



US EPA General Assistance Program
Indoor Air Quality Needs Assessment
FY16- October 1st 2015 through September 31st 2016

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Department

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Introduction

Indoor Air Quality is defined as the air within and around buildings. The Wiyot Tribe recognizes that poor Indoor Air Quality (IAQ) poses a high risk to its community members, and there is a need for an established IAQ program to help address these issues. Children, elders, pregnant women, and those with respiratory illnesses and allergies are especially at risk. Many residents of Table Bluff Reservation are low-income, disabled, and lack access to reliable transportation. Therefore, access to medical care to treat an urgent respiratory condition such as an asthma attack, is difficult. The nearest hospital is located 13 miles from Table Bluff Reservation, an almost 20-minute drive, and the nearest UIHS clinic is a 40-minute drive from the reservation. Maintaining healthy IAQ is also important because health impacts of poor IAQ can be highly variable from individual to individual. While one person may experience severe symptoms from exposure to a certain pollutant, that same exposure may have little or no impact on someone else. Poor home maintenance can also result in low IAQ if repairs to homes aren't made in a timely manner, such as leaky faucets or cracks in windows. Problems with IAQ are the result of two main sources: insufficient ventilation and pollution. Cracks in ceilings, walls, and/or the building foundation can let in excess moisture, pests, radon, and other pollutants. Other home issues such as water leaks and poorly maintained gas and wood stoves can be a source of pollution. Additional pollution sources can come in the form tobacco smoke, cleaning products containing harsh chemicals, pesticides, pet dander, and many others.

Due to their unique developmental physiology, children are more likely to suffer the effects of pollutant exposure, beginning in the womb. Children breathe more air and drink more water relative to adults, therefore, they have a tendency to take in higher doses of pollutants found in air and drinking water. Because of their higher life expectancies, children are more likely to manifest a disease with a higher latency period, and have to live longer with toxic damage. Normal behaviors associated with a child's developmental stage, such as placing their hands and other objects in their mouths, is another way children are exposed to pollutants found in their indoor environment. Children also present unique exposure pathways, such as breastfeeding and trans-placental exposure. Pollutants can pass from mother to child through the placenta as well as through breast milk. As a result of their small body size, children tend to be closer to the ground where many pollutants concentrate (i.e. pesticides, dust from carpets, etc.). Due to these risks, it is important to take special precautions in environments where children live and attend school. Exposure to carcinogens such certain Volatile Organic Compounds (VOCs), allergens such as dust, pollen, and mold, can cause life-long damage to a child.

According to US EPA, people spend up to 90% of their time indoors, adding to the importance of educating the Tribal community on the various issues related to IAQ. Low ventilation in any building causes pollutants to concentrate on higher levels indoors. While many IAQ issues are obvious, others are more insidious, such as radon and carbon monoxide because they are colorless and odorless. IAQ mainly involves people's homes and work environments. As a result, the Natural Resources Department has little regulatory authority and the majority of our efforts must be concentrated in outreach and education. There are many simple measures homeowners can take to improve their IAQ. For example, many people don't use their kitchen or exhaust fans due to the noisiness associated with them. Simply opening windows and using exhaust fans (and

changing the filters frequently) can help reduce the concentrations of pollutants found indoors. Minimizing exposure to the effects of poor IAQ is an important step for a healthier community.

With support from the EPA General Assistance Program (GAP), the Wiyot Tribe Natural Resources Department compiled this IAQ Needs Assessment to identify the areas of most concern and in need of the most resources.

Background

Table Bluff Reservation consists of 88.5 acres situated on coastal bluffs located in Humboldt County, northern California. There are 37 homes on the reservation with a total of about 135 residents. There is currently little to no demographic data on how many Tribal members suffer from cardiovascular, respiratory, and other illnesses. The climate in the northern coast of California is humid, characterized by cool, wet winters and cool summers with frequent fog and strong winds. Humboldt County experiences an average of 40 inches of rain per year, with about 90% of the rainfall occurring from October through April. The characteristic humid environment of the California north coast promotes the concentration of various indoor pollutants. For example, homes with high relative humidity can develop mold growth, especially where there is little education on how to prevent and remediate it. Based on observations, due to cold temperatures and humidity, many Tribal members close their doors and windows for the majority of the day. As a result, most homes have little natural ventilation.

