DRAFT

Perimeter Air Monitoring Plan
for Phase B Soil Remediation of Remediation Zones RZ-B through RZ-E
Tronox LLC
Henderson, Nevada

March 30, 2010

Prepared For:

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2027.01

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1.0 INTRODUCTION

As part of the Removal Action Work Plan (RAW) for the Tronox Facility Site (Site), Northgate Environmental Management, Inc. (Northgate) has developed this *Perimeter Air Monitoring Plan* (PAMP) to be implemented during the soil remediation at the Site, located at 560 West Lake Mead Parkway in Henderson, Nevada. The overall Tronox Facility Site is approximately 450 acres. Of this area, approximately 170 acres contain impacted soil that is proposed for remediation. Soil remediation will consist of excavation, off-haul, and disposal at an approved landfill facility. Additional associated activities may include demolition of existing buildings and other Site features, excavation and removal of existing utility lines, installation of new utility lines, and capping of soils in institutional control areas. This PAMP has been developed to establish the procedures by which the project team will monitor the effectiveness of the engineering controls for mitigating off-Site airborne emissions of particulate matter and associated chemicals found in the soil at the Site. The PAMP will be submitted to the Nevada Division of Environmental Protection (NDEP) for their review and approval prior to being implemented.

The planned soil remediation activity includes the following tasks:

- Implementation of dust control measures, including pre-wetting before excavation;
- Excavation of near-surface soil and potential stockpiling within the remediation areas of the Site; and
- Loading of soil into trucks and transportation to the approved landfill for disposal.

The planned dust control procedures to be carried out before and during the remediation are described in the RAW Section 3.1.3 and in the *Dust Control and Mitigation Plan* attached as an Appendix A to the RAW.

It is anticipated that the dust mitigation activities will be performed for the duration of the remediation project, presently estimated to be roughly an 8-month period.

This PAMP has been developed to meet the requirements of interested governmental agencies such as the Clark County Department of Air Quality Management (CCDAQM) and NDEP. This PAMP establishes requirements for monitoring particulate emissions, as well as sampling for selected airborne constituents at the Site perimeter and for controlling and assessing potential exposures to on-Site Tronox employees located in operational areas and the general public. This PAMP consists of the following:

- Identification of constituents of concern (COCs);
- Air monitoring program;
- Action levels; and
- Reporting requirements.

Dust suppression controls shall be implemented during the project to comply with the *Clark County Air Quality Regulations* Sections 90-94 administered and enforced by the CCDAQM, and to impede the generation of airborne dust due to intrusive on-Site activities. These control measures are discussed in the RAW. The Northgate Project Manager will designate a Dust Control Monitor as required by Section 94. This individual shall have full authority to provide that dust suppression is implemented, including inspections, record keeping, deployment of resources, and shutdown of construction activities as needed. The Dust Control Monitor shall be present at all times that potential dust generating construction activities occur on the Site and shall devote the majority of his or her time specifically to managing dust prevention and control on the Site. This individual will have successfully completed the required CCDAQM classes necessary to maintain certification as a Dust Control Monitor.

2.0 IDENTIFICATION OF CONSTITUENTS OF CONCERN

The intent of the PAMP is to establish procedures for monitoring the effectiveness of dust control measures during remediation by mitigating the impact of potential airborne COCs to the on-Site Tronox employees and the general public located outside the boundaries of the Site. Exposure of on-Site remediation workers to COCs will be addressed in the Contractor's Site-specific Health and Safety Plan (HSP) contained in Appendix D to the RAW. The following constituents have been identified at the Site, and have been considered in the development of this PAMP:

- Airborne particulates;
- Asbestos;
- Metals (including arsenic, manganese and magnesium);
- Semi-volatile organic compounds (SVOCs, including hexachlorobenzene); and
- Dioxins and furans.

