

Sion Power
Air Quality Permit # 5001
TECHNICAL SUPPORT DOCUMENT (TSD)

February 21, 2008

I. GENERAL COMMENTS:

A. Company Information

1. Sion Power
2. Source Address: 2900 East Elvira Road, Tucson, AZ 85706-7129
Mailing Address: 9040 South Rita Road, Tucson, AZ 85747-9108

B. Background

Sion Power is applying for an operating permit as a new source. Sion Power is currently operating a lithium battery research and development (R&D) laboratory at the University of Arizona and Technology Park (UASTP). The design phase has now reached the stage where Sion is prepared to begin commercial production at a new location. A permit application was submitted for processing on September 07, 2007 and this TSD supports the permit written as a result of that application.

There are no New Source Performance Standards (NSPS) or National Emission Standards for Hazardous Air Pollutants (NESHAP) that apply to the process or facility.

C. Attainment Classification

Sion Power is located in a region that is designated as attainment for all criteria pollutants.

II. SOURCE DESCRIPTION

A. Process Description

The Sion lithium battery production includes a cathode and primer slurry mixing operation, a cathode coating and drying operation, a lithium vapor deposition process, an electrolyte mixing process and a battery assembly process. A description of each of these operations is provided below:

1. Cathode and Primer Slurry Mixing

The cathode slurry will contain solvents, binders, carbon black, ammonium bicarbonate, and sulfur. The primer slurry will contain solvents, binders and carbon black. Sion will use enclosed mixer systems to mix the slurry. Batch mixing will be in containers less than five cubic feet. Four hoods in the mixing room will exhaust to the atmosphere through roof vents.

2. Web Coating

Two coating and drying machines will be operated in the cathode room where “web” is unwound on a spindle and fed into the coater. At the coater, the web is coated with primer and cathode slurry which is then guided to an electrically heated multi-zone air flotation dryer. Emissions are directed to a regenerative thermal oxidizer (RTO) for destruction. During low

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battery production; and low solvent use rates (< 15lbs/ hr), Sion has elected to bypass the RTO. See PTE discussion for estimated VOC emissions.

3. Lithium Vapor Deposition

The anodes are made by three vapor deposition machines that deposit lithium metal on Mylar substrate to make lithium foil. Three vapor deposition machines will be used. Two of them are existing machines that were also used during the R&D process. A new third machine will be installed in early 2008. There are no emissions from this process since the deposition occurs in a tightly sealed vacuum. The reason for the vacuum is due to lithium metal being very reactive.

4. Electrolyte Mixing

Solvents and electro-chemicals containing VOCs are mixed in four “glove boxes” to make the electrolyte used in the batteries. The electrolyte is eventually injected into each battery cell which is then sealed. The miniscule emissions from the electrolyte process are absorbed by carbon filters in the dry room.

5. Battery Assembly

The electrolytes, anodes, and cathodes are then assembled in the dry room, tested, and then shipped as a final product. The dry room will contain miscellaneous machines such as winders, welders, filling machines, and a sealing machine. The individual battery cells are eventually connected together to form a higher voltage and more powerful battery. The dry room contains hoods equipped with self-contained carbon filters that will be replaced periodically. Three roof-mounted natural-gas-fired burners with their own stacks will be used to dehumidify the battery assembly in the dry room.

6. Equipment Engineering Laboratory

Sion fabricates spare parts for its existing production equipment, and as needed. Occasionally, the lab will be used for research and development projects. The lab will be used infrequently and will be an insignificant activity.

7. NOx Emissions from burning Ammonia in RTO

Ammonium Bicarbonate will at times be added to the slurry. When the slurry is heated in the New Era dryer, ammonia emissions are generated from the ammonium bicarbonate at a rate of up to 2 cfm. The ammonia emissions will be routed to the RTO where they will be oxidized to NOx. During periods of RTO bypass, ammonia is emitted directly to the atmosphere.

8. Regenerative Thermal Oxidizer (RTO)

In order to reduce emissions below major source levels for VOCs, single HAP and combined HAPs, Sion will use a natural-gas fired RTO as an air pollution control device to destroy pollutants at 98% efficiency. However, to include a factor of safety in emission calculations, Sion has used a destruction efficiency of 95%.

