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HOME & FAMILY

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THE AMERICAN CIVIL DEFENSE ASSOCIATION
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The staff and Board of Directors of
The American Civil Defense Association
would like to take this opportunity to thank you
for your continued support of our organization
and wish you and your families
a wonderful holiday season and a very

Merry Christmas

It is the perfect time of year to give the gift of TACDA to those you care about. Annual Gift Memberships are available for only $24.00.




IN THIS ISSUE

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PRESIDENT'S MESSAGE

The time to address the potential threats that exist is now. We are currently presented with many threats to our safety and security. We are seeing an increase in economic problems at home and abroad. We see increased political tension and civil unrest that are straining the fabric of our society. There is an increase in solar spot activity with corresponding increases in coronal mass ejections that threaten the power grid. There is also the problem of nuclear weapons proliferation and more countries that are openly hostile to the United States obtaining nuclear weapons and missile technology that can be used to destroy the infrastructure that we need to survive.

As individuals, can best protect ourselves by becoming prepared to survive without the infrastructure that most people take for granted. We need to be prepared to survive without the electrical power grid, clean running water delivered to our homes, sewage systems that handle our waste water, garbage collection systems that dispose our refuse, and other utilities that we use.

We endeavor to provide you with the information you need to efficiently and effectively prepare for events that would threaten your survival. We implore you to earnestly prepare yourselves for any of the events described above and maintain a high state of readiness. We also ask you to try to convince others to do the same for their benefit and yours. The more prepared we are as a population the better it will be for everyone if confronted with an emergency. I realize that I am addressing those that are already concerned and doing something about it, but we can always do more for ourselves and promote a more prepared stance to our neighbors. Do it now!

I wish you well in your efforts.

Jay R.Whimpey
TACDA President

FROM THE **EDITOR**

We are happy to welcome our newest member of the board, Dr. Tammy Taylor. *

We would also like to recognize the resignation of Jonathan and Kylene Jones, and thank them for their service to our TACDA organization. They will both continue to serve as advisors to our board.

We have three articles that have been contributed from our board of directors in this issue of the journal. We are appreciative of the support of the board.

Jay Whimpey, our current president, has written an informative article on the use of alcohol stoves, and Kirk Paradise has written a very practical article on the use of bicycles as wheeled porters during times of evacuation.

We have received many comments of concern about the safety of nuclear power plants, since the disaster in Japan. Dr. Sandquist of our board of directors, has contributed an article on the 'Nuclear and Hazardous Material Perspective'. He makes the case that the risks from low levels of radiation is very poorly understood by the public and even by many in the scientific community, and that low levels of radiation have, in fact, been proven to be beneficial. He also shows how the small risks from nuclear power could have significant additional reduction by closing the nuclear fuel cycle and placing the nuclear plants in underground sites. Power shortages pose severe consequences, both politically and economically. Nuclear power is critical to our economic recovery, and we hope you will read this article carefully and with an open mind.

Best Regards,

Sharon Packer
Editor, *Journal of Civil Defense*

* Dr. Tammy Taylor serves the Nonproliferation Division as Division Leader at the Los Alamos National Laboratory. She joined the division office in June of 2010 following three and a half years of service at the Office of Science and Technology in the Executive Office of the President where she led the nuclear portfolio for the President's Science Advisor. Previously, she was Group Leader of the Safeguards Security Systems Group (N-4), in the Nonproliferation Division. Her technical training is in Civil and Environmental Engineering; she received her B.A. in Civil Engineering at New Mexico State University, and her Masters and Ph.D. in Environmental Engineering at the Georgia Institute of Technology. She is a licensed Professional Engineer in the state of New Mexico. She spent two years as a Director's Postdoctoral Fellow at LANL. Taylor's research interests include topics related to radiological/nuclear threat reduction and environmental restoration. She has led projects related to radiological dispersal device decontamination and emergency responder preparedness and response to radiological and nuclear terrorism.

NUCLEAR & HAZARDOUS MATERIAL PERSPECTIVE

By Gary Sandquist

ABSTRACT

The reemerging nuclear enterprise in the 21st century, empowering the power industry and nuclear technology is still viewed with fear and concern by many of the public and many political leaders. Nuclear phobia is also exhibited by many nuclear professionals. The fears and concerns of these groups are complex and varied, but focus primarily on (1) management and disposal of radioactive waste [especially spent nuclear fuel and low level radioactive waste], (2) radiation exposures at any level, and (3) the threat of nuclear terrorism.

Continues

energy needs. Furthermore, the development of advanced nuclear plants such as the APWR, ABWR, EPR, and Generation IV designs promise greater passive safety, improved economics, and a more stable and environmentally attractive energy supply. China has recently ordered four, Westinghouse PWR's, and other nations are now rapidly expanding their nuclear infrastructure. These power plant benefits coupled with growing demands for reduction of green house gas emissions make nuclear a particularly attractive energy choice for the 21st century.

However, the actual realization of this renaissance for nuclear power is still problematic and dependent upon the resolution of numerous technical, social, and political issues. A very significant issue is the satisfactory resolution of acceptable management and disposal of radioactive waste associated with the entire nuclear fuel cycle [1]. All radioactive waste classes associated with the complete nuclear fuel cycle, viz., LLW, HLW, spent fuel, TRU, and mill tailings pose major challenges for successful radioactive waste management. Furthermore, it is not improbable that nuclear development could be again stalled and even closed because of rational and irrational public and political concerns regarding satisfactory, acceptable nuclear waste management and the inordinate fears of nuclear radiation.

The root cause of all these concerns is the exaggerated risk perceived to human health from radiation exposure. These risks from radiation exposure are compounded by the universal threat of nuclear weapons and the disastrous consequences if these weapons or materials become available to terrorists or rogue nations. This paper addresses the bases and rationality for these fears and considers methods and options for mitigating these fears. Scientific evidence and actual data are provided. Radiation risks are compared to similar risks from common chemicals and familiar human activities that are routinely accepted.

