Air Quality Permitting
Statement of Basis

May 9, 2006

Permit to Construct No. P-060306

Tronox, LLC

Soda Springs, ID
Lithium Manganese Oxide Process
Facility ID No. 029-00002

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FINAL PERMIT

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Acronyms, Units, and Chemical Nomenclatures

acfm	actual cubic feet per minute
AFS	AIRS Facility Subsystem
AIRS	Aerometric Information Retrieval System
AQCR	Air Quality Control Region
CAA	Clean Air Act
DEQ	Department of Environmental Quality
dscf	dry standard cubic feet
EPA	U.S. Environmental Protection Agency
gr	grain (1 lb = 7,000 grains)
HAPs	Hazardous Air Pollutants
IDAPA	a numbering designation for all administrative rules in Idaho promulgated in accordance with the Idaho Administrative Procedures Act
lb/hr	pound per hour
LCO	lithium cobalt oxide
Li	lithium
LMO	lithium manganese oxide
LVO	lithium vanadium oxide
m	meter(s)
Mn	manganese
NESHAP	National Emission Standards for Hazardous Air Pollutants
NO_2	nitrogen dioxide
NOx	nitrogen oxides
NSPS	New Source Performance Standards
O_3	ozone
PM	particulate matter
PM_{10}	particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers
PSD	Prevention of Significant Deterioration
PTC	permit to construct
PTE	potential to emit
Rules	Rules for the Control of Air Pollution in Idaho
scf	standard cubic feet
SIC	Standard Industrial Classification
SIP	State Implementation Plan
SM	Synthetic Minor
SO_2	sulfur dioxide
SOx	sulfur oxides
T/yr	tons per year
$\mu g/m^3$	micrograms per cubic meter
UTM	Universal Transverse Mercator
V	vanadium
VOC	volatile organic compound

1. PURPOSE

The purpose for this memorandum is to satisfy the requirements of IDAPA 58.01.01.200, Rules for the Control of Air Pollution in Idaho, for issuing permits to construct.

2. FACILITY DESCRIPTION

The Tronox, LLC (Tronox) facility in Soda Springs produces cathode materials for rechargeable batteries. The facility currently includes two manufacturing process housed separately at the same location: a lithium vanadium oxide (LiV_3O_8 or LVO) process and a lithium manganese oxide ($LiMn_2O_4$ or LMO) process which can also be used to produce lithium cobalt oxide ($LiCoO_2$ or LCO). The LVO process is permitted under a separate permit to construct, PTC No. 029-00002, issued on October 7, 2002. The use of cobalt in the LMO process to produce LCO is permitted under PTC No. 029-00002, issued April 30, 1997.

The use of these hybrid materials is an emerging technology, and therefore requires some flexibility in the specific arrangement and use of individual heating or milling units. The LMO/LCO production plant currently consists of three electrically heated calciners, one new annealing calciner, and various material sizing and handling equipment.

Feed material is received in bags, supersacks or totes. LMO/LCO is produced by reacting manganese oxide or a cobalt compound and a lithium-bearing material (i.e., lithium hydroxide or lithium carbonate) at an elevated temperature. If lithium hydroxide is used as one of the feed materials, it is first dried in an electric static bed oven (the LiOH Bake calciner). Under the current configuration, however, manganese oxide is fed through the first electrically-heated rotary calciner, the Mn_2O_3 calciner. The powder is then sized to desired customer specifications using milling and classification, which are new units being added with this PTC. After sizing, the material is then blended with the lithium-bearing material and passed through a second rotary calciner (reaction calciner or $LiMn_2O_4$ calciner) to form LMO or LCO. The LMO/LCO product is then passed through a third electric calciner used to control the cooling rate of the product (the new annealing calciner) for product enhancement.

If required to meet customer specifications, a final treatment or coating is done during a fourth pass through a rotary calciner (the current use for the LiOH Bake calciner). A lanthanum compound may be mixed with the powdered product in one of the calcining steps of this process, which may lead to emissions of lanthanum oxide from one of the calciner baghouses.

The LMO/LCO is then fed through a screening system with a magnetic separator, and the product is then blended and packaged into containers for shipment. The product is then shipped to customers in drums or totes.

Each batch processing unit is provided with a dedicated baghouse or filter/collector to recover product. The collected material is stored separately and returned to the process, or according to the permittee, returned to the supplier. Using dedicated baghouses or filter/collectors for each batch unit and recycling the collected material minimizes waste generation, illustrates the level of focus on limiting the loss of process material, and provides support for the determination that the baghouses and filter/collectors should be treated as process equipment rather than as air pollution control devices.

Fugitive emissions of particulates or toxic air pollutants are well controlled. The entire LMO/LCO process takes place inside a building. Exterior doors and windows are generally kept closed during operations to limit the introduction into the product of wind-blown contaminants from other facilities in this industrial area. Within the building, the generation of fugitive dust from the process is mainly from the manual transfer of powder from one piece of equipment to another. Internal control procedures specify placing plastic liners in the hopper/containers to contain the dust within the hopper or container. Product powder is collected from the discharge of rotary kilns into high temperature bags that are tied onto the discharge outlet of the kiln. During the replacement of these bags with new ones, the bags are untied from the discharge outlet, closed off, and the new bag is tied on.

General dust remaining on floors and equipment is routinely vacuumed up using a HEPA-rated mobile vacuum. Airborne dust in the process area is controlled below the OSHA-stipulated Time Weighted Average (TWA), and is measured on a regular basis to ensure that dust is kept below this limit.

3. FACILITY / AREA CLASSIFICATION

Table 3.1 shows the potential to emit (PTE) for criteria air pollutants and hazardous air pollutants from the LVO and LMO/LCO process facility for Aerometric Information Retrieval System (AIRS) facility classification purposes. The Tronox Soda Springs facility is classified as a natural minor facility because as shown in the table, without requiring limits on its potential to emit, the potential to emit is less than major source thresholds. The AIRS classification is therefore "B."

This PTE estimate is based on a determination by DEQ that, in accordance with EPA guidance,[1] the baghouses and filters are inherent components of the LVO and LMO/LCO production process. Each emissions unit has a dedicated baghouse or collector, which allows recovery of product at each processing step. The primary purpose of the equipment is to recover product and would be installed if no air quality regulations were in place.

Table 3.1 EMISSION INVENTORY ESTIMATES – PM_{10} AND HAZARDOUS AIR POLLUTANTS

Lithium Vanadium Oxide Process[a] Throughput: 460 pounds per hour (lb/hr), 2,015 tons per year (T/yr)[b]			**Lithium Manganese Oxide/ Lithium Cobalt Oxide Process Throughput: 300 pounds per hour (lb/hr), 1,314 tons per year (T/yr)[b]**		
Emission Source	**Emissions[c] (lb/hr)**	**Emissions[c] (T/yr)**	**Emission Source**	**Emissions[d] (lb/hr)**	**Emissions[d] (T/yr)**
Kiln Baghouse + HEPA Filter	2.6E-05	1.13E-04	LiOH Bake Calciner + Baghouse	0.114	0.50
Blending Baghouse + HEPA Filter	7.4E-05	3.30E-04	Mn_2O_3 Calciner + Baghouse	0.114	0.50
Milling + High Efficiency Filter	2.6E-05	1.13E-04	$LiMn_2O_4$ Calciner + Baghouse	0.114	0.50
Classification + High Efficiency Filter	2.6E-05	1.13E-04	Annealing Calciner + Baghouse	0.114	0.50
Total LVO Process Emissions[c]	**1.54E-04**	**6.75E-04**	150 Mill + Baghouse	6.10E-03	0.027
			250 Classifier + Filter/Collector	3.40E-03	0.015
			500 Classifier + Filter/Collector	7.60E-02	0.33
			Total LMO/LCO Process Emissions[c]	**0.542**	**2.37**
Total Facility Emissions (LVO + LMO/LCO) of PM_{10}, or Manganese Compounds				**0.542**	**2.37**

[a] Throughput and emissions data for LVO taken from PTC No. 029-00002, issued on October 7, 2002.
[b] Annual throughput and emissions were very conservatively based on operating 8,760 hours per year. Reductions in total hours due to batch processing and scheduled downtime for routine maintenance were not estimated.
[c] These rates are applicable to estimated emissions of PM_{10}.
[d] These rates are applicable to estimated emissions of PM_{10} or hazardous air pollutants (HAPs from the LMO process are limited to manganese compounds).

The facility is located within AQCR 61 and UTM Zone 12. The facility is located in Caribou County, which is currently designated as unclassifiable for all regulated criteria pollutants (PM_{10}, CO, NO_X, SO_2, lead, and ozone).