The WNRD (formerly known as the Environmental Department) was established in the late 1990s. Since that time, there is record of one IAQ assessment created in 2005. This assessment consisted of assessing radon, carbon monoxide, fumes from pesticides and cleaners, and biological contaminants. There was also an IAQ workshop held in that same year. Although the previous environmental staff tested for radon, there was no mention of any home assessment or other IAQ measurements or surveys performed. Without these baseline measurements, it is difficult to make an accurate assessment of the health risks TBR residents face.

The Wiyot Tribe currently does not have a housing department. As a result, few resources have gone towards assisting low-income homeowners maintain or repair their homes. Because the majority of homes on TBR were built in the early 1980s, it is possible that lack of maintenance over the years could be contributing to poor IAQ.

Findings Summary

The Wiyot Tribe Natural Resources Department (WNRD) created surveys that were sent out to Table Bluff residents. These surveys asked several questions regarding the residents' health and concerns they may have about IAQ. Although a survey was sent out to all residencies, we received ten responses. Encouraging community participation in outreach is an important part in promoting healthier indoor conditions. Community participation remains one of our biggest challenges. During the week of September 12th through the 16th of 2016, the WNRD invited Mansel Nelson from the Institute of Tribal Environmental Professionals (ITEP) to participate in community outreach efforts and provide technical assistance for conducting this assessment. Nelson's visit proved invaluable for gathering data to make an informed and thorough assessment.

Our outreach efforts included the following:

- Community presentation with Mansel Nelson of ITEP on common IAQ issues and Green Cleaning
- Four home assessments
- Radon testing in two homes and NRD building
- Newsletter articles
- Distribution of flyers, brochures, and other educational materials.
- Community survey on IAQ issues
- Loleta Elementary school assessment and staff presentation
- Environmental education activity with After School program
- Training for WNRD and neighboring Tribal environmental staff on IAQ in Tribal Communities

We also obtained information for this needs assessment by reviewing existing information. In 2005, WNRD staff conducted a small IAQ needs assessment. No other assessment had been conducted since that time, and the Wiyot population on Table Bluff has grown substantially since then. The WNRD assessed and evaluated the most common risk factor components for IAQ. These include, but are not limited to, carbon monoxide, microbial organisms, radon, tobacco smoke, and Volatile Organic Compounds (VOCs).

The majority of the survey respondents indicated that they have carpet flooring. Carpets, especially if they aren't maintained properly, can collect large amounts of pollutants. For example, an infrequently vacuumed carpet can have high amounts of dander, VOCs, and harbor mold growth.

The survey results are summarized on the table below:

Wiyot Tribe IAQ Community Survey- Part 1: Home Building Characteristics					
Respondent #	number of bedrooms	carpet in the home?	heating type	visible mold	Leaks in the home
1	4	no	wood stove	yes	no
2	4	yes	wood stove	no	no
3	2	yes	gas	no	no
4	3	yes	wood stove	no	no
5	2	yes	wood stove	yes	no
6	2	yes	wood stove/electric	yes	no
7	2	yes	wood stove/propane	no	no
8	3	yes	wood stove	no	yes
9	3	yes	wood stove	yes	no answer
10	4	yes	wood stove	yes	yes

Table 1. Summary of the results from the first section of the community IAQ survey. To protect the respondent's privacy, the survey was anonymous and they were assigned random respondent numbers.

Wiyot Tribe IAQ Community Survey- Part 2: Resident' Health						
respondent #	respiratory illnesses?	number of children	total residents	smokers inside?	pets inside?	cleaning products stored?
1	no	0	5	yes	no	garage
2	allergies	0	2	no	no	shed
3	no	0	2	no	no	garage and under kitchen sink
4	no	0	1	no	yes	none in the home
5	yes- didn't specify	0	2	yes	yes	under kitchen sink
6	yes- didn't specify	1	3	no	yes	under kitchen sink
7	asthma, allergies	1	3	no	yes	garage
8	sleep apnea	0	4	no	yes	under kitchen sink
9	asthma	2	3	no	no	under kitchen sink
10	asthma, allergies	3	5	no	no	under kitchen sink

Table 2. Summary of the results from second section of the community IAQ survey.

Biological Contaminants

There are several kinds of microbial organisms that can be pollutants in indoor environments. Microbial organisms include pollen, dust mites, mold, bacteria and viruses.

