

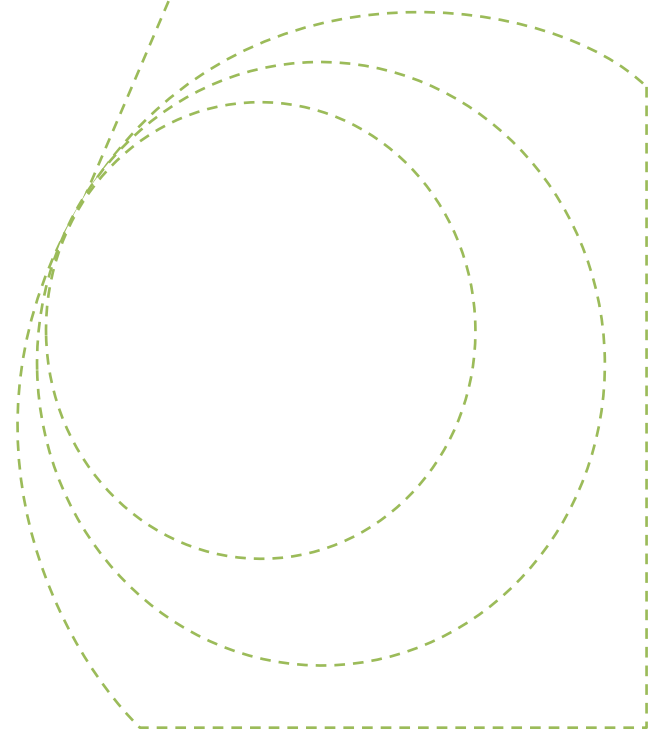


# 10 Years Worth of Data

Saint Regis Mohawk Tribe Air Quality Program

The Air Quality Program of the SRMT has been monitoring for a variety of pollutants over the past 10 years. This report summarizes the results.

**Angela Benedict**  
**08/18/2011**



### *The Beginning*

The SRMT Air Quality Program began in 1990. The SRMT Air Quality Program provides research, analysis and educational outreach to the Mohawk community. The program has operated under CAA Section 105, Section 103 and private funding. Currently in 2011 the air program is operating under just the CAA section 105 grant which is part of a five year Partnership Performance Grant (PPG). At times, the Air Quality Program also cooperates with public and private institutions to finance research activities. When appropriate, the Air Quality Program is supplemented by the SRMT Environment Division, which is currently staffed with over 30 employees.

The St. Regis Mohawk Reservation, Akwesasne, is located in northern New York, 10 miles east of Massena, NY. It is situated in the north, western most corner of Franklin County, bordered by St. Lawrence County. It is also divided by the international boundary of the United States and Canada. Approximately 6,000 Mohawks reside on the US portion of the Reserve with a total population nearing 10,000 overall.

The Akwesasne (US portion) consists of approximately 14,600 acres, primarily unused agricultural land and wetlands. There has been a decline in agricultural activities over the years due to the negative influence of industrial emissions and pollution. The rivers had also previously provided a means of income through guide fishing, and fish marketing. Since then, industrial pollution has been responsible for the contamination of the fish, to the point that government warnings have been limiting the consumption of fish.

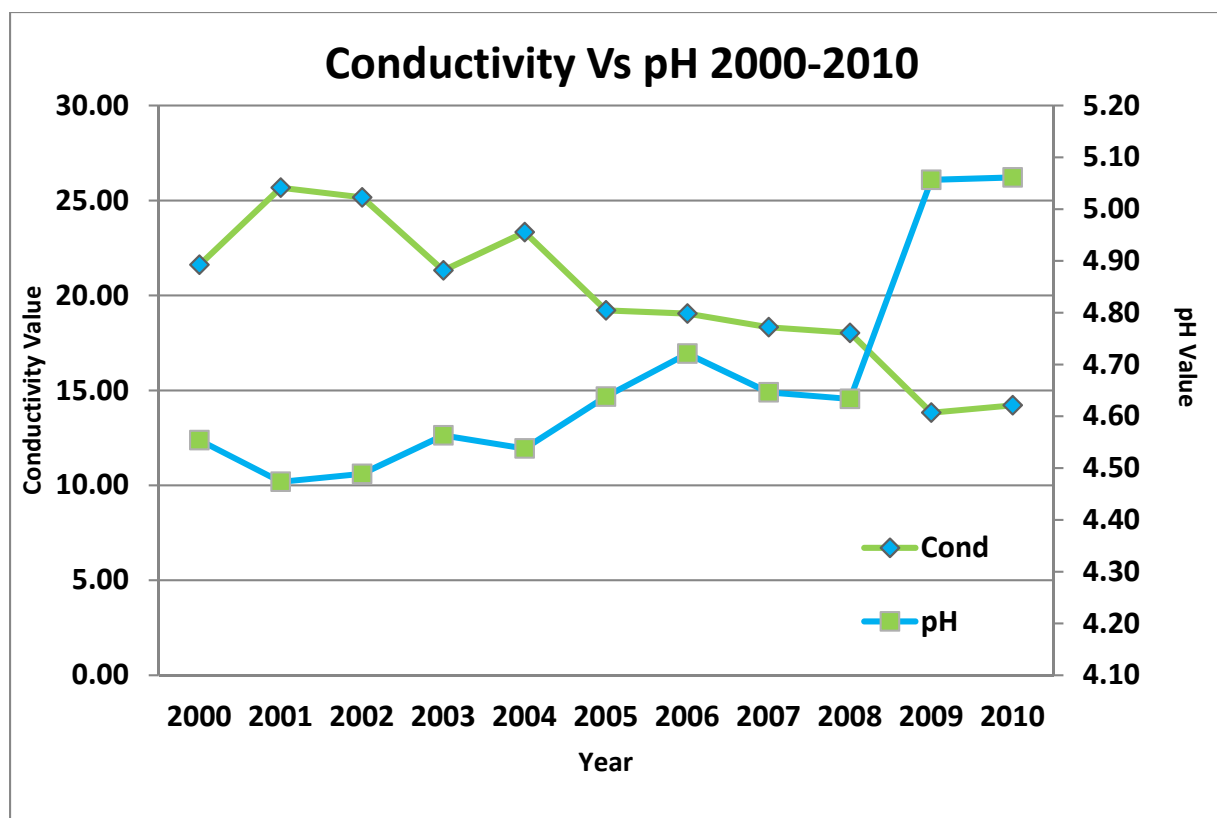
In the early 1990's the air program focused on monitoring for polycyclic organic compounds i.e. polycyclic aromatic hydrocarbons or PAH's. At this time the neighboring industry was in violation of the Clean Air Act. A review committee was put together to ensure the design and installation of the state of the art fume treatment system was of the highest quality. The new fume treatment system was designed, installed, completed and is running.

