



## CASE STUDY

# Motor Vehicle Air Conditioning Servicing among Tribal Technicians



## Background

To prevent refrigerant emissions during the servicing of motor vehicle air conditioning (MVAC) systems, the U.S. Environmental Protection Agency (EPA), under Section 609 of the Clean Air Act, requires that motor vehicle technicians be trained and certified in the proper use of approved MVAC servicing equipment. In 2013, through funds from EPA's Tribal Program, EPA partnered with two tribes to conduct Section 609 certification sessions for about 60 technicians from tribal fleet service centers across Arizona and California. The observations and conclusions of this case study are only representative of a subset of technicians from the tribal fleet service centers for which training was provided.

Currently, the most common refrigerant used in MVAC systems is hydrofluorocarbon (HFC)-134a. HFCs are intentionally made fluorinated greenhouse gases used in air-conditioning, refrigeration, foam-blowing, fire retardants, solvents, and aerosols. They are widely used as replacements for ozone-depleting substances, whose use is being phased out globally under the *Montreal Protocol on Substances that Deplete the Ozone Layer*. Ozone-depleting substances destroy the stratospheric ozone layer that shields the Earth from the sun's harmful ultraviolet radiation. Use of the ozone-depleting refrigerant, chlorofluorocarbon (CFC)-12, in new MVAC systems in the United States ceased in the 1990s. Since 1994, the most common refrigerant has been HFC-134a, a substance that does not deplete the ozone, but is a potent greenhouse gas. Today, many motor vehicle manufacturers are beginning to transition to new, climate-friendly alternatives.

Under Section 609 of the Clean Air Act, EPA-approved technician training and certification programs provide education on the proper use of MVAC servicing equipment, the regulatory requirements of the Clean Air Act, the importance of refrigerant recovery, as well as the effects of improper handling of refrigerants on the ozone layer and climate system. To be certified, technicians must be trained by an EPA-approved program and pass a test demonstrating their knowledge in these areas. Section 609 certification is required to service any motor vehicle air conditioning system for consideration (i.e., payment or bartering), regardless of the refrigerant used in the system.

EPA's [Significant New Alternatives Policy \(SNAP\) program](#) ensures the smooth transition to alternatives that pose lower overall risk to human health and the environment. The SNAP program evaluates and finds acceptable substitutes for ozone-depleting substances. Under the SNAP program, EPA recently found acceptable, subject to use conditions, three low global warming potential MVAC refrigerants:

HFC-152a, hydrofluoroolefin (HFO)-1234yf, and carbon dioxide (CO<sub>2</sub>). None of these alternatives deplete the ozone layer and all have significantly lower global warming potentials than CFC-12 or HFC-134a. Table 1 shows the relative global warming potential of these MVAC refrigerants and whether or not they are ozone depleting. Today, there are cars on the road that use CFC-12, HFC-134a, and HFO-1234yf. It is important for motor vehicle technicians to know how to safely handle these refrigerants and others approved under the SNAP program.

Table 1. Environmental impacts of MVAC refrigerants<sup>i, ii</sup>

MVAC refrigerant	Global warming potential	Ozone depleting?
CFC-12	10,900	Yes
HFC-134a	1,430	No
HFC-152a	124	No
HFO-1234yf	4	No
CO <sub>2</sub> (R-744)	1	No

## Summary of Activities

Many tribes manage vehicle fleets that serve their communities in a variety of capacities and are serviced locally by tribal technicians. EPA partnered with tribal fleet programs that hosted, and recruited technicians to participate in, training sessions offered by an EPA-approved Section 609 technician training and certification program.<sup>1</sup> In 2013, EPA supported two sessions with technicians from eight tribes. The participating tribes were the Karuk Tribe, the Morongo Band of Mission Indians, the Navajo Nation, the Picayune Rancheria of Chukchansi Indians, the Soboba Band of Luiseño Indians, the Tachi Yokut Tribe (Santa Rosa Indian Community), the Viejas Band of Kumeyaay Indians, and the Yavapai-Apache Nation.