Mold

Mold, like most fungi, is ubiquitous in both indoor and outdoor environments. Mold can grow on almost any surface as long as there is sufficient moisture in the environment and organic material to feed on. Because most mold spores are microscopic, they are not visible to the naked eye making it impossible to completely eradicate them. Thus, controlling indoor moisture is key to preventing indoor mold growth. Potential health effects of mold can vary from severe allergic reactions to no effects at all. Individuals vary highly in their sensitivity to mold. However, even if a person doesn't experience severe reactions to mold despite living in a home where it's found, symptoms can develop at any point and tend to worsen over time.

Mold can concentrate in areas inside the home that experience the most moisture, such as bathrooms. Another common place to find mold is under carpets, which can be much more inconspicuous. Cold surfaces, such as outside walls, can be an area where condensate forms and gravity pulls the droplets to the floor and creating an environment for mold growth. Anywhere in the home where condensate forms can be a potential breeding ground for mold. While mold can be detected visually most of the time, mold can grow in areas hidden from view. Hidden mold growth can make it difficult to detect and remediate. Often, a room will smell moldy or "stuffy," providing clues that there is mold growth. It is important to educate the community to look for

mold behind furniture, under the carpet, the back of walls, etc.



Mold on the roof of a TBR resident's home. Permission from homeowner was obtained to use this photo.

Indoor Relative Humidity (RH) levels vary widely from region to region. As a rule of thumb, homes should have an RH level of 30-60%. Levels higher than 60% promote mold growth in most environments. During home assessments conducted over the week of September 12th, the four homes that were assessed presented a RH level from 50-60%, on the higher end of normal. The

days when the assessments were conducted were particularly humid days, which is the norm in Humboldt County. Unsurprisingly, many TBR residents reported problems with mold in their surveys.

During IAQ Week, Mansel Nelson from ITEP and WNRD staff led a community presentation focusing on common IAQ issues and Green Cleaning. We educated the community on proper

cleaning of mold in their homes, emphasizing the need for controlling moisture as the best way to prevent mold. Many residents expressed that they don't use exhaust fans in their bathrooms as much as they should because of noisiness. As with many IAQ issues, increasing ventilation plays a large role in reducing pollutants such as mold. During this presentation, we demonstrated a step-by-step process for cleaning mold by using soapy water, a squeegee, a scrub sponge, and ending with drying the area well with a microfiber cloth. Many members attending the presentation believed the best way to eradicate mold was with bleach, a common belief. However, bleach is itself a pollutant and should be avoided to the extent possible. Also, we communicated the need to wear Personal Protective Equipment (PPE) such as gloves and face masks, and that residents should consult with a professional if an area covered in mold is larger than 10 sq. ft.

Pet Dander, Pests and Pollen

Pet dander, pests and pollen are three other sources of indoor pollution that are often less talked about than mold. These pollutants are biological contaminants that present the most issues for those who suffer from asthma and allergies. When pets are kept inside the home, especially in bedrooms, their dander can exacerbate asthma symptoms. Pollen is also considered a trigger for asthma and allergy symptoms. Pests such as cockroaches, dust mites, and rodents can be serious sources of IAQ pollution and triggers for asthma. Their droppings, skin flakes, and hair could all cause adverse health effects.

It is important to educate the Tribal community on the importance of identifying allergy and asthma triggers such as the aforementioned pollutants. Maintaining sanitary conditions in homes and applying Integrated Pest Management (IPM) practices can greatly reduce exposure to these biological contaminants. By addressing these issues, people who suffer from these conditions can see improved symptoms, and children can improve their attendance in school by having less asthmatic episodes. Like other IAQ issues, solutions come mostly in the form of education and empowering Tribal members to make appropriate choices for their homes.