ALCOA, the main plant (west) is in general compliance with the NESHAP air discharge standards. Reynolds Metals (ALCOA east) installed a new fume control system that meets the NESHAP requirements. The ALCOA east facility has installed replacements for pot hoods designed for an improved capture of pollutants. When operated properly, the new fume control system and new pot hooding at Reynolds (Alcoa East) provides for meeting air discharge requirements. General Motors installed rooftop thermal incinerators to destroy styrene and benzene VOCs. GM stopped manufacturing in 2009 and is being deconstructed in 2011.

Since the beginning, the air program has grown to collect monitoring data from a wide variety of pollutants.

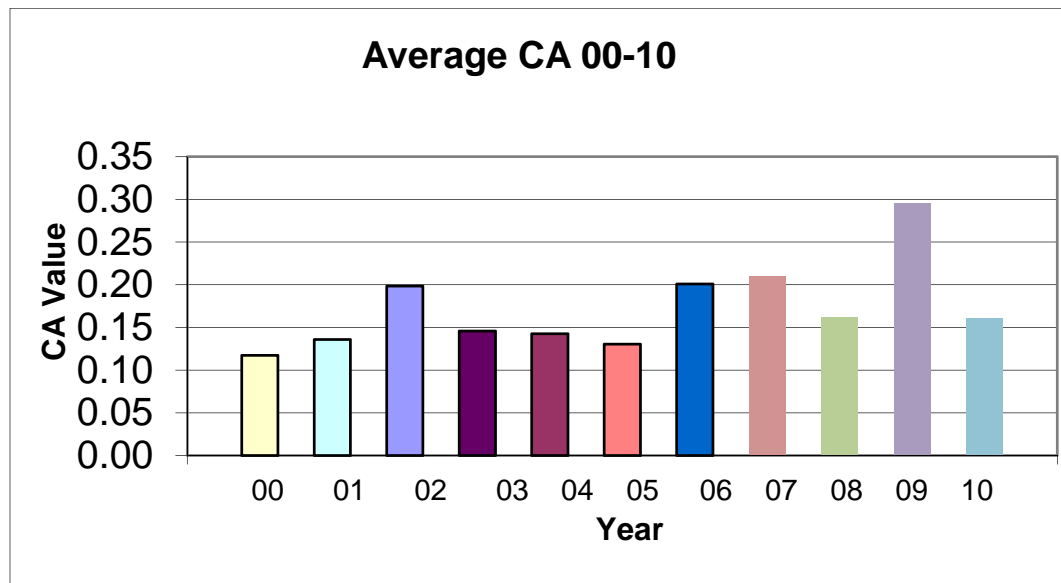
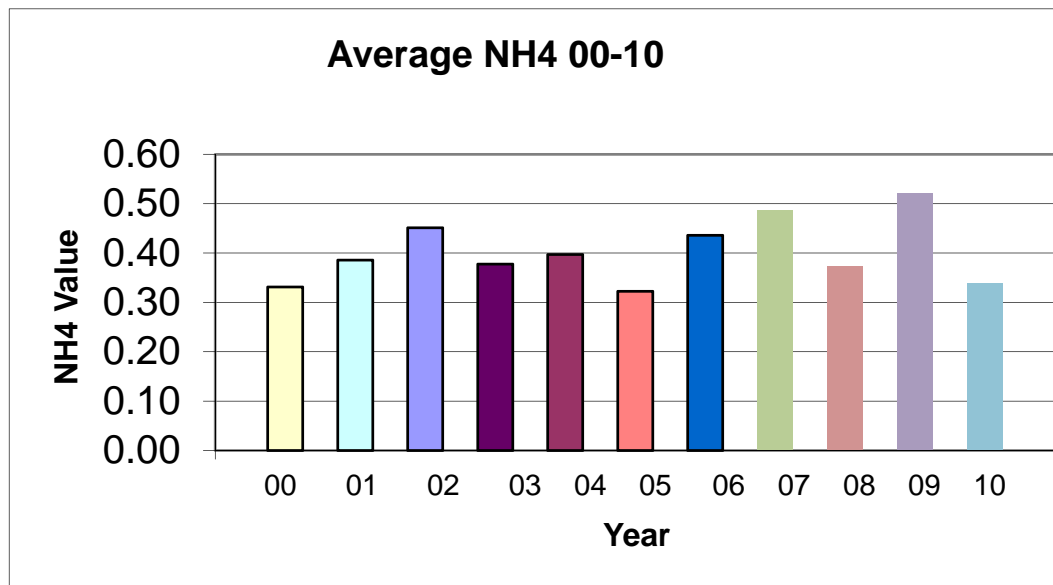
### National Atmospheric Deposition Program