The two sessions trained approximately 60 tribal fleet technicians. The session held in February was hosted by the Morongo Band of Mission Indians and trained technicians from their tribal fleet service center as well as fleet technicians from other nearby tribes in California and Arizona. The second session held in April trained technicians from five service centers across the Navajo Nation. Eight tribes with a total of 12 fleet service centers participated in the training sessions.

Figure 1 shows the locations of tribes that participated in the training sessions. The Navajo Nation, located in Arizona, New Mexico, and Utah is the largest participating tribe, with a population of approximately 274,000 tribal members and 46 tribal fleet technicians.<sup>iii</sup> The other participating tribes are considerably smaller with populations between approximately 200 and 3,400 members.<sup>iii, iv</sup> These tribes are located in California, with the exception of the Yavapai-Apache Nation, which is in Arizona.

Each training session included several hours of classroom instruction by an [EPA-approved technician training and certification program](#). The EPA-approved program provided the instruction and administered the exam using their training materials. All Section 609 certification programs must cover a standard set of topics, including the environmental benefits of reducing emissions of refrigerants with high global warming potential and proper use of refrigerant recovery equipment. Supplemental information on new alternative refrigerants HFC-152a, HFO-1234yf, and CO<sub>2</sub>, was also included for these sessions. At the end of the instruction period, the technicians



Figure 1. Location of participating tribes.

1. Training was provided by the Mobile Air Conditioning Society (MACS) Worldwide.

completed a closed-book, multiple-choice exam to earn certification (Figure 2). All technicians that took the exam passed and obtained certification.

## Observations

Eight follow-up telephone interviews were conducted with participants from five tribes to better understand the experience of the technicians, characteristics of the fleets they service, current MVAC servicing practices, and benefits gained from the training session. This section summarizes that information. The observations and conclusions of the case study are only representative of technicians from a subset of the tribal fleet service centers for which training was provided, based on information collected during the follow-up interviews.



**Figure 2.** Navajo technicians taking the Section 609 certification exam in Window Rock, Arizona on April 29, 2013.

## Technician Characteristics

The technicians had automotive repair experience ranging from 18 months to more than 30 years. The average experience of the technicians represented in this case study was just over 17 years. Most of these individuals had formal automotive repair education, training, or certification. Several relied on experiential learning. Most of the technicians had previously earned Section 609 certification. The newly certified technicians indicated several reasons for not obtaining their certification earlier, including a lack of opportunity to attend training and misunderstanding of requirements.

The technicians reported that about one-half of their colleagues had previously earned Section 609 certification before participating in the current training sessions supported by EPA. Many technicians opted to retake the certification exam to earn a new certification card (e.g., some technicians had misplaced their cards and did not recall the issuing certification program to request replacements), to demonstrate their understanding of the training material, or because it was requested by their manager.

The technicians also reported that some of their colleagues did not have Section 609 certification and did not attend the training session. Reasons for this include scheduling conflicts, difficulty learning in a classroom setting or completing an exam, an impression that training would not be useful, or a sense that they already know the information and do not need additional training.

## Fleet Program Characteristics

The technicians provided the number, types, and age of vehicles in their fleets and described their service centers' resources. Fleet characteristics are important to help determine the environmental benefits of proper servicing practices for two reasons: (1) different types of vehicles contain different amounts of refrigerant, with buses containing the most and cars the least and (2) model year 1994 and older vehicles may contain CFC-12. Model year 1995 and newer MVAC systems contain HFC-134a; in the future MVAC systems may contain other alternative refrigerants.

Across the tribal fleets included in this case study, there are approximately 2,200 vehicles. About 64% were identified as light-duty vehicles, including cars, sport utility vehicles, and pick-up trucks; about 21% were classified as heavy-duty vehicles, including large trucks and utility vehicles such as those used for road work or trash collection; and about 15% were classified as buses (Figure 3). Less than 1% of the fleet vehicles were model year 1994 or older.