The AIRS information provided in Appendix A defines the classification for each regulated air pollutant at the Tronox Soda Springs facility. This required information is entered into the EPA AIRS database.

[1] U.S. EPA Office of Air Quality Planning and Standards, "Criteria for Determining Whether Equipment is Air Pollution Control Equipment or Process Equipment," letter from Solomon (EPA) to Mohin (Intel), November 27, 1995.

4. APPLICATION SCOPE

Tronox has submitted an application requesting approval for installation of an additional mill and two classification units (sizing equipment) in the lithium manganese oxide (LMO)/lithium cobalt oxide (LCO) production process, to authorize using a lanthanum compound in part of the manufacturing process, and to change the facility owner name from Kerr-McGee Chemical, LLC to Tronox, LLC.

As requested during a February 28, 2006 meeting with the permittee, this PTC renews the authorization granted by Permit No. 029-00002 (issued February 14, 2000) to add an annealing calciner in the LMO/LCO process line. Based on that discussion, and with the concurrence of the permittee, this PTC is also intended to supersede LMO PTC Nos. 029-00002 issued September 23 and November 25, 1994; November 4, 1996; and February 14, 2000, the terms and conditions of which will no longer apply.

4.1 Application Chronology

February 28, 2006	PTC application received.
March 2, 2006	Additional information received regarding stack dimensions.
March 3, 2006	PTC application fee received.
March 10, 2006	Additional certified information received for stack dimensions and particulate emission rates.
March 21, 2006	Additional certified information received regarding lithium oxide emissions.
March 24, 2006	Application determined to be complete.
March 30, 2006	Public notice for opportunity to comment was published.
April 27, 2006	Facility Draft permit issued for regional and permittee comment.
May 1, 2006	Close opportunity for public comment.
May 5, 2006	E-mail received from the facility stating that they had no comments.
May 5-8, 2006	E-mails received from Regional Office confirming that they had no comments.

5. PERMIT ANALYSIS

This section of the Statement of Basis describes the regulatory requirements for this PTC action.

5.1 Equipment Listing

Table 5.1 lists all sources of regulated emissions for the LMO/LCO process line. Emissions sources added in this PTC are noted as "New." The annealing calciner, which was authorized in PTC No. 029-00002 in 2000, but which has not yet been installed, is noted as "Renewed."

Table 5.1 SUMMARY OF REGULATED SOURCES

Source Description	Emission Point
<u>LMO/LCO Mill 150 (NEW)</u> Manufacturer: CCE Technologies Model 150 Feed Material: Manganese Dioxide Fuel Type: Electric Max Rated Capacity (Feed Input): 300 lb/hr, 1,314 tons/year Normal Max Output: 300 lb/hr, 1,314 tons/year	<u>Collector (NEW)</u> Manufacturer: Torit Model: TD 573 Mfr Grain Loading: 0.002 gr/dscf

Source Description	Emission Point
LMO/LCO Classification 250 (NEW) Manufacturer: CCE Technologies Model 250 Feed Material: Manganese Dioxide Fuel Type: Electric Max Rated Capacity (Feed Input): 300 lb/hr, 1,314 tons/year Normal Max Output: 300 lb/hr, 1,314 tons/year	**Collector (NEW)** Manufacturer: Torit Model: TD 573 Mfr Grain Loading: 0.002 gr/dscf
LMO/LCO Classification 500 (NEW) Manufacturer: CCE Technologies Model 500 Feed Material: Manganese Dioxide Fuel Type: Electric Max Rated Capacity (Feed Input): 300 lb/hr Normal Max Output: 300 lb/hr	**Baghouse (NEW)** Manufacturer: Mac Equipment Model: 72RT52 Mfr Grain Loading: 0.02 gr/dscf
Mn_2O_3 Calciner Manufacturer: (not noted) Model: (not noted) Fuel/Rating: Electric	**Baghouse #4** Manufacturer: Micro Pul Model/Type: Model 25S-8-20 Mfr Grain Loading: 0.02 gr/dscf
$LiMn_2O_4$ Calciner (reaction calciner) Manufacturer: (not noted) Model: (not noted) Fuel/Rating: Electric Normal Max Output: 300 lb/hr	**Baghouse #3** Manufacturer: Micro Pul Model/Type: Model 25S-8-20 Mfr Grain Loading: 0.02 gr/dscf
Annealing Calciner (RENEWED) Manufacturer: (not noted) Model: (not noted) Fuel/Rating: Electric Normal Max Output: 300 lb/hr	**Baghouse #2 (RENEWED)** Manufacturer: Micro Pul Model/Type: Model 25S-8-20 Mfr Grain Loading: 0.02 gr/dscf
LiOH Bake Calciner Manufacturer: (not noted) Type: Electric Heating, Static Bed, Totally Enclosed Normal Max Output: 300 lb/hr	**Baghouse #1** Manufacturer: Micro Pul Model/Type: Model 25S-8-20 Mfr Grain Loading: 0.02 gr/dscf Efficiency: 98%

Table 5.2 identifies all other air pollution emitting sources at the facility that do not require specific permit conditions to demonstrate compliance with applicable air quality standards.

Table 5.2 OTHER AIR POLLUTION SOURCES AT THE FACILITY

Source Description	Emissions Control(s)
Mill /Grinder (old) Manufacturer: Vibra-Energy Grinder Type: Totally Enclosed	None
Transfer Equipment Type: 6-inch Screw Feeders, Totally Enclosed No. of units: 2	None

5.2 *Emissions Inventory*

Emissions from the LMO/LCO process are limited to particulate matter (PM). PM emissions from each baghouse or filter/collector were based on manufacturers' guarantees for grain loading. PM_{10} emissions were estimated as being equal to PM emissions.

The change in emissions of PM and PM_{10} resulting from this PTC is shown in Table 5.3. The change in the emissions inventory for the existing calciners is not due to any change in the process or calculations—it is the result of more accurately reflecting the calculated emissions before rounding. The detailed emissions inventory is contained in Appendix B.

Table 5.3 PTC CHANGES TO EMISSIONS – PM and PM_{10}

LMO/LCO Process Throughput: 300 pounds per hour (lb/hr), 1,314 tons per year (T/yr)[a]						
	Existing PTC Permitted Emissions		Current PTC Emission Inventory		Total Change in Emissions	
Emission Source	**Emissions (lb/hr)**	**Emissions (T/yr)**	**Emissions (lb/hr)**	**Emissions (T/yr)**	**Emissions (lb/hr)**	**Emissions (T/yr)**
Existing Permitted Sources:						
LiOH Bake Calciner + Baghouse	0.1	0.5	0.114	0.50	0.014	---
Mn_2O_3 Calciner + Baghouse	0.1	0.5	0.114	0.50	0.014	---
$LiMn_2O_4$ Calciner + Baghouse	0.1	0.5	0.114	0.50	0.014	---
Sources Added with this PTC:						
Annealing Calciner + Baghouse			0.114	0.50	0.114	0.50
150 Mill + Filter/Collector			6.10E-03	0.027	6.10E-03	0.027
250 Classifier + Filter/Collector			3.40E-03	0.015	3.40E-03	0.015
500 Classifier + Baghouse			7.60E-02	0.33	7.60E-02	0.33
Total LMO/LCO Process Emissions	**0.3**	**1.5**	**0.542**	**2.37**	**0.242**	**0.87**

[a] Annual throughput and emissions were very conservatively based on operating 8,760 hours per year. Reductions in total hours due to batch processing and scheduled downtime for routine maintenance were not estimated.

Potential emissions of lanthanum oxide were reviewed by DEQ's air toxics specialist, and a determination was made that permit limits were not required to control lanthanum oxide emissions. A summary of this review is contained in Appendix D.

Emissions of toxic air pollutants (TAPs) are therefore limited to emissions of manganese compounds, which are not carcinogens. As shown in Table 5.4, the increase in hourly emissions of toxic air pollutants does not exceed the screening emission level for manganese compounds. As shown in Table 5.4, if the total change in PM emissions associated with this PTC (shown in Table 5.3) were emitted as manganese compounds, the increase in hourly emissions would not exceed the screening emission level (EL) for manganese dust and compounds.

Table 5.4 PTC CHANGES TO EMISSIONS – TOXIC AIR POLLUTANTS

LMO/LCO Process Throughput: 300 pounds per hour (lb/hr), 1,314 tons per year (T/yr)[a]				
	Total Change in Emissions			
Emission Source	**Emissions (lb/hr)**	**Emissions (T/yr)**	**Screening Emission Level (lb/hr)**	**Exceeds EL?**
PM (as manganese dust or compounds)	0.242	0.87	0.333	No. Modeling Not Required.

