Air Monitoring Safety Program

New Hampshire Department of Environmental Services
Air Monitoring Program

November 6, 2008

Air Monitoring Program
Safety Training Program Outline

Initial Safety Training – for all new employees

- **Field Training** - accompanied by Seasoned Employee w/Safety Checklist
- **Air Monitoring Safety Presentation** - Power Point

Refresher Safety Training (once a year – everyone)

Safety Meetings (at least Monthly)

- Provide forum for discussions of safety concerns
- Disseminate new safety information

General Safety Classes (outside of AMP)

- Fire safety
- Hazardous Material handling
- Defensive Driving
- Other

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Gasses

- Characteristics
- Exposure limits
- Target organs/symptoms
- First aid
- Information comes from the NIOSH Pocket Guide to Chemical Hazards (available electronically at http://www.cdc.gov/niosh/npg/default.html)

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Exposure Limit Definitions

- REL = Recommended Exposure Limit
- PEL = Permissible Exposure Limit
- STEL = Short Term Exposure Limit (15 minutes)
- Ceiling = should not be exceeded at any time during the workday
- IDLH = Immediately Dangerous to Life or Health
- NAAQS = National Ambient Air Quality Standard

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Ozone (O3)

- Colorless to blue gas with a very pungent odor
- NIOSH REL/OSHA PEL = 0.1 ppm (0.2 mg/m^3)
- IDLH = 5 ppm
- NAAQS = 0.075 ppm (8-hour)
- Target organs: eyes, respiratory system
- Symptoms: irritates eyes & mucus membranes, pulmonary edema (swelling/fluid in the lungs), respiratory disease

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Ozone (Continued)

- Target organs: eyes, respiratory system

- Symptoms: irritates eyes & mucus membranes, pulmonary edema (swelling/fluid in the lungs), respiratory disease

- First aid: Fresh air, 100% O_2 – move exposed person to fresh air at once, trained personnel may administer oxygen if breathing is difficult, get medical attention as soon as possible

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Ozone Equipment and Levels in AMP

- Thermo NO2 Analyzer (42 series)
  - Produces ozone in large quantities as part of process
  - Up to 10,000 ppm in exhaust (IDLH = 5 ppm)
  - Must be exhausted at all times
  - Always Check Connections
  - Keep ozonator off while warming up after new installations
  - Most have destroyers, but don't count on them

- Ozone Calibration Systems
  - Any station that measures ozone – Lab during Certification
  - Thermo 49 series and API 400 analyzers
  - Internal Ozone systems
  - Must be exhausted at all times
  - Auto checks in early AM
  - Up to 0.5 ppm (IDLH = 5 ppm)

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Carbon Monoxide (CO)

- Colorless, odorless gas
- NIOSH REL = 35 ppm (40 mg/m^3)
- NIOSH Ceiling = 200 ppm (229 mg/m^3)
- OSHA PEL = 50 ppm (55 mg/m^3)
- IDLH = 1,200 ppm
- NAAQS = 35 ppm (1-hour), 9 ppm (8-hour)

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Carbon Monoxide (Continued)

•Target organs: cardiovascular system, lungs, blood, central nervous system

•Symptoms: headache, tachypnea (rapid breathing), nausea, weakness, dizziness, confusion, cyanosis (blue discoloration of the skin)

•First aid: Respiratory support – move the exposed person to fresh air at once, get medical attention as soon as possible

Carbon Monoxide Equipment and Levels in AMP

- Thermo CO Analyzer (48 series)
  - CO supplied by cylinder during auto checks/calibrations and audits
  - Certifications in Laboratory
  - Up to 40 ppm in exhaust during checks (IDLH = 1200 ppm)
  - Must be exhausted at all times
  - Always check connections

- CO Cylinders
  - Concentration of 2400 ppm of CO (IDLH = 1200 ppm)
  - CO detector everywhere there is a CO cylinder
  - Cylinder safety a must (later)

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Nitrogen Dioxide (NO_2)

- Reddish-brown gas (above 70°F) with a pungent, acr id odor
- NIOSH STEL = 1 ppm (1.8 mg/m^3)
- OSHA ceiling = 5 ppm (9 mg/m^3)
- IDLH = 20 ppm
- NAAQS = 0.053 ppm (annual)

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Nitrogen Dioxide (Continued)

•Target organs: eyes, respiratory system, cardiovascular system

•Symptoms: Irritates eyes, nose, throat; cough, decreased pulmonary function, chronic bronchitis, dyspnea (breathing difficulty), chest pain, pulmonary edema, cyanosis, tachypnea, tachycardia (rapid heartbeat)

•First aid: Eyes – immediately wash with large amounts of water, get medical attention immediately; inhalation – respiratory support (move person to fresh air, get medical attention as soon as possible)