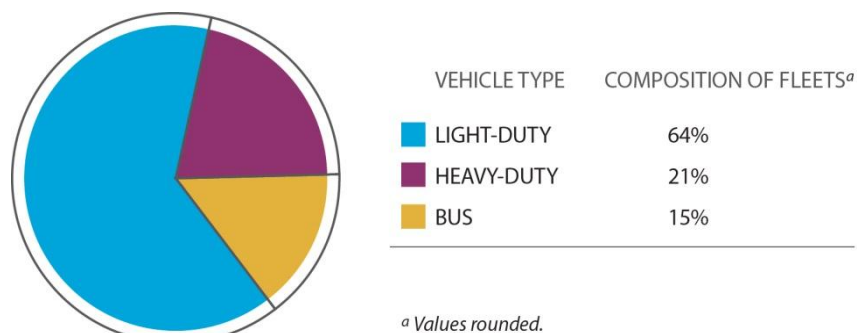


Figure 3. Approximate composition of fleets.

The size and composition of the individual tribal fleets in this case study vary widely. The size of the fleets ranges from 15 to about 800 vehicles. Table 2 demonstrates the variation in fleet composition by vehicle type, listing the percentage of light-duty vehicles, heavy-duty vehicles, and buses for each of the tribal service centers that are represented in the case study.

Table 2. Fleet vehicle compositions reported								
Vehicle type	Service center							
	A	B	C	D	E	F	G	H
Light-duty	55%	30%	34%	67%	60%	60%	70%	70%
Heavy-duty	25%	50%	33%	17%	35%	20%	20%	15%
Bus	20%	20%	33%	17%	5%	20%	10%	15%

The fleet vehicles are used for a wide range of purposes. The technicians said that they worked on emergency response vehicles (e.g., police cruisers, fire trucks, ambulances), school and Head Start buses or vans, utility and maintenance vehicles, casino vehicles, and other social service vehicles, such as those used to transport the elderly.

Available fleet maintenance resources vary by tribe. Many of the tribes have refrigerant recovery and recycling equipment. Those without service equipment must send their vehicles offsite for refrigerant recovery. Many tribes lack newer service equipment models. Figure 4 displays two of the recovery and recycling machines being used by tribes in the case study. Only some of the fleets have access to leak detectors and refrigerant identifiers. Notably, the number of technicians per vehicle served at each fleet service center varies considerably, with some technicians individually responsible for up to several hundred vehicles.



**Figure 4.** Examples of older (left) and newer (right) models of recovery and recycling machines among participating tribes.

### **MVAC Servicing Practices**

The tribes' approaches to servicing their fleets vary. Most technicians inspect and repair systems when there is a customer complaint. Others check systems on a regular schedule, but only perform refrigerant recovery, recycling, and recharging if a system is damaged or not working properly. A few technicians indicated a higher rate of servicing.

On average across the United States, MVAC systems in cars or light-duty vehicles are serviced once every six years.<sup>v</sup> It appears the rate at which some tribal fleet technicians service vehicles is higher than average. However, there is reason to believe that tribal fleet vehicles require servicing more frequently than other vehicles. Systems are frequently damaged due to wear from driving on unpaved roads. Fleet vehicles may also experience more wear than non-fleet vehicles because of the greater number of miles they drive each year. Fleet vehicles, such as buses, may need to be serviced more regularly to meet customer or management demands. Buses may also require more frequent servicing than cars because buses have longer refrigerant lines that are more prone to leaks.<sup>vi</sup> There are additional factors that could increase the frequency with which MVAC systems are serviced in tribal fleets. Based on the fleet composition and an assumed MVAC servicing schedule of once every six years for light - duty and heavy-duty vehicles, and once every three years for buses, EPA expects that across all fleets that participated in this case study, each year these tribal fleet technicians will service about 230 light-duty vehicles, 80 heavy-duty vehicles, and 110 buses.<sup>v, vi</sup> It is expected that about half of all servicing conducted by these fleet technicians each year will be on light-duty vehicles.