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B. Process Rate and Operating Hours

1. Liberty (Small) Coating and Drying Machine

This machine has a maximum process rate of 6 lbs VOC/hr and has no hourly operating restrictions and can thus operate for 8760 hours per year. There is also no requirement to use a pollution control device to limit emissions from this machine.

2. New Era (Large) Coating and Drying Machine

There are two process rates for the New Era coater. At the lower process rate Sion will operate at a solvent feed rate of 15 lbs VOC/hr or less during which the RTO will be bypassed as emissions at this rate will not exceed major source levels. The maximum process rate for this machine is 99.4 lbs VOC/hr. When the process rate exceeds 15 lbs/hr; Sion will use the RTO which has a 97% rated destruction efficiency, though Sion has used 95% in its maximum PTE calculations to accommodate a factor of safety. There are no hourly limitations on the New Era Coater.

C. Applicability Categories

There is only one category addressed by the permit: Lithium Battery Manufacturing.

D. Air Pollution Control Equipment

The Permittee is required to install and operate a Regenerative Thermal Oxidizer (RTO) to control VOC and HAPs emissions from the large coater. When Sion adds ammonium bicarbonate to the slurry, the RTO will also be used to control ammonia emissions from the dryer leading to the formation of NO_x as ammonia is oxidized in the RTO. During periods of RTO bypass, ammonia is emitted directly to the atmosphere.

III. REGULATORY HISTORY

This is a new source and as such there is no regulatory history.

IV. EMISSION ESTIMATES

A. Facility Wide Estimates

The following table of emission estimates is a result of calculations submitted by Sion that have been verified by PDEQ. These values may be used for the following purposes:

- (i). Comparing source potential-to-emit with emission rates allowable by relevant standards; and;
- (ii). Comparing source potential-to-emit with emissions inventory and test data if necessary.

The table is not meant to establish any baseline emission levels. These emission figures (except for the ALLOWABLE emissions) are not meant to be emission limitations of any form. Table I summarizes the potential to emit (PTE) and allowable emissions at the facility. The emission factors used to calculate the potential to emit are a result of source limitations, solvent use rates, and AP-42 (1/95 ed with updates.) See application received September 07, 2007 for detailed calculations.

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Table I – Potential to Emit and Allowable Emissions

Pollutant	Liberty¹ Uncontrolled Emissions (TPY)	New Era Uncontrolled Emissions (TPY)	Controlled Emissions² (Both Coaters) (TPY)	Natural Gas Combustion Processes	Facility- wide Allowable Emissions (TPY)
NO _x	N/A	N/A	1.24	4.73	68.50 ³
CO	N/A	N/A	0.62	5.74	6.76
SO ₂	N/A	N/A	N/A	0.01	0.01
VOC@ 15 lbs/hr ⁴	26.28	65.70	N/A	0.09	92.02
VOC @ max. rates	26.28	435.37	48.05	0.09	48.09
PM ₁₀	N/A	N/A	0.23	0.12	0.35
Ammonia	N/A	23.14	N/A	N/A	23.14
Single HAP	0.49	8.02	0.89	0.03	8.50
Total HAPs	1.25	20.75	2.29	0.03	22.00

Based on the facility PTE, Sion is a **Class III; synthetic minor source**. Sion is a synthetic minor source for VOCs.

B. Ammonia Emissions

Ammonia is not a regulated pollutant. Information listed here is for informational purposes only and for verification that PDEQ has reviewed and approved the release of ammonia. Should a need arise to regulate ammonia at a future date, Sion shall submit the necessary revision(s) to the permit.

V. APPLICABLE REQUIREMENTS

A. Pima County Code (PCC) Title 17, Chapter 17.16:

- 17.12.185 Permit Contents for Class II and Class III permits (Operational Requirements)
- 17.12.190 Permits Containing Voluntarily Accepted Emission Limitations and Standards
- 17.16.020 Noncompliance with Applicable Standards
- 17.16.040 Standards and Applicability (Visible Emission Standard)
- 17.16.050 Visibility Limiting Standards
- 17.16.165 Standards of Performance for fossil-fuel fired industrial and commercial equipment

¹ There are no emission or hourly controls on the Liberty Coater. This unit is always operated uncontrolled.

² Controlled emissions only apply to the New Era Coater using a 95% efficiency for the RTO when the solvent rate exceeds 15lb/ hr.