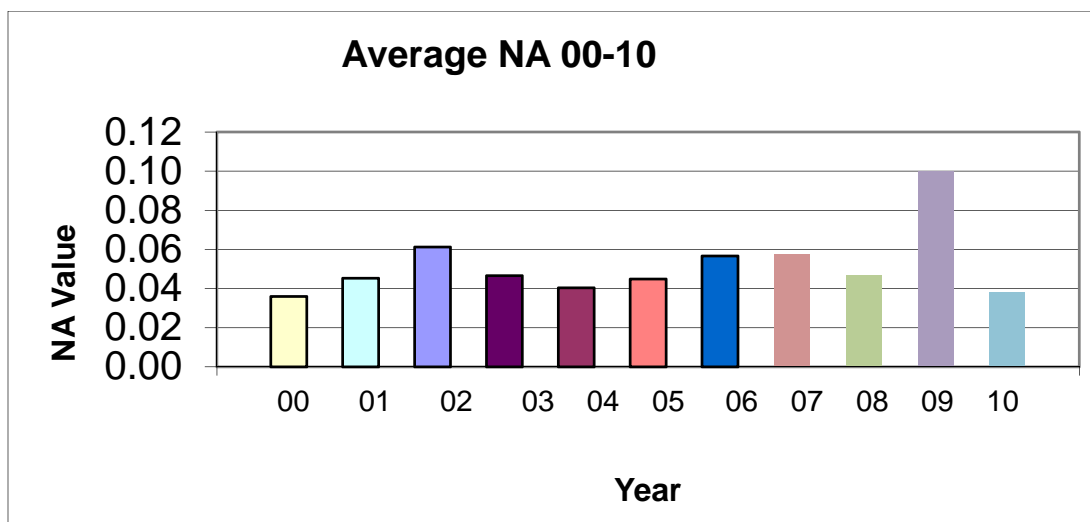
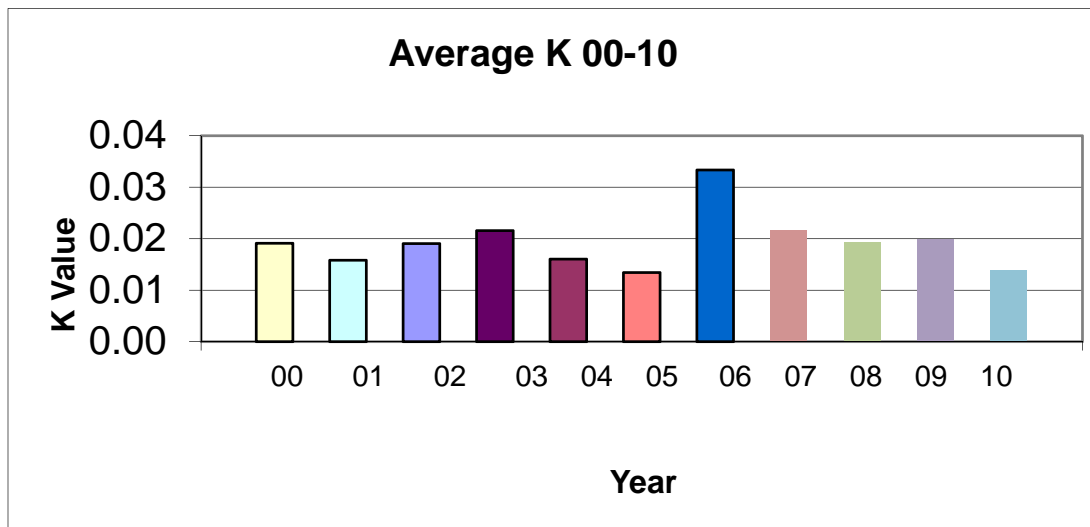
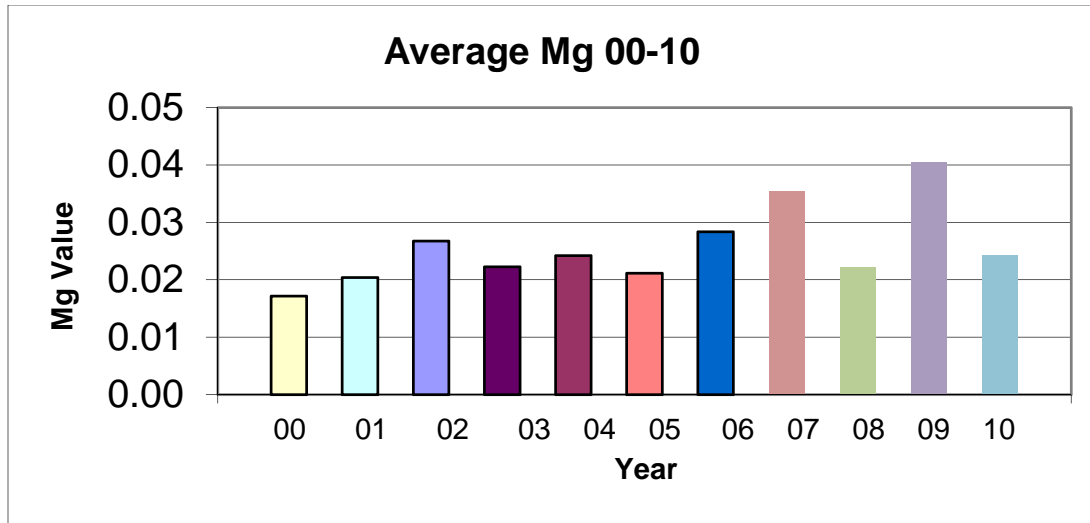
In August 1999, the SRMT Air Quality Program, officially started collection at site NY22. The long-term goal is to examine trends over years of collection. By following the NADP/NTN guidelines for collection, every Tuesday at 9:00 am, the Air Program collects the precipitation from the week and ships it off to the lab for further testing. Over 300 operators across the country head out weekly to collect the week's precipitation: whether it's rain, snow, mist or even fog. Samples are collected continuously in a wet/dry precipitation sampler. The collector opens automatically during wet weather, allowing the precipitation to fall into the bucket, and then closes as soon as the precipitation stops. At the site, the operator replaces the old bucket with a new, specially cleaned bucket for next week's sample. The operator then takes the sample collected to the field laboratory at the environment division where it is weighed and acidity/conductivity is measured. The standard operating procedures for checking pH and conductivity at the field lab changed in 2005. Now the SOP only requires weighing at the field lab. The sample is then sent to the NADP Central Analytical Laboratory (CAL) in Champaign, IL. At CAL, the concentrations of important inorganic chemicals in the sample are analyzed. These chemicals include acidity, sulfate, nitrate, ammonium, chloride and base cations.