Participants provided information about service practices in their service centers. None of the technicians identified serious lapses in servicing practices, such as the intentional releasing or venting of refrigerant.

## Environmental Benefits

The environmental benefits gained from properly servicing MVAC systems result from reductions in emissions of greenhouse gases. HFC-134a, the most common MVAC refrigerant, does not deplete the ozone layer, but is a potent greenhouse gas with a global warming potential of 1,430, as indicated in Table 1.

The technicians in this case study cumulatively service hundreds of vehicles each year, all using HFC-134a. Using conservative estimates of MVAC system charge size and frequency of servicing, these technicians will handle a minimum of 0.8 metric tons of HFC-134a annually, with an associated global warming potential of over 1,155 metric tons CO<sub>2</sub>-equivalent. To put this in perspective, proper servicing of these MVAC systems has the potential to avoid greenhouse gas emissions equivalent in magnitude to those resulting from electricity used by 159 U.S. homes in one year.

Properly handling refrigerants is vital to reducing harm to the environment. Section 609 training provides information for MVAC technicians on how to handle refrigerant properly to avoid intentional venting of refrigerant. Best practices learned by technicians through Section 609 certification can improve refrigerant handling, MVAC system inspection, maintenance, and repair, and ultimately minimize the unintentional venting of refrigerant.

## Training Benefits Identified by Technicians

About one-half of the technicians who participated in the training sessions were already Section 609 certified, and many of the uncertified technicians seemed to be familiar with proper MVAC servicing practices. For example, none of technicians that participated in the case study indicated that the venting of refrigerant occurs in their fleet service centers. The technicians reported that they and their colleagues use approved refrigerant recovery, recycling, and recharge equipment, or send their vehicles offsite to be serviced by a facility with approved equipment.

Technicians stated that they gained new knowledge and an understanding of best practices from the EPA training sessions. More specifically, the technicians indicated that they learned the following information during the training sessions:

- Technicians must be certified to work on HFC-134a systems (some had been told that certification was only required for CFC-12 systems)
- It is important to check for cross-contamination in systems before servicing by using a refrigerant identifier
- How to properly maintain recovery equipment
- Best practices to use when servicing systems, including conducting a visual inspection of system hoses and components before servicing, and using a heat gun
- Personal safety practices to use when servicing systems (e.g., wearing safety glasses)
- How to verify if a refrigerant canister is empty
- [Recovery machines must be registered with EPA regional offices](#)
- More sensitive leak detection equipment is now available
- New refrigerants are being introduced.

## Conclusions and Next Steps

With funding provided from EPA's Tribal Program, EPA sponsored training for approximately 60 tribal fleet vehicle technicians on how to properly service MVAC systems and limit harmful refrigerant emissions. Through two training sessions, all participating technicians received Section 609 certification, about half of which were new certifications. Some of these technicians may have previously serviced MVAC systems without certification and others had sent vehicles offsite for servicing due to a lack of certification. These technicians can now perform MVAC servicing in-house, after obtaining approved MVAC refrigerant recovery equipment. The conclusions of this case study are the following:

**More training is needed.** These sessions reached a relatively small number of tribal fleet technicians and work is needed to identify technicians who require Section 609 certification. Tribal technicians in rural areas or other regions may have limited access to Section 609 certification opportunities. Currently certified technicians can also benefit from access to updated training content. Figure 5 displays tribal lands across the Continental United States. With 566 recognized tribes and roughly 2 million tribal members in the United States, there are many more outreach opportunities.<sup>iii, vii</sup> Training will help ensure proper servicing of MVAC systems and minimize unintentional refrigerant release during MVAC servicing. Ongoing outreach could also dispel technicians' misconceptions about Section 609 requirements, such as the perception that certification is only required for CFC-12 systems.