The COCs may occur as particulates (e.g., manganese tailings or asbestos fibers) or be adsorbed to soil grains. Dust suppression measures will be implemented to suppress particulate emissions during excavation, loading, and hauling activities, as described in the Dust Mitigation Plan (see Appendix A of the RAW). These measures involve a significant amount of particulate mitigation (such as watering and vacuuming of releases off of paved roadways, etc.) to be implemented in conjunction with the remediation activities. Volatile organic compound (VOC) emissions are not expected during remediation. Despite this, if volatile constituents are in fact present in the remediated soil, direct read-out monitoring will identify whether VOCs are released to the atmosphere during remediation activities.

It is anticipated that addenda to the RAW will be submitted to address specific COCs for each Remediation Zone (RZ).

3.0 AIR MONITORING PROGRAM

The air monitoring program will address the following elements:

- Air monitoring strategy;
- Monitoring locations;
- Monitoring and sampling methods;
- Monitoring schedule;
- Notification requirements; and
- Quality assurance and control measures.

3.1 Air Monitoring Strategy

Northgate's air monitoring strategy includes the following monitoring and sampling tasks:

- Air monitoring will be performed on a daily basis for dust (PM_{10});
- When working in areas containing asbestos, Northgate will sample for asbestos on Mondays, Wednesdays, and Fridays; and
- Samples will be collected for chemical testing the first five days of operations in a new Remediation Zone work area. Samples will be analyzed for the COCs including dioxin, hexachlorobenzene (HCB), and COC metals.

This PAMP addresses air monitoring at stations established at the Site perimeter, as well as locally at the limits of the active work area for each Remediation Zone. The methodology by which this air monitoring strategy will be implemented is summarized below:

- One "permanent" air monitoring station will be established along the perimeter of the Tronox Facility to measure upwind airborne emissions. Two alternative air monitoring stations will be established at downwind locations. In addition, one upwind and one downwind monitoring location will be established at the perimeter of the Remediation Zone working area for that day. When working upwind of an on-Site Tronox operational area, the downwind location will be located to measure air concentrations at the perimeter of the operational area;
- Periodic VOC monitoring will be performed with a direct read-out organic vapor analyzer (i.e., photo ionization detector) as part of the Health and Safety monitoring;
- Meteorological conditions, including wind direction and velocity, will be monitored during the work to assist in positioning the monitoring stations upwind and downwind of the Remediation Zone work areas, as noted above;

- Air monitoring for particulates will be performed by the Dust Control Monitor or Health and Safety Officer using a direct-reading instrument, such as a DataRAM dust monitor equipped with the necessary accessories (omnidirectional inlet and a temperature conditioning heater, if appropriate);
- Air sampling for COC metals will be performed using United States Environmental Protection Agency (USEPA) Compendium Method IO-2.1 and Method IO-3.3, if appropriate;
- Sampling for suspended particulate (TSP) will be performed using high volume samplers and polyurethane foam (PUF) samplers. The analytes chosen will depend on the chemicals known or suspected of being present in the subject Remediation Zone work area and the human inhalation toxicity of those chemicals;
- Sample testing for asbestos will be performed using Method 7400 and if needed NIOSH Method 7402;
- A laboratory certified by NDEP and National Environmental Laboratory Accreditation Conference (NELAC) and/or accredited by the American Industrial Hygiene Association (AIHA) will perform analysis of the samples, as appropriate; and
- Quality assurance and control measures will be implemented to provide proper calibration of instrumentation, confirm that appropriate sample collection and handling procedures are used, and assess if additional air monitoring and sampling at the Site perimeter stations are necessary.

3.2 Monitoring Locations

3.2.1 Air Monitoring Stations

This PAMP includes the establishment of one "permanent" air monitoring station at an upwind location. The location of this air monitoring station is presented in Figure 1 and is based on an assumed typical wind flow from the southwest, as noted in that figure in the Wind Rose Diagram. Two alternate downwind locations have been established for the Tronox Facility; only one of these is planned to be operational on a given day. The specific monitoring station location will be determined based on the wind conditions on a given day.