INTRODUCTION

It is evident that a resurgence of nuclear power as a major energy source for the world is developing in the world and the US. The US Energy Policy Act of 2005 provides major commitments for resumption of nuclear power in the US. Other nations such as China and Japan are also expanding their development of nuclear power to meet their

Issues Confronting Nuclear Enterprise

The following issues are significant factors in effectively addressing and ameliorating concerns and perceived risks that should receive serious consideration if nuclear energy is to become a major, global energy source in the 21st century.

Closing the Nuclear Fuel Cycle

Important research and development is underway to close the fuel cycle and extract the remaining potential fission energy (greater than 6%) of the available fuel from the fuel assemblies currently used in light water reactors. [3]

Underground Nuclear Reactor Parks (UNP):

Studies indicate economic, safety, political, and security advantages for building Underground Nuclear Reactor Parks (UNP) containing large numbers (3 to 18) of GW nuclear reactors integrated within the complex and providing permanent waste storage within the underground complex. [4], [5]

Linear No-Threshold Radiation Model
There is mounting documented evidence that the Linear No-Threshold (LNT) hypothesis for assessing radiation effects on humans at all levels of exposure is *invalid at low dose levels and low dose rates*. These levels and rates of exposure are characteristic of natural background radiation levels that all humans and indeed are flora and fauna on the earth have been exposed to since life first appeared on this planet. Furthermore, there is growing awareness that low levels of radiation typical of natural background may actually be *beneficial rather than detrimental* to humans. Human evolution transpired under varying levels of background radiation that was greater in the past over the time span of homosapiens. [1]

"There is indisputable evidence that plutonium is not the most toxic material on earth."

Radiotoxicity of Plutonium:
There is indisputable evidence that plutonium is not the most toxic material on earth. Indeed, the ingestion of minor amounts of alpha emitters such as U and Th found in the earth's crust is not significantly detrimental to health. Low lifetime radiation doses from such exposures are ubiquitous, but tolerable. Plutonium, another alpha emitter, poses less risk than similar ingested doses of Pb, Hg, DDT, PCB's, etc. that are commonly found in soil, water, and foodstuffs at much greater levels than plutonium. [2]

Radiological and Hazardous Chemical Risks:
The realization that the minor and readily controlled hazards to the biosphere from nuclear power plant wastes are substantially less than global warming and hazards from everyday chemicals commonly used and ubiquitous in the environment. [6]

Once Through Nuclear Fuel Cycle Policy
Current US designs and regulatory policies for nuclear power reactors have focused on the "once through fuel cycle" and the concentration of these high-level radioactive wastes at one or more national repositories. This development was the result of a protracted and complex historical and political setting. This fuel cycle policy has resulted in contentious spent fuel management issues and very inefficient utilization of US uranium resources. Disposal of the entire, unprocessed spent fuel core portends disposal security for 10,000 years and the loss of the valuable unused uranium and transuranic fission fuel potential. If the once through fuel cycle policy is actually implemented, then additional repositories besides Yucca Mountain must be identified and developed. The very likely outcome is that nuclear power development in the US will stagnate and end and the US well continue to rely upon fossil fuels through much of the 21st century. If nuclear power is to be maintained and hopefully flourish in the US, then fuel reprocessing is essential and inevitable.

Practical Alternative for US Nuclear Development
The concept of large underground nuclear parks (UNP), located 100 to 300 meters underground, with a closed fuel cycle facility co-located, providing reprocessing, (re)fabrication of new fuel assemblies, and disposition of the remaining high level (fission product) waste for permanent storage in the same underground nuclear park is technically feasible, safe and secure. Such UNPs are responsive to existing concerns and political issues. An adequate number of these UNPs strategically sited throughout the US for effective electrical power distribution and siting would significantly reduce the very small risk from nuclear plant accidents and the inventory and burden of nuclear plant wastes. Spent fuel reprocessing would continuously recycle the transuranics until they were fully consumed while providing essentially energy production. This process would fully utilize all the fissionable fuel content in the uranium and its transuranic products leaving only short-lived fission product waste to be disposed. Radioactive decay through twenty half-lifes (about 1000 years) for these fission product wastes would reduce their activity by a factor of 1 million. Thus, UNP's would virtually eliminate the concerns of spent fuel disposal, fuel transportation above ground, the risk of diversion of fissile materials for nuclear weapons, and the contentious political and social issues regarding the present once through fuel cycle policy of the US.

Linear Non-Threshold (LNT) Model
Ionizing radiation effects on human health have been a concern for decades and have resulted in strict controls on allowed limits of radiation to both workers and the public. Though official radiation limits for radiation workers have not changed for the past five decades, regulatory policies have now firmly establish the ALARA concept (As Low As Reasonably Achievable), which results in operating limits that are an order of magnitude more restrictive than international and national scientific recommendations established by the ICRP (International Council on Radiation Protection) and the NCRP (National Council on Radiation Protection. These regulatory practices result in radiation regulations and control expectations that both mandate control, remediation, and decommission of radiation infrastructure and sites that are more than an order of magnitude lower than ambient natural radiation background and incur excessive public and private expenditures.

The projected health effects assessed for ionizing radiation is based upon the so-called linear no threshold (LNT) model and its corollary, the collective dose hypothesis, for regulating exposures to radioactive materials. It is the implementation of this model that results in the great regulatory burden associated with the management of all radioactive materials. Although the LNT model is under intense scrutiny, the National Research Council in BEIR VIII still strongly endorses LNT [6].