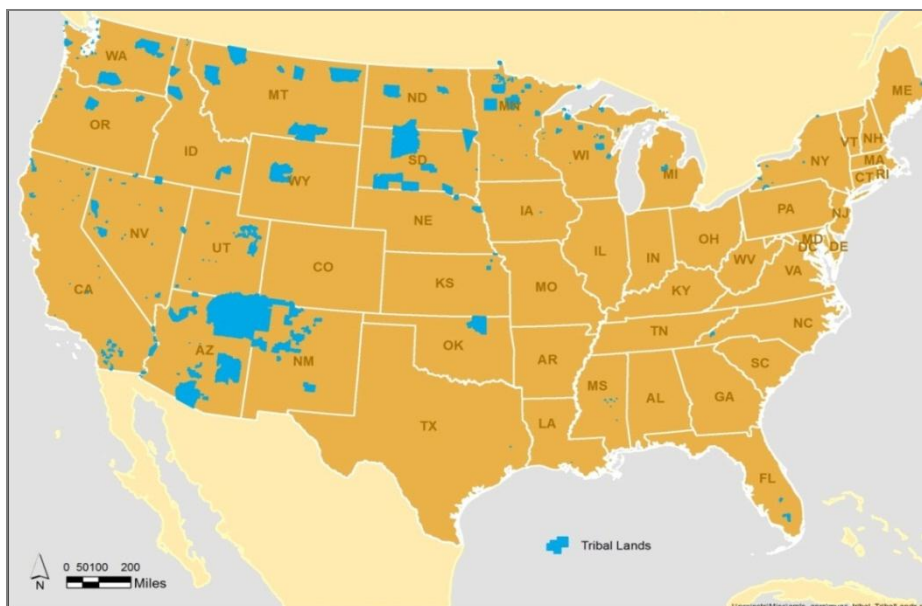


Figure 5. Tribal lands in the Continental United States.<sup>viii</sup>



**Technicians want to know about recently listed alternatives.** A beneficial portion of the training was the supplemental information on newer alternative refrigerants HFC-152a, HFO-1234yf, and CO<sub>2</sub>. Even though these newer refrigerants are not widely used today, the technicians found value in knowing what refrigerant technologies they may service in the near future.

**Servicing procedures addressed in Section 609 training are becoming an industry standard.** Uncertified technicians appeared familiar with proper servicing practices. This might indicate the pervasiveness and success of the Section 609 training requirement since its introduction in the early 1990s. However, continued training ensures that new technicians learn the Section 609 requirements and best servicing practices, and become certified.

**Fleet vehicle servicing frequencies might be higher than average.** In some cases MVAC refrigerant recovery frequencies were higher than expected. The reason for this is not clear, and could be attributable to several factors, including general wear on fleet vehicles, system damage from vehicle miles on unpaved roads, or greater demand for MVAC system functionality in fleet vehicles.

Based on the findings of this case study, potential next steps could include outreach to additional tribal communities to provide training opportunities, information on the importance of certification, information on new alternative refrigerants, and details on how to get trained by an [EPA-approved technician training and certification program](#). Hands-on training could be valuable as an addition to Section 609 certification training programs. Lastly, many tribal fleet programs could benefit from access to newer recovery machines, leak detectors, and refrigerant identifiers. To respond to the need for additional information on the new alternative refrigerants, EPA recently published the brochure [New Climate-Friendly Motor Vehicle Air Conditioning Refrigerants](#).

By partnering with the Morongo Band of Mission Indians and the Navajo Nation, EPA was able to help facilitate training for approximately 60 MVAC technicians servicing tribal fleet vehicles. EPA was also able to identify areas where additional efforts could help bridge gaps in information.

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**EPA Ozone Layer Protection Website**

[www.epa.gov/ozone/strathome.html](http://www.epa.gov/ozone/strathome.html)

430-K-13-002  
January 2014



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