In addition, as noted in Section 3.1, two air monitoring stations (one upwind, one downwind) will be established at the current Remediation Zone work area for each day. The work area is defined as that area where soil is being disturbed through Site preparation, excavation, stockpiling, and/or loading. Specific monitoring station locations will be based on the prevailing wind direction and Site-specific meteorological conditions. If the Remediation Zone work area is upwind of on-Site Tronox operational area, the downwind location will be located to measure

the concentrations at the perimeter of the operational area. An example Remediation Zone Work Area and the anticipated local air monitoring stations associated with that work area (assuming typical wind flow from the southwest) are depicted in Figure 1.

The location of the stations will be chosen on the basis of where remediation activities are being performed on-Site relative to wind direction.

It is important to note that PM_{10} monitoring will be conducted daily and has been selected to provide a reasonable indication of particulate concentration being contributed to the ambient environment by intrusive activities in these areas. The measurement of these concentrations at the Remediation Zone Work Area perimeters will provide an indication of the effectiveness of the dust suppression measures being employed on-Site. Such monitoring is not intended to address VOCs, as these will be addressed by the employment of direct read-out organic vapor analyzers during Site operations (see below) as part of Health and Safety monitoring. Rather, the PM_{10} monitoring is intended to address the potential for exposure to chemicals and elements that are not volatile, but are associated with fugitive dust emissions from the Remediation Zone Work Area.

3.2.2 Site Specific Meteorological Conditions

The prevailing wind direction at the Site is from the southwest. However, daily local meteorological conditions (wind direction, wind speed) will be obtained from the Tronox wind station. The meteorological conditions will be collected continuously and recorded in real-time by computer throughout the workday, including the monitoring time. In addition, the locations of the monitoring stations will be established and precisely recorded by GPS prior to each day's excavation based on the scheduled work and associated wind direction.

3.3 Air Monitoring and Sampling Methods

Air monitoring and sampling will be performed during the soil remediation activities performed at the Site. These activities are expected to last up to 5 months. The sampling monitors or collection media will be placed at a height of approximately 5 feet above ground surface to represent the breathing zone. PM_{10} monitoring will be performed daily and air sampling three days a week (Monday, Wednesday, and Friday) during remediation activities (up to 24-hour duration) for specific constituents of interest for each Remediation Zone area (i.e., RZ-D dioxin, HCB). As such, the following monitoring and sampling will be performed during this work using the prescribed methods:

3.3.1 Real-Time Air Monitoring

Respirable fractions of dust will be monitored daily using real-time DataRAM monitors. These monitors have a detection limit of 0.1 micrograms of dust per cubic meter of air. However, to avoid erroneous results, the monitors will be equipped with an omni-directional inlet and a temperature conditioning heater unit, if appropriate.

Monitoring will be performed continuously at the upwind and downwind monitoring locations and the results will be logged approximately every 10 minutes. A record of the monitoring results will be maintained by Northgate for a period 5 years after completion of the remediation. This record shall include the collection time, monitoring location, and the associated results. Instrumentation calibration will be performed according to the manufacturer's specifications. The calibration requirements are discussed in Section 3.6.

As described above, the dust monitoring on-Site will provide an indication of the effectiveness of the dust suppression activities being employed on-Site. Downwind minus upwind dust levels in excess of the action levels will result in a modification of the dust suppression controls (i.e., in their enhancement until levels are lower than the action levels; See Section 4.0).

In addition, air monitoring for volatile compounds will be performed as part of the Health and Safety program. This monitoring will be performed using a direct read-out organic vapor analyzer (i.e., photo ionization detector). The real time air monitoring VOC measurements will be taken in the Site workers' typical breathing zones. Factors influencing the monitoring will be the location and type of excavation activity being performed, data regarding the presence, or suspected presence of VOCs, indicators of impact (including odors or soil staining) and weather. If VOCs are expected to be present in the Remediation Zone Work Area, monitoring will be performed at regular intervals during the work day and will be recorded on log forms for record retention. In the unlikely event that an area of elevated VOCs is encountered, personal protective equipment will be modified as appropriate in accordance with the project HSP, and work activities will be modified to reduce VOC emissions to the atmosphere.

