Medical Preparedness and Nuclear War

CIVIL DEFENSE AND SDI IN THE 1990's

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NUCLEAR WEAPONS are often thought of as an epidemic or a cancer, so naturally doctors tend to think of themselves as experts on the subject. Various doctors have written prescriptions for the nuclear weapons outbreak. Do we want to take their medicine?

Suppose you visited your doctor, and he shook his head sympathetically and gave you a diagnosis of a bad disease believed to be caused by virus X.

"I'm so sorry," he might say. "But for the disease that you have, there is no treatment, only prevention."

"But isn't there *something* you can do? An operation? Chemotherapy? Radiation?" you would ask.

"There just isn't anything that's 100 percent effective."

You might bring in a newspaper clipping about a new treatment, or a textbook describing an old treatment. "Look, people who took this medicine got better. Can't you prescribe some of that for me?"

"I'm afraid not. It was only 80 percent effective, and it cost $1000. Sure, there might have been some people who lived for a while, but they were only temporary survivors. And they had side effects. Several of them even got cancer 20 years later. There's just no adequate medical response to this disease. Think of it, there's enough virus X in the world to kill everybody 100 times over!"

By this time, you would probably be thinking, "How about a second opinion?"

Is There No Defense Against Nuclear Weapons?

Many doctors approach nuclear weapons with the same type of analysis that our imaginary doctor used for virus X. If you ever read or listen to the mass media, you are familiar with this opinion. It goes like this: if somebody ever "pushes the button," they'll "blow up the world," and everybody will surely die. This is the Star Wars Theory of Nuclear Weapons, which is based on the concept of the Death Star battle station. When Darth Vader pushed a button, Princess Leia's planet Alderon disappeared in a flash. This theory is grounded solidly on fantasy and special effects.

Preventive Technology

The science fiction fans will be disappointed today, because our discussion will concern technology that is earthy, mundane, and far from futuristic. In fact, the discussion will not even sound at all like a medical lecture. Although doctors would like for you to be impressed with our importance, the truth of the matter is that most preventive medicine is not done by people with medical degrees. I first learned to appreciate this fact from Dr. Harold Brown, Professor of Tropical Medicine at Columbia University. His lecture on the diagnosis and treatment of exotic worms and protozoans was climaxed by photography of the technology that would put the majority of parasitologists out of business: an out-house. But it can be remarkably difficult to persuade people to adopt such technology.

Now people don't *have* to lower themselves to do jobs like digging ditches for a sanitary waste disposal system. They have a choice. They can and often do opt for peaceful coexistence with their gastrointestinal parasites.

However much we modern scientists like to congratulate ourselves on our superior knowledge and insight, some of the most important discoveries were made in ancient times and then forgotten for centuries. It is written in Deuteronomy 23:13: "And thou shalt have a paddle upon thy weapon; and . . . when thou wilt ease thyself abroad, thou shalt dig therewith, and shalt turn back and cover that which cometh from thee."

In the early days in which dysentery killed more soldiers than enemy weapons did, both ends of the Israelites' weapons were of strategic importance.

At the time of the War Between the States, dysentery still killed more soldiers than weapons did.

In the days of modern physics, the shovel and its more sophisticated equivalents such as the backhoe are still of vital strategic importance. While I do not mean to understate the importance of high technology, especially for protecting our wealth, we could protect our people's lives with the most basic of engineering principles, known since ancient times and proved effective in atmospheric tests of nuclear weapons. Before the atmospheric test ban treaty, about 650 megatons of nuclear warheads were exploded in the atmosphere. Protective measures were tested at the same time. Until the laws of physics change, these data will remain valid, even though they are several decades old.

Yet it is difficult to persuade people of the value of protective measures, once they have heard the Star Wars Theory of Nuclear Weapons many hundreds of times. This theory tends to destroy one of the prerequisites for making use of our knowledge: it's called the will to survive. Also, the technology is primitive and mundane. Many people quail at the thought of digging a hole in the ground. They do have a choice. But would they really prefer to die of radiation sickness?

Immediate Weapons Effects

Most of the people in the world would survive the immediate weapons effects of blast, heat, and radiation in an all-out nuclear exchange, according to Sagan and coworkers in the original "nuclear winter" report in *Science* (12/23/83). Furthermore, millions of lives could be saved with low-technology protective measures, even within the target areas.