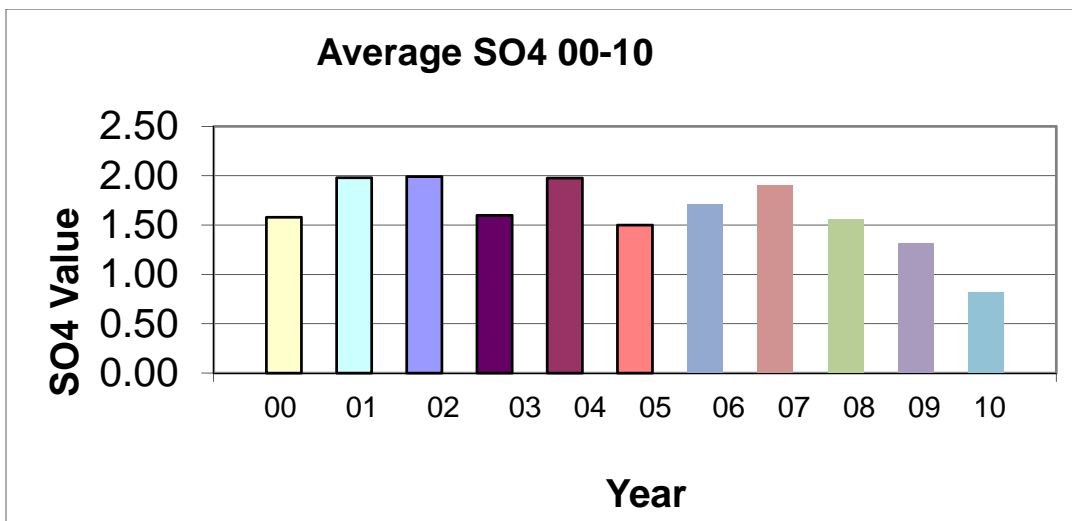
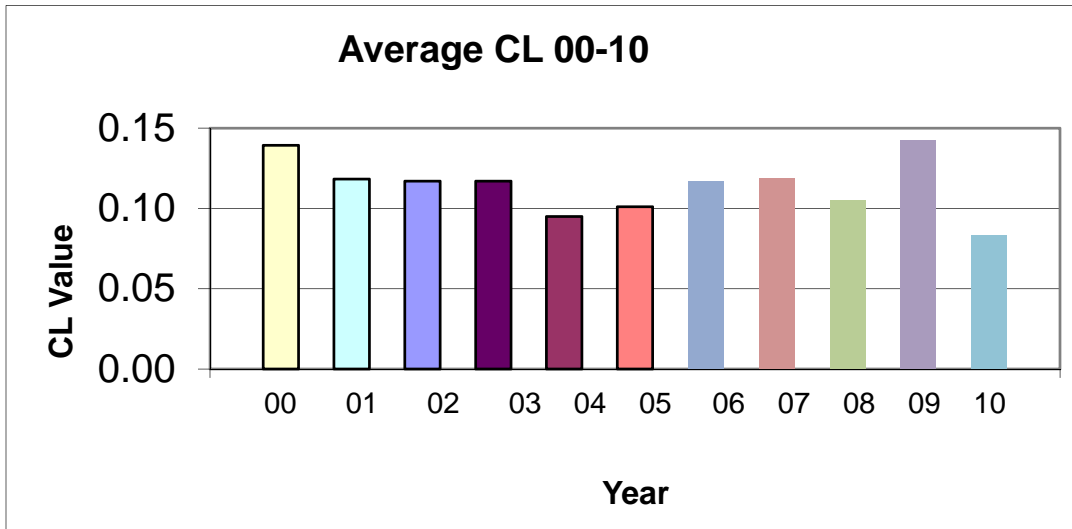
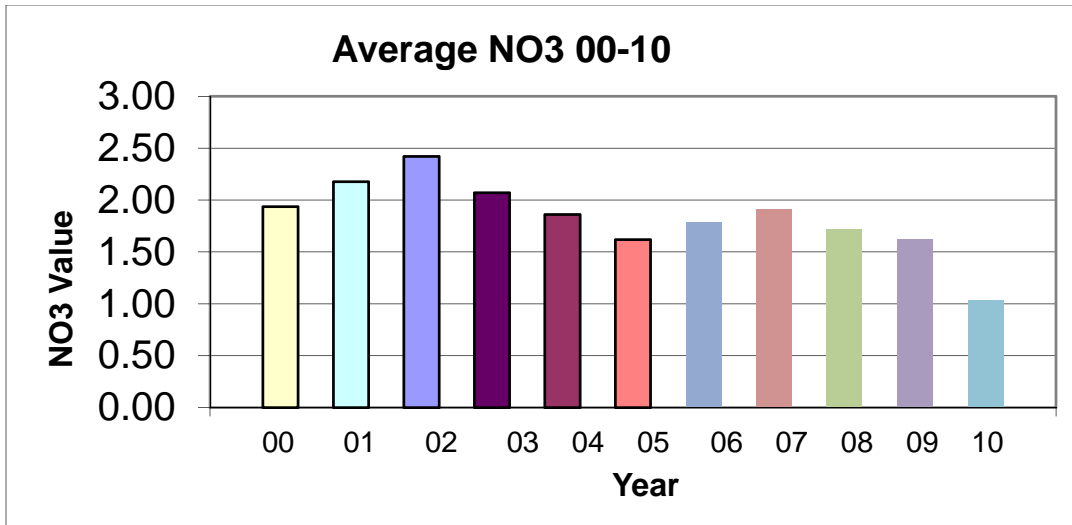


This chart represents the potential of hydrogen (pH) or acidity compared to the conductivity of the precipitation collected over the years. The pH of precipitation is affected by gases in the atmosphere. Gaseous Carbon Dioxide in the air creates a weak acid in precipitation. From the data seen in the chart above the precipitation or rain seems to be getting less acidic. It also shows how conductivity relates to pH: the lower the conductivity the higher the pH.

The series of charts to follow show the average of the concentration of inorganic chemicals in the precipitation by years.







## Fluoride

The Mohawk community has always sustained themselves through farming and fishing. With the threat of fluoride contamination, as well as other chemical contamination, that is not a choice for our members any longer. Over the past 10 years, the SRMT Environment Office and NYS DEC have collected vegetation samples throughout the surrounding area of the three industrial plants and several places on the Reservation. Fluoride vegetation levels are regulated by NYS Air Resources, Ambient Air Quality standards, part 257.8 and by the newly promulgated Maximum Achievable Control Technology (MACT) standards for Primary Aluminum Smelters. Vegetation showing the following levels are in exceedance:

80 ppm = 30 day violation

60 ppm = 60 day violation

40 ppm = growing season violation

Samples are made up of orchard and timothy grass to represent the type of vegetation that a grazing animal would eat. Samples are collected into paper bags and delivered to a contracting laboratory previously in Ithaca, NY. The samples are dried, ground up and sieved through a 1.0 mm mesh screen. It is then combusted in an oxygen bomb and analyzed using a specific ion electrode. In past years, four sampling sites were the primary trouble spots, northeast of Alcoa and north of Reynolds. Alcoa has recently installed a new fume system, yet that year was the worse year Alcoa has seen for fluoride levels. Installation of a new fume system at Reynolds in the year 2000 was hopeful to show a dramatic decrease in fluoride deposition. During the winter of 1999, the Tribe, NYS DEC and the industries worked together to write a consistent standard operating procedure (SOP) for sampling and analyzing for vegetative fluoride. With the new SOP in place, each sampling plot will be harvested uniformly and results comparable to each other. New data for the 2000 growing season has shown low levels of fluoride in the vegetation. The Air Quality Program hopes to see this trend go even lower as Reynolds fine tunes its new fume control system.

The following data represents all the results for the collection of forage in the designated plots. 9S, 10S, 11S, 13S are all SRMT sites where Wilson, Love, Airport, Donahue and N of Alcoa(west) are all Alcoa site and 6R and 7R are Reynolds sites. Once Alcoa purchased Reynolds and a review of the sampling plan and data the two Reynolds sites were discontinued as well as two of the original Alcoa sites. The plot located at the N of Alcoa site was deemed informational only and not regulatory because there are no homes or residences in the area. There have been some problems with laboratories and from time to time analysis was not done. Alcoa amended the work plan to have an Alcoa Laboratory do the analysis and the SRMT and NYS DEC are to sign off on the changes.