5.3 Modeling

DEQ conducted screening-level modeling to demonstrate preconstruction compliance with ambient air quality standards for the increases in criteria pollutants. The description of the modeling approach and the detailed results are contained in Appendix C. Modeling of the increases in emissions associated with this PTC showed that both the annual and the 24-hour PM_{10} ambient impacts are predicted to be significant, i.e., the predicted annual impact of 2.42 $\mu g/m^3$ exceeds 1.0 $\mu g/m^3$, and the predicted 24-hour average impact of 12.1 $\mu g/m^3$ exceeds 5 $\mu g/m^3$. In accordance with DEQ modeling guidance, facility-wide modeling for PM_{10} emissions was therefore required.

The results of facility-wide modeling for PM_{10} emissions showed that the ambient impacts from operation of the LMO/LCO facility, when added to background levels, was less than 77% of the short-term PM_{10} NAAQS and less than 70% of the annual PM_{10} NAAQS, emissions rates predicted in the emissions inventory and for the permitted hourly emission rates, which were set at about 120% of the predicted emission rates. Modeling therefore demonstrated to DEQ's satisfaction that emissions from the facility will not cause or significantly contribute to a violation of any air quality standard.

5.4 Regulatory Review

This section describes the regulatory analysis of the applicable air quality rules with respect to this PTC.

IDAPA 58.01.01.201 .... Permit to Construct Required

The facility's proposed project does not meet the permit to construct exemption criteria contained in Sections 220 through 223 of the Rules. Tronox has requested a permit to add an additional emissions sources and an additional chemical compound to the LMO/LCO process, in addition to requesting an ownership name change. Therefore, a PTC is required. This is a modification to an existing permit to construct for this facility.

IDAPA 58.01.01.203 .... National Ambient Air Quality Standards (NAAQS)

Air dispersion modeling demonstrated to the satisfaction of DEQ that the facility will comply with all applicable emissions standards, ambient air quality standards, and toxic increments.

IDAPA 58.01.01.161 .... Toxic Substances
IDAPA 58.01.01.210 .... Demonstration of Preconstruction Compliance with Toxic Standards

DEQ has determined that lanthanum oxide will not be emitted in such quantities or concentrations as to alone, or in combination with other contaminants, injure or unreasonably affect human or animal life or vegetation. Preconstruction compliance with TAPs increments for the change in emissions of manganese dust and compounds has been demonstrated to DEQ's satisfaction.

5.5 Permit Conditions Review

This section describes only those permit conditions that have been revised, modified or deleted as a result of this permit action. All other permit conditions remain unchanged.

Permit Conditions 1.1 through 2.2

Permit Conditions 1.1 through 2.2 contain the purpose of this permit and a current list of the regulated sources and process description. Permit Condition 1.2 reflects the permittee's request during a February 28, 2006 meeting with DEQ to supersede existing permits that contain conflicting permit conditions for throughput, i.e., LMO PTC Nos. 029-00002 issued September 23 and November 25, 1994; November 4, 1996; and February 14, 2000. Permit Condition 1.3 identifies the existing PTCs that are still in effect for the Tronox Soda Springs facility.

Permit Condition 2.3

The superseded permits included hourly and annual limits on PM and PM_{10}. Permit Condition 2.3 of this permit imposes hourly PM_{10} limits set at levels equal to about 120% of the estimated emissions rate for a throughput of 300 pounds per hour. Operation of all the batch processing units at the permitted hourly rate would increase the facility-wide PM_{10} ambient impacts from 72.5% to 76.8% of the 24-hour PM_{10} NAAQS, but would not cause an exceedance of the NAAQS. An annual limit on PM_{10} equal to the estimated annual emissions rate in tons per year for each batch processing unit was established to protect the annual PM_{10} NAAQS. The facility's total PM emissions are estimated to be less than 3 tons per year; an annual limit on PM was not necessary to limit the facility's potential to emit below major source thresholds.

Compliance Assurance

Permit Condition 2.8 limits total production, which inherently limits the PM_{10} emissions from the entire process. Permit Condition 2.12 requires monitoring and recording to ensure compliance with production limits.

Permit Condition 2.4

The standardized language prohibiting exceedances of 20% opacity for period(s) greater than 3 minutes in any 60-minute period was included in the superseded permits, and has not been changed in the current permit.

Compliance Assurance

No monitoring and recordkeeping requirement is established in the permit to demonstrate compliance with the opacity limitation. Each batch processing unit is provided with a dedicated baghouse or filter/collector to recover product. Visible emissions are not anticipated to be an issue for these sources.

Permit Conditions 2.9 through 2.12

The superseded February 14, 2000 permit (Permit Conditions 2.3 and 2.4) requires an O&M manual and pressure drop capabilities on the calciner baghouses. Permit Conditions 2.9 through 2.12 of this permit impose similar requirements, apply the requirements to all baghouses and filter/collectors, and provide more detail regarding the specific requirements.

Compliance Assurance

Permit Conditions 2.10 and 2.11 require that records be maintained on site, and Permit Condition 2.12 requires monitoring and recording of pressure drop, inspections, and throughputs.

6. PERMIT FEES

Tronox paid the $1,000 permit to construct application fee as required in IDAPA 58.01.01.224 on March 3, 2006.

A permit to construct processing fee of $1,000 is required in accordance with IDAPA 58.01.01.225 because the estimated total increase in emissions of 0.87 tons per year from the changes associated with this PTC is less than one ton per year. Tronox paid the processing fee on May 9, 2006. This facility is not a major facility and is not subject to registration fees.

Table 5.1 PTC PROCESSING FEE TABLE

Emissions Inventory			
Pollutant	**Annual Emissions Increase (T/yr)**	**Annual Emissions Reduction (T/yr)**	**Annual Emissions Change (T/yr)**
NO_X	0.0	0	0.0
SO_2	0.0	0	0.0
CO	0.0	0	0.0
PM_{10}	0.87	0	0.87
VOC	0.0	0	0.0
TAPS/HAPS	0.0	0	0.0
Total:	**0.87**	**0**	**0.87**
Fee Due	**$1,000.00**		

7. PERMIT REVIEW

7.1 Regional Review of Draft Permit

On April 27, a draft of the permit and statement of basis was provided electronically to the Pocatello Regional Office for review. On May 5 and May 8, Regional Office reviewers submitted e-mails confirming that they had no comments.

7.2 Facility Review of Draft Permit

On April 27, a draft of the permit and statement of basis was provided electronically to the facility for review. On May 5, 2006, DEQ received an e-mail from the facility confirming that they had no comments.

7.3 Public Comment

An opportunity for public comment period on the PTC application was provided from March 31, 2006 through May 1, 2006, in accordance with IDAPA 58.01.01.209.01.c. During this time, there were no comments on the application and no requests for a public comment period on DEQ's proposed action.

8. RECOMMENDATION

Based on review of application materials, and all applicable state and federal rules and regulations, staff recommends that Tronox, LLC be issued a PTC No. 060306 for the Lithium Manganese Oxide/Lithium Cobalt Oxide production process. No public comment period is recommended, no entity has requested a comment period, and the project does not involve PSD requirements.

CR/bf Permit No. P-060306

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Appendix A

AIRS Information

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AIRS/AFS[a] FACILITY-WIDE CLASSIFICATION[b] DATA ENTRY FORM

Facility Name: **Tronox, LLC**
(Lithium Vanadium Oxide AND Lithium Manganese Oxide Production)
Facility Location: **1864 N. Highway 34, Soda Springs, Idaho**
AIRS Number: **029-00002**

AIR PROGRAM POLLUTANT	SIP	PSD	NSPS (Part 60)	NESHAP (Part 61)	MACT (Part 63)	SM80	TITLE V	AREA CLASSIFICATION A-Attainment U-Unclassified N- Nonattainment
SO_2								
NO_x								
CO								
PM_{10}	B							U
PT (Particulate)	B							U
VOC								
THAP (Total HAPs)	B							
			APPLICABLE SUBPART					

[a] Aerometric Information Retrieval System (AIRS) Facility Subsystem (AFS)

[b] AIRS/AFS Classification Codes:

A = Actual or potential emissions of a pollutant are above the applicable major source threshold. For HAPs only, class "A" is applied to each pollutant which is at or above the 10 T/yr threshold, or each pollutant that is below the 10 T/yr threshold, but contributes to a plant total in excess of 25 T/yr of all HAPs.