If this same regulatory LNT model were imposed upon the production, use, and disposal of stable chemicals and their compounds employed by humans, then industry, manufacturing, commerce and even agriculture would be threatened and possibly immobilized. Some of the ubiquitous, common materials are known to pose risk to human health at any exposure level. These very hazardous materials include fossil fuels, lead, pesticides, arsenic, asbestos, beryllium, chlorine, heavy metals, PCBs, and other natural and man-made organic compounds. The LNT model would imply that most medicines, both non-prescription and prescription, are hazardous at any level of human use.

In fact, most materials found in every sector of human environment prove hazardous at some level of exposure to humans. It is well accepted that obesity from overeating is a serious health threat. Paradoxically, any increment of food intake could produce those health risks observed with obesity such as diabetes. Of course, lack of food and hunger is even a greater risk to health as is evident by continued starvation in many areas of the world.

"A reduction of this lethal dose by a factor of 1 million ... is comparable to exposure to all humans on earth from natural cosmic and terrestrial background sources."

Acute Exposure to Elevated Radiation Levels

To quantify the burden of reducing hazardous materials in the biosphere, a useful measure is a normalized unit of mass of the given material that results in an acute 30LD50 dose or exposure. This unit is defined as the dose of a given hazardous material within or exposing the human body that will result in a lethal dose (mortality) to 50% of a human population within 30 days. The resulting acute health effects are extrapolated assuming the absence of any subsequent medical treatment.

For ionizing radiation, the 30LD50 dose for human adults is about 450 Rem received within a 24-hour period either internally or externally. A reduction of this lethal dose by a factor of 1 million results in a radiation dose of 0.5 mRem per day, which, is comparable to exposure to all humans on earth from natural cosmic and terrestrial background sources. A reduction of the radiation source equivalent to the 30LD50 dose occurs by the decay of the original radiation source over 20 half lives or equivalently a reduction in source concentration by a factor of one million. The reduction by dilution and dispersion is the primary means by which stable hazardous materials are controlled by nature.

Similar values for non-radioactive materials are not as readily quantified, but so-called lethal doses have been developed for stable compounds. Using this methodology for quantifying the potential impact of nuclear and stable hazardous materials, a typical annual US production of selected toxic materials in the US is given in Table 1 with total lethal doses associated with each material and the ratio of these lethal doses to a lethal dose of nuclear waste extracted from the present US nuclear fuel cycle after 10 years of decay. Note that most US water supplies are treated with chlorine for potability. However, chlorine evaporation from chlorine sources and the ubiquitous water supply pose a potential threat 2000 times greater than nuclear waste. Also note that lead poses about the same threat as this 10-year-old nuclear waste.

Table 1. US production of toxic materials 1976 [2]

Material	Lethal doses	Ratio to nuclear-10 yr	
	Inhalation		
Chlorine		4E14	2000
Phosgene	2E13	200	
Ammonia	6E12	30	
Hydrogen cyanide	6E12	30	
Nuclear Waste (@10 yr)	2E11	1	
Nuclear Waste (@500 yr)	5E10	0.3	
	Ingestion		
Barium	9E10	3	
Copper	9E10	3	
Arsenic	1E10	0.3	
Lead	4E9	0.1	
Nuclear Waste (@10 yr)	3E10	1	
Nuclear Waste (@500 yr)	1E7	0.0003	

Note: *1E10 = 1x1010, nuclear waste @ 10 yr or 500 yr is time after removal from reactor*

Nature's inventory of indigenous hazardous materials is also of interest in assessing risk from radioactive (viz., uranium) and naturally occurring, stable compounds. The crustal abundance of toxic materials in the soil and water, together with their hazard index [3] is provided in Table 2. The hazard index is a useful measure for modeling risk and is defined as the volume of water required to dilute the hazardous material to current US EPA drinking water standards. All these hazardous materials occur in ocean water that is nature's eventual and ultimate disposal site for most hazardous materials. Note that the oceans can dilute uranium to EPA drinking water standards, but not dilute the other hazardous materials to these same standards.

Table 2. Crustal hazardous materials [3]

Material	Hazard index (m3)	Crustal abundance (kg)
Uranium	3.5E17	4.0E16
Selenium	1.8E20	1.8E15
Cadmium	3.6E20	3.6E15
Arsenic	2.0E21	1.0E17
Mercury	5.0E21	1.0E16
Lead	6.4E21	3.2E17
Barium	8.6E21	8.6E18
Chromium	8.0E22	4.0E18
Ocean	1.7E18 (volume)	1.7E21 (mass)

Chronic Exposure to Low Radiation Levels

During the last 3 decades, a vast demographic data base with large cohorts of exposed communities and individuals has lead to the conclusion that exposure to moderate, low doses of radiation above background results in improved health, longer life, greater resistance to disease, and lower incidence of solid cancer. However, US regulatory bodies have not responded to these data by increasing radiation dose limits to workers and the public, nor has the ALARA mandate been modified or abandoned. The prevailing regulatory philosophy is "conservatism" for any exposures above local ambient background. This despite mounting evidence that elevated radiation levels as high as 0.1 Sv (10 Rad) per year enhance the overall health of most humans. This attitude of regulatory conservatism actually results in greater risk to human health and well-being and unnecessary additional costs to the regulated society.

In fact, there are still many scientists besides those establishing the regulatory standards who are doubtful that there are positive effects from low levels of radiation. These scientists insist that without extensive, carefully conducted "double-blind" studies with human subjects, significant risk may result from modifying current regulations regarding radiation exposures.