Radon

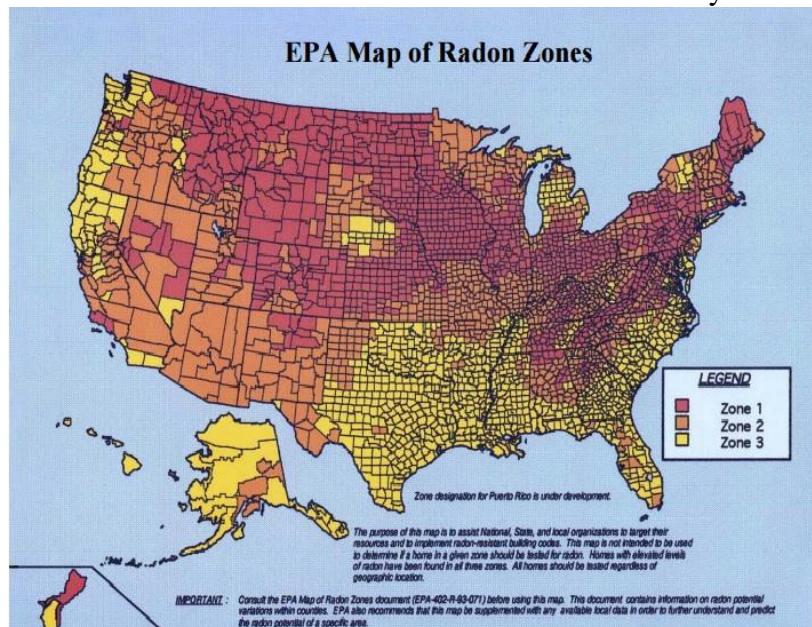
Radon is a colorless, odorless radioactive gas that is a product of the decay of uranium. Radon occurs naturally in the soil, and can be found almost anywhere in the United States. Radon is the second leading cause of lung cancer in the United States, causing over 21,000 deaths per year. Smoking tobacco products in combination with exposure to radon have a synergistic effect. Therefore, smokers who are also exposed to radon have a much higher chance of developing lung cancer.

Differences in pressure inside and outside the home create the effect of a vacuum, allowing radon to enter indoor environments. Hot air naturally rises, creating a low pressure zone near the ground and a high pressure zone towards the top of a home. This process of airflow is what allows radon to enter a home and concentrate in higher levels than the outside. The radioactive gas can enter homes through cracks, pores, loose fitting pipes, floor-wall joints, and other openings. During rainfall events, water seeps into the soil creating hydrostatic pressure that displaces air in the soil, which in turn can cause more air to be driven into a home. Poorly ventilated homes can further exacerbate a radon problem by allowing higher levels of concentration.

In the IAQ assessment conducted in 2005, the Environmental Department tested seven buildings on TBR using 48-hr activated charcoal radon tests. All the buildings tested well below the EPA action level of 4.0 pCi/L. As shown by the EPA map below, Humboldt County is considered to be a zone 3, with the lowest risk of radon.

Because of this, low levels of radon could be expected and don't come as a surprise. However, EPA warns that regardless of the zone, homes should still be tested for radon, as high levels have been found in all three zones. Furthermore, as homes age and deteriorate, it is possible for radon to enter the home through new cracks or pores, so low levels of radon can change in a home over time.

During the week of September 12th of 2016, the NRD tested two homes and the NRD building for radon using simple activated charcoal tests. The tests were used for educational purposes during Mansel Nelson's visit from ITEP. The results of these tests read as follows:



According to EPA, Humboldt County is not at high risk for radon exposure.

Building	Result
Home #1	0.6 pCi/L
Home #2	<0.4 pCi/L
NRD Building	<0.4 pCi/L

Table 3. Results of radon tests done in TBR.

We are pleased to report that all three radon tests are below the EPA action level. Although this is good news, ITEP recommends all homes should be tested for radon.

Tobacco Smoke & Electronic Cigarettes

Tobacco Smoke

Tobacco use is the number one cause of lung cancer deaths in the United States. Cardiovascular disease is also closely linked to tobacco consumption. According to the Centers for Disease Control (CDC), smoking is more prevalent among Native Americans than any other racial and ethnic group in the United States. Needless to say, it is a major source of pollution in indoor environments. Smokers, and those who live with them, breathe in carbon monoxide and other chemicals when smoking.

Tobacco consumption continues to be a prevalent issue in Native American communities. During IAQ Week, a representative from United Indian Health Services (UIHS) provided education and outreach to TBR residents on their smoking cessation program. Because addiction to cigarettes is a difficult habit to break, this presents an IAQ concern that does not have a simple solution. Decreasing tobacco use requires the resident's continued effort and cooperation. The Wiyot Tribe's Health and Human Services Department provides support and information for Tribal members trying to quit smoking. Although prevention efforts are widespread, continued work is necessary to bring awareness to the dangers of tobacco smoking.

Electronic Cigarettes

Electronic cigarettes, also known as e-cigarettes, are becoming an emerging health concern. Contrary to popular belief, e-cigarettes are not an approved smoking cessation tool, although they have been marketed as such. These devices usually consist of a battery, a chamber to hold liquid, and a heating element. The liquid used to create aerosol contains nicotine, artificial flavoring, and other chemicals. Some of the chemicals known to be found in e-cigarette fluid are VOCs, such as formaldehyde. The FDA does not regulate e-cigarettes, therefore manufacturers are not required to provide information on what chemicals are used in their products, thus making it difficult to quantitatively assess their danger.