SM = Potential emissions fall below applicable major source thresholds if and only if the source complies with federally enforceable regulations or limitations.

B = Actual and potential emissions below all applicable major source thresholds.

C = Class is unknown.

ND = Major source thresholds are not defined (e.g., radionuclides).

Appendix B

Emissions Inventory

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Calciner Emissions, with Micro Pul baghouses (taken from previous permit technical memos):

664 dscf/min x 0.02 gr/dscf x 1 lb/7000 gr x 60 min/hr = 0.114 lb/hr
0.114 lb/hr x 8760 hr/yr x 1 ton/2000 lb = 0.50 ton/year

Emission Inventory submitted with this PTC application:
Assumptions:

1. 300 lb/hr total permitted throughput (136 kg/hr)
2. Emissions are as listed, i.e., Mn_2O_3 unless otherwise stated.
3. Calculations based on average inside building temp (average 70°F)
4. Pressure in Soda Springs @ 6000 ft altitude, (11.78 psia)
5. Average relative humidity in Soda Springs (35%)
   Ts→ Average Ambient Temp (°F)
   Ps → Average Ambient Pressure (psia)
   Ews → Volumetric fraction of water vapor
6. Lanthanum powder compound is added at no more than 5% of throughput
7. Lanthanum powder compound averages 25% moisture from hydrate
8. Lanthanum emissions are in the form of lanthanum oxide, La_2O_3

$$\text{dscfm} = \text{acfm} \times \frac{(460+70)}{(460+\text{Ts})} \times \frac{\text{Ps}}{14.7} \times (1-\text{Ews})$$

150 Milling
Model TD 573, Torit Collector

Air Flow (acfm)	680	
Air Flow (dscfm)	354	
Grain Loading	0.002 gr/dscf (per Donaldson/Torit)	
Calculated Emissions	6.1E-03 lb/hr	2.7E-02 ton/year

250 Classification
Model TD 573, Torit Collector

Air Flow (acfm)	385	
Air Flow (dscfm)	201	
Grain Loading	0.002 gr/dscf (per Donaldson/Torit)	
Calculated Emissions	3.4E-03 lb/hr	1.5E-01 ton/year

500 Classification
Model 72RT52, Mac Environmental

Air Flow (acfm)	850	
Air Flow (dscfm)	443	
Grain Loading	0.02 gr/dscf (per MAC Environmental)	
Calculated Emissions	7.6E-02 lb/hr	3.3E-01 ton/year

Calciner, Emissions as La2O3
MicroPul 25S-8-20

Air Flow (acfm)	811	
Air Flow (dscfm)	422	
Grain Loading	0.02 gr/dscf (per MicroPul)	
Calculated Emissions	2.0E-03 lb/hr	8.6E-03 ton/year

Appendix C

Modeling Review

P-060306

DEQ conducted screening-level modeling to demonstrate preconstruction compliance with ambient air quality standards for the increases in criteria pollutants (limited to PM_{10} emissions). The modeling assumed flat terrain, no downwash, a receptor height of 0.0 meters, and that ambient air was located at a distance of 450 meters from the LMO/LCO facility in a rural area. A full range of stability classes and wind speeds were evaluated within the model to identify the "worst case" meteorological conditions that result in the highest concentrations at the receptor height.

For modeling purposes each emission source air pollutant emission rate was set at one pound per hour (0.126 grams per second), and the distance to the receptor set at 450 meters. Using this method, SCREEN3 model identifies the estimated concentration in micrograms per cubic meter ($\mu g/m^3$) per pound per hour of emissions at the ambient air boundary (i.e., at the fenceline). This value was used as the dispersion coefficient for that emissions point source (i.e., each stack).

Stack parameters used in the SCREEN3 modeling analysis for the point sources of emissions, and the SCREEN3 dispersion coefficient at the ambient air boundary for each stack are shown in Table C.1

TABLE C.1 LMO/LCO PROCESS STACK PARAMETERS

Batch Processing Emission Point:	**LiOH Bake Calciner Baghouse**	**Mn2O3 Calciner Baghouse**	**LiMn2O4 Calciner Baghouse**	**Annealing Calciner Baghouse**	**150 Mill Filter/Collector**	**250 Classifier Filter/Collector**	**500 Classifier Baghouse**
Baghouse or Filter/Collector:	North-Monsen Micro Pul 25S-8-20 0.02 gr/dscf	North-Monsen Micro Pul 25S-8-20 0.02 gr/dscf	North-Monsen Micro Pul 25S-8-20 0.02 gr/dscf	North-Monsen Micro Pul 25S-8-20 0.02 gr/dscf	Torit TD 573 99.999% 0.002 gr/dscf	Torit TD 573 99.999% 0.002 gr/dscf	Mac Equipment 72RT52 99.9% 0.02 gr/dscf
Stack Height	25 ft 7.62 m	25 ft 7.62 m	25 ft 7.62 m	25 ft 7.62 m	8 ft 2.4384 m	6 ft 1.8288 m	8 ft 2.4384 m
Stack Diameter	0.75 ft 0.2286 m	0.75 ft 0.2286 m	0.75 ft 0.2286 m	0.75 ft 0.2286 m	14 in 8 in exit 0.2032 m	7 in 3 in exit 0.0762 m	8 in 8 in exit 0.2032 m
Exit Gas Volume	811 acfm	811 acfm	811 acfm	811 acfm	680 acfm	385 acfm	850 acfm
Exit Gas Velocity	---	---	---	---	---	---	---
Exit Gas Temperature	70°F 294.2611 K	70°F 294.2611 K	70°F 294.2611 K	70°F 294.2611 K	70°F 294.2611 K	70°F 294.2611 K	70°F 294.2611 K
Emission Rate	1 lb/hr 0.126 g/s	1 lb/hr 0.126 g/s	1 lb/hr 0.126 g/s	1 lb/hr 0.126 g/s	1 lb/hr 0.126 g/s	1 lb/hr 0.126 g/s	1 lb/hr 0.126 g/s
SCREEN3 Dispersion Coefficient ($\mu g/m^3$ per lb/hr)	89.06	89.06	89.06	89.06	208.2	187.2	260.3

The linear relationship between emission rate and ambient impact was used to predict the actual ambient impact by multiplying the dispersion coefficient for each point source by the actual change in emission rates associated with this PTC.

The predicted ambient impact for each emission source was then multiplied by a persistence factor to convert the SCREEN3 one-hour concentration to the averaging periods of the ambient standards. The values for each averaging period were summed for all emissions sources to determine the total maximum ambient air quality impact predicted by the changes authorized in this PTC.

Table C.2 shows the calculation of the ambient impacts for PM_{10} emissions from this PTC, which demonstrates that both the annual and the 24-hour PM_{10} ambient impacts are predicted to be significant, i.e., the predicted annual impact of 2.42 μg/m³ exceeds 1.0 μg/m³, and the predicted 24-hour average impact of 12.1 μg/m³ exceeds 5 μg/m³. In accordance with DEQ modeling guidance, facility-wide modeling for PM_{10} emissions was therefore required.

Table C.2 PREDICTED AMBIENT IMPACTS FROM THIS PTC – PM_{10}

Batch Processing Emission Point:	LiOH Bake Calciner Baghouse	Mn2O3 Calciner Baghouse	LiMn2O4 Calciner Baghouse	Annealing Calciner Baghouse	150 Mill Filter/ Collector	250 Classifier Filter/ Collector	500 Classifier Baghouse	TOTAL AMBIENT IMPACT (μg/m³)
Baghouse or Filter/Collector:	North-Monsen Micro Pul 25S-8-20 0.02 gr/dscf	North-Monsen Micro Pul 25S-8-20 0.02 gr/dscf	North-Monsen Micro Pul 25S-8-20 0.02 gr/dscf	North-Monsen Micro Pul 25S-8-20 0.02 gr/dscf	Torit TD 573 99.999% 0.002 gr/dscf	Torit TD 573 99.999% 0.002 gr/dscf	Mac Equipment 72RT52 99.9% 0.02 gr/dscf	
Estimated Change in Emission Rate (lb/hr)	0.014	0.014	0.014	0.114	6.10E-03	3.40E-03	7.60E-02	
SCREEN3 Dispersion Coefficient (μg/m³ per lb/hr)	90.14	90.14	90.14	90.14	208.2	187.2	190.1	
PM_{10} 24-hour Average Impact[a] (μg/m³)	0.499	0.499	0.499	4.061	0.508	0.255	5.779	**12.1**
PM_{10} Annual Average Impact[b] (μg/m³)	0.100	0.100	0.100	0.812	0.102	0.051	1.156	**2.42**

[a] PM_{10} 24-hour average impact = 0.4 x Emission Rate x Dispersion Coefficient
[b] PM_{10} Annual average impact = 0.08 x Emission Rate x Dispersion Coefficient

Based on facility information regarding practices to control fugitive emissions, facility-wide modeling for PM_{10} included emissions only from the LMO/LCO point sources (i.e., the stacks). Table C.3 shows the calculation for facility-wide PM_{10} impacts from the LMO/LCO facility.