3.3.2 Air Sampling

As noted above in Section 3.1, upwind and downwind air samples will be collected for analysis of particulate, asbestos fibers, and COCs attenuated to particulates. These sampling and analysis procedures are summarized in this section. For all sample types, consistent with the project Quality Assurance Project Plan (QAPP), field blanks on a frequency of 10 percent (one in 10 samples) will be collected and submitted for analysis for quality control purposes. The air samples will be submitted to a laboratory using proper chain-of-custody procedures. A

laboratory certified by NDEP and NELAC, or accredited by AIHA will perform analysis of the samples, as appropriate.

3.3.2.1 Airborne Particulate

Air samples for particulate will be collected each day for the first five days of a new Remediation Zone work area operation at the upwind and downwind monitoring stations. TSP samples will be collected using a BGI, Inc. Model PQ100 USEPA-approved (approval Number RFPS-1298-124) portable sampler with 47 millimeter Teflon filter media or equivalent instrument. Samples with be tested using USEPA Method IO-2.1 (gravimetric analysis). Upon completion of the sampling event, the samples and the associated information will be recorded on a chain-of-custody sheet (see example provided in Attachment A). This form will require a record of the sample identification number, pump number, sample location, sampling time, and flow rate to calculate the total sample volume and the required analysis.

3.3.2.2 Asbestos

Air samples for asbestos fibers will be collected three days per week (Mondays, Wednesdays and Fridays) at each of the upwind and downwind monitoring stations. Upon completion of the sampling, the samples and the completed chain-of-custody sheet shall be submitted to a laboratory for analysis. These samples will be analyzed by NIOSH Method 7400 and if needed Method 7402. Per NIOSH Method 7400, the sampling train shall consist of a low-flow pump attached to a 25-millimeter diameter filter, which has a mixed cellulose ester membrane. The air samples will be collected at a flow rate of 5 liters per minute (LPM) using a low flow pump. The sampling will be performed for a minimum of eight hours.

3.3.2.3 Other COCs

At the start of remediation at a Remediation Zone work area, Northgate will modify the sampling approach for the first five days of excavation of soils/sediments to accommodate additional sampling of total suspended particulate (TSP) for subsequent chemical analyses at both the upwind and downwind sampling locations. In addition to the TSP samplers, one polyurethane foam (PUF) samplers will be employed at each monitoring location for sampling and subsequent analysis of:

- Dioxins/furans, and
- SVOCs (hexachlorobenzene).

The PUF sampler operates at a flow rate of approximately 20 CFM and incorporates a 4-inch diameter quartz glass filter followed by a polyurethane foam plug contained in a glass cartridge.

One set of PUF samples (filter plus PUF plug) from each location will be analyzed for dioxins/furans and hexachlorobenzene using gas in accordance with EPA Methods TO-9A and TO-4A.

A summary of the air sampling methods and frequency is presented in Table 1.

3.4 Air Monitoring and Sampling Schedule

3.4.1 Monitoring Schedule

At each of the monitoring locations, monitoring for PM_{10} will be performed on a daily basis. Air sampling for asbestos will be performed on Mondays, Wednesdays, and Fridays. Samples will be analyzed for asbestos fibers on a turnaround time of roughly five business days. As noted above, chemical analyses will be performed on TSP samples collected during the first five days of active disturbance of surficial materials in a given Remediation Zone work area. Turnaround time for the chemical analyses will be approximately five business days for all analyses. If the sampling results indicate that particulate matter produced during excavation activities contains downwind minus upwind levels of chemicals at concentrations below those that could pose an unacceptable threat to human health, there will be no further need for additional chemical analyses of TSP samples for that Remediation Zone work area. Maintenance of downwind minus upwind PM_{10} levels at or below those measured daily during the five day period will be considered sufficiently protective of human health. If downwind minus upwind PM_{10} levels increase appreciably relative to levels measured during those first five days, additional chemical analyses will be considered by the Certified Industrial Hygienist, if the initial results indicate an unacceptable risk to human health could be posed by such an increase.