Example of an e-cigarette

Research has shown that e-cigarette consumption has increased among teenagers. Because of the perception that these devices are safer than commercial cigarettes, they also pose a strong IAQ threat. Outreach efforts regarding smoking cessation should include specific information about e-cigarettes to debunk common myths regarding their safety.

Woodstove Smoke/Carbon Monoxide

The homes at Table Bluff Reservation were all built with woodstoves, which the majority of residents use throughout the year for heating. Woodstoves can be a source of pollution in two ways: carbon monoxide and particulate matter.

Carbon Monoxide

Like radon, carbon monoxide is a colorless, odorless gas. It arises as a result of incomplete combustion. Gas stoves, woodstoves, and other heating sources such as kerosene heaters can all be a source of carbon monoxide. Exposure to high levels of carbon monoxide can be deadly. On average, 170 people in the United States perish due to high carbon monoxide exposure. Lower levels of exposure can cause a variety of symptoms, such as headache, nausea, and fatigue.

During the community presentation, we spoke to attendees about the importance of having a carbon monoxide detector in their homes, as well as regular maintenance of their stoves and furnaces. We informed the community that carbon monoxide detectors should be changed out every five years to ensure there is always a well-functioning detector in the home. During the four home visits and inspection of the administrative buildings, levels of carbon monoxide were either zero or very low. Also worthy of note, individuals that smoke commercial cigarettes and e-cigarettes also inhale carbon monoxide.

Lead

Lead is a naturally occurring metal that is toxic to humans. Although it is found everywhere in the environment, lead poisoning can occur inside the home via exposure to lead paint, pottery, water pipes, and other sources. In homes with paint containing lead, indoor pollution can occur when the paint is chipped and creates a dust that residents inhale. Lead was banned in paint in 1978, therefore any homes built prior to that ban may be sources of lead pollution. Generally, all homes built before 1978 should be tested for the chemical.

Homes on Table Bluff Reservation were built in the 1980s and 1990s. While it is unlikely that lead poisoning would occur as a result of lead-based paint in homes on the reservation, the CDC



Woodstove at TBR Community Center

recommends that all children be screened for lead with a blood test. Because lead exposure can occur through several different sources, the only way to rule out lead poisoning is through blood testing, regardless of whether or not there is lead-based paint in the home.

Hazardous Household Chemicals

Hazardous household chemicals in the home can cause allergic reactions, irritation, discomfort, and also be carcinogens and endocrine disruptors. The fumes produced by cleaners, pesticides, and other household products are one of the largest contributors of poor IAQ. In 2014, the Wiyot Tribe was awarded a California EPA Environmental Justice small grant that focuses on pesticide and household product awareness and education. Through this project, the WNRD was able to combine efforts with GAP activities and make the most out of our IAQ assessment.

Household Cleaners

Common household cleaners such as antibacterial sprays, wipes, air fresheners, and bleach often contain Volatile Organic Compounds (VOCs). These chemicals are defined by EPA as gases that are emitted by other solids or liquids. Using common household cleaners can expose a person to high levels of pollution, as VOCs inside the home can be over ten times more concentrated indoors than outdoors. Many chemicals in common household cleaning products contain allergens, carcinogens, and endocrine disrupting compounds.



NRD building cabinet with several cleaning products.

During our visit to Loleta Elementary, the majority of the staff were not aware that household cleaners contained dangerous substances, or that they could be asthma triggers for their students. Teachers and janitorial staff widely used disinfecting wipes on student desks and counters, unaware of how their ingredients may affect their students or how to use the wipes properly. Teachers stated they rarely opened windows when using antibacterial wipes. Also, several teachers stated that they kept cleaning products under the sink inside their classrooms. Such storage of these products can be problematic because of how easily accessible these are to young students. We returned the next day and took several measurements to make a better evaluation on the condition of the school's IAQ. Based on those measurements, we made recommendations to the superintendent on how to make improvements, such as the purchase of carbon monoxide alarms. Overall, our visit was well received and we were encouraged to return for additional presentations.

Through our Cal EPA project, the WNRD created brochures, held a community presentation, and presented several after-school activities with Tribal youth on hazardous chemical safety.

Pesticides

Pesticides used inside the home, such as insect sprays and rat poison, are another source of indoor pollution. In homes where carpet is the main type of flooring, pesticides can concentrate and persist on the carpet, along with other types of pollutants. Children are at a higher risk of being exposed to pesticides in the home due to their propensity towards hand-mouth activity and their time spent playing on or near the ground.