In their compulsory civil defense training sessions, Soviet citizens learn about these protective measures. Here are some examples of such measures. They are told that a shelter's ceiling can withstand tremendous loads, including that of the collapse of the building. Thus, in the center of a nuclear strike (presuming that it is an airburst), even in the zone of complete destruction, shelters reliably protect people from the shock wave, from thermal radiation, fires and products of combustion, and also from radiation. Soviet citizens also learn that many types of structures could serve as shelters, including garages, tool supply rooms, mines and other underground shelters, and subways. The capacity of subways could be increased by building platforms over the tracks. Of course, all structures require advance preparation to provide for such

needs as ventilation, laboratories, and survival supplies.

Civil defense instruction includes fire-fighting techniques. Citizens learn about the characteristics of the thermal radiation from a nuclear weapon, including the fact that the burns from the fireball depend on the color and density of clothing. White fabric radiates the effect of thermal radiation, and burns are worse under dark clothing, as shown by photographs from Hiroshima. Also, thermal radiation follows only straight-line propagation and objects that cause shade offer partial or total protection against thermal radiation. In other words, those caught outside shelter in a nuclear attack can still do some things to protect themselves from burns.

Some Americans scoff at this information, saying that it demonstrates Soviet stupidity and paranoia and perhaps an insane desire to waste money. But remember that the effectiveness of civil defense measures is not just a matter of opinion; it is testable.

Blast

Recent tests of shelters built from steel cylinders and buried concrete domes had the same results as previous tests: all the blast shelters survived. The mannikins which were standing up in the shelters before the tests were still standing up after the tests. Because of the atmospheric test ban treaty, these tests were made with chemical explosives. But the effect of x pounds per square inch overpressure is the same regardless of its cause. In fact, you don't even need to set off an explosion to demonstrate the end result of a nuclear blast and the hurricane-force winds that result from it. Such effects are shown on the evening news after a tornado or hurricane. According to estimates made by the official in charge of the disaster response to Hurricane Camille in Mississippi, it would have taken about 214 5-megaton bombs to produce an equal area of devastation.

Although nuclear weapons are very powerful, they are not able to blow up the world. The Soviets have enough megatonnage to subject about 15 percent of our land area to lethal (5 psi) blast damage. (This means that 85 percent of our land area could *not* be subject to heavy blast effects.)

Thermal Effects

One frequently sees calculations of the number of burn beds that would be required after a nuclear war (apparently based on the tacit assumption that everyone would be standing outside watching the bombs fall.) It is obvious that we could not possibly build enough intensive care beds to take care of that many casualties with the high technology means we currently use. However, we already have more than enough bedsheets to prevent the burns. At a distance such that a person would survive the blast effect, diving under a sheet or into a shadow would protect one from a painful and possibly fatal burn. Furthermore, many patients with lesser burns could be saved by low technology treatment, especially oral hydration. (Four to eight quarts of water containing 1 slightly rounded teaspoon of salt per quart in the first eight hours, followed by another four to eight quarts in the next sixteen hours.)

If you have heard one of the "Bomb Run" presentations about nuclear war, given by groups such as Physicians for Social Responsibility, you may be very skeptical about what I have said so far. You may have heard assertions that shelters would become crematoria (Dr. H. Jack Geiger, *The Final Epidemic: Physicians and Scientists on Nuclear War.* Adams A and Cullen S, eds. Chicago: Educational Foundation for Nuclear Science, 1981:173–181). For example, Dr. Alexander Leaf of Harvard stated that "anyone caught in the fire zone would be promptly roasted, and those in underground shelters would be either suffocated from lack of oxygen or asphyxiated by carbon dioxide or carbon monoxide, as occurred in Hamburg and Dresden" (*N Engl J Med* 1986;315:905–912). This statement appeared in the nation's most highly respected medical journal.

Since the results of the Hamburg firestorm are presented as the irrefutable "proof" that shelters wouldn't work, we must ask what really did happen in Hamburg. On the night of July 27–28, 1943, Allied bombing caused a terrible firestorm that devastated a 5-square mile area. About 280,000 people were in that area. About 40,000 of them died. And about 240,000 survived. The 15 percent who died were in the streets or in basements beneath heavily timbered buildings. The 85 percent who survived were in bomb shelters. In the best bomb shelters (bunkers), there were no casualties due to fire. Data on the Hamburg firestorm survivors are found in the U.S. Strategic Bombing Survey, in reports by the British Home Office, and in the report of the Police President of Hamburg, who was in charge of fire, rescue, and civil defense operations. All these sources are basically in agreement.

