Evaporator odor has been a long-standing problem, although it’s also been a source of service revenue that we’re sure many shops would say has made a steady contribution to the bottom line. Evaporator disinfecting with spray-on products, like AirSept Cooling Coil Coating, or even something easier to apply (therefore lower-cost), like the shorter-term UView MIST system, are well-established. However, there’s another side to this subject, because many shops will tell you they’ve also had a lot of failures. One primary reason is likely to be technique; another is because the real problem may not have been what it seemed to be.

There are three types of what we actually consider evaporator odor. DENSO defined them this way (Figure 1):

- “Rancid odor.” It’s also called the smelly socks odor, and is microbial or fungal-growth, created from airborne debris and condensate on the evaporator core face that feeds the airborne fungus. It’s what responds to the disinfecting treatment.
- “Dusty odor.” Some have described this as a cold refrigerator odor. It’s caused by corrosion of the aluminum core. The most effective anti-corrosion coatings the factories could apply will raise environmental issues, and their

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**Figure 1:** DENSO chart shows three basic types of odors from the A/C system; rancid from fungal growth, which is the “classic” type; dusty (“refrigerator”) type from evaporator corrosion; and “adherent” odor from such particulate gasses as cigarette smoke, exhaust gasses, perfumes, animal dander, etc. The antibacterial coating effectiveness (and life) varies, and the amount of airborne debris and evaporator core moisture determines the development of fungal odor. The anti-corrosion coatings are a compromise, with the need to promote condensate drainage to reduce adherent odor particles.
replacements seem to be not as good.

- Odor from a variety of airborne particles that combine on the evaporator, such as cigarette smoke, food, perfume, plastics emissions, animal dander, etc. DENSO calls this “adherent odor,” because it adheres to the moist evaporator core.

It might seem that factory-applied evaporator coatings that promote drainage should help prevent odor, removing anything that is collecting on the evaporator core. And in fact, the coatings chosen are actually multi-functional, that is, they’re designed to work on all three. However, nothing works unfailingly under all conditions on all odorants. A simple fact is that not all odorants are water-soluble, so if those non-solubles have adhered to the evaporator, drainage will have no effect on removing them. And in fact, moisture may cause the deposits to become malodorous.

Further, all of the odorants’ tendency to release is related to temperature variation in the HVAC case. And what’s equally significant is that some odorants are released when the A/C is on, some when the A/C is off. In both cases, of course, the release into the passenger compartment is when the blower is turned on, so if there is no OFF position on the blower switch (just a LOW position); the odor is released as soon as the ignition is turned on.

One of the odor issues we’ve seen on a number of cars is where a rancid smell comes from the upper registers when the system is first turned on, and in a half minute or less, it’s gone. The problem is temperature-related, from the evaporator core, and because of its brevity, there’s typically no factory fix—with one exception we have heard about, on 2010-11 Lexus ES-350s built at Toyota’s Kentucky assembly plant. Toyota didn’t have a new evaporator with a new coating that produced immunity to odor. It just replaced the A/C control unit (“amplifier”) with one that has a clever strategy. When the A/C is turned on, the airflow is directed to the floor registers for enough time for the odor to dissipate, away from the passengers’ nostrils. These cars are still covered by the four year/50,000-mile warranty, and even if the car is over the mileage figure, a Lexus dealer might still replace the amplifier for a customer with the problem.

The manufacturer-applied evaporator coatings in use, by promoting drainage, as noted, do remove some of the water-soluble “adherent odorants”, and much of it drains from the HVAC case. However, because the coatings are a compromise, they may not be able to work for the life of the evaporator to control the overall development and later release of odorants.

So we’re going to continue to have evaporator odor, because at this time, there’s no perfect coating to deal with the moisture issue, and certainly not in humid areas. Recognizing that, General Motors approved an add-on afterblow module that engages about 50 minutes after engine shutdown with A/C operation, and runs the blower motor for approximately five minutes to dry off the evaporator, reducing the amount of moisture that contributes to the microbial growth. In 2007, it began to incorporate an afterblow feature in many of its software packages, with the capability to be enabled or disabled. Unfortunately, it also may cause a dead battery if the car is not driven long enough between ignition cycles to recharge the battery after each afterblow operation. So GM’s fix is to disable the afterblow, although eventual release of a new strategy is a possibility. If your experience with the add-on module has been successful (Figures 2, 3) you may choose to continue to install it, but it does add cost.