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Nitrogen Dioxide Equipment and Levels in AMP

- Thermo NO_2 Analyzer (42 series)
  - NO_2 supplied by cylinder during auto checks/calibrations and audits
  - Certifications in Laboratory
  - Up to 0.5 ppm in exhaust during checks (IDLH = 20 ppm)
  - Must be exhausted at all times (due to O_3)
  - Always check connections

- NO and Nox in Cylinders (make NO_2 through titration)
  - Cylinder safety a must (later)
  - Auto checks in early AM

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Nitric Oxide (NO)

- Colorless gas
- NIOSH STEL = 25 ppm (30 mg/m^3)
- OSHA ceiling = 25 ppm (30 mg/m^3)
- IDLH = 100 ppm
- NAAQS = NA

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Nitric Oxide (Continued)

- Target organs: Eyes, skin, respiratory system, blood, central nervous system

- Symptoms: Irritation eyes, wet skin, nose, throat; drowsiness, unconsciousness; methemoglobinemia

- First aid: Breathing: Respiratory support

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Nitric Oxide Equipment and Levels in AMP

- Thermo NO2 Analyzer (42 series)
  - NO supplied by cylinder during auto checks/calibrations and audits
  - Certifications in Laboratory
  - Must be exhausted at all times
  - Always check connections

- NO and Nox in Cylinders
  - **Concentration of 26 ppm of NO (IDLH = 100 ppm)**
  - Cylinder safety a must
  - Auto checks in early AM

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Sulfur Dioxide (SO_2)

- Colorless gas with a characteristic, irritating, pungent odor
- NIOSH REL = 2 ppm (5 mg/m3)
- NIOSH STEL = 5 ppm (13 mg/m^3)
- OSHA PEL = 5 ppm (13 mg/m^3)
- IDLH = 100 ppm
- NAAQS = 0.5 ppm (3-hour), 0.14 ppm (24-hour), 0.03 ppm (annual)

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Sulfur Dioxide (Continued)

- Target organs: Eyes, skin, respiratory system

- Symptoms: Irritates eyes, nose, throat; choking, cough, reflex bronchoconstriction, frostbite (when in liquid form)

- First aid: Respiratory support – move the exposed person to fresh air at once, get medical attention as soon as possible

Sulfur Dioxide Equipment and Levels in AMP

- Thermo SO2 Analyzer (43 series)
  - SO2 supplied by cylinder during auto checks/calibrations and audits
  - Certifications in Laboratory
  - Up to 0.5 ppm in exhaust during checks (IDLH = 100 ppm)
  - Must be exhausted at all times
  - Always check connections

- SO2 in Cylinders
  - 25 ppm
  - Cylinder safety a must (later)
  - Auto checks in early AM

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Compressed Gas Cylinders

- Potential hazards:
  - ✓Contents
  - ✓Accidental high-pressure release
  - ✓Electrical
- Safety precaution categories
  - ✓Receiving
  - ✓Storage
  - ✓Handling and operating

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Safety Precautions for Receiving Cylinders

✓The contents of any compressed gas cylinder must be clearly identified

✓Cylinders with missing or illegible labels should not be used and returned to the vendor

✓Never rely on the color of the cylinder for identification

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Safety Precautions for Storing Cylinders

✓Cylinders must be secured at all times to prevent tipping (they can be attached to a bench top, attached individually to a wall, placed in a holding cage, or have a no-tip base attached)

✓Cylinders should be stored with the valve accessible at all times

✓The cover cap should remain in place until the cylinder is ready for use

✓Do not place cylinders where they could become part of an electrical circuit

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Safety Precautions for Handling and Operating Cylinders

✓Cylinders should not be dragged, rolled, or picked up by the cover cap

✓Only open the cylinder valve with the tools supplied by the vendor; do not use a hammer or wrench to open a hand-wheel valve; if the valve is frozen and can't be operated by hand, return the cylinder to the vendor

✓If a special tool is required to open a valve, it should be left on the valve stem so that the valve can be closed in an emergency

✓The main cylinder valve should be closed as soon as it is no longer necessary that it be open

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Compressed Gas Cylinder Safety References

- http://www.pp.okstate.edu/ehs/modules/cylinder/index.htm
- http://www.uwm.edu/Dept/EHSRM/LAB/labgascyl.html
- http://www.ehs.uiuc.edu/css/factsheets/compgas.aspx

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Ladder Safety

- Potential hazards:
  - ✓Falling
  - ✓Minor injuries (splinters, etc.)
  - ✓Injury to others (from unattended ladders)
  - ✓Electrical
- Safety precaution categories
  - ✓Maintenance
  - ✓Carrying ladders
  - ✓Using ladders