However, in 1982 the equivalence of a major double-blind study has occurred unintentionally in Taiwan. Several large apartments and other public buildings were constructed with concrete unknowingly containing radioactively contaminated (Co-60) steel rebar. The presence of this high man-made background level was not discovered until 10 years after the occupancy of these facilities. Between 7,000 and 10,000 residents in these building received integrated exposures averaging about 1 Sv (100 Rads) with maximum of 5 Sv (500 Rads) during the decade of exposure. Approximately 7,000 of these exposed residents have been identified, tracked, and their subsequent health effects evaluated. Two recent reports on these Taiwan residents have been published. One report [found that overall health and longevity was improved for those exposed to chronic radiation levels as high as 0.1 Sv per year (10 Rad per year). Furthermore, cancer deaths were substantially lowered by nearly two orders of magnitude. However, another report concluded that cancer incidence for leukemia in building residents under the age of 30 was higher than the Standard Incidence Ratio (SIR=1), but thyroid cancer incidence was not significantly different from the average of Taiwan residents in adjacent areas. Furthermore, for solid cancers the SIR was less than 1.0 for all residents.

These results can be explained as follows. The overall health and longevity was improved for all residents exposed to chronic radiation levels as high as 0.1 Sv per year. However, younger residents (those under age 30) also experienced improved health effects, but did experience excess risk for leukemia.

Fear of Radiation by Public

The benefits of low, chronic levels of radiation and the reduction in risk from potential acute, high radiation levels by moving the nuclear enterprise underground still do not absolve the perceived public concern that any amount of radiation is dangerous and unacceptable. The naïve concept still prevails among much of the US citizenry and political leaders that materials are either "radioactive" or "not radioactive." Of course, this perception is patently false and radioactivity and radiation is ubiquitous throughout the earth and the universe.

For many critics of nuclear power, the view is held that radioactive wastes issuing from the nuclear fuel cycle are uniquely dangerous. Managing and safely disposing of radioactive waste are perceived by some as intractable and provoke great apprehension and risk. Despite this rhetoric, radioactive materials from the nuclear fuel cycle pose no unique, interminable or irresolvable threat to humans. Actually, the radiation emission and health risks from radioactive materials in the nuclear fuel cycle are not different from those from natural radioactive and stable hazardous and toxic materials that are ubiquitous in our environment.

Considerable time, effort and expense have been committed by society to manage and dispose of radioactive waste materials from the nuclear fuel cycle. Attempts to sequester this waste in a few limited locations both in shallow land disposal units and in deep geological beds for time periods that range from a few hundred years for LLW to 10,000 years for spent nuclear fuel have not had great success. Many useful man-made short-lived isotopes will decay through 10 to 20 half lives in a hundred years. The nemesis for the nuclear critics, of course, is plutonium and its isotopes. Plutonium-239 is the principal fissile material in nuclear weapons and thus carries a great burden of fear and contempt. Also, Pu-239 has the longest half-life, (24,000 years) of the principal nuclear fuel cycle plutonium isotopes. A thousand-fold reduction in initial activity requires 240,000 years. However, the hazard index of plutonium is less than naturally occurring uranium ore after 10,000 years of decay.

Continues on page 16

EMERGENCY TRANSPORT OF YOUR MOST IMPORTANT POSSESSION:

Your Family

By Kirk Paradise

When any disaster strikes, the safety of your Family becomes the focus of your thoughts and actions. If you must abandon your home, moving your family and survival gear, intact, can be a huge challenge. Transporting them in the aftermath of a large- scale disaster is a major hurdle – at a time when you don't need more problems. Imagine that your home is damaged and uninhabitable; that roads are blocked by debris and there is no power. You have a young child. You have more gear and supplies than you can carry. The distance you have to go may be short but there are many obstacles between where you are and where you want to be. Help from neighbors is scant; they face the same predicament as you. Authorities are stretched thin. Once you get out of the damaged area, you expect that your first stop will be an Evacuation Center or a Shelter. Do you carry your child and abandon your survival gear? Or, do you stay put and face discomfort or danger? Cold, heat or property damage may force you to leave your home, and taking your family and supplies with you becomes necessary, not optional. One answer is to rig your bicycles into the "Wheeled Porter" system to carry your 72-hour kits, extra gear, and even infants. Being able to take your survival gear and keep your family together will greatly reduce the stress on both adults and children.

Start with a standard bicycle (adult sized for adults; youth sized for youth) and remove the seat and pedals. Place these, along with a wrench, into a sturdy plastic bag and securely attach them to the handlebar. Take a wood pole (such as a closet rod) that is about 1.25" in diameter and between about 3.5' and 4' long; a steel pipe can be substituted. It should reach from where the handlebar attaches to the head tube on the frame out over the rear wheel. Use an automobile hose clamp to secure it to the top tube of the frame at the handlebar; with a file or rasp, flatten the end of the pole where it meets the head tube to make clamping more secure. Where it passes over the seat tube (where the seat used to be, drill a hole through the pole, angled to match that of the seat tube. Reinforce the area around the hole with sheet metal to prevent the pole from cracking. Pass a steel rod through the hole and put a steel washer between the frame and the pole. The rod slips down inside the seat tube, through the hole in the pole, locking the pole in place. Use a rod about 18" long and 3/8" diameter; put a round knob on the top. Bend the rod slightly in two places so that it firmly wedges into the seat tube, leaving about 10" sticking out the top. The first bend is 1" from the bottom end (about 10° will do) and the second, also 10°, about 7" from the bottom. There should be 6-7" between the bends. Secure the pole with another hose clamp here, if needed. The rod must fit tightly in the seat tube. This simple modification allows you to "carry" a much heavier load, (two to three hundred pounds) and still allows you to ride the bicycle when needed.

Get or make enough S hooks to use as load hangers. The S must be large enough to fit over the wooden pole. The load hangs from the open end of the S and hangs from both sides of the pole.

Once you make your conversion kit, bundle all the parts and S hooks together with a heavy- duty plastic bag plus a wrench and screwdriver. Attach everything to the pole and store it with your 72-hour kits. Make a kit for each bike you intend to use. The kits are then ready when needed and take but a few minutes to assemble. Even after storing the kits for several years, I was able to retrieve it, remove the seat and pedals and install the pole in just six minutes.