Why, then, do many famous doctors say otherwise? How could these doctors be wrong?

Perhaps they rely on the prestigious National Academy of Science, which published a book called *The Medical Implications of Nuclear War.* In this book, Theodore Postel of Stanford University writes: "I was unable to find any unambiguous data on survival rates within the region of the mass fire in Hamburg." Dr. Postel lists the report of the Police President of Hamburg in his bibliography, and states that it is considered the most reliable source, but apparently he didn't read what the Police President had to say.

Or perhaps the doctors quote from a 1962 article in the *New England Journal of Medicine,* which itself was quoting a single source, a book entitled *The Night Hamburg Died,* a sensationalist work by a popular author, a book that was called "the infamous swindle-report" by a German eyewitness to the firestorm. (Of course, Hamburg did not die. Its industrial production reached 85 percent of the pre-firestorm level within about five months.)

Radiation Effects

The most feared effect of nuclear weapons is radiation. People are not very well educated in physics, so it is quite easy to terrify them with mysterious effects that they don't understand. In some instances, this can be useful. It has been found that laboratory equipment labeled with the "radioactive" symbol is less likely to be stolen. (You can label anything radioactive without telling a lie, because everything in the world is radioactive.) This mystique is also good for comic book writers, who have a ready explanation for things like the supernatural powers of Spiderman. (He acquired them from a bite of a radioactive spider).

However, ignorance can be a dangerous thing. In the movie *Testament,* all the children in a small town in California died a slow, agonizing death from radiation sickness, even though none of the buildings had been destroyed by blast. The town was downwind from the military facilities in the Bay Area, which had been subjected to a groundblast in a nuclear attack. The townspeople had no idea how to measure fallout, much less how to protect themselves.

One reason why people are not motivated to learn about fallout is that they believe that nothing can be done about it.

In the movie *The Day After,* one of the actors said "radiation is forever." This is the exact opposite of the truth. Stable elements are (almost) forever; their half-life is comparable to the age of the universe. Radioactive elements decay. The very process of emitting radiation turns them into another element, eventually one which is nonradioactive. Radiation, by its very nature, becomes less with time. Yet even Isaac Asimov, despite the fact that he knows better as proved by his own words in the very same book, could not resist the temptation, for the sake of his plot, to have the earth becoming more and more radioactive in the novel *Foundation and Earth.*

For some obscure reason, people worry most about isotopes with the longest half-lives, forgetting that these are the ones that give off the least radiation. Plutonium 239 has a half-life of 24,100 years. If you inhaled some Pu-239, you would probably die of old age long before it got around to radiating you. (A number of workers from Rocky Flats have been walking around with plutonium in their lungs for more than 20 years. Their incidence of lung cancer is lower than normal. This doesn't "prove" that plutonium cures lung cancer, however!)

In contrast, many isotopes in weapons fallout are very hot, delivering a high dose of radiation very quickly. These isotopes also disappear very quickly, their radioactivity declining to tolerable levels within weeks.

Fallout protection is a matter of placing mass and/or space between yourself and the source of the gamma rays. It's the same principle that is applied daily in every hospital. When the portable x-ray technician announces "X-ray," the nurses and doctors duck behind a wall, or move some distance away, if it happens to be convenient to do so. To reduce the dose from fallout by a factor of 10 requires 18 inches of earth or 12 inches of concrete. A second 18 inches of earth reduces the dose by another factor of 10, i.e. 10 times 10 or 100. A basement that is completely underground has a protection factor of at least 20 (i.e. reduces the dose by a factor of 20). Inside corridors of a tall building can provide high levels of protection (PF 250–1000), and structures completely buried under several feet of earth have PFs greater than 1000.

People crowded into a shelter wouldn't want to stay there any longer than necessary. To know when they can come out, they need a device for measuring radioactivity. State-of-the-art wrist dosimeters are worn by astronauts on the Space Shuttle. But to get the best available radiation meter for civil defense, you have to make it yourself out of a tin can, according to the instructions in Cresson Kearny's book *Nuclear War Survival Skills* (available for $9.95 from the Oregon Institute of Science and Medicine, PO Box 1279, Cave Junction, OR 97253). I made a Kearny fallout meter and tested it for accuracy in the Nuclear Medicine Department at the University of Arizona College of Medicine. It works very well, and requires no batteries.