The danger of pesticides depends on various factors such as the type of pesticide, how long a person is exposed, and the amount of the chemical one is exposed to. For example, an individual may be at greater risk if a pesticide is used often to combat a pest issue inside a home where there are carpets. Acute health effects range from headaches, dizziness, nausea or vomiting, and rash or skin irritation. Long-term health effects can be severe and last a lifetime, such as cancers, learning disabilities, and asthma.

Table Bluff Reservation is located in a rural area, where nuisance wildlife is often an issue. During IAQ Week, we educated the community on Integrated Pest Management practices to help prevent the use of pesticides. Chemical-free pest traps were also distributed to attendees of our IAQ community workshop. The WNRD recently created an administrative policy on Green Cleaning, titled *Wiyot Tribe Green Cleaning Policy*, to address the use of pesticides. It is now policy for an employee to have to obtain prior approval from the Natural Resources Department to use pesticides on any Tribal building. The use of such chemicals must be logged, and surplus chemicals must be disposed of safely.

Next Steps for Improving IAQ

Achieving healthy IAQ for Wiyot citizens requires continued effort from the Natural Resources Department. In creating this assessment we've identified the areas of most need among several possible IAQ concerns. Overall, an outreach and education approach is the best method for encouraging changes in behavior that lead to improved IAQ. Unlike other types of environmental programs, monitoring and regulatory actions are not typically well suited for IAQ because the pollution takes place inside a resident's home. In order to make an impact for the long-term health of the community, continued education will be essential.

Although TBR does not appear to be a high-risk area for radon, we will continue to advocate to residents that every home should be tested to be certain. Mold may continue to be an issue for homeowners. After the community presentation was held, many tribal members learned the skills necessary to combat and prevent mold growth in their home. Household cleaner and pesticide use are also commonly used inside most homes, and in the community presentation, participants learned about alternatives to these products. Also, the Wiyot Tribe Green Cleaning Policy that was passed in September will lead to improved IAQ in Tribal offices. Well-educated Tribal

employees will be prepared to answer questions from community members. Tobacco smoke, carbon monoxide exposure and particulate matter are also ongoing threats to IAQ in Wiyot homes. Again, education is key to helping people make changes. When the community surveys were distributed, we also included EPA's publication *Help Yourself to a Healthy Home*, which contains a wealth of information on IAQ and other home hazards. The NRD will continue to have this publication available in the Tribal offices, and will distribute this booklet during other community events.

An important outcome the IAQ Needs Assessment is the relationships that were developed with other IAQ partners. ITEP, Tribal Air Monitoring Support Center (TAMS), and UIHS are some of the important organizations that contribute assistance to Tribal air programs. Organizations like ITEP and TAMS offer continuing education trainings and webinars on a regular basis. The WNRD will attend these educational opportunities as time and funding allows. After Mansel Nelson's visit to TBR, attendees to the IAQ tribal workshop completed a training equivalent to ITEP's *Indoor Air Quality in Tribal Communities*. NRD staff is now prepared to participate in more advanced level trainings, such as *Air Pollution Technology*, and *IAQ Diagnostic Tools*.

A challenge for the WNRD is securing funding to continue to grow an IAQ program. Funding opportunities such as GAP and CAA 103 are mainly for capacity building, and are not intended for long-term program implementation. EPA produced a document titled *The Tribal Air Grants Framework: A Menu of Options*, in which several options for air funding program development are provided. Through GAP, the WNRD met several of the activities outlined in the *Indoor Air Quality Assessment and Training* section, such as: community education, home assessments, attending trainings, and gathering baseline information. Other funding sources such as CAA 103 are not designed for the purpose of remediating IAQ concerns, such as weatherization or stove change-out programs.

Several programs exist to assist individuals with home repairs and improvements to enhance their IAQ. Many of these provide assistance directly to the Tribal member, or are otherwise administered through Tribal housing departments (i.e. HUD, BIA). The Wiyot Tribe does not currently have a housing department that could bridge Tribal members between the available services and the repairs their homes need. Without financial assistance to help remediate the burden IAQ issues cause, Tribal members are likely to continue to experience poor IAQ in their homes. The NRD staff will include IAQ components in future GAP workplans to the extent allowable. Also, attending trainings provided by ITEP will help NRD staff develop important skills to serve the community in their IAQ needs.