Annual Averages											
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
9S	6	5	8	7	21		10	15		<5	9
10S	30	26	29	29		42	24	41	52	5	11.3
11S	3	16	5	48	2	7	4	15		8	10.3
13S				1		3					
Wilson	1	1	2	1	1	1	2	8	<5		2
Love	3	5	2	2	4	1	7				
NofAlcoa		249	116	46	108	127	77	42	43	72	62
Airport		4	9	11	5	4	2	8	9	5.4	6
Donahue		4	3	5	6	5	2				
6R		1	3	4	6	5	2				
7R		5	5	2	3	1	5				

### *Particulate Matter*

Air Pollution called particulate matter includes dust, dirt, soot, smoke and liquid droplets directly emitted into the air by sources such as factories, power plants, cars, construction activities, fires, and natural windblown dust. Particles formed in the atmosphere by condensation or the transformation of emitted gases such as sulfur dioxide and volatile organic compounds are also considered particulate matter. Particles less than 2.5 $\mu$ m in diameter are formed primarily by combustion or secondary chemical reactions in the atmosphere whereas particles greater than 2.5 $\mu$ m are formed primarily by mechanical processes (construction, demolition, wind erosion). Since particles originate from a variety of mobile and stationary sources, their chemical and physical compositions vary widely depending on location and time of year.

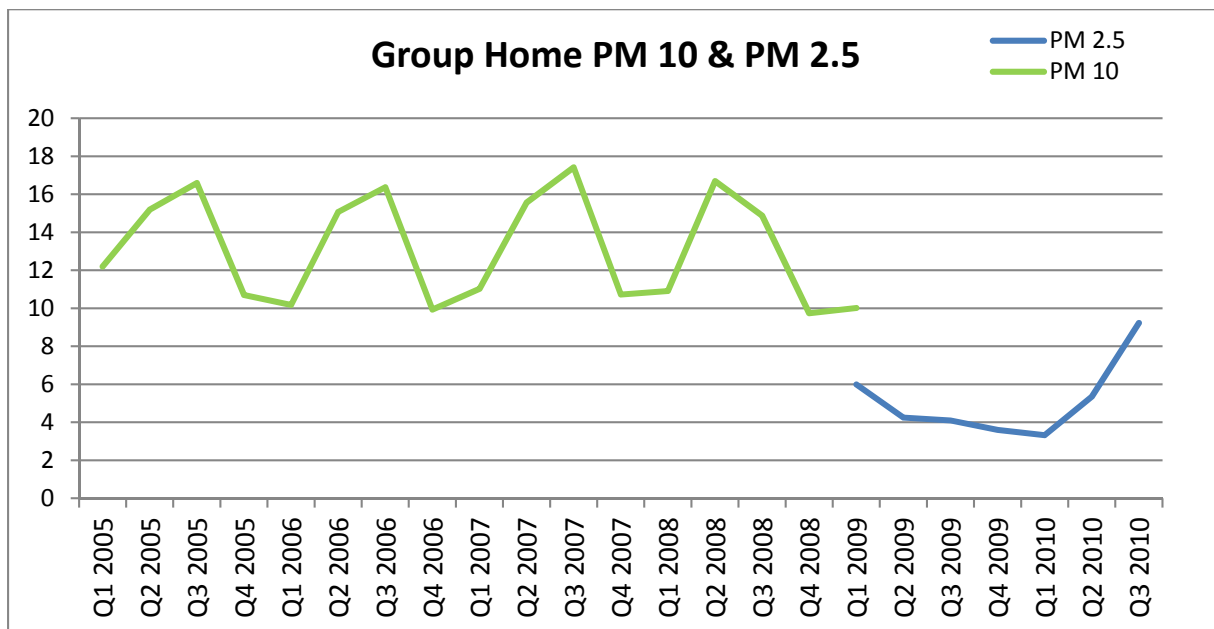
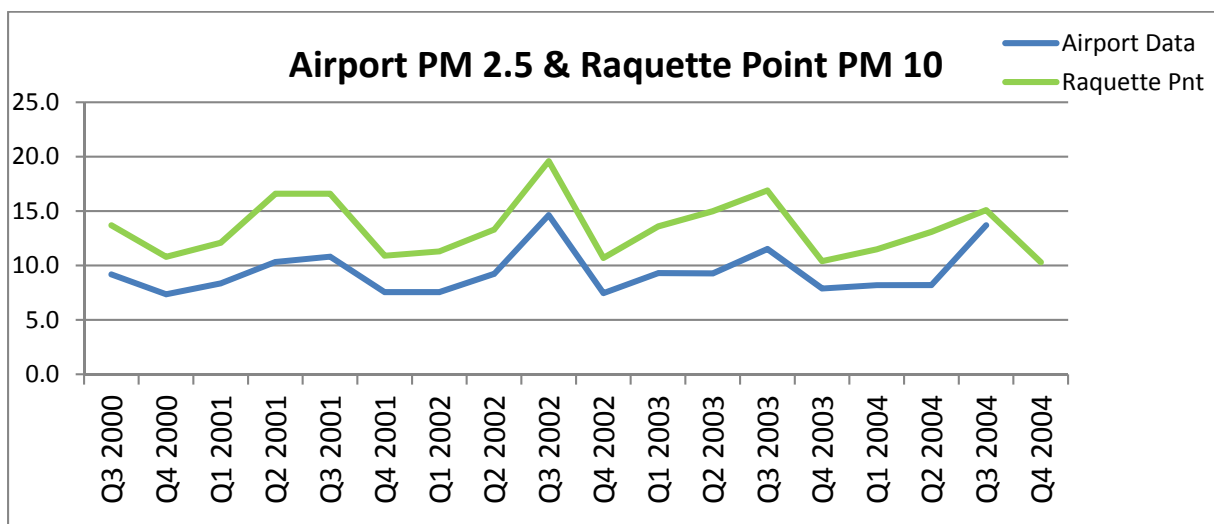
The Air Program's goal is to better understand the concentrations and pattern of particulate matter. This data will be used for comparison to the national standards as well as provide useful data for reporting short-term concentrations for understanding diurnal and episodic behavior of fine particles. It can also be utilized by health scientists investigating exposure patterns, (i.e. asthma studies).

Samples have been collected continuously with two monitors known as the TEOM, Tapered Element Oscillating Microbalance. The monitor is a true "gravimetric" instrument that draws ambient air through a filter at a constant flow rate, continuously weighing the filter and calculating near real-time (10 minute) mass concentrations.