It seems to come to this: in areas where humidity is at levels
that result in odor, the motorist usually has to get an evaporator odor service of some form.

**Treating the Evaporator and Case**

We’ve had some success with the UVee “MIST” (Figure 4) deodorizer, but even as the company will tell you, the treatment has to be performed repeatedly, in our experience, about twice a year. Deep-cleaning, with the disinfectant sprayed on the evaporator (then allowed to cure on the core face) and the interior of its case, is a more durable treatment. And after it’s done, we would suggest you perform an annual filter replacement, and/or perhaps a misting treatment, which takes about 15 minutes and involves no real labor. Once a car has suffered evaporator odor, it’s apparent that the geographical area and climate (with the evaporator design itself a contributing factor) are likely to cause a repeat unless there’s aggressive preventive maintenance.

**The Most Durable Treatment**

The most long and widely-used cleaning treatment, recommended by most carmakers, is the AirSept disinfectant and resin coating that is cured to the core. Just about every carmaker that recommends it also provides specific details for the application, and that occasionally includes the best access point for the spray tool (Figure 5). Without specific guidance we’ve typically removed the evaporator temperature sensor, or in vehicles without one, the blower resistor or even the blower motor itself. But you can save a lot of work if you check the service bulletins. There have been templates or precise measurements for locating a place to drill through the case (typically with a drill stop to avoid making contact with the evaporator core).

Mid-1990’s Hyundais, for example, provided measurements (different for each model) to locate a 7 mm (9/32”) hole for the spray wand, which is inserted and moved around in a specific pattern. After the treatment is complete, the hole is covered with a piece of Scotch moisture sealing tape, or something equivalent (perhaps a dab of RTV sealer) that will hold securely in place. You can get the details at the Hyundai tech info website (with no charge for admission), www.hmaservice.com (Figures 6, 7, 8).

A very important pre-cleaning step, whatever method you use, is to make sure the evaporator core is dry. You could just run the engine and the blower motor with the A/C compressor disconnected. Also useful is putting the system into recirc, moving...
the temperature control to hot and perhaps even adding heat by blowing warm air into the case with a hair dryer. Allow more time than less; a half hour is a good minimum.

To emphasize the drying issue, AirSept warns that if the recommended times and procedure for drying and curing the resin coating are not observed, condensate may wash it away, and the odor will return quickly. Do it right, and it can last for a couple of years, even more in some climes.

**The Effect of Filters**

It would seem that cabin air filters would keep most odor-causing debris from the passenger compartment, but often not. In many cases, the filter itself goes from being effective to becoming a breeding ground for odorant.

Nissan has had a fungal debris problem with 2003-05 Infiniti FX SUVs and G35 sedans, and 2006 Infiniti M sedans, which were factory-fitted with a conventional cabin filter. In this case the factory fix (also recommended as a new procedure) is to use an activated-charcoal filter available as a replacement. The dealers carry the new filter, but of course you can obtain an aftermarket replacement. Just be sure it’s the charcoal type for maximum effectiveness.

It’s not an absolute fix for these Infinitis, but if you also clean the evaporator and evap case interior (both of which will have some fungal debris accumulation) and use the charcoal filter, the improvement should be considerable.

However, at some point these charcoal filters, even if they help at first, may accumulate enough debris to form an environment for odor. You should not decide that the charcoal was ineffective and just replace with a conventional filter.

As Toyota once said in a statement about its cars, but obviously applicable to all, “Odor elements in the air are accumulated and absorbed in the charcoal-activated air filter. In rainy or humid weather, the odor elements are displaced or evaporated with the water and an odor is emitted. The cleanliness of the filter plays a large role in the potency of the odor. Servicing the filter more frequently lessens the possibility of experiencing this condition.”

We add this caution: be very, very careful when you replace a filter, particularly if it’s been in there for quite a while. Particular matter may drop off the element and stay in the case, where the blower motor will deposit it on the evaporator core. What’s the likely result: a premature case of fungal debris and evaporator odor?