3.4.2 Control Measures Governing Sampling Frequency

If at any time during the monitoring and sampling activities the downwind minus upwind airborne concentrations exceed the action levels as prescribed in Section 4.0 of the PAMP, the Northgate Project Manager or his designee will immediately stop work and modify dust control measures. Furthermore, work will be halted at the Site if wind speed exceeds 20 miles-per-hour based on a 10-minute average, as measured by the Site's meteorological station. Work will only resume once the wind speeds are below 20 miles-per-hour. Dust control measures to be implemented during the soil remediation activities shall comply with applicable air quality regulations as administered and enforced by the CCDAQM, specifically Sections 90-94. Measures to be implemented to control dust emissions are described in the Dust Mitigation Plan (Appendix A to the RAW).

A summary of the air sampling frequency is presented in Table 1.

3.5 Notification Requirements

Downwind minus upwind air monitoring results detected above the action levels will prompt notification of the Northgate Project Manager or their designee. This notification will be performed within four hours of the assessment, and it will include a summary of any revisions to the control measures that were implemented in response to the exceedance and air monitoring/sampling completed to confirm that these revised control measures were effective in reducing emissions to below the action levels. If downwind minus upwind air sampling results for COCs exceed project screening levels, the Northgate Project Manager, the Project Certified Industrial Hygienist (CIH) and NDEP will be notified within 24 hours. Northgate will propose additional measures to reduce off-Site emissions to acceptable levels.

3.6 Quality Assurance and Control Measures

Quality control and assurance measures will be implemented to ensure proper calibration of instrumentation, confirm that appropriate sample collection and handling procedures are used, and assess if additional air monitoring and sampling in the Remediation Zone work area or at the Site perimeter is necessary.

All real-time instrumentation will be calibrated according to the manufacturer's specifications prior to and after use each day. A record of this calibration will be logged on an appropriate form and this information will include: equipment manufacturer and model, serial number, factory calibration date and time, methodology, and results of the daily field calibration.

Air sampling will be performed using approved National Institute for Occupational Safety and Health (NIOSH) and/or USEPA methods as discussed previously. Prior to sampling, the asbestos air sampling pumps will be properly calibrated to collect an adequate volume of air. As a consequence, a record of the calibration will be maintained and the information will include: equipment manufacturer, pump or canister identification number, calibrator type, time of calibration, and pre- and post-calibration results to verify the flow rate was maintained. The PM_{10}/TSP/PUF samplers will be calibrated using National Institute of Standards and Technology (NIST) -certified calibration orifices prior to initiation of the program and at least quarterly thereafter. Prior to sampling each day, the sampling flow rate will be verified to be operating at the proper set-point and the flow rate indicator reading will be recorded at the beginning and end of each day's sampling.

The air samples will be submitted to the appropriate laboratory using proper chain-of-custody procedures. A laboratory certified by NDEP and NELAC or accredited by AIHA will perform chemical analyses of the samples. As noted above, consistent with the project QAPP field

blanks will be collected and analyzed for quality control purposes on a frequency of 10 percent (one in 10 samples).

4.0 ACTION LEVELS

Specific limits have been established to monitor potential impacts to general public during soil excavation activities. Upwind levels will be subtracted from downwind levels to compare measured direct-read monitoring and continuous air sampling data to the perimeter screening criteria presented below for airborne particulate and asbestos. Additional dust and/or emission control measures will be necessary if the downwind minus upwind perimeter monitoring results exceed the perimeter action levels. The action level for inhalable particulate (PM_{10}) is 100 micrograms per cubic meter of air ($\mu g/m^3$) based on the difference between the highest downwind sampler result and the upwind sampler result. This value represents the recommended maximum impact attributable to Site activities in the working area. Table 1 presents a summary of the action levels.