The first unit collects particulate matter of 10 microns or less, and is equipped with the optional Automatic Cartridge Collection Unit (ACCU) which can also collect particles of 2.5 microns and less. This unit is located in Akwesasne and was previously at the air monitoring station located on Cornwall Island. It was then moved to the air monitoring shed in 2005 located on Library Rd: where it is currently located. The TEOM was changed monitor 2.5 microns or less on Ennisko:wa/March 2009 and was replaced with a new TEOM 2.5 in Onerahtohko:wa/May 2011.

The second unit collects only 2.5 microns or less and was located at the Massena airport till the Kentenhko:wa/November 2005. Then it was decommissioned.



### *Sulfur Dioxide*

Sulfur dioxide (SO<sub>2</sub>) results from the combustion of sulfur-containing coal and oil used for energy production and industrial processes, largely from stationary sources such as power plants, steel mills, refineries, pulp and paper mills and from nonferrous smelters. Many emissions originate from tall stacks, enabling them to be dispersed according to wind patterns, temperature and velocity. Once released, Sulfur dioxide and other oxides of sulphur can combine with oxygen to form sulfates and with water to form aerosols of sulfurous and sulfuric acid. This mixture is a precursor of acid rain, which is associated with the acidification of lakes and streams, impacts on forest soils and the decline of certain high elevation trees.

The Air Program is using a UV fluorescent analyzer for SO<sub>2</sub> and a chemiluminescence analyzer for NO<sub>x</sub>. The SO<sub>2</sub> analyzer depends on the radiation produced by SO<sub>2</sub> molecules when excited by UV Radiation. A reference detector measures the excitation UV radiation and a photomultiplier tube measures the fluorescent radiation. The final concentration of SO<sub>2</sub> is corrected for temperature and pressure changes, and is displayed in units of parts per million or milligrams per cubic meter.

### *Ozone*

Ground-level ozone, the primary component of smog, is formed when emissions of nitrogen oxides and volatile organic compounds react in the sun. Sources for these emissions include power plants, factories, motor vehicles, chemical solvents and consumer products. When inhaled, ground level ozone can cause acute respiratory symptoms, such as coughing and discomfort in the throat and chest, aggravate asthma, reduce lung function, inflame and damage lung tissue, and impair the body's immune response to respiratory infection. Children, especially those with asthma, are at the greatest risk from ozone pollution. During the summer, when concentrations of ground-level ozone are highest, children playing outside are most likely to experience respiratory symptoms and effects.

Several months ago, the Air Program submitted its recommendation for the 8-hour ozone designation. Even though the reservation is located in the Northeast Ozone Transport Region, the area was recommended for attainment.

The Air Quality Program is part of the **Northeast Regional Planning Organization (RPO) for Regional Haze and Visibility**. This involves developing a long-term strategy for reducing the precursors of haze. Eventually, this strategy will be incorporated into the Tribal Implementation Plan. With increased emphasis on collecting local data, the SRMT Air Quality Program purchased an ozone monitor. The data from this monitor will be submitted to the RPO for

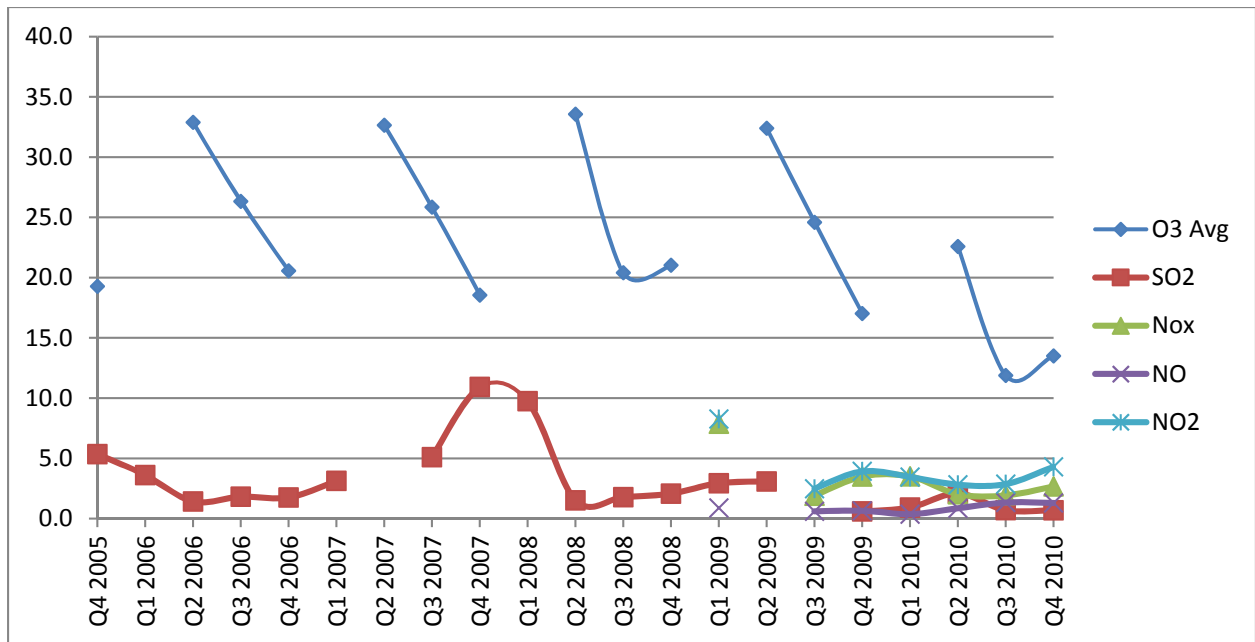
future planning strategies and for the use of the Tribe. Plans include adding an additional collocated monitor for designation purposes, which is a requirement.

The Tribe is using a UV Absorption Ozone Analyzer with EPA approval (EQOA-0992-087). This analyzer is a microprocessor-controlled analyzer that uses a system based on the Beer-Lambert law for measuring low ranges of ozone in ambient air. A 254 nm UV light signal is passed through the sample cell where it is absorbed in proportion to the amount of ozone present. Every four seconds, a switching valve alternates measurement between the sample stream and a sample that have been scrubbed of ozone. The result is a true ozone measurement unbiased by interferences.

### *Nitrogen Oxides*

Nitrogen oxides (NO<sub>x</sub>) are a group of highly reactive gases primarily formed through the use of fossil fuels. Although short term health effects of nitrogen dioxide are inconclusive, prolonged exposure may increase the incidence of respiratory conditions, especially in children. Nitrogen oxides are an important precursor to the formation of ground-level ozone and acid rain. Nitrogen deposition influences both chronic and episodic acidification of lakes and streams, sometimes resulting in uninhabitable conditions for fish and plankton species. Acidic deposition may also result in forest damage due to nutrient leaching, corrosion of historical structures and exacerbation of respiratory illnesses.