Table C.3 FACILITY-WIDE PREDICTED AMBIENT IMPACTS[a] – PM_{10}

Batch Processing Emission Point:	LiOH Bake Calciner Baghouse	Mn2O3 Calciner Baghouse	LiMn2O4 Calciner Baghouse	Annealing Calciner Baghouse	150 Mill Filter/ Collector	250 Classifier Filter/ Collector	500 Classifier Baghouse	TOTAL AMBIENT IMPACT (μg/m³)
Baghouse or Filter/Collector:	North-Monsen Micro Pul 25S-8-20 0.02 gr/dscf	North-Monsen Micro Pul 25S-8-20 0.02 gr/dscf	North-Monsen Micro Pul 25S-8-20 0.02 gr/dscf	North-Monsen Micro Pul 25S-8-20 0.02 gr/dscf	Torit TD 573 99.999% 0.002 gr/dscf	Torit TD 573 99.999% 0.002 gr/dscf	Mac Equipment 72RT52 99.9% 0.02 gr/dscf	
Emission Rate (lb/hr)	0.114	0.114	0.114	0.114	6.10E-03	3.40E-03	7.60E-02	
SCREEN3 Dispersion Coefficient (μg/m³ per lb/hr)	90.14	90.14	90.14	90.14	208.2	187.2	190.1	
PM_{10} 24-hour Average Impact[b] (μg/m³)	4.061	4.061	4.061	4.061	0.508	0.255	5.779	**22.8**
PM_{10} Annual Average Impact[c] (μg/m³)	0.812	0.812	0.812	0.812	0.102	0.051	1.156	**4.56**

[a] LVO PM_{10} emissions were not modeled. These would not contribute significantly to the facility-wide impacts. Based on total LVO facility PM_{10} emissions of 1.54E-04 lb/hr (see Table 3.1 in this Statement of Basis), and a conservatively high dispersion coefficient of 210, the 24-hour impact would be 0.013 μg/m³, the annual impact would be 0.003 μg/m³.
[b] PM_{10} 24-hour average impact = 0.4 x Emission Rate x Dispersion Coefficient
[c] PM_{10} Annual average impact = 0.08 x Emission Rate x Dispersion Coefficient

To determine whether the facility will meet National Ambient Air Quality Standards (NAAQS), the results of the facility-wide PM_{10} modeling are combined with background levels for the Soda Springs area and compared to the PM_{10} NAAQS. Table C.4 shows this calculation, and demonstrates that the facility emissions would not result in exceeding the 24-hour or the annual NAAQS for PM_{10}. This is true both for the predicted maximum emissions from the facility as well as for the permitted emission rates (which were set at about 120% of the predicted emission inventory rates).

Background concentrations reflect the proximity of the Tronox facility (located at 1864 N. Highway 34) to the Monsanto/P4 Production, LLC facility (located at 1853 N. Highway 34). The total background levels were estimated in a May 8, 2006, memo from Kevin Schilling, DEQ's Modeling Coordinator (see below) by adding Monsanto/P4 contributions to baseline ambient concentration data[1] from a monitoring location at the Soda Springs High School.

TABLE C.4 FACILITY-WIDE COMPLIANCE WITH PM_{10} NAAQS

Pollutant	Maximum Predicted Ambient Impact (μg/m³)	Background Concentration (μg/m³)	Total Ambient Impact (μg/m³)	NAAQS (μg/m³)	Percent of NAAQS
Emission Rates Based on Emission Inventory					
PM_{10} 24-Hour	22.8	86	108.8	150	72.5%
PM_{10} Annual	4.56	30	34.6	50	69.2%
Emission Rates Based on Permitted Emissions					
PM_{10} 24-Hour	29.2	86	115.2	150	76.8%
PM_{10} Annual	5.83	30	35.8	50	71.6%

From: Kevin Schilling
Sent: Monday, May 08, 2006 1:48 PM
To: Cheryl Robinson
Subject: background for Soda Springs near P4

Cheryl:

The approach I used for background was as follows:

The monitored value in Soda Springs is the best value for non-source (large industrial point source) impacted air. However, it appears the facility is likely within 1 km of the Monsanto P4 plant. Therefore, impacts from the P4 plant must be considered. I then used our method for accounting for nearby sources – this involves calculating emissions then using the table to determine the additional value to add to the non-source impacted value. Based on emissions of just under 1000 ton/y4, the additional PM10 impacts would be 86 ug/m3 for the 24-hour period and 10 ug/m3 for the annual period. The total background values are then:

24-hour = 51 ug/m3 + 35 ug/m3 = 86 ug/m3
Annual = 20 ug/m3 + 10 ug/m3 = 30 ug/m3

I hope this helps.

Kevin

---

[1]March 14, 2003, DEQ Memo, Hardy, Rick and Kevin Shilling to Mary Anderson, "Background Concentrations for Use in New Source Review Dispersion Modeling."

04/25/06
20:10:36

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 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 95250 ***
```

P-060306 TRONOX SODA SPRINGS LMO/LCO CALCINER STACKS (MICRO PUL BAGHOUSE)

```
SIMPLE TERRAIN INPUTS:
   SOURCE TYPE              =        POINT
   EMISSION RATE (G/S)      =      .126000
   STACK HEIGHT (M)         =       7.6200
   STK INSIDE DIAM (M)      =        .2286
   STK EXIT VELOCITY (M/S)=         9.3255
   STK GAS EXIT TEMP (K)    =     294.2611
   AMBIENT AIR TEMP (K)     =     293.0000
   RECEPTOR HEIGHT (M)      =        .0000
   URBAN/RURAL OPTION       =        RURAL
   BUILDING HEIGHT (M)      =        .0000
   MIN HORIZ BLDG DIM (M)   =        .0000
   MAX HORIZ BLDG DIM (M)   =        .0000

   STACK EXIT VELOCITY WAS CALCULATED FROM
   VOLUME FLOW RATE =    811.00000     (ACFM)

BUOY. FLUX =      .005 M**4/S**3;  MOM. FLUX =      1.131 M**4/S**2.

*** FULL METEOROLOGY ***

**********************************
*** SCREEN AUTOMATED DISTANCES ***
**********************************

*** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***
```

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
10.	.1374E-03	1	3.0	3.0	960.0	9.75	3.41	1.69	NO
100.	82.47	2	1.0	1.0	320.0	14.02	19.35	10.76	NO
200.	80.27	4	1.0	1.0	320.0	14.02	15.67	8.69	NO
300.	92.02	5	1.0	1.0	10000.0	12.90	16.96	8.83	NO
400.	84.85	6	1.0	1.0	10000.0	12.43	14.70	7.18	NO
500.	89.92	6	1.0	1.0	10000.0	12.43	18.02	8.51	NO
600.	85.90	6	1.0	1.0	10000.0	12.43	21.28	9.78	NO
700.	78.61	6	1.0	1.0	10000.0	12.43	24.50	11.02	NO
800.	70.64	6	1.0	1.0	10000.0	12.43	27.67	12.05	NO
900.	63.36	6	1.0	1.0	10000.0	12.43	30.81	13.05	NO
1000.	56.93	6	1.0	1.0	10000.0	12.43	33.91	14.02	NO

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND   10. M:

299.	92.02	5	1.0	1.0	10000.0	12.90	16.96	8.83	NO

```
DWASH=   MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB
```

```
***********************************
*** SCREEN DISCRETE DISTANCES ***   CALCINER STACK (MICRO PUL BAGHOUSE)
***********************************

*** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

  DIST      CONC              U10M   USTK  MIX HT   PLUME   SIGMA   SIGMA
   (M)    (UG/M**3)    STAB  (M/S)  (M/S)    (M)    HT (M)   Y (M)   Z (M)  DWASH
-------  ----------    ----  -----  -----  ------   ------  ------  ------  -----
   450.   89.06          6    1.0     1.0 10000.0   12.43   16.37    7.85    NO

 DWASH=   MEANS NO CALC MADE (CONC = 0.0)
 DWASH=NO MEANS NO BUILDING DOWNWASH USED
 DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
 DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
 DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

     ***************************************
     *** SUMMARY OF SCREEN MODEL RESULTS ***
     ***************************************

 CALCULATION           MAX CONC   DIST TO   TERRAIN
  PROCEDURE           (UG/M**3)   MAX (M)    HT (M)
--------------       -----------  -------   -------
SIMPLE TERRAIN         92.02         299.        0.