**White Powder/Flaking**

There are cases, as we pointed out earlier, where the evaporator really is the root cause. Sometimes the problem is beyond blaming on the “normal” limits of evaporator coatings. If there are white flakes or white powder blowing out of the registers, this may indicate an evaporator manufacturing defect, typically an issue with the flux used. When this happens, there’s usually a service bulletin with a replacement part recommendation, and because powder or flakes can obviously cause respiratory and/or eye irritation, the problem should be taken care of ASAP.

A couple of high-volume makes with some degree of problem cars: 2007-10 Toyota Camry and 2006-09 Toyota Avalon. The factory-recommended fix is a new evaporator, and the part number is the same for Camry and Avalon (No. 88501-06112). There’s a different, specific part for the Camry hybrid (No. 88501-06102). Toyota says that in addition to cleaning off any powder on the dashboard and A/C registers, also take apart and clean the entire evaporator case with warm soapy water and blow out the blower and its case and the ductwork with shop air. You may have to do some further passenger compartment and dashboard cleaning up after that. Only after the cleaning operation is complete should the new evaporator be installed.

Toyota covered the evaporator replacement and case cleaning only under the 3-36 bumper-to-bumper warranty. But when there’s replacement of a part that obviously has some “issues,” there’s a chance a good will adjustment will be made. So you should advise the customer of the bulletin (No. 0379-09). It wasn’t released until late 2009, and as a result, there’s a good chance that an owner can press the dealer on the subject.

There’s also a host of Ford products in the 2000-10 period, which suffer with the white powder/flaking syndrome. They include: 2000-05 Ford Expedition, Lincoln Navigator and F-150; 2005-09 Ford Focus; 2007-09 Ford Edge and Lincoln MKX; and...
a stack of 2008-10 models comprised of Lincoln Town Car, Mercury Grand Marquis and Ford Crown Victoria, and Ford Escape/Mercury Mariner. Ford recommends only a cleaning procedure, but a pretty comprehensive one.

The basic approach is to use a shop air gun to blow the flakes and powder off the ducts and evaporator core, and also the blower motor and case, collecting the debris with a vacuum cleaner. The job requires closing off or taping over ducts (whichever applies) and momentary engine starts to shift HVAC modes. The details are in a Ford service bulletin (09-21-6, dated 11/09), which is in your aftermarket electronic information system. Because this is a cleaning procedure, it may not be covered beyond the warranty period, however.

In either case, when you’re cleaning—particularly blowing through with shop air, you should be wearing a dust mask, close-fitting (dustproof) goggles and of course chemical-resistant plastic gloves.

**Other Causes of Odor**

There are lots of other causes of interior odor, and although they may be classified with evaporator odor, they require different treatments. One of the most common is from the heater core and case. It also can accumulate some debris, particularly if there’s even minor seepage from the heater core, which a motorist might ignore and put in the category of “normal system top up needed.” The seeping coolant becomes stagnant and mixes with the debris, producing an odor.

An assortment of interior odors may be coming from under the hood. One check is to put the system into recirc and see if the odor goes away or at least is sharply reduced. Most cars today do not fully close the outside air door, so you can’t expect a total isolation. The underhood odors may seep through the “firewall” (now called the bulkhead). But more often, they’re drawn through the air inlet grille in the plenum, particularly if the grille, designed to draw in outside air, is not well-sealed around its mounting perimeter.

Late-model GM full-size crossovers (2007-11 GMC Acadia, 2008-11 Buick Enclave, 2009-11 Chevy Traverse and the 2007-10 models of the discontinued Saturn Outlook) may emit an oily odor, traced to the location of the transfer case vent. The air inlet was the entry point but there was no simple way to relocate the vent. So the factory fix is to install a charcoal air filter in the HVAC case. The case is designed with a tray-like section to hold a filter, but as on many vehicles, one was never installed (saving a few dollars per vehicle). The installation requires cutting out a molded-in area that forms an access panel, then filing the perimeter of the opening to remove rough edges and burrs, slide the filter into the tray and install the cover (Figures 9, 10, 11). Both the filter (part number 20958479) and the cover (part number 25837964) must be ordered separately. The charcoal filter will absorb oil fumes. However, because the filter is exposed to this source of contamination, filter life can be expected to be shorter.
Cigarette smoke doesn’t easily dissipate when the doors are opened, and if a vehicle’s previous owner was a heavy smoker, the smoke particles will drop into the carpeting and other interior fabrics and become embedded. Air fresheners don’t do more than add a perfume smell, and even a product made for fabric (such as AirSept’s Air Smoke) can’t be used on leather, although it is recommended for cloth and vinyl. The safest treatment is to sprinkle baking soda on the upholstery, let it sit for several hours, and then vacuum it off. Upholstery spray cleaner may be moderately effective, and a spray deodorizer for pet odors also can work. But if cigarette smoke and/or pet dander, etc. are where the odor is coming from, your best bet is to advise the customer, and suggest he try one or more of the possible products.