What do we mean by a "safe" level of radiation? In a postwar environment, people would be exposed to much more radiation than they are now. Even present levels have inspired panic in many people.

Ironically, people are most concerned about minor sources of radiation, like nuclear power plants, and are quite complacent about much more important sources, like their own houses. The estimate of the standard lung cancer risk from living in certain "energy-efficient" homes (with radon concentrations of 10 pCi/liter) is comparable to the *life-time* risk incurred by being in the area of an *uncontained* nuclear meltdown. In Sweden, there are 8000 homes with such high radon levels that to receive an equivalent dose, a person would have to eat 7.5 tons of the reindeer meat that "had to" be condemned due to contamination from Chernobyl.

So how much radiation should you worry about? The normal dose that you receive from background is between 100 and 200 mrems per year (1 millirem = 1/1000 rem). If you were to receive about 200 rems all at once (that's 100,000 times the annual background dose), you would get radiation sickness. Your hair would fall out, and you would have a severely upset gastrointestinal tract, but you would probably recover. The median lethal dose (the amount it takes to kill half the people exposed to it) is approximately 400 rems. Persons who recovered from the exposure, however, might well have a normal life span. To "triage" them to a list of persons not to receive medical care for the rest of their lives, as in the popular novel *War Day* by Whitley Strieber and James Kunetka, would be an inhumane absurdity.

Long-Term Radiation Effects

Besides the immediate effects of radiation, there are long-term effects. The most important one is cancer. Survivors of Hiroshima had a higher than normal incidence of leukemia, beginning about two years after the war, and a higher than normal incidence of other cancers, around 20 to 30 years after the war. After a nuclear war, survivors would probably have about a 1–2 percent increase in their risk of getting cancer. Some people argue that we shouldn't bother with civil defense because the survivors might get cancer. You each will have to ask yourself this question: would you drink Kool-aid laced with cyanide today rather than face a 2 percent higher than normal risk of cancer 30 years from now?

Perhaps the most feared effect of radiation is birth defects. This has been a fertile subject for cartoonists and science fiction writers, who dream up creatures with their hands where their feet should be and vice versa. There would probably be some increase in birth defects, but they would be of the same types that normally occur. Their number would be much smaller than the number of cancers. It still has not been possible to demonstrate an increase in inherited defects in the children of the survivors of Hiroshima and Nagasaki.

Medical Preparedness

Although preventive medicine is always best, I think there is still a place in the world for doctors and hospitals. For one thing, people who survived nuclear war would continue to have the usual types of sicknesses and injuries. The Swiss have modern hospitals in underground blast shelters as an essential part of their civil defense system. In the 1950s, when the U.S. had civil defense, we started a Packaged Disaster Hospital program, based on some 2000 mobile emergency hospitals from the Korean War. These were given to state and local governments, (and some eventually to foreign nations). A recent inventory showed that few of them remain.

Besides the usual medical equipment and drugs, a medical preparedness program would have stockpiles of potassium iodide. One of the most important elements in fallout is iodine-131, which is water soluble and can cause cancer of the thyroid or hypothyroidism. Both of these problems could be prevented by "blocking" the thyroid gland with normal, nonradioactive iodine in the form of a saturated solution of potassium iodide (four drops daily) before the person ingests the radioactive iodine. It was proposed that we stockpile KI as part of a preparedness program for nuclear power plant acci-

dents. This was never done, because the risk of accidental overdose or side effects from the KI far exceeded the probable hazard due to nuclear power plants. However, in a postwar situation, the risk due to I-131 would be far more significant.

Other Long-Term Nuclear Weapons Effects

Even though they recognize that a shelter stay could save their lives, many people feel that life wouldn't be worth living after a nuclear war. Indeed, life would be very difficult without the material comforts to which we are accustomed. This introduces the philosophical question of whether material possessions are the most important things in life. Leaving that question aside, I will concentrate on factors that many believe would make life altogether impossible.

The Doomsday Mechanism that is invoked most frequently is the nuclear winter. This hypothesis was introduced with great fanfare and an expensive public relations campaign, including television extravaganzas. The scientific criticism of the study received much less attention, even though strong words (such as "fraud") were used. One physician of my acquaintance continues to show slides of the Cold and the Dark to sixth graders, apparently in the sincere belief that he's doing a good deed by frightening the little children.