***************************************************
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
***************************************************
```

04/25/06
20:14:55

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 ***   SCREEN3 MODEL RUN   ***
 *** VERSION DATED 95250 ***
```

P-060306 TRONOX SODA SPRINGS LMO/LCO 150 MILL STACK (TORIT FILTER/COLLECTOR)

```
SIMPLE TERRAIN INPUTS:
   SOURCE TYPE              =        POINT
   EMISSION RATE (G/S)      =      .126000
   STACK HEIGHT (M)         =       2.4384
   STK INSIDE DIAM (M)      =        .2032
   STK EXIT VELOCITY (M/S)=         9.8961
   STK GAS EXIT TEMP (K)    =     294.2611
   AMBIENT AIR TEMP (K)     =     293.0000
   RECEPTOR HEIGHT (M)      =        .0000
   URBAN/RURAL OPTION       =        RURAL
   BUILDING HEIGHT (M)      =        .0000
   MIN HORIZ BLDG DIM (M)   =        .0000
   MAX HORIZ BLDG DIM (M)   =        .0000

   STACK EXIT VELOCITY WAS CALCULATED FROM
   VOLUME FLOW RATE =    680.00000     (ACFM)

BUOY. FLUX =      .004 M**4/S**3;  MOM. FLUX =     1.007 M**4/S**2.

*** FULL METEOROLOGY ***

**********************************
*** SCREEN AUTOMATED DISTANCES ***
**********************************

*** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***
```

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
10.	71.32	1	3.0	3.0	960.0	4.45	3.41	1.69	NO
100.	291.7	5	2.5	2.5	10000.0	4.85	6.16	3.60	NO
200.	308.2	6	1.0	1.0	10000.0	7.07	7.84	4.30	NO
300.	290.4	6	1.0	1.0	10000.0	7.07	11.31	5.78	NO
400.	234.1	6	1.0	1.0	10000.0	7.07	14.70	7.17	NO
500.	185.4	6	1.0	1.0	10000.0	7.07	18.01	8.50	NO
600.	148.5	6	1.0	1.0	10000.0	7.07	21.28	9.78	NO
700.	121.0	6	1.0	1.0	10000.0	7.07	24.49	11.01	NO
800.	101.3	6	1.0	1.0	10000.0	7.07	27.67	12.05	NO
900.	86.16	6	1.0	1.0	10000.0	7.07	30.80	13.05	NO
1000.	74.31	6	1.0	1.0	10000.0	7.07	33.91	14.02	NO

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND   10. M:

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
227.	314.3	6	1.0	1.0	10000.0	7.07	8.82	4.72	NO

```
 DWASH=   MEANS NO CALC MADE (CONC = 0.0)
 DWASH=NO MEANS NO BUILDING DOWNWASH USED
 DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
 DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
 DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB
```

****
*** SCREEN DISCRETE DISTANCES ***   150 MILL (TORIT FILTER/COLLECTOR)
****

*** TERRAIN HEIGHT OF 0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
450.	208.2	6	1.0	1.0	10000.0	7.07	16.36	7.84	NO

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****
*** SUMMARY OF SCREEN MODEL RESULTS ***
****

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	314.3	227.	0.

****
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
****

*** SCREEN3 MODEL RUN ***
*** VERSION DATED 95250 ***

P-060306 TRONOX SODA SPRINGS LMO/LCO 250 CLASSIFIER (TORIT FILTER/COLLECTOR)

```
SIMPLE TERRAIN INPUTS:
   SOURCE TYPE              =        POINT
   EMISSION RATE (G/S)      =      .126000
   STACK HEIGHT (M)         =       1.8288
   STK INSIDE DIAM (M)      =        .0762
   STK EXIT VELOCITY (M/S)=        39.8432
   STK GAS EXIT TEMP (K)    =     294.2611
   AMBIENT AIR TEMP (K)     =     293.0000
   RECEPTOR HEIGHT (M)      =        .0000
   URBAN/RURAL OPTION       =        RURAL
   BUILDING HEIGHT (M)      =        .0000
   MIN HORIZ BLDG DIM (M) =          .0000
   MAX HORIZ BLDG DIM (M) =          .0000

   STACK EXIT VELOCITY WAS CALCULATED FROM
   VOLUME FLOW RATE =    385.00000      (ACFM)

BUOY. FLUX =      .002 M**4/S**3;  MOM. FLUX =     2.295 M**4/S**2.

*** FULL METEOROLOGY ***

**********************************
*** SCREEN AUTOMATED DISTANCES ***
**********************************

*** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***
```

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
10.	62.68	2	5.0	5.0	1600.0	3.65	2.39	1.35	NO
100.	243.1	5	3.0	3.0	10000.0	4.86	6.18	3.64	NO
200.	233.0	6	1.0	1.0	10000.0	7.92	7.92	4.45	NO
300.	242.4	6	1.0	1.0	10000.0	7.92	11.37	5.89	NO
400.	206.6	6	1.0	1.0	10000.0	7.92	14.74	7.26	NO
500.	169.1	6	1.0	1.0	10000.0	7.92	18.05	8.57	NO
600.	138.3	6	1.0	1.0	10000.0	7.92	21.31	9.84	NO
700.	114.4	6	1.0	1.0	10000.0	7.92	24.52	11.07	NO
800.	96.60	6	1.0	1.0	10000.0	7.92	27.69	12.10	NO
900.	82.73	6	1.0	1.0	10000.0	7.92	30.83	13.10	NO
1000.	71.73	6	1.0	1.0	10000.0	7.92	33.93	14.06	NO

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 10. M:

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
30.	271.9	3	5.0	5.0	1600.0	3.65	4.24	2.60	NO

```
DWASH=   MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB
```

****
*** SCREEN DISCRETE DISTANCES ***   250 CLASSIFIER (TORIT FILTER/COLLECTOR)
****

*** TERRAIN HEIGHT OF   0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
450.	187.2	6	1.0	1.0	10000.0	7.92	16.40	7.92	NO

DWASH=   MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****
*** SUMMARY OF SCREEN MODEL RESULTS ***
****

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	271.9	30.	0.

****
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
****

04/25/06

20:23:58

```
 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 95250 ***
```

P-060306 TRONOX SODA SPRINGS LMO/LCO 500 CLASSIFIER (MAC EQUIP BAGHOUSE)

```
SIMPLE TERRAIN INPUTS:
   SOURCE TYPE             =        POINT
   EMISSION RATE (G/S)     =      .126000
   STACK HEIGHT (M)        =       2.4384
   STK INSIDE DIAM (M)     =        .2032
   STK EXIT VELOCITY (M/S)=       12.3702
   STK GAS EXIT TEMP (K)   =     294.2611
   AMBIENT AIR TEMP (K)    =     293.0000
   RECEPTOR HEIGHT (M)     =        .0000
   URBAN/RURAL OPTION      =        RURAL
   BUILDING HEIGHT (M)     =        .0000
   MIN HORIZ BLDG DIM (M) =         .0000
   MAX HORIZ BLDG DIM (M) =         .0000

   STACK EXIT VELOCITY WAS CALCULATED FROM
   VOLUME FLOW RATE =   850.00000     (ACFM)

BUOY. FLUX =      .005 M**4/S**3;  MOM. FLUX =     1.573 M**4/S**2.

*** FULL METEOROLOGY ***

**********************************
*** SCREEN AUTOMATED DISTANCES ***
**********************************

*** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***
```

DIST (M)	CONC. (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
10.	38.81	1	3.0	3.0	960.0	4.95	3.43	1.74	NO
100.	234.2	5	3.0	3.0	10000.0	4.95	6.17	3.61	NO
200.	235.9	6	1.0	1.0	10000.0	7.81	7.88	4.37	NO
300.	247.3	6	1.0	1.0	10000.0	7.81	11.34	5.83	NO
400.	210.2	6	1.0	1.0	10000.0	7.81	14.72	7.21	NO
500.	171.4	6	1.0	1.0	10000.0	7.81	18.03	8.53	NO
600.	139.9	6	1.0	1.0	10000.0	7.81	21.29	9.81	NO
700.	115.4	6	1.0	1.0	10000.0	7.81	24.50	11.04	NO
800.	97.36	6	1.0	1.0	10000.0	7.81	27.68	12.07	NO
900.	83.29	6	1.0	1.0	10000.0	7.81	30.81	13.07	NO
1000.	72.15	6	1.0	1.0	10000.0	7.81	33.92	14.04	NO