Mildew, to many people’s sense of smell, resembles evaporator odor (the two are from fungus growth, so no surprise) and often is in the carpeting, from outside moisture seepage through poorly-sealed body seams and/or leaking door weather-stripping. You can suggest the motorist clean the carpeting, but first reseal the body seams. However, severe cases of mildew on the underside of the carpet usually require removal and replacement of the carpet, in addition to treating the floor pan. Hopefully the mildew is confined to a small, open area, in the footwells for example, where carpeting could be lifted up, or if necessary, removed for cleaning and then refitted. Otherwise, we’re talking about a labor-intensive job for a body shop.

Today’s synthetic materials for car interiors are generally low gloss, and if you use solvent-based cleaners/deodorizers, you could change the appearance. That’s probably not important on an old commuter car, but with a late-model on which the motorist is still making payments –no good. Unless you bring special expertise to the job, such as evaporator disinfecting, or (a body shop) removing seats, etc. for carpet replacement, maybe you should let the customer try to do it himself.

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**Electronic Leak Detection—One More Thought**

The February 2012 issue of this publication covered in depth, the SAE Interior Climate Control Committee’s latest evaluation of A/C leak detection methods, from soap bubbles to trace dyes to electronic leak detectors that sense small refrigerant leaks. The SAE document, J1628, warns against using means other than with refrigerant, to introduce pressure, and we said we’d cover this subject separately in this issue.

It comes down to this, to quote SAE J1628, “A pressurization substance other than the system’s refrigerant has not been tested to any SAE standard for suitability for A/C leak detection, and there are no affordable service shop-useable, leak detection devices that have been tested to any SAE standard to demonstrate they can consistently measure the equivalent leakage rate of less than 25 g/yr. Current industry technology has not developed cost-effective refrigerant leak detection equipment other than that meeting SAE J1627 and J2791 (performance criteria for electronic leak detectors for R-134a) and J2913 (for R-1234yf).”

What about the tracer gas detectors, such as those being marketed for shop use with a mixture of nitrogen and a small amount of hydrogen? We’ve discussed this type (see MACS Service Reports March 2010 issue). They do detect hydrogen, but at this time there is no SAE standard to which they have been tested and validated, so we can’t tell you if they have the ability to detect the same size leaks as the latest refrigerant detectors.

That said, SAE recognizes that in some parts of Europe, the laws seem to bring into question the use of any amount of refrigerant for leak detection, and these nitrogen-hydrogen detectors (such as “Loktracer”) are being used. In fact, they also are being sold here. The Interior Climate Control Committee, as a result, is developing a new standard, SAE J2970, which will provide a basis for evaluating any electronic detectors that rely on pressurizing the A/C system with a leak tracer gas other than the system refrigerant. The standard should be finished and published sometime this year. But the draft has been circulated to all affected parties, so they know pretty much what they would be expected to demonstrate with their leak detection systems to certify to the standard. Basically, the standard would require any alternative trace gas to demonstrate equivalency to A/C refrigerant in detecting size of leaks, and with equal accuracy to those meeting J2791 and J2913.

J1628 warns against the use of pure hydrogen, because it poses a flammability hazard, and even with a hydrogen sensing device, its escape velocity from a leak is so high it “may move away from the leak too quickly to be detected.”