The nuclear winter theory was based on a crude computer model which neglected such details as oceans, winds, and the rotation of the earth. When a better model was used by scientists at the National Center for Atmospheric Research, nuclear "winter" was reduced to a small, transient drop in temperature, possibly sufficient to damage a year's crops if it occurred at a critical point in the growing season. The difference between the two predictions is very dramatically shown by graphing them on the same scale, as was done by Russell Seitz of the Harvard Center for International Affairs.

The advice of scientists at Oak Ridge National Laboratory is to take your winter coat with you if you evacuate or go to a shelter: "January will come, even if nuclear winter doesn't."

Whether or not a drop in temperature resulted from a nuclear war, the food supply would be endangered. In some areas, the fallout would prevent farming for a year or so. Fuel supplies and transportation would be disrupted. Also, scientists at Oak Ridge National Laboratory believe that a prolonged drought might follow an extensive nuclear attack.

Does this mean that everyone would inevitably starve after a nuclear war? Starvation in this land of surpluses and high technology would certainly be a bitter irony. Food storage technology was available to the ancient Egyptians. On the advice of a slave named Joseph, Pharaoh stored enough grain for seven lean years during the course of seven good years. In a *single* good year, the United States produces enough grain to feed our entire present population for ten years, assuming we did not feed livestock. We have a four-year supply of grain in storage now. The problem is that it is not located close to population centers, and might be inaccessible if the transportation system were severely damaged.

People sometimes worry that all the food would be contaminated. This misperception is so widespread and so deeply ingrained that our local government in Tucson destroyed all the canned goods stored in the school district's kitchen when a nearby factory was found to be leaking minuscule amounts of tritium. People who knew something about radiation tried very hard to buy that food, but it was buried in a top secret location in the desert under cover of night.

Just as having a chest x-ray does not make a person radioactive, being near fallout does not make food radioactive. It could, of course, become contaminated with fallout particles, a problem that could be avoided simply by covering it.

Medical Ethics and Civil Defense

Doctors who give advice about civil defense should be guided by the usual principles of medical ethics.

The first principle, from the Hippocratic Oath, says to "do no harm."

It has been argued that nuclear weapons do tremendous harm even if they are not exploded, because the "arms race" diverts resources from other human needs. This is called "destruction before detonation." The existence of the Bomb has been used to explain a wide variety of problems, including drug addiction, the deterioration of housing in New York City, and children not getting their measles immunizations. Both the weapons themselves and civil defense are seen as competing with other medical and social needs. Furthermore, many people think that civil defense is unusually expensive.

Let us compare the cost of various life-saving measures with the cost of civil defense:

Method	*$/life saved*
Immunizations (Indonesia)	$ 210
Improved sanitation (3rd world)	4,030
Cervical cancer screening	50,000
Breast cancer surgery	160,000
Hypertension control	150,000
Kidney dialysis	400,000
Mobile ICUs in small towns	120,000
Improved traffic signs	31,000
Upgrade guard rails (highways)	101,000
Drugs for cholesterol/*yr* of life	1,000,000
1979 FDA ban on DES in cattle feed	132,000,000
High level radioactive waste: strict precautions vs random burial with simple precautions	220,000,000
Stricter safety standards for nuclear reactors, compared with prior standards	$2,500,000,000

(The reason for the high costs per life saved through more stringent radiation safety standards is that loss of life due to lax standards is so improbable to begin with.)

For comparison, the cost of a space in a blast shelter could be as low as $200. The cost of a year's supply of food (mostly whole grain) is about $100 per person. The cost of saving lives by intercepting Soviet missiles on the way to their targets might be about $1000 each.

To make a cost-effectiveness comparison, these costs must be divided by the probability of a Soviet nuclear attack. If such an attack were impossible, the money would be wasted.

If such an attack is not impossible, we must ask the next question: how much is an American life worth?

Many people, especially members of Congress, argue that we cannot afford to provide our population with this type of insurance against attack. Apparently, our people aren't worth it.

Other nations have apparently placed a higher value on their citizens' lives. The People's Republic of China has followed the advice of Chairman Mao: "dig tunnels deep, store grain everywhere." The tunnels beneath Chinese cities are a construction project that rivals the Great Wall of China. Are these tunnels of any use? Official Soviet strategic doctrine does not call for targeting civilians as such, although many would inevitably be killed even in a "counterforce" strike, because of

living close to military facilities. Killing civilians is not a useful military objective. (However, it has been used in the past to terrorize the population, as in the fire-bombing of Dresden, which the Germans did not expect to be targeted.) In any event, killing Chinese civilians with ICBMs is not easily achievable. Therefore, the Commander of the Soviet Strategic Rocket Forces would certainly think twice about targeting Chinese cities, if he knew that few of the inhabitants could be killed. (How would you like to be across the border from 1 billion Chinese, who were alive, healthy, and extremely angry because their cities were in ruins?) For the Chinese, the shovel is apparently thought of as a strategic weapon of deterrence.