³ 62.50 TPY of the NO_x emissions are from the combustion of ammonia in the RTO

⁴ 15 lbs/hr only applies to the New Era (Large) Coater, so estimated emissions from Liberty Coater will still be 26.28 tpy.

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VI. PERMIT CONTENTS

A. Applicability:

Sion is required to obtain a permit for the Lithium Battery manufacturing facility, pursuant to PCC 17.12.140.B.3.a. The facility's NOx and VOC potential to emit exceeds the permit thresholds.

B. Operational Limitations

Sion is required to operate the RTO for destruction of VOCs and HAPs when the solvent use rate from the New Era Coater exceeds 15 lbs/hr. When the rate is below this number Sion will bypass the RTO. The RTO destruction efficiency used for calculations is 95% though the rated RTO efficiency is 97%. The RTO is also used to convert ammonia to NOx. Ammonia results from heating ammonium bicarbonate which is added to the slurry mix during the battery manufacturing process. During periods of RTO bypass, ammonia is emitted directly to the atmosphere.

C. Emission Limits/ Standards:

1. Facility Wide

Citation	Applicable Units	Standard Title	Description	Discussion
II.A.	Facility	VOC Limitation	Limits VOC emissions to 80 tpy.	PCC 17.12.190 requirement established to prevent Sion from becoming a major or PSD source of VOCs.
II.B.	Facility	HAPs Limitation	Limits single HAP & combined HAP emissions to 8.5 and 22 tpy respectively.	PCC 17.12.190 requirement established to prevent Sion from becoming a major source of HAPs.
II.C.	Facility	Fuel & Sulfur Content Limitation	Limits Sion to natural gas fuel not exceeding 0.9 % by weight.	Use of diesel fuel or natural gas with a higher sulfur content may result in emission levels above major source.
II.D.	Facility	Opacity Standard	Limits opacity to 20%.	It is highly unlikely that Sion will have any visible emissions from the stacks at the facility. However the standard has been included simply because it is an applicable requirement and Sion has combustion sources and emission stacks.

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2. Operational Limitations

Citation	Applicable Units	Standard Title	Description	Discussion
III.A	New Era Coater	RTO Installation	Install RTO prior to startup of New Era Coater.	PCC 17.12.190.B requirement established to prevent Sion from operating the large coater unless an RTO is installed to control emissions from the coating process.
III.B	New Era Coater	Solvent Rate	Install, operate and maintain a recording device.	Sion is required to operate a device that shows the solvent usage rate since that determines when the RTO is used. (i.e. above 15 lbs/hr).
III.C	New Era Coater	Destruction of Emissions	All drying emissions from the coater shall be directed to the RTO for destruction.	When usage rate is above 15 lbs/ hr all emissions from the coater are required to be directed to the RTO for destruction. PCC 17.12.190.B requirement to keep Sion below major source levels for VOCs & HAPs.
III.D	All Units	Good Engineering Practice	Operate and maintain all units in good effective working order.	Authority from 17.12.185.A.2 to operate all units in a manner consistent with good air pollution practice for minimizing emissions.

3. Air Pollution Controls

Citation	Applicable Units	Standard Title	Description	Discussion
IV.A	RTO	Operation & Maintenance	Operate RTO according to manuf. Specs or an O & M plan approved by the Control Officer.	Operation of the RTO according to manufacturer's specifications ensures that the unit is operating effectively.
IV.B	RTO	Combustion Temperature	Maintain combustion temperature above 1500 °F.	Sion is required to maintain the combustion temperature above 1500 °F to ensure destruction of emissions.
IV.C	RTO	Temperature recording	Installation of temperature recording device.	Sion is required to install and continuously operate a temperature measurement device that also records the combustion temperature. This device will also be equipped with an alarm and will ensure that the temperature is above 1500 °F.

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D. Monitoring Requirements:

1. Facility Wide

Citation	Applicable Units	Standard Title	Description	Discussion
V.A.	Facility	VOCs, NOx, HAPs & Sulfur Content	See Recordkeeping.	
V.B.	RTO	Inspections	Once per permit term inspection.	Thorough inspection of the RTO once every 5-years to ensure structural and operational integrity. During the 5 years, following manufacturer's specs ensures that it is operated correctly.
V.C.	Facility	Opacity Standard	A visible emission check on the stacks while the facility is operating is sufficient as the combustion fuel is natural gas and there will hardly be any emissions from the facility. Should there be any visible emissions; the facility would most likely shut down the equipment to prevent any damage. In such situations, there would not be sufficient time to conduct visible emissions observations and so visible emission checks are sufficient to verify compliance with this standard.	