The NO<sub>x</sub> analyzer is designed to measure the concentration of nitric oxide (NO), total oxides of nitrogen (NO<sub>x</sub>) and, by calculation, nitrogen dioxide (NO<sub>2</sub>). The instrument measures the light intensity of the chemiluminescent gas phase reaction of nitric oxide NO and ozone O<sub>3</sub>. The reaction of NO with ozone results in electronically excited NO<sub>2</sub> molecules. The excited NO<sub>2</sub> molecules release their excess energy by emitting a photon and dropping to a lower energy level. The analyzer samples the gas stream and measures the NO concentration by digitizing the signal from the analyzer's photomultiplier tube (PMT). A valve then routes the sample stream through a converter containing heated molybdenum to reduce any NO<sub>2</sub> present to NO. The analyzer now measures the total NO<sub>x</sub> concentration. The NO<sub>x</sub> and NO values are subtracted from each other by the built in computer yielding the NO<sub>2</sub> concentration. The three results NO, NO<sub>2</sub>, NO<sub>x</sub> are then further processed and stored by the computer yielding several instantaneous and long term averages of all three components.



The results shown from the graph above are based on quarterly averages. All the data in this graph represents data that has been uploaded into EPA’s Technology Transfer Network for air quality data called the Air Quality System or AQS. All instruments are running under USEPA approved quality assurance project plans.

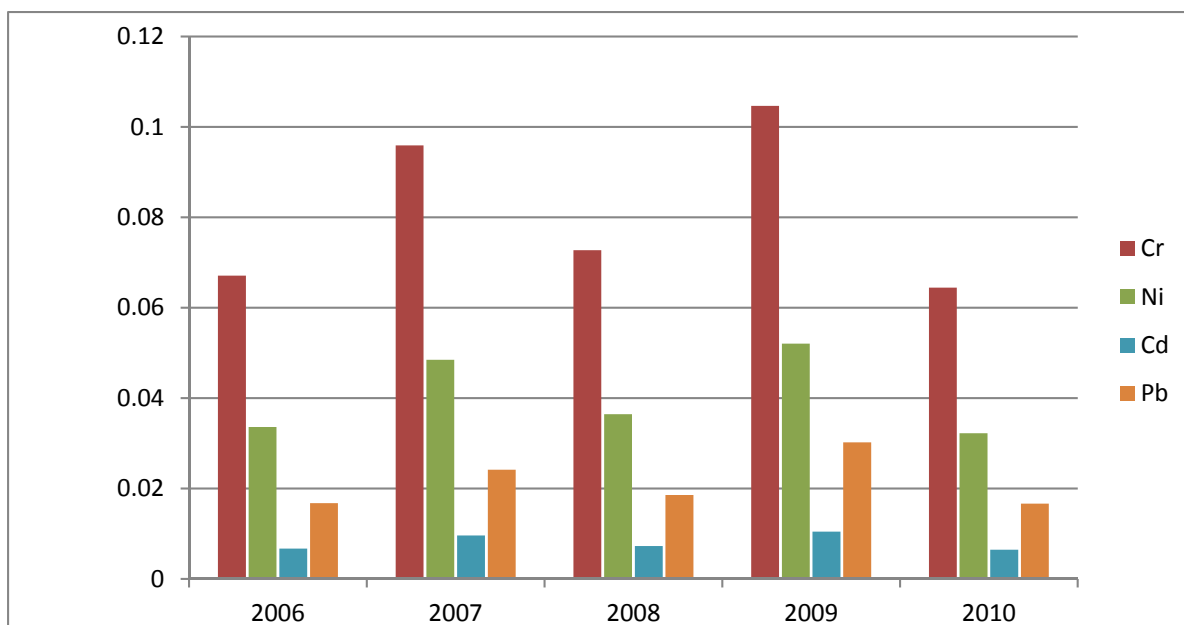
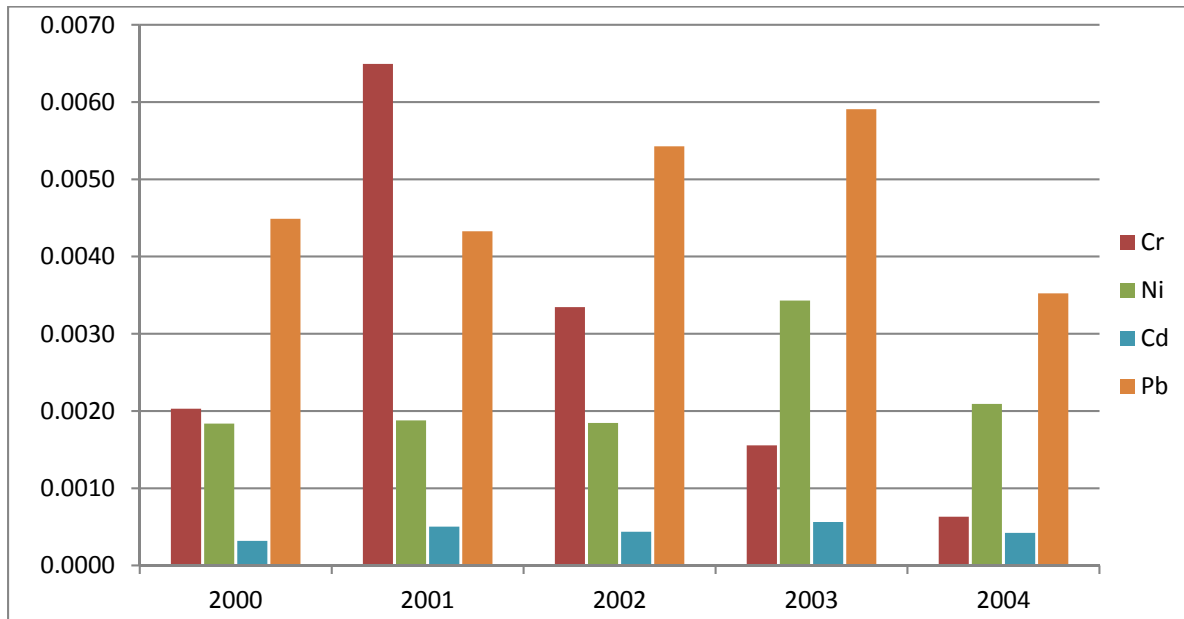
**Metals**

The Air Program is concerned with source characterization, exposure levels and health impacts to community members from heavy metals such as nickel, cadmium, lead, zinc, and chromium, contained in the air. Funded for three years through the US EPA, the Air Program had set up two metals samplers at a Raquette Point resident’s property. This sampler ran from 2000-2005 and has since been sampling at the air monitoring shed located on Library road since then.