At this point, you have a bike with no seat or pedals but with a wood pole – the load hanger – running from the handlebar to the end of the rear wheel and with a control knob at the seat position. Hang your gear on the S hooks. Backpacks can be hung either from hooks or by threading the shoulder straps around the pole. You can suspend 5 or 6 gallon pails, or anything with handles from the hooks. Bulky items like sleeping bags, water jugs, duffel bags or even luggage can ride on top of the other gear, above the pole. Use rope or elastic cords to lash these loads to the pole. Keep the heaviest gear as low as possible to increase the stability of the bike. Additional gear can be carried in front of the handlebar. Carry it in either a basket or lashed to the handlebar. Balance the load, left side and right side, front and back, to make the bike easier to push. One person can manage the bike but two make it easier.

Steer the bike by using one hand on the handlebar and the other on the knob. The knob and rod are important as they are a lever which is needed to prevent a heavily loaded or unevenly balanced bike from tipping over. The bike may be top heavy and the lever is needed to control the load. The lever greatly reduces the effort needed to control the load by providing an immovable handle located in the center of the load. Trying to control the load by using the handlebar or grabbing a piece of gear is very difficult - both will move and throw your balance off. The lack of pedals allows you to walk closer to the bike without interference. This improves balance and stability plus saves your shins form bumps and bruises. No stumbling, either! At the end of the day, you can remove the gear and hangers, reattach the seat and pedals and ride the bike normally.

If you have an infant or young child, add a carrier seat over the rear wheel. It may be necessary to shorten the pole depending on the carrier design. If you carry a child, have someone on each side of the bike for safety's sake. This means you can take your gear and your family, including infants, together, all at once.

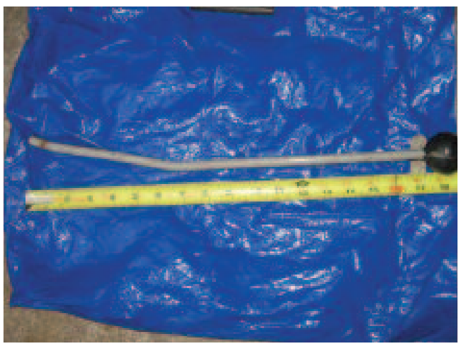
I advocate using bikes as "Wheeled Porters" for families, especially for those with small children. One or both parents can use one and even make them for their children to push their own gear. That takes the load off your shoulders and puts it on the bike. Now, one person can comfortably push hundreds of pounds instead of carrying just 35 pounds, which is a good load even for experienced back packers. This reduces the stress on parents as well as all others involved. Instead of bare essentials, you can move things that add comfort and contribute to the emotional as well as physical wel lbeing of your family.

If you have teenagers, delegate! Have them push the bike while parents plan and direct the action.

If debris blocks the roads, the bike can be pushed around the blockage and go places that would stop a car. The bike and gear can be taken apart and loaded on an evacuation bus, a truck or used with a bike carrier. If necessary, one adult can manage their gear plus that of several children and greatly reduce the exertion required. The bike

Continues

Conversion kit contents: pole, rod, washer, clamp, hangers, storage bag and wrench.



The rod should be at least 18″ long with slight bends, about 1″ and 7″ from bottom end.

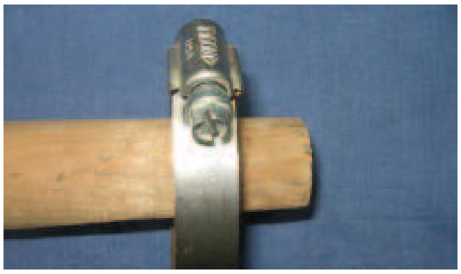
The rod passes through the pole and the metal tube reinforces the pole.

Peddles and seat removed and ready to go into the storage bag.

Conversion kit bundled for storage.

Conversion kit sitting on bicycle, ready to be installed.

Fully-assembled conversion kit ready to be loaded.



Clamp over flattened end of pole. The flat end makes it much easier to securely clamp the pole to the frame.

The pole is tightly clamped to the frame. Any wiggle here can cause the pole to break or the load to come loose.

Rod passing through the reinforced part of the pole and into the seat tube. The bends in the rod allow it to jam tightly in the tube which makes controlling the bike easier.

Washer between seat tube and pole is essential. Metal reinforcement on pole and washer spread out weight, reducing stress on the pole. Heaviest load should go between rod and clamp.

Backpack held by hangers. Backpack straps may be threaded over pole as well.

can be parked, fully loaded, when you need to attend to your children; no need to pull off and don a back pack. The driver wears nothing on their back; the entire load is on the bike. The driver just pushes. Others can help push on hills, move debris out of the way or just take turns as needed. The Porter system greatly reduces exertion and fatigue while greatly increasing load capacity and mobility. This is invaluable when you need to concentrate on keeping your family safe. ●

Backpack, six gallon bucket and a gallon of water — a heavy load for one person but leaves plenty of room on a Porter for more gear.

Living a SHELTERED LIFE

By Paul Seyfried & Sharon Packer

Location, location, location! Choose your underground (UG) site carefully. The first attribute for a good shelter location is an area with a low water table- that is, an area where you can dig a trench 18 to 20 feet deep without hitting ground water. In many areas, the water table can vary by seasonal rainfall (areas subject to hurricanes fall into this category).

Rocky Soil

Rocky soil will work, but it can add time and expense to the excavation. The soil on our remote site is very rocky. We were taking out rocks the size of a small Volkswagen. Never back fill with large rocks. If you have solid rock you will need to blast (which is very expensive but doable). Gravely type soil is fine and drains well.

Rocky soil will work, but it can add time and expense to the excavation.