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Ladder Maintenance

✓Wooden ladders should be protected with a clear varnish or wood preservative

✓Wooden ladders should not be painted because this could hide defects

✓Wooden ladders should be checked carefully for cracks, splinters, and hardware in poor condition

✓Metal ladders should be inspected for burrs or sharp edges

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Carrying Ladders

- ✓Ladders should be carried parallel to the ground
- ✓Ladders should be held by the side rail and carried from the middle to balance the load
- ✓Stepladders should always be carried in the closed position
- ✓Get help with carrying long ladders

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Using Ladders

✓Use the 1:4 ratio – the base of the ladder should be placed one foot from the wall for every four feet that the ladder rises (e.g. if a ladder rises 16 feet, place the base four feet from the wall)

✓Provide solid footing on soft ground to prevent sinking

✓For a particularly high ladder, it should be lashed or otherwise secured to prevent slipping

✓Do not place one foot on the ladder and one foot on an adjacent object

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Using Ladders (Continued)

- ✓Always face the ladder when climbing or descending
- ✓Be sure that stepladders are fully open and the divider secure before using
- ✓Never use a metal ladder near power lines
- ✓If material must be handled, raise and lower it with a rope
- ✓When climbing from a ladder to a roof, the ladder should extend three feet above the roof
- ✓Once a ladder is placed, never leave it unattended – someone could climb it, especially a child

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Ladder Safety References

- http://www.cdc.gov/nasd/docs/d000801-d000900/d000826/d000826.html
- http://orthoinfo.aaos.org/topic.cfm?topic=A00235&return_link=0

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Electrical Safety

- Types of injuries
- Potential hazards
- Safety precautions
- Responding to an electrical emergency

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Electrical Injuries

- Three types of electrical injuries:
  - ✓Burns
  - ✓Physical injuries (muscle damage, falls from reacting to a shock)
  - ✓Nervous system effects (stoppage of breathing, heart fibrillation)

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Potential Electrical Hazards

•Defective insulation – when insulation in an electric tool or appliance is damaged, exposed metal parts can become energized

•Similarly, metal parts of electric tools or appliances can become energized if not grounded properly

•Wet conditions – standing water, wet clothes, high humidity, and perspiration can increase the danger of electric shock

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Electrical Safety Precautions

- Ground Fault Circuit Interruptors (GFCIs)
  - ✓GFCIs detect leakage currents, which is different from circuit breakers, which detect overloads
  - ✓GFCIs should be tested monthly with the test button
- Electrical Cords
  - ✓Use only 3-pronged extension cords
  - ✓Extension cords should be inspected regularly – don't repair them, buy new ones
  - ✓When stored, cords should be coiled or hung to prevent tight kinks that could damage insulation

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Electrical Safety Precautions (Continued)

- Outlets
  - ✓Do not overload outlets
- Analyzers and equipment
  - ✓Be familiar with and follow the electrical safety warnings in the equipment user's manuals

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Responding to an Electrical Emergency

•Do not touch the person or use a conductive tool to try and move them – they could still be energized

•If possible, shut off the power with the fuse, circuit breaker, or by pulling the plug

•Call 911

•Only use a Class C or multi-purpose (ABC) fire extinguisher on an electrical fire.

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Electrical Safety References

- http://www.cdc.gov/niosh/02-123pd.html
- http://www.pp.okstate.edu/ehs/MODULES/electric/index.htm

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Slips, Trips, & Falls

- Consequences
- Causes of slips, trips, & falls
- Prevention

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Consequences of Slips, Trips, & Falls

- They can have serious consequences such head injuries, back injuries, broken bones, sprains, and muscle strains

- Trying to catch your balance can cause strains or back injuries, even if you don't fall

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Some Causes of Slips, Trips, & Falls

- Obstacles
- Uneven surfaces
- Slippery surfaces
- Poor lighting
- Carrying objects

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Some Ways to Prevent Slips, Trips, & Falls

- Housekeeping – remove clutter and obstacles
- Place absorbent mats at entranceways to prevent slippery surfaces (but make sure they're secure – unanchored mats can cause a tripping hazard in themselves)
- Keep light switches accessible, preferably near entranceways; keep a flashlight in a central location in case of power outage
- When carrying an object, make sure it doesn't obstruct you view; make sure you have a clear path before proceeding

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Reference for Slips, Trips, & Falls

- http://www.uwsp.edu/ehs/Slips,%20Trips%20&%20Falls.htm

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Lifting and Back Safety

- Injury prevention and proper techniques

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Injury Prevention and Proper Lifting Techniques

•Your waist acts as a fulcrum, but because it's not centered, there's a 10:1 operating ratio (i.e. lifting a 10-pound object can put 100 pounds of pressure on your back)

•Avoid bending and lifting whenever possible:

✓Place objects on shelves and tables, not on the floor

✓Use carts, hand trucks, and dollies

✓Avoid lifting over your head, across a table, or out the back of a truck

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Injury Prevention and Proper Lifting Techniques (Continued)

- Determine if you need help, considering the object's weight and the distance to be traveled
- Check the path to be traveled for tripping hazards, slippery surfaces, blind spots, etc.
- Inspect the object to be carried for sharp edges, splinters, etc.
- Use a full grip, not just your fingers
- Keep back straight and lift with the legs
- When lifting a heavy object as a team, designate one person to give commands

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Lifting and Back Safety References

- http://www.pp.okstate.edu/ehs/manuals/ppsafety/Back.htm
- http://www.pp.okstate.edu/ehs/manuals/ppsafety/Lifting.htm

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Vehicle Safety

- Defensive driving
- Preventive Checks
- Distracted driving
- Slippery conditions
- Safety supplies
- Cylinder Transport
- Trucks, trailers, 4WD
- Mule 3010 4 x 4

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Defensive Driving

•Make safe and legal driving decisions

•Create a safe, stress-free personal space in and around your vehicle

•Drive to your destination safely, without an accident or ticket, and without affecting other driver's safety

•Practice common sense, courtesy, and cooperation

Preventive Maintenance

Tire Pressure and wear, Oil, Brake Fluid, Antifreeze

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Courtesy and Dealing with Aggressive Drivers

•Cooperative behavior will breed more cooperative behavior; aggressive behavior will only breed more aggressive behavior

•Be courteous: helping someone will give you a good feeling, as opposed to trying to compete with someone and losing

•Do not allow yourself to get upset: stay in control of the situation, rather than be victimized by it

•Focus on doing what you need to do, not on the uncooperative behavior of another driver

•You win by reaching your destination safely, not by competing with another driver

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Distracted Driving

- When driving, focus on driving – the work can wait until you get there

- Don't try to multi-task in the car – see above: focus on work when you arrive at the site

- Pull over to a safe place to make or take a call – an intense or detailed call will distract you from the task at hand, which is driving

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Slippery Conditions and Skid Control

- Know your vehicle: whether a vehicle has anti-lock brakes or not makes a difference in controlling a skid

- Vehicles without anti-lock brakes:

  - ✓Ease off the gas pedal
  - ✓Do not touch the brakes
  - ✓Steer in the direction that you want the front of the vehicle to go (i.e. in the opposite direction of the skid)

- Vehicles with anti-lock brakes

  - ✓Apply the brakes firmly
  - ✓You shouldn't lose steering control unless you take your foot off the brakes

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Vehicle Safety Supplies

- Make sure you vehicle has the proper safety supplies:
  - ✓Jack and wheel wrench
  - ✓Properly inflated spare tire
  - ✓Ice scraper and brush
  - ✓Flashlight

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Cylinder Transport

-Transport tank in an upright and secure position.
  -Never allow tank to be bounced around.
  -Secure to vehicle frame
  -Geographical center of vehicle for cars (in the bed for trucks)

- Keep Windows at least 1 inch open (cars)

- The maximum number of tanks that should be transported is 2

- Place warning label on vehicle

- Remove the tank from the vehicle as soon as possible after transporting

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Trucks, Trailers, and 4WD Vehicles

- Do not overestimate what a truck/4WD can do – you still need to drive slowly and cautiously in poor conditions

- In open-backed trucks and trailers, make sure all cargo is secure

- Inspect trailer hitch components:

  - ✓The pin securing the ball mount to the receiver
  - ✓The hitch coupler
  - ✓Safety chains
  - ✓Electrical plug

- Use a helper when backing a trailer

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General Safety Precautions for the Kawasaki Mule 4 x 4

- Wear seat belt and use ear protection
- Refuel in a well-ventilated area with the engine off (unleaded regular only)
- Not for use on roads
- The cargo bed is not for passengers
- Maximum cargo load is 800 lbs

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General Safety Precautions for the Kawasaki Mule 4 x 4 (Continued)

- Three "musts" when starting:
  - ✓Must be in neutral
  - ✓Parking brake must be on
  - ✓Must check gas pedal for proper operation
- Must be loaded onto the trailer backwards and secured
- Read the owner's manual and follow the procedures outlined in the Mule operation checklist (H:\Air Monitoring\Training\2008-03-28_Mule_Checklist.doc)

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Vehicle Safety References

- National Safety Council's Defensive Driving Course 4, Course Guide 5th Edition, 2007

- http://www.safety-council.org/info/traffic/winter-car.html

- http://www.dmv.ca.gov/pubs/dl648/dl648pt12.htm

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General Field Safety

- Call Supervisor when leaving Stations
- Team up when possible
- If you think it is unsafe – Don't do it

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THE END