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND   10. M:

256.	253.9	6	1.0	1.0	10000.0	7.81	9.86	5.21	NO

```
 DWASH=   MEANS NO CALC MADE (CONC = 0.0)
 DWASH=NO MEANS NO BUILDING DOWNWASH USED
 DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
 DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
 DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB
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************************************
*** SCREEN DISCRETE DISTANCES ***  500 CLASSIFIER (MAC EQUIPMENT BAGHOUSE)
************************************

*** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

  DIST      CONC              U10M    USTK  MIX HT    PLUME    SIGMA    SIGMA
   (M)    (UG/M**3)   STAB   (M/S)   (M/S)    (M)    HT (M)    Y (M)    Z (M)   DWASH
 -------  ----------  ----   -----   -----  ------   ------   ------   ------   -----
   450.    190.1        6     1.0     1.0 10000.0     7.81    16.38     7.88     NO

 DWASH=   MEANS NO CALC MADE (CONC = 0.0)
 DWASH=NO MEANS NO BUILDING DOWNWASH USED
 DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
 DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
 DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

     ***************************************
     *** SUMMARY OF SCREEN MODEL RESULTS ***
     ***************************************

 CALCULATION        MAX CONC    DIST TO   TERRAIN
  PROCEDURE        (UG/M**3)    MAX (M)    HT (M)
--------------    -----------   -------   -------
SIMPLE TERRAIN      253.9         256.        0.

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** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
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Appendix D

Lanthanum Oxide Toxicity and Modeling Review

P-060306

TRONOX, LLC P-060306
Applicability of IDAPA 58.01.01.161, 585/586 to Lanthanum Oxide Emissions

DEQ's Air Toxics Analyst, Michael DuBois, was asked to determine whether permit limits or other controls should be imposed on the Tronox, LLC Lithium Manganese Oxide/Lithium Cobalt Oxide (LMO/LCO) production facility to control new emissions of lanthanum oxide.

Insufficient information was located regarding specific human health or environmental concerns for lanthanum oxide, La_2O_3, or for other rare earth oxides. DEQ noted that more information was available for a similar compound, lanthanum carbonate, which was tested to support Food and Drug Administration (FDA) approval of this compound for medical use. DEQ's evaluation regarding the potential risks associated with lanthanum oxide emissions was therefore based on using lanthanum carbonate as a comparative surrogate.

For lanthanum carbonate, DEQ was able to obtain the maximum recommended human dose (MHRD) and convert it to an RfC (reference concentration). This required using the MHRD as a surrogate RfD (reference dose). Since the MHRD was based on oral exposure, it was treated as a surrogate oral RfD. DEQ also assumed that route-to-route extrapolation was valid, although it would be reasonable to expect that there would be differences in pharmacodynamics between the two exposure routes.

An inhalation reference dose was then estimated based on the following two assumptions:

1) That the MHRD equals the RfD, and
2) The Oral RfD equals the inhalation RfC).

In this case, the RfD is an ingestion quantity derived from animal studies. The RfD represents the no observed effects level (NOEL) and can be converted to a reference concentration (RfC) which is the preferred unit for inhalation assessment. The RfD is in mg/kg/day, the kg referring to kg of body weight (BW).

The RfD is then divided by (20 m^3/day * 1/70 kg), which represents the average volume of air a 70-kg person breathes in a 24 hour period.

$$RfC = RfDi \times 1/\text{inhalation rate} \times BW, \text{ or } 95.41 \text{ mg/kg-day} \times (\text{day}/20m^3) \times (70 \text{ kg}) = \mathbf{333.94\ mg/m3}$$

It is important to remember that the RfD value is actually the original dose divided by 100 to account for cross species uncertainty (100 being the "uncertainty factor"), and is therefore conservative. Incorporating this uncertainty factor of 100 provides an estimated RfC equal to **3.34 mg/m3**

This process is called a "route to route extrapolation," which is described in EPA Region 9's User's Guide for Preliminary Remediation Goals (PRG), page 7 "Inhalation Conversion Factors" http://www.epa.gov/region09/waste/sfund/prg/index.htm and is used extensively in Superfund assessments. Lanthanum carbonate hasn't been declared a carcinogen so a 24-hour averaging value is appropriate.

Comparison of Surrogate RfC with Estimated Fenceline Concentrations of Lanthanum Oxide: A conservative modeling estimate of the fenceline concentration of lanthanum oxide (i.e., the estimated maximum concentration at the nearest ambient air boundary) was developed by air quality permitting engineer Cheryl Robinson.

The maximum fenceline concentration of lanthanum oxide was estimated at about **0.012 mg/m^3**, which is more than 270 times less than the estimated reference concentration of **3.34 mg/m^3**. Based on this information, DEQ determined that permit limits or other controls on the lanthanum oxide emissions were not needed in this case to demonstrate compliance with IDAPA 58.01.01.161.

Lanthanum Oxide Toxicity and Fenceline Concentration Estimates

MEMORANDUM

Date:	April 3, 2006
To:	Michael DuBois, Air Toxics Analyst, Air Division
From:	Cheryl A.Robinson, P.E., Permit Writer, Air Division
Cc:	Dan Pitman, Permit Coordinator, Air Division
Subject:	Tronox, LLC, Soda Springs Estimated Lanthanum Oxide Emissions and Fenceline Concentrations

Given:

1) A lanthanum compound is added to the final calciner step at a maximum rate of 5 weight percent of the total product powder mix. The lanthanum compound (in the form of a powder) averages 25% moisture from hydrate. Maximum proposed throughput is 300 lbs/hr of product
2) Calciner emissions are captured and routed through a baghouse. Manufacturer's guarantee the MicroPul 25S-8-20 baghouse will meet a grain loading standard of 0.02 gr/dscf.
3) Lanthanum emissions are in the form of lanthanum oxide, La_2O_3. No lanthanum halides are formed (per e-mail from applicant on 3/2/2006). Controlled La_2O_3 emissions = 2.0E-03 lb/hr (provided by applicant in 3/22 fax)
4) Ambient air boundary is 1,350 feet (450 meters) away, per 3/2/2006 e-mail from applicant.
5) Modeling Parameters:

Stack Height	=	25 ft	Building Height	=	28 ft (18.6 ft to eave)
Stack Internal Diameter	=	0.75 ft	Building Width	=	50 ft
Exit Flow	=	811 acfm	Building Length	=	200 ft
Exit Temp	=	70°F			

Assumptions:

1) Worst-case (high estimate) : Total weight of lanthanum compound added is emitted as La_2O_3

Calculations:

(from 2/14/2000 Statement of Basis):

Calciner Uncontrolled PM:	664 dscf/min x 1 gr/dscf x 1 lb/7000 gr x 60 min/hr	= 5.7 lb/hr
Calciner Controlled PM:	664 dscf/min x 0.02 gr/dscf x 1 lb/7000 gr x 60 min/hr	= 0.114 lb/hr

(La_2O_3 emission estimate, 4/3/2006):

Lanthanum compound added at 5% of product mix = 0.05 x 300 lb/hr		= 15 lb/hr La Cmpd + H_2O
Lanthanum compound is 25% moisture from hydrate = 15 lb/hr x 75%		= 11.25 lb/hr La Cmpd
Fraction of PM emitted that is La_2O_3= (11.25 lb/hr)/(300+11.25)		= 0.032
Uncontrolled La_2O_3 Emission Rate	**= 0.032 x 5.7 lb/hr**	**= 0.182 lb/hr La_2O_3**
Controlled La_2O_3 Emission Rate	**= 0.032 x 0.114 lb/hr**	**= 3.65E-03 lb/hr La_2O_3**

Dispersion Modeling Results (See Table 1):

Predicted distances to maximum concentrations are less than the 450 m distance to ambient air.

Max. Uncontrolled Impact at Ambient Air Boundary (24-hr avg) = 12.0 $\mu g/m^3$ = 0.012 mg/m3

TABLE 1. SCREENING LEVEL DISPERSION MODELING - AMBIENT AIR IMPACTS

	Distance from Emission Source (Stack)	SCREEN3 Coefficient $\mu g/m^3$ per lb/hr	La_2O_3 Emission Rate (lb/hr)	Ambient Air Impact 1-hr Average ($\mu g/m^3$)	Persistence Factor (1-hr to 24-hr Avg)	Ambient Impact 24-hr Average ($\mu g/m^3$)
Uncontrolled Impact at Ambient Air Boundary						
Rural Terrain, No Downwash	450 m	90.14	0.182	16.4	0.4	6.56
Rural Terrain, With Downwash	450 m	164.4	0.182	29.9	0.4	12.0
Uncontrolled Impact at Distance to Maximum Concentration						
Rural Terrain, No Downwash	295 m	92.72	0.182	16.9	0.4	6.75
Rural Terrain, With Downwash	26 m	1327	0.182	242	0.4	96.6
Controlled Impact at Ambient Air Boundary						
Rural Terrain, No Downwash	450 m	90.14	3.65E-03	0.329	0.4	0.130
Rural Terrain, With Downwash	450 m	164.4	3.65E-03	0.600	0.4	0.240
Controlled Impact at Distance to Maximum Concentration						
Rural Terrain, No Downwash	295 m	92.72	3.65E-03	0.338	0.4	0.140
Rural Terrain, With Downwash	26 m	1327	3.65E-03	4.84	0.4	1.94

04/03/06
15:24:46

*** SCREEN3 MODEL RUN ***
*** VERSION DATED 95250 ***

TRONOX CALCINER STACK EMISSIONS OF LANTHANUM OXIDE - NO BUILDING DOWNWASH