Wet Soil
Wet soil of any kind, is a total non-starter. Spring excavations will show you the most likely 'high water' level. For installations later in the year, carefully estimate the high water level of the soil. If you reach wet soil during excavation, back fill to a safe, dry soil level before installing the shelter. If you need more cover for warmth or radiation protection, mound the dirt to make a hill over the shelter. In areas of potential blast or high winds, make sure the slope of the mound does not exceed 30 degrees.

Hills & Valleys
We would suggest that you look for an area that is not at the bottom of a vast slope. When placed in these locations, over a period of hours to days, the water that has collected over a shelter will super-saturate the soil and find any imperfection in the integrity of the shelter...and come inside. When a shelter is located up-slope, on high ground ... the rain will run *away* from the shelter, and not saturate the soil deep underground (unless the soil is 100% sand). In short, high ground good, low ground, not good.

We have built "submarines", where the entire shelter is below the water line, but they are welded plate shelters (steel fuel tanks), with solid steel pipe entrances. Submarine shelters must be held in place by heavy steel straps that are anchored into concrete. Steel plate shelters are heavy and harder to handle in the hole. A 48" diameter entrance elbow made of corrugated pipe may weigh 250 lbs., where a 1/2 inch walled steel pipe entrance will weigh thousands of lbs. Water problems can be dealt with, but they increase costs, and the shelter components are more difficult to assemble on the job site. Keep in mind that wet soil and clay type soils do not 'arch' and will compromise your blast protection.

Clay Soil
Clay type soils hold water for a long time. When this type of soil is saturated, your underground structure is not only holding up the weight of the soil, but also of the water it holds. Clay soils are not even recommended for use against concrete foundations, as clay creeps and moves, and will eventually crack concrete walls.

In clay excavations, water will collect in and around the disturbed areas and the clay will hold the water, forming a "swimming pool" effect. Clay soils will require a good drainage system, such as a French drain.

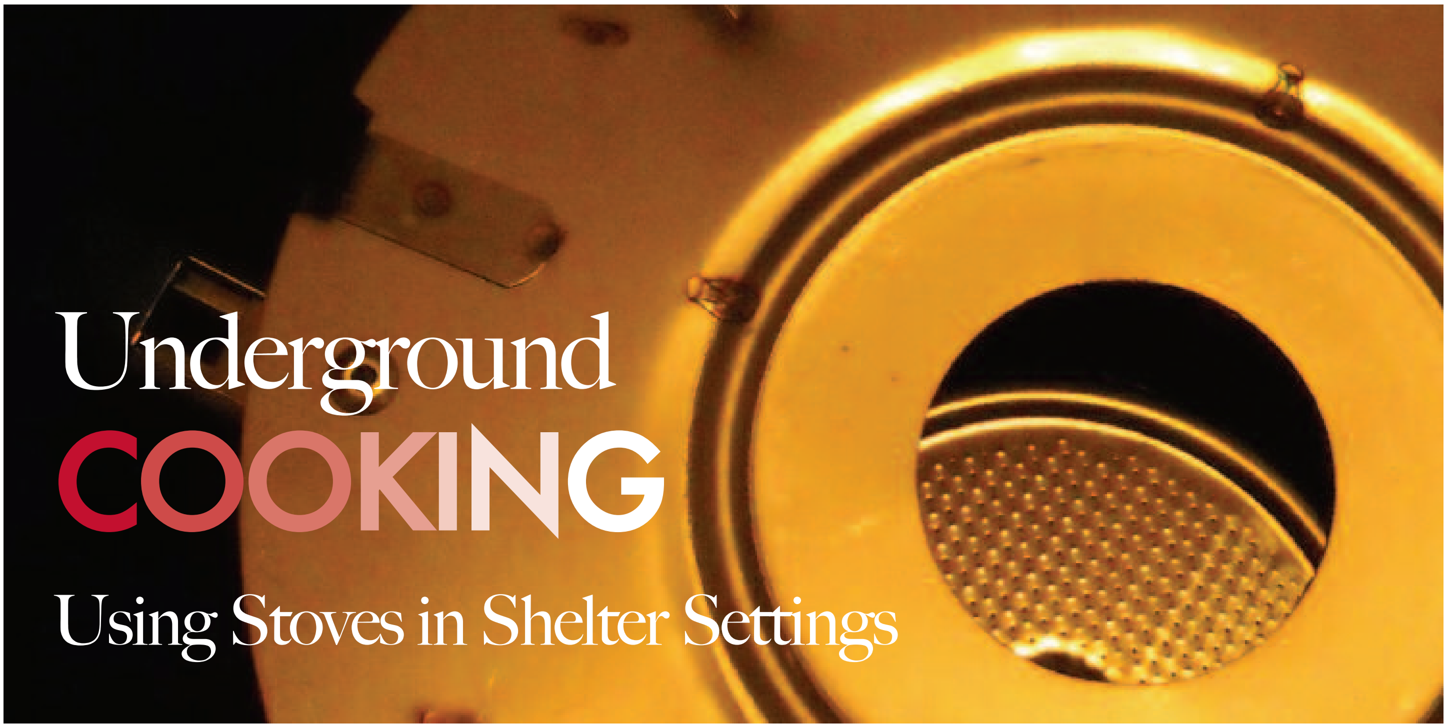
Always consult a good soil engineer before installing your underground shelter. When installing in clay, soil engineers often recommend that you totally remove the clay overburden, fill with crushed rock up to about 3 feet or so of grade and then apply engineer's fill or road base for another couple of feet before applying a top soil layer. A layer of sediment screen over the crushed rock before the engineer's fill goes in will protect your French drains from becoming clogged in the future.