Other nations also prepare for the contingency of nuclear attack. Switzerland spends about $43 per person per year on civil defense, the U.S.S.R. spends about $14.50, and the U.S. spends about $0.60.

Besides diverting resources from other areas, civil defense might be harmful if it increased the risk of war. Apparently, other nations do not think that protecting their population will provoke an enemy attack. Indeed, opponents of American civil defense do not think so either; they are more concerned that American civil defense would make *American* leaders reckless and more likely to launch a first strike against the Soviet Union.

Obviously, if a nation is going to attack another, it uses its bombs, not its bomb shelters, in the assault. Is the U.S. building up a first strike force? Actually, the U.S. has not been running an arms race either in terms of warhead number (which has been stable since the 1970s) or yield (which has decreased dramatically since the 1960s). In contrast, the Soviet arsenal continues its relentless growth. More pertinent than the gross numbers is the ratio of accurate warheads to high priority military targets. The number of such targets is about 3000 to 4000 on both sides. The Soviets have about 3,000 warheads on SS-18 missiles alone, and by the 1990s may have more than 10,000 warheads of sufficient accuracy to strike our priority military forces. The U.S. has fewer than 1000 warheads suitable for that purpose. It is this imbalance which has made me much more worried about the prospects of war.

Strangely enough, the people who worry the most about nuclear war tend to be the most vehemently opposed to civil defense. Besides the cost argument, there are basically two others:

1. We couldn't save everybody. (Corollary: therefore, we shouldn't try to save *anybody*.)

2. The nation with the fewest survivors would be better off, because there would be fewer people having to share the remaining resources. (Corollary: human lives don't count as a resource, or are far less important than other resources.)

Conclusions

The decision of this country not to have a civil defense or a strategic defense has made us all hostage to Soviet ICBMs. In time of crisis, it puts our leaders in the dilemma of choosing suicide or surrender.

Our government policy is quite similar to that of our imaginary doctor, who writes a "do not resuscitate" or "no code" order for all his patients with virus X. If the patient has a cardiac arrest, the "code team" is not to be called. There is to be no artificial ventilation, no defibrillation to correct a problem with the heart rhythm, and no shot of adrenalin. The only thing to be done for such a patient is to pronounce him dead.

Writing a "no code" order for any patient is a heavy responsibility. Before doing such a thing, the doctor wants to be very sure of his prognosis. In renouncing defense, our government has in essence written a "no code" order for more than just one patient.

With no defenses, about 30 percent of our population might survive an all-out nuclear attack, depending on the targeting strategy. With good civil defense and SDI, perhaps 80 percent people might survive.

The policy of not having defenses writes off more than 100 million human beings in the event of an attack. Alternately, it dictates a policy of unconditional surrender as a response to nuclear blackmail, and the consequent destruction of United States of America as a free nation.

Ask the doctors who are writing these orders just how sure they are about their prognosis.

Then ask yourself whether we need to find another doctor.

A Formula for the Future

CREATING VALUE IN INDUSTRY

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THANK YOU, Mr. Holbrook, for that kind introduction. They say that when a person is drowning his whole life flashes before him . . . it is somewhat disconcerting, then, to realize that mine would take only 30 seconds or so.

As you have just learned in the introduction, by education, I am an accountant. By training and experience, I am a manager. By selection of Cooper Tire & Rubber Company's board of directors, I am the company president. I "lucked out" many times, as some of my envious colleagues would likely comment. But goal setting, planning, achievement and competing is the story of my life, and I love it.

And it is a special honor, to me, to have been asked to address you at – this – your 134th technical meeting.

But, to tell the truth, it is just a bit intimidating – perhaps awesome – to be asked to present an idea to scientists and scholars who regularly and commonly discuss such esoteric subjects as visco-elasticity, thermo-analysis and zirconium silica hydrogel.

The subject – then – that I present today will not deal with the technical aspects of our industry. I must leave those matters to the experts at your conferences and seminars.

Today, I want to give you a plan for operating – a formula