Tribune Editor Note: this letter was written before the 2001 recall

August 10, 2000

Re: Firestone Tires and the Ford Explorer
An Open Letter from Robert C. McElroy, Ph.D.

This letter is sent as a personal safety advisory to help you better understand the current problem of Firestone tires fitted to Ford Explorers.

As a very popular vehicle, each of you either owns an Explorer, knows someone who drives an Explorer, or at the very least, you see these vehicles on our city streets countless times daily.

For a number of years, as a part of my technical forensic investigation practice, I have examined numerous tire delaminations. However, during the past year, a pattern has emerged which is typical and reasonably predictable.

If you continually drove your Explorer with Firestone tires in your community at local speeds, up to say 45 mph, you would probably not ever experience a delamination.

If you operate your Explorer at freeway speeds for extended periods of time, you have achieved two pieces of the puzzle (1) speed and (2) operational time. This freeway driving would permit sufficient time for the tire to reach peak operational temperature. If tire pressures are low (3), operational temperature will be higher than if tire pressures are properly maintained.

A typical modern tire is hand built by tire craftsmen. Yes that tire is built in a factory by a production worker. Modern tires are composed of many different types of components including rubber and steel.

After the tire craftsman builds the tire, it is vulcanized or cooked in a special chamber to produce a monolithic or single uniform product - namely the finished tire, ready to install on your vehicle.

A tire has a heat life or heat memory.

Every rotation of the tire flexes the tire sidewall and tread. This movement creates heat buildup in the tire. Air passing over the tire provides cooling.

As an example, if the vehicle were driven for 100 miles at a constant 60 mph, at some point in our trip a very uniform and maximum temperature would develop in each section or portion of the tire, i.e.: tread surface, inner liner, sidewall, rim flange, etc.

Effectively, each section of the tire would reach its proper expected design temperature. Simply stated, tires operated on the freeway get very hot Touching a tire or wheel can result in a painful burn. Time and use will ultimately wear out the tire, time and use put varying amounts of heat into a tire. The issue of heat is very significant for the life and vitality of the tire.

If this were a boat or airplane, we might have an hour meter clock to record engine life to schedule engine maintenance or replacement. A tire is not fitted with an hour meter or use gauge, at least not in a conventional sense. However, tire tread depth is a good indicator from a general safety standpoint. If a tire has 2/32" of tread or less, it should be replaced because of wet weather performance. Tires are typically built with molded in wear bars which provide a visual indication of this condition.

Ford Explorer tires do not need to be worn out to delaminate. These tires do require extended heat buildup to put another piece of the puzzle into the total picture of delamination.

Tire chemistry is the next to last piece of the puzzle. How old is old for a person? George Burns, the famous actor, lived to be 100 years old. Daily reports in the news address death at all ages, infants to Viet Nam and World War II veterans.

When will that tire fail? Tire failure is a function of heat history and chemical aging. I have not seen a common denominator for tread depth or mileage. The tire may perform flawlessly until the tread is worn away or the tire may delaminate - rather unexpectedly.

The last piece of the puzzle is impact. In every delamination I have examined, tire impact has played a role. Minor impact or severe impact, but never the less, some sort of impact. This action is responsible of causing the tread to delaminate or separate from the tire.

The entire tread package is not normally thrown from the tire. If the entire tread were thrown or removed from the tire, the tire would typically be holding air and the tire would still be supporting the car. You would simply have no tread on the tire, almost like a totally slick or bald tire.

In this condition, the steel reinforcement of the tire and a very thin rubber layer would be contacting the pavement. This tire would be very unstable to drive on and a driver would need to exercise extreme care to maintain control. This would be analogous to winter driving on snow and ice.

Most of the delaminations I have seen have been partial. This condition means that you have a large and heavy flap of tread hitting the body every time the tire goes around, on the order of about 750 times a minute at 60 mph. Major vibration and noise result ... and significant body damage can happen.

If this condition happens to you when driving at freeway speed, slow down gently with light brake pressure or lift your foot off the gas and let the vehicle slow naturally. Do not

make a sharp or sudden steering movement. Driving through this type of emergency can save your life and the lives of your passengers. Calm and knowledgeable control promotes vehicle and passenger safety.

Should you replace those tires? Should George Burns have another martini or cigar?

When impact occurs to a tire which is predisposed to delaminate because of usage, total heat accumulation and aging tire chemistry the tire will fail.

There is a relationship between vehicle mass (M), vehicle speed (v) and Force where $F = 1/2\ mv^2$. For the non math reader to visually clarify the equation, with one vehicle, would change the equation to 1 (vehicle) = 1/2m, so the equation would look like $F = 1v^2$ or $F=v^2$ representing Force of one vehicle. Here's the Force numbers for various speeds:

$10\ mph^2 = 100\ F$
$20\ mph^2 = 400\ F$
$30\ mph^2 = 900\ F$
$60\ mph^2 = 3600\ F$
$80\ mph^2 = 6400\ F$

Slower speeds are safer. You know that it takes a much greater distance to stop at higher speeds. 30 mph has 9 times the energy of 10 mph.

The intent of this letter is not to create alarm but to provide a logical technical explanation about a contemporary problem. When your tires are worn, have them replaced normally. Be cautious in your driving at all times.

Based on what I have seen up to this point, x-ray, magnetic resonance imaging, or other non destructive testing methods will be hard pressed to provide a simple yes or no, go or no-go answer to tire integrity.

If the tire feels loose internally, which can create a feeling of instability when the vehicle is driven, this is one subtle indicator of partial delamination and you should replace the tires. If you roll down your window while driving and listen to your car moving down the highway at 40 mph, is the sound smooth and uniform coming from the car, or is there a constant thumping coming from the tires which varies proportional to vehicle speed. This constant proportional thumping indicates that your tires may be delaminating. Have your tires professionally checked by the tire shop, and if tires are the problem they should be replaced.

There is a very low probability of a catastrophic failure. Check your tires regularly for physical irregularity and tire pressure. Unfortunately, this issue will remain in the news.

Sincerely,

Robert C. McElroy, Ph.D.