4.1 Application of Action Levels

Based on the action levels developed for the scope of work, the Northgate Project Manager will use these levels to implement measures to reduce airborne emissions to below these levels or if necessary to cease work activities. Appropriate air sampling and monitoring will be performed to verify that such measures have effectively reduced potential off-Site emissions to acceptable limits. If work is stopped due to action level exceedances, work will only resume once the emissions meet the required action levels.

4.2 Reporting

A daily log or set of logs of the monitoring results will be maintained (see examples provided in Appendix A). The logs shall include a map of the monitoring locations, calibration information as specified, a copy of the sampling collection record (chain-of-custody sheet), and the monitoring results. As described in the main body of the RAW (Section 4.0), Northgate will submit daily and monthly reports to NDEP regarding remediation progress. These reports will include information regarding any circumstances associated with perimeter air monitoring that required the implementation of additional control measures and/or termination of work. At the conclusion of the soil remediation activities, a report of the air monitoring program will be prepared. This report shall provide a compilation of all of the monitoring and sampling data, comparison of the data to the action levels, circumstances requiring the implementation of control measures and/or termination of work, and any observed discrepancies between the field and laboratory documentation. This report will be submitted as an appendix to the Removal Action Completion Report (see Section 4.2 of the RAW).

FIGURES

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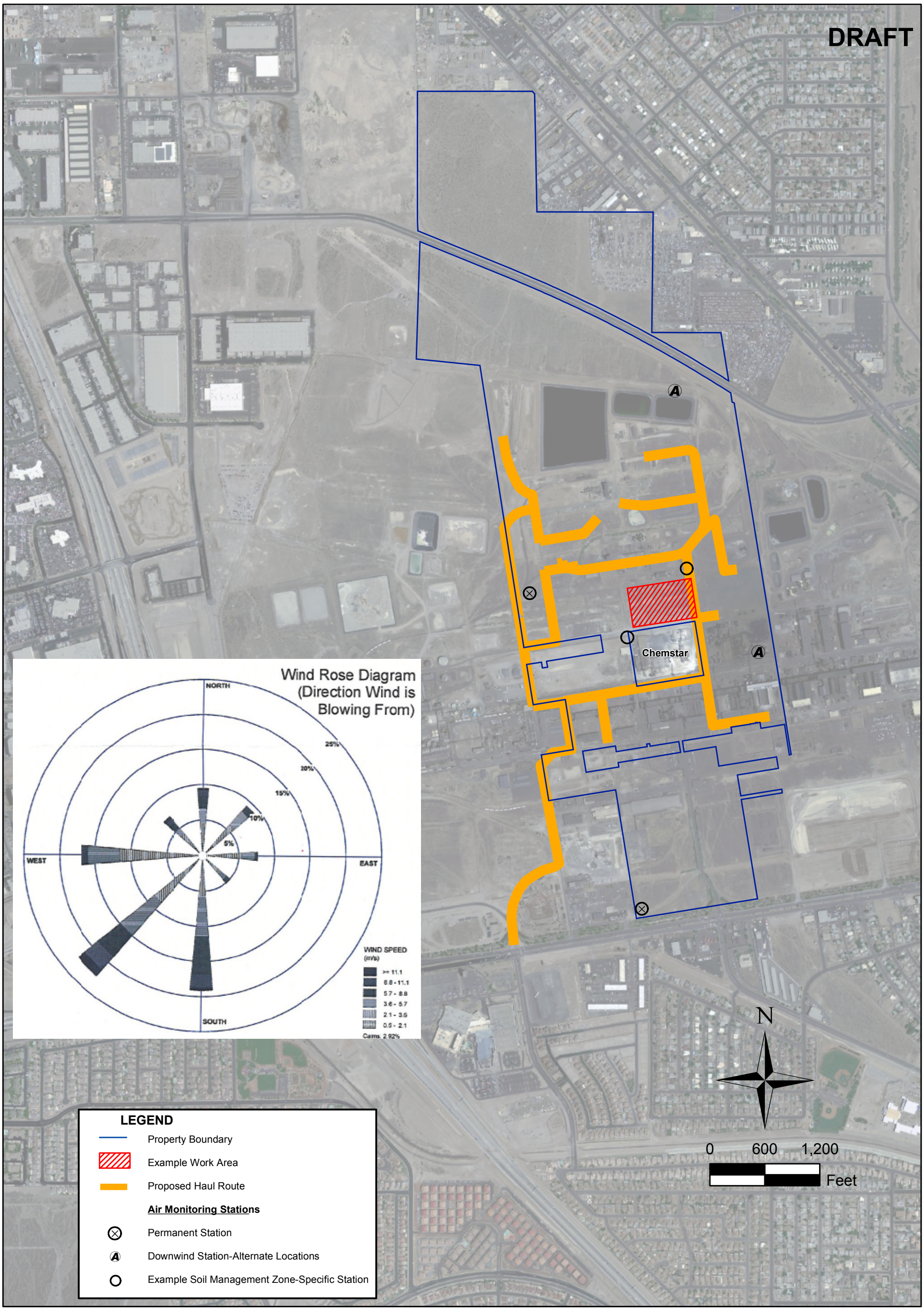