Helium is used as a leak detection gas in laboratories, particularly at the component manufacturing level. So a mixture of helium and nitrogen would be another possibility, because helium also can be detected. But J1628 advises that the dilution effect of the nitrogen would require an extremely sensitive detector. Further, at high pressure, the nitrogen would not only pose a danger to the evaporator, but as J1628 warns, it “would tend to be adsorbed by the desiccant, so a good vacuum would be needed to remove the residual gasses after leak detecting is accomplished. Leak detectors using this technology have not been evaluated for meeting appropriate SAE leak detector performance requirements.”
We know that some shops pressurize systems with dry nitrogen or shop air, and listen for leakage with a mechanic’s stethoscope. The J1628 position: “Pressurizing the entire closed (refrigerant) circuit over 1050 kPa (150 psi) could cause failure of an evaporator. The use of shop compressed air can introduce moisture into the system, saturate the desiccant and cause overpressure damage to the evaporator... The use of a higher-pressure refrigerant, such as R-22, can result in system chemical contamination. Do not use R-22, as it can contaminate the refrigerant recovered in the service equipment.”

The bottom line: so long as refrigerant-sensing electronic leak detectors are legal for use (and we have no reason to suspect any legislation to the contrary here in the U.S.), that’s what you should use, and of course, the ones that meet the latest SAE standard. If you’ve tried all the electronic leak detectors available, you’d know there are differences in performance. And as the refrigerants in use change, and the state of the art advances, the latest SAE standards also reflect affordability. Yes, the truth is that we could produce standards for better leak detectors, but what we have okayed provides a combination of performance and affordability. By requiring a list of common chemicals that could cause a detector to false-trigger and having the instruction manual tell you which ones will affect a particular detector – in a laboratory test that eliminates the guesswork—you can make a choice you can afford.

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**ASK THE RIGHT QUESTIONS, GET THE RIGHT INFORMATION**

Too many technicians fail to get all the information they really need when a car comes in with a “poor A/C performance” complaint. Okay, not all motorists are observant, but you can at least try. The following are based on standard questions on a GM list, and if you don’t use one of the forms provided for service writers by MACS and many parts distributors, the following should eliminate most false starts:

1. How long was the motorist driving the car when he first noticed the problem?
2. Did he notice the airflow itself going from cold to warm (seems obvious, but you’d be surprised).
3. Did he check the airflow from all or just a specific vent, and did he notice if there was low flow from any one or some of them, or from all.
4. Did he feel any moisture in the air coming from the vents? This could be a tipoff to plugged evaporator drains.
5. If the problem has existed for multiple driving events, was the air cold on any one of them, at least for part of the time. This might lead to identifying a sensor issue.
6. If the problem has existed for multiple driving events, when did it start? The motorist is unlikely to remember the ambient temperature and humidity for all of them, but he might remember a starting date. If the weather has been changing dramatically over the period, the easiest way to check past days’ weather (temperature at least, and with some searching around, humidity too in many areas) is to go to [http://www.nws.noaa.gov/climate](http://www.nws.noaa.gov/climate).

**When You Assign the Job to a Non Specialist**

If the shop’s A/C specialist is busy and you want to get the diagnosis started, you can assign the preliminaries to any technician in the shop. Here is what GM asks a technician to be able to provide when he calls in with an A/C performance problem:

- A/C high and low side pressures.
- Inside temperature sensor reading.
- Outside temperature sensor reading.
- Evaporator temperature sensor reading (if used).
- Duct temperature sensor reading (if used).
- A/C refrigerant charge level. This is actually a tough one, because we ask, how can he tell? We’ve said many times that the pressures won’t tell you, although if very low, could be an indication. Our recommendation (as it’s been for years) is to use an SAE J2788 recovery/recycle/recharge machine and see how much refrigerant it pulls out. Assuming you’ve been checking the scale calibration, the machine should produce a number that’s accurate, and if the charge was correct, that number should be 95% or more of what’s supposed to be in the system.
ANOTHER HVAC WITH LOTS OF INTELLIGENCE

It was only a matter of time until the HVAC system began to use another of the available pieces of information on a car, in this case the GPS (global positioning system) on the 2011 Acura RL. The navigation system computer uses GPS to determine the position of the sun relative to the driver and front passenger, and sends this information to the HVAC computer, which uses the sun load sensor to determine amount of sun load, and calculate the effect based on the sunrays’ angle, as adjusted by the GPS signal.

The adjustments are both for temperature and airflow, and the output to the driver’s side may be different from that to the front passenger. In addition, the navi screen also has an interactive feature that (with operation of the multi-function control stack dial) allows the driver to adjust the air temperature from the A/C registers.

