slurry material handling and mixing process.

5.3 Testing Requirements

The permittee shall conduct performance tests as required in Sections §§5.A and 5.B of the permit.

6. National Ambient Impact Assessment

The permittee has voluntarily accepted to conduct an ambient air quality impact analysis as required in Section §5.C of the permit to ensure that the facility is in compliance with the National Ambient Air Quality Standards (NAAQS).