E. Recordkeeping Requirements:

1. Facility Wide

Citation	Applicable Units	Standard Title	Description	Discussion
VI.A	New Era Coater	Solvent Use	Requirement to log all monthly usage of all VOC and HAP containing solvents.	Required as a secondary check to verify solvent usage rates.
VI.B	New Era Coater	Solvent Usage Rate	Requirement to log slurry pump rate while coater is in operation. Logs must be available for inspection by the Control Officer.	Required to verify solvent usage rates.
VI.C	Facility	VOC Limitation	Calculate and record 12 month rolling total of VOCs as outlined in permit. The Permittee has 14 calendar days following the end of the month to update records.	Verifies compliance with the 80 tpy limit.

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Citation	Applicable Units	Standard Title	Description	Discussion
VI.D	Facility	HAPs Limitation	Calculate and record 12 month rolling total of single and combined HAPs as outlined in permit. The Permittee has 14 calendar days following the end of the month to update records.	Verifies compliance with limits of 8 tpy for single HAPs and 22 tpy for combined HAPs.
VI.E	RTO	Air Pollution Control	Maintain all operational records for RTO as required by the permit	Verifies operation of RTO when solvent use rate is 15 lbs/hr or greater. All records that verify RTO compliance with the permit need to be retained.
VI.F	Facility	Fuel & Sulfur Content Limitation	Maintain FERC agreement or natural gas purchase records.	Verifies that only natural gas is purchased.
VI.G	Facility	Opacity Standard	Record date, time and name of person conducting visible emissions checks.	Verifies compliance with the monitoring requirement.
VI.J	Facility	Records Maintenance	Maintain all records for at least 5 years from the reference date.	Authority from PCC 17.12.185.A.b.

F. Reporting Requirements:

Citation	Applicable Units	Standard Title	Description	Discussion
VII.A	RTO	Submittal of operations and maintenance manual	Requirement to submit manufacturer's recommendations, or an O & M plan to be approved by the Control Officer.	Control Officer needs to verify that the unit will be operated according to good modern engineering and air pollution control practices.
VII.B	Facility-wide	Emission Inventory	Requirement to submit emissions inventory upon request by the Control Officer.	Requirement taken directly from PCC 17.12.320.

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G. Testing Requirements:

Citation	Applicable Units	Standard Title	Description	Discussion
VIII.A	Facility-wide	Opacity Testing	When necessary or required by the Control Officer.	Requirement taken directly from PCC 17.20.010.
VIII.B	RTO	Particulate Matter Testing	Not required as maximum emissions are far below those allowed by the PM equation in PCC 17.16.165.C.1	
VIII.C	Facility-wide	General Testing	Requirement that a written request with applicable test methods be made to the Control Officer or the Permittee depending on who is making the request.	Requirement taken directly from PCC 17.20.010. Authority for Permittee to request a test from PCC 17.12.185.A.3.

H. Alternate Operating Scenarios:

None.

VII. MISCELLANEOUS COMMENTS

Particulate Matter (PM) Standard

Although the Standards of performance for fossil-fuel fired industrial and commercial equipment (PCC 17.16.165.C.1) applies to the RTO and other fuel-fired equipment above 500, 000 BTU/ hr, it has not been included in the permit because the maximum estimated PM emissions (0.28 TPY), are demonstrably less than the allowable emissions 1.176 lb/hr (or 5.15 TPY) (calculated using the equation in PCC 17.16.165.C.1). The standard will be included by reference in Attachment 1, but will not be explicitly included in the specific conditions of the permit.

VIII. IMPACTS TO AMBIENT AIR QUALITY

Not required for permit processing of a Class III source in Pima County, so no modeling was requested from Sion.

IX. CONTROL TECHNOLOGY DETERMINATION

Control technologies are not required for the source.

X. PREVIOUS PERMIT CONDITIONS

None, this is a new facility that did not have an operating permit.

XV. INSIGNIFICANT ACTIVITIES

None identified by Sion.