The sampling techniques for collecting metals is quite similar to the apparatus used in the PAH study. Both are housed in similar shelters; use the same motors and times, only the filters are different. The samplers draw a measured quantity of ambient air into the housing and through an 8x10 inch filter during a 24-hr sampling period. The sampler flow rate and the geometry of the shelter favor the collection of particles up to 25-50mm.

The charts below are of the data collected. The first chart is data from 2000-2004. The data was analyzed by a contracted laboratory, Battelle, and is in  $\mu\text{g}/\text{m}^3$ . The second chart goes from 2006-2010. This data was analyzed by a different contracted laboratory, Galson Labs, and is

also in  $\mu\text{g}/\text{m}^3$ . 2005 is not represented here because the completeness percentage was not reached.



**Studies**

An asthma survey of Mohawk elders was conducted on the St. Regis Mohawk Reservation in 2000. The purpose of the survey was to examine indoor and environmental factors and their relationship to asthma in Mohawk elders. 45 elders were surveyed and information obtained and analyzed for indoor

air quality factors measured and information obtained from a survey form. **Final Project Report Children's Health – Indoor Air and Radon Project (Agreement number CH982113-01-0)**. The full report can be found at the Environment Division website [www.srmtenv.org](http://www.srmtenv.org) of the Saint Regis Mohawk Tribe.

**CAA Fluoride Grant: XA98279801-3** Past industrial activities in and around the St. Regis Mohawk Territory of Akwesasne have resulted in contamination of the land, water, and air with hazardous substances, including polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), aluminum, styrene, cyanides, dioxins, dibenzofurans, phenols, and fluoride compounds. In order to address potential concerns by community members about exposures to various contaminants in the region, the Tribe has asked Industrial Economics, Incorporated to produce a series of data reports that summarize pertinent information about contamination of natural resources of specific concern to the Tribe. This report synthesizes available information about concentrations of fluoride measured in vegetables grown in Tribal members' gardens, as well as in soil from the gardens, and water applied to the gardens. It also examines concentrations of fluoride measured in cattle feed grasses as part of ongoing monitoring of fluoride pollution and particulate fluoride from filter samples as well as local deer jaw samples.

Low levels of fluoride contamination in the soils and flora of Akwesasne is still apparent after historical contamination by two ALCOA facilities in the area was first recorded several decades ago. Data collected by the Tribe Environment Division on concentrations of fluoride in vegetables grown in the private gardens of community members indicate that the risk of adverse health effects from fluoride exposure via the consumption of home grown vegetables is likely below the level the U.S. EPA considers to be safe. Spatial analysis of vegetable data indicates a spatial trend in fluoride contamination. Fluoride contamination decreases with increasing distance from the ALCOA plants. Such a trend supports the assertion that the ALCOA plants may represent the dominant sources of fluoride pollution in the area. The Deer part of the study indicates that the local deer have not been affected by the fluoride pollution that still exists in the Akwesasne area. The full report can be found at the Environment Division website [www.srmtenv.org](http://www.srmtenv.org) of the Saint Regis Mohawk Tribe.

**Characterization of Benzene and Other Air Toxics in Akwesasne.** Akwesasne, in the early years prior to being introduced to industrialization, was wealthy in regards to natural resources such as land for vegetation and livestock, clean rivers and streams for aquatic life and clean air for our people and wildlife to breathe. This way of life no longer exists since the settling of three major industrial plants, General Motors Central Foundry and two Alcoa Aluminum smelters.

Almost everything affects the air: paint and solvents evaporate; air conditioners release Freon (ozone depleting substances); cars emit combustion by-products (smog) that are released into the environment; power plants supplying electricity and manufacturing plants making products release millions of tons of pollutants into the air each year.

The Akwesasne community (US portion) consists of approximately 14,600 acres, primarily unused agricultural land and wetlands. There has been a decline in agricultural activities over the years partially due to the negative influence of industrial emissions and pollution. The rivers had also previously provided a means of income through guide fishing, and fish marketing. Since then, industrial pollution has been severely responsible for the contamination of the fish, to the point that government warnings have been limiting the consumption of fish.

The air quality program through a grant from the US Environmental Protection Agency assessed the impact of benzene and other air toxics on the Akwesasne Community in conjunction with the Center for Air Resources Engineering and Science at Clarkson University. The Center for Air Resources Engineering and Science at Clarkson University partnered with the Tribe for support of instrumentation for the monitoring and sample analysis and the expertise in data analysis and modeling of this project. The Tribe's Air Quality Program was responsible for monitoring, sample/quality assurance project plans, and recruitment of individuals to participate as well as reports and budget for grant.

State Route 37, which runs through Akwesasne, is the major artery for the North Country connecting major ports of entry to Canada as well as connecting cities and towns to the shipping industry and is heavily used by the trucking industry. The Akwesasne Mohawk Casino and other facilities attract a number of additional people to the territory and increase the volume of traffic and gasoline use. Thus, the problem is to assess the impact of the ALCOA plant on benzene concentrations across the territory relative to the ambient and personal exposure from motor vehicles and other gasoline use. The results of the study show that the primary exposure of Benzene (the chemical of concern) was from vehicle exhaust and fueling stations. Benzene is very volatile, which means it evaporates readily at normal temperatures and pressures so exposure would come from a more localized source. The full report can be found at the Environment Division website [www.srmtenv.org](http://www.srmtenv.org) of the Saint Regis Mohawk Tribe.

### **Conclusion**

The SRMT Environment Division is dedicated to preventing disease and injury, while at the same time, promoting lifestyles that respect, protect and enhance the environment for the next seven generations at Akwesasne. Through the continued support of the USEPA and other private funding sources the air quality program was able to collect, analyze and compile all the data within this report.

The air quality program has made many positive advances utilizing the data like making recommendations on area designations of the NAAQS as well as the Tribal implementation plan which was written to help protect and preserve the quality of air the people of Akwesasne breathe.

*Ieti' nistenha Ohonstia*

*(The Earth, Our Mother)*

*"We are all thankful to our Mother, the Earth, for she gives us all that we need for life. She supports our feet as we walk about upon her. It gives us joy that she continues to care for us as she has from the beginning of time. To our Mother, we send greetings and thanks. Now our minds are one."*

*Niawen*