Also contributing to the perceived comfort are the solar shades that have become a popular premium addition to the luxury vehicle class. On the RL, the rear window (“backlight”) sunshade is power operated by the driver to be raised to reduce parked vehicle sun load. There also are manual sunshades on the rear side windows, which typically are left raised for vehicles parked in hot sunny weather.

If any of these solar shades doesn’t work and is stuck down, the driver might complain about slow initial cool down, forgetting to mention the possible reason why.

COMPUTER SAVERS—ANOTHER THOUGHT

We have discussed this subject often, and in the April, 2011 issue talked about what we consider the best type: one that plugs into the vehicle’s diagnostic link connector and a 110 volt outlet. However, we still suspect that many shops will use the type with the 9 volt battery that plugs into the cigarette lighter socket, for quick jobs anyway (Figure 12).

That’s okay, if you have a fresh 9 volt battery, but remember this: on an increasing number of late model cars, that “cigarette lighter” socket doesn’t even have a lighter element in it – it’s just a 12 volt power outlet, and more important, it’s off unless the ignition is on. That pretty well eliminates it for computer memory saving. However, if you grab that power outlet plug in type computer saver and want to use it, first try plugging in something that will tell you if the outlet is live with the ignition off, such as a spotlight.

Figure 12: Simple computer saver that snaps into a 9 volt battery is probably in every technician’s toolbox, but the control stack power outlet into which it plugs may not be “live” with the ignition off, making it useless for many functions, including HVAC.
MACS Service Reports Quiz #MSR0212

Fill out the information at left, and circle the correct answer for each question in the box below.

Mail or fax your completed test to: MACS Worldwide, P.O. Box 88, Lansdale, PA 19446; Fax: (215) 631-7017

1. Technician A says the largest refrigerant capacity in front/rear A/C systems in automotive use today is about six pounds. Technician B says a typical passenger car with a front-only A/C system has a capacity of 24 ounces or less. Who is right?

2. The oil charge on many modern automotive A/C systems is as low as:
   a. 9-10 ounces  b. 6-8 ounces  c. 4-6 ounces  d. 3-5 ounces

3. The spare refrigerant capacity in 1980's-1990's cars with a total capacity of 3-4 pounds and a receiver-drier was typically:
   a. 4-5 ounces  b. 8-10 ounces  c. 12-14 ounces  d. Approximately one pound

4. Technician A says a late-model car's front-only A/C with tight sealing and low-permeation hose has a refrigerant leakage rate of about one ounce per year. Technician B says a late-model car with front and rear A/C has a refrigerant leakage rate of about two ounces per year. Who is right?

5. The previous generation of electronic leak detectors (meeting SAE J1627) had to be calibrated to detect leak rates of:
   a. 0.5 ounce (14-15 grams/year) or greater  b. 1.0 ounce (28-30 grams/year) or greater  c. 0.1 ounce (3 grams/year) or greater  d. 0.1 ounce/year or greater on one scale, 1.0 ounce/year or greater on another scale

6. SAE J1628 defines a large leak as:
   a. 3 ounces/year (85-90 grams/year)  b. 2 ounces/year (57-60 grams/year)  c. Refrigerant loss in one cooling season sufficient to cause the system to fail the car maker's performance test  d. Refrigerant loss in one week sufficient to cause the system to fail car maker's performance test

7. Technician A says rear A/C system leakage often occurs from corrosion in the refrigerant lines that run along the underbody to the rear evaporator. Technician B says rear leakage often occurs from rub-throughs in the refrigerant lines. Who is right?

8. Technician A says the leakage from a compressor shaft seal is greatest with excess oil in the system. Technician B says the leakage is greatest with the system running. Who is right?

9. The maximum amount of refrigerant that should be installed in an empty system for an electronic leak detector check, as a percentage of the specified refrigerant charge, is:
   a. 9% at 88 degrees F  b. 11% at 77 degrees F  c. 13% at 86 degrees F  d. All of the above are correct

10. All electronic refrigerant leak detectors will alarm if exposed to:
    a. Transmission oil  b. Methanol-based windshield washer fluid  c. Ethylene glycol-based antifreeze  d. All of the above

Your Name: _______________________________
Company Name: ___________________________
Position/Title: ______________________________
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City: __________________ State: __ Zip: ___________
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