SHEET NUMBER:	FIGURE NUMBER:
1	1

PRELIMINARY AIR MONITORING LOCATIONS AND EXAMPLE WORKING AREA MONITORING

Tronox LLC
Henderson, Nevada

SCALE:	DATE:	PROJECT NUMBER:
1 in = 1,000 ft	03/29/10	2027

DESIGNED BY:	REVISIONS			
E. Krish	NO.:	DESCRIPTION:	DATE:	BY:
DRAWN BY:				
NGEM				
CHECKED BY:				
NGEM				
APPROVED BY:				
NGEM				

northgate environmental management, inc.

TRONOX

http://www.ngem.com

TABLES

TABLE 1
Summary of Perimeter Air Monitoring Constituents and Screening Criteria

Chemical	Analytical Method	Sampling Frequency	Occupational Exposure Level [a]	Residential ambient air screening levels [b]	Site Advisory Level	Site Action Level
PM10	NA	Daily – 24 hours	na	na	50 ug/m3 (24-hr average)	100 ug/m3 (24-hr average)
Asbestos	NIOSH 7400/7402	Monday, Wednesday , Friday	0.1 f/cc	na	na	Na
Manganese	IO.2.1	First five days of operations in new remediation Zone work area	5000 ug/m^3 (ceiling)	0.052 ug/m^3	na	na
hexachlorobenzene	TO-4A	First five days of operations in new remediation Zone work area	2 ug/m^3 [b]	0.0053 ug/m^3	na	na
Dioxin	TO-9A	First five days of operations in new remediation Zone work area	na	6.4 x 10-8 ug/m^3	na	na
Arsenic	IO-2.1	First five days of operations in new remediation Zone work area	10 ug/m^3	0.00057 ug/m3	na	na

Notes:
[a] — OSHA 8-hour PEL or American Conference of Governmental Industrial Hygienists 8-hour Threshold Limit Values
[b] -- NDEP Ambient Air Comparison Levels or EPA Regional Screening Levels (RSLs) for residential air PPRE
ug/m^3 —micrograms per cubic meter
Note: All values noted above will be compared to downwind minus upwind sample concentrations.

APPENDIX A
EXAMPLE FORMS

Air Monitoring Calibration Log

Sheet: _____of_____

Project Name: _____

Project Number: _____

Building or Site: _____

Manufacturer & Model	Serial Number	Factory Calibration Date and Time	Calibrator Type and Time		Pre Calibration Results	Post Calibration Results	Sampler Flow Rate	Comments

northgate environmental management, inc.

AIR MONITORING LOG

Project name _____

Project No. _____

Sampled by _____

PPE Used _____

Date _____

Page _____ of _____

Time	Location	MiniRam mg/m3	OVM-PID ppm	NH3 meter	HCN meter	H2S meter	GasTech	Wind Direction	Activities, Remarks