We surveyed a shelter (not one of ours) that was buried in red clay soil in Virginia about six months ago, and it was near collapse when we looked at it. In addition to the clay soil present, the site was located in a large bowl- about 300 acres worth- so that all the rain in the world drained down to where the shelter was installed. (Location, location, location!) Parts of the shelter may possibly be saved if they remove the clay and replace it with engineer's fill and crushed rock ... something that will arch. The crushed rock will arch well, even when wet. Clay does not arch well, even when dry.

Deformation of Shelter
Some deformation of the end caps/bulkheads in steel shelters is completely normal and expected. I know this will happen and I locate the bolt pattern holding the air handler brackets in a close, square pattern knowing that the strut will lift away from the end cap upon backfill. I plan for this when installing the deck (that's why the deck does not contact the end caps) and the ventilation intake pipe. Corrugated pipe is not a particularly accurate cylinder, as it is wound in a spiral format, like a paper towel tube. Some deviation in the diameter dimensions is very normal. Most of them seem to come out a little larger on the ends than in the middle- but not always.

We recommend using a large track hoe (size 290 to 330) instead of a backhoe. Most all makes of track hoes will size the same way. The track hoe will get the job done much more quickly, and time is money. It also provides a huge safety factor when digging a deep installation. Never, never use a Bob Cat to back fill a steel shelter. Bob Cats cannot reach into the center of your excavation, and will fill on one side of the shelter before moving around the shelter to fill on the other side, resulting in uneven loading and possible shelter failure. Rock fill and soil must be evenly placed on both sides of the shelter with no more than a 6-inch variance at any time. Also, Bob Cats must get uncomfortably close to the edge of the hole to dump their load.

Pick your location carefully. Don't be in a hurry. Dig a test hole and do a perk test. It will more than pay for it's self in the long run—and *never* back fill with clay.



Underground COOKING

Using Stoves in Shelter Settings

By Jay Whimpey

I often get feedback on articles about using stoves in underground (UG) shelters, enough so that I would like to answer some of the issues it brought up.

I wrote about methyl alcohol (methanol), propane and butane being short-chain carbon molecules and said they give off only carbon dioxide and water when they tend to combust completely.

We need to look at the method of delivery of the fuel to the point that it will be lit and create the fire to cook with (this would be the burner). The delivery method is important, because while the FIRE is not giving off poisonous gases as the fuel is being consumed, the fumes from the fuel, itself, can be an issue when the stove is in storage. This is especially important when the stove is warm.

In another article, I spoke mainly about the alcohol and butane stoves, but didn't go into propane stoves for use in undergrounds. Propane can be used in confined spaces, however, there are issues that arise when using propane that don't arise when using the butane stove. We'll get into that later in this article.

We want to look at options that do not allow any of the fumes or vapors from the fuel to evaporate into the airspace of a shelter. In a closed environment, like an underground shelter, a whole different set of rules apply than if you are camping in the open air, or on a boat or even in a regular kitchen that has doors, windows and exhaust fans.

Below are excerpts from the MSDS (Material Safety Data Sheet) on the 3 fuels we've been discussing. The highlighting is my own in order to draw attention to certain sentences.

FROM THE MSDS on METHANOL/METHYL ALCOHOL:

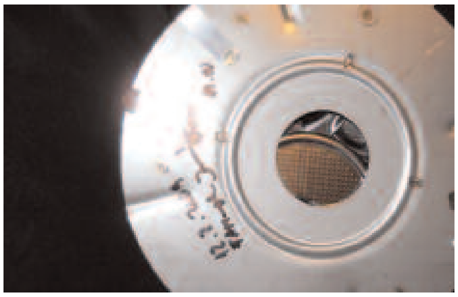
Vapor: Flammable liquid and vapor is harmful if swallowed, inhaled or absorbed through the skin and causes eye, skin, and respiratory tract irritation. It may cause central nervous system depression. It cannot be made nonpoisonous. Its target organs are: eyes, nervous system, optic nerve.

Inhalation: Methanol is toxic and can very readily form extremely high vapor concentrations at room temperature. (Inhalation is the most common route of occupational exposure.) At first, methanol causes CNS (central nervous system) depression with nausea, headache, vomiting, dizziness and poor coordination. A time period with no obvious symptoms follows (typically 8-24 hours). This latent period is followed by metabolic acidosis and severe visual effects, which may include reduced reactivity and/or increased sensitivity to light, blurred, double and/or snowy vision, and blindness. Depending on the severity of exposure and the promptness of treatment, survivors may recover completely or may have permanent blindness, vision disturbances and/or nervous system effects.

Chronic: Prolonged or repeated skin contact may cause dermatitis. Chronic exposure may cause effects similar to those of acute exposure. Methanol is only very slowly eliminated from the body. Because of this slow elimination, methanol should be regarded as a cumulative poison. Though a single exposure may cause no effect, daily exposures may result in the accumulation of a harmful amount. Methanol has produced fetotoxicity in rats and teratogenicity in mice exposed by inhalation to high concentrations that did not produce significant maternal toxicity.

Continues next page

An alcohol burner unit from a Swedish mess kit.



The flame control plate of an alcohol stove.

Components of an Origo Heat Pal alcohol stove.

FROM THE MSDS ON BUTANE:
Handling Precautions: Butane vapor is heavier than air and can collect in low areas that are without sufficient ventilation. Conduct system checks for leaks with a leak detector or solution, never with flame. Make certain the container service valve is shut off prior to connecting or disconnecting. If container valve does not operate properly, discontinue use. The vapor pressure of butane is less than propane.

Ingestion: Ingestion is unlikely.

Inhalation: This product is considered to be non-toxic by inhalation. Inhalation of concentrations of about 10,000 ppm may cause central nervous system depression such as dizziness, drowsiness, headache, and similar narcotic symptoms, but no long-term effects.

Eyes: Vapors are not irritating.

Skin: Vapors are not irritating.