```
SIMPLE TERRAIN INPUTS:
   SOURCE TYPE              =        POINT
   EMISSION RATE (G/S)      =      .126000
   STACK HEIGHT (M)         =       7.6200
   STK INSIDE DIAM (M)      =        .2286
   STK EXIT VELOCITY (M/S)=         9.3255
   STK GAS EXIT TEMP (K)    =     294.2611
   AMBIENT AIR TEMP (K)     =     293.0000
   RECEPTOR HEIGHT (M)      =       1.0000
   URBAN/RURAL OPTION       =        RURAL
   BUILDING HEIGHT (M)      =        .0000
   MIN HORIZ BLDG DIM (M) =          .0000
   MAX HORIZ BLDG DIM (M) =          .0000

   STACK EXIT VELOCITY WAS CALCULATED FROM
   VOLUME FLOW RATE =    811.00000      (ACFM)

BUOY. FLUX =      .005 M**4/S**3;   MOM. FLUX =     1.131 M**4/S**2.

*** FULL METEOROLOGY ***

**********************************
*** SCREEN AUTOMATED DISTANCES ***
**********************************

*** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***
```

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
10.	.1753E-02	1	3.0	3.0	960.0	9.75	3.41	1.69	NO
100.	82.86	3	1.5	1.5	480.0	11.88	12.52	7.54	NO
200.	81.12	4	1.0	1.0	320.0	14.02	15.67	8.69	NO
300.	92.69	5	1.0	1.0	10000.0	12.90	16.96	8.83	NO
400.	86.49	6	1.0	1.0	10000.0	12.43	14.70	7.18	NO
500.	90.62	6	1.0	1.0	10000.0	12.43	18.02	8.51	NO
600.	86.17	6	1.0	1.0	10000.0	12.43	21.28	9.78	NO
700.	78.70	6	1.0	1.0	10000.0	12.43	24.50	11.02	NO
800.	70.65	6	1.0	1.0	10000.0	12.43	27.67	12.05	NO
900.	63.34	6	1.0	1.0	10000.0	12.43	30.81	13.05	NO
1000.	56.90	6	1.0	1.0	10000.0	12.43	33.91	14.02	NO

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND   10. M:

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
295.	**92.72**	5	1.0	1.0	10000.0	12.90	16.76	8.73	NO

```
DWASH=   MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB
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**********************************
*** SCREEN DISCRETE DISTANCES ***
**********************************
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LANTHANUM OXIDE - NO DOWNWASH

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*** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***
```

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
450.	**90.14**	6	1.0	1.0	10000.0	12.43	16.37	7.85	NO

```
DWASH=   MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

***************************************
*** SUMMARY OF SCREEN MODEL RESULTS ***
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CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	92.72	295.	0.

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***************************************************
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
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04/03/06
15:29:23

*** SCREEN3 MODEL RUN ***
*** VERSION DATED 95250 ***

TRONOX CALCINER STACK EMISSIONS OF LANTHANUM OXIDE- WITH BUILDING DOWNWASH

SIMPLE TERRAIN INPUTS:

SOURCE TYPE	=	POINT
EMISSION RATE (G/S)	=	.126000
STACK HEIGHT (M)	=	7.6200
STK INSIDE DIAM (M)	=	.2286
STK EXIT VELOCITY (M/S)	=	9.3255
STK GAS EXIT TEMP (K)	=	294.2611
AMBIENT AIR TEMP (K)	=	293.0000
RECEPTOR HEIGHT (M)	=	1.0000
URBAN/RURAL OPTION	=	RURAL
BUILDING HEIGHT (M)	=	8.5344
MIN HORIZ BLDG DIM (M)	=	15.2400
MAX HORIZ BLDG DIM (M)	=	60.9600

STACK EXIT VELOCITY WAS CALCULATED FROM
VOLUME FLOW RATE = 811.00000 (ACFM)

BUOY. FLUX = .005 M**4/S**3; MOM. FLUX = 1.131 M**4/S**2.

*** FULL METEOROLOGY ***

****
*** SCREEN AUTOMATED DISTANCES ***
****

*** TERRAIN HEIGHT OF 0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
10.	.0000	0	.0	.0	.0	.00	.00	.00	NA
100.	684.1	6	1.0	1.0	10000.0	8.49	4.07	7.16	SS
200.	370.8	6	1.0	1.0	10000.0	8.49	7.73	8.50	SS
300.	250.1	6	1.0	1.0	10000.0	8.49	11.23	9.78	SS
400.	187.1	6	1.0	1.0	10000.0	8.49	14.64	10.64	SS
500.	146.2	6	1.0	1.0	10000.0	8.49	17.97	11.73	SS
600.	118.5	6	1.0	1.0	10000.0	8.49	21.24	12.75	SS
700.	98.52	6	1.0	1.0	10000.0	8.49	24.46	13.72	SS
800.	84.72	6	1.0	1.0	10000.0	8.49	27.63	14.36	SS
900.	73.19	6	1.0	1.0	10000.0	8.49	30.78	15.22	SS
1000.	64.05	6	1.0	1.0	10000.0	8.49	33.88	16.04	SS

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 10. M:

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
26.	**1327.**	6	1.5	1.5	10000.0	7.82	1.20	4.88	SS

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

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***********************************
*** SCREEN DISCRETE DISTANCES ***  LANTHANUM OXIDE EMISSIONS - WITH DOWNWASH
***********************************

*** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

   DIST     CONC               U10M    USTK   MIX HT    PLUME    SIGMA    SIGMA
    (M)   (UG/M**3)   STAB   (M/S)   (M/S)     (M)    HT (M)    Y (M)    Z (M)   DWASH
 -------  ----------  ----   -----   -----   ------   ------   ------   ------   -----
   450.    164.4        6     1.0      1.0  10000.0     8.49    16.31    11.21     SS

 DWASH=   MEANS NO CALC MADE (CONC = 0.0)
 DWASH=NO MEANS NO BUILDING DOWNWASH USED
 DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
 DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
 DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

 *** CAVITY CALCULATION - 1 ***        *** CAVITY CALCULATION - 2 ***
  CONC (UG/M**3)      =    111.6        CONC (UG/M**3)      =    191.3
  CRIT WS @10M (M/S) =      2.89        CRIT WS @10M (M/S) =      6.75
  CRIT WS @ HS (M/S) =      2.89        CRIT WS @ HS (M/S) =      6.75
  DILUTION WS (M/S)  =      1.45        DILUTION WS (M/S)  =      3.38
  CAVITY HT (M)      =      9.87        CAVITY HT (M)      =      8.53
  CAVITY LENGTH (M)  =     37.11        CAVITY LENGTH (M)  =     18.44
  ALONGWIND DIM (M)  =     15.24        ALONGWIND DIM (M)  =     60.96

     ***************************************
     *** SUMMARY OF SCREEN MODEL RESULTS ***
     ***************************************

 CALCULATION       MAX CONC    DIST TO   TERRAIN
  PROCEDURE       (UG/M**3)    MAX (M)    HT (M)
--------------   -----------   -------   -------
SIMPLE TERRAIN     1327.           26.        0.

BLDG. CAVITY-1     111.6           37.       --   (DIST = CAVITY LENGTH)
BLDG. CAVITY-2     191.3           18.       --   (DIST = CAVITY LENGTH)

***************************************************
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
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