Note from Teri Simpson from www.optimum preparedness.com:

"The butane canisters used with the Porta Chef stove are designed to not allow any butane out of the canister until you have engaged the canister in the stove. Even at that point, no butane is released until the 'piezo' electric starter clicks and ignites the fuel – hence no butane vapors. The canisters do not leak. I have some from 1999 and they are all full. I am including the MSDS data *not because there is any danger of breathing butane gas,* but because if I present *only* information on the methanol then you would wonder about the information on the other fuels. I include this information so I do not leave any of you wondering."

FROM THE MSDS ON PROPANE:
Handling Precautions: Propane vapor is heavier than air and can collect in low areas that are without sufficient ventilation. Conduct system checks for leaks with a leak detector or solution, never with flame. Make certain the container service valve is shut off prior to connecting or disconnecting. If container valve does not operate properly, discontinue use.

Toxicological Information: Propane is nontoxic and is a simple asphyxiant, however it does have slight anesthetic properties and higher concentrations may cause dizziness.

Inhalation: Asphyxiation. Before suffocation could occur, the lower flammability limit of propane in air would be exceeded, possibly causing both an oxygen-deficient and explosive atmosphere. Exposure to concentrations >10% may cause dizziness. Exposure to atmospheres containing 19% or less oxygen will bring about unconsciousness without warning. Lack of sufficient oxygen may cause serious injury or death.

Ingestion: Ingestion is not expected to occur in normal use.

Chronic Effects: None.

Carcinogenicity: Propane is not listed by NTP, OSHA or IARC.

Skin Absorption: None.

QUESTIONS:

HOW LIKELY IS IT THAT YOU WILL GET FUMES OR VAPOR IN THE AIR?
Carefully consider the potential for each fuel of interest.

WILL YOU GET BUTANE FUMES IN THE AIR?
Not unless you puncture the canister (bad idea), or go take the tip off of a can of hair spray or spray paint and see if you can get butane to squirt out of the canister (and how likely is THAT to happen?). Butane has a lower pressure than propane at a given temperature and is handled in much less substantial containers. Butane is heavier than air and will tend to collect in lower areas similar to propane and heavier alcohols. Methanol is only slightly heavier than air.

I am going to say, NO, you will not have any butane vapor/fumes in the air.

WILL YOU GET PROPANE FUMES IN THE AIR?
A lot depends on how the stove/range is installed. If installed by a professional, and there are safe guards in place to ensure your safety, you should be absolutely fine. You would want to have propane leak detectors in place by any propane appliances. These range from simple battery operated ones to leak detectors that will automatically shut

off the supply of propane to that appliance (these require a manual reset and manually restarting the flow again).

Because propane is heavier than air it pools on the floor much the way water would. Because of this, oftentimes "propane drains" are installed in the floor of an underground shelter so that should there ever be a leak the propane would flow down into the propane drain, the same way a water leak would go down a floor drain.

Consideration must be given on how to get the propane from a buried propane tank into the inside of an underground shelter so as to minimize pipe shearing should there be earth movement.

If you have your propane stove/range installed by a professional, and the builder has taken into consideration ground movement, air flow, air consumption by the stove in its varying roles: single burner being used, multiple burners being used, the oven being used - and you have propane leak detectors, then I am going to say, NO, you should not have any propane vapors/fumes in the air.

For some people that level of technology is not in the budget, and this is where a portable butane stove comes in so handy. What about portable propane stoves, you may ask. There are a lot of camping stoves that use the dark green 1 lb. propane canisters. All I can say about those is that my brother bought a huge quantity of them right before Y2K (1999). Two years later they were all empty, and not because he used them. Because the propane all leaked out! Not a good thing in my book. And luckily he didn't have them in a confined living space like an underground.

WILL YOU GET ALCOHOL FUMES IN THE AIR?

If you use the Trangia stove or the Origo alcohol stoves, yes you will. Are these fumes bad for you? YES, we have seen that they are. Ethanol (drinking alcohol) and isopropyl alcohol/isopropanol fumes are not significantly toxic. Methanol is much more toxic than the larger alcohols because of the way it is metabolized.

Can you minimize the skin contact with the methanol/ethanol? Sure. Wear latex or nitrile gloves or just be really tidy when filling the burners. Can you minimize the vapors that will evaporate into your air? Sure. When you put the Trangia burner out, and when the burner has cooled down, screw on the gasketed lid. When you turn the knob on the front of the Origo, it just slides a non-airtight plate across the top of the burner. This will allow fumes to escape into the air. You will need to wrap aluminum foil over the top and sides of the burner to keep evaporation from occurring. There are also some Swedish mess kits that come with an alcohol burner that have a lid which screws onto the burner when not in use. This arrangement reduces fuel loss from evaporation and exposure.

I have a Trangia stove and a bunch of alcohol. I figure I can use it "top side" (i.e. not in a closed shelter situation) if I use the outlined safety practices, which include lots of ventilation, maximizing vapor containment and not letting any get on my skin.

With alcohol, I'm going to say YES, you will have alcohol/methanol /ethanol vapors/fumes in the air of an underground shelter. Be sure to ventilate well while cooking and immediately afterwards.

A COUPLE OF OTHER POINTS

A lady wrote in asking if I was suggesting using a propane/ butane light/lantern to make light in the Underground. No!

Fire uses air. Fire is in direct competition with you for the air that is available. With enough fire (stoves, oil lamps, oil lanterns, candles, etc.), the fire will win and you will die. If you have lots of fire from different sources using up the oxygen in the air faster than fresh air can be brought into the shelter, soon there will be less and less available oxygen and you will pass out. If the air consumption continues at a rate faster than the air can be replaced, eventually you die. As carbon dioxide builds up, your body will react by increasing breathing rate and depth. Carbon monoxide from incomplete combustion will put you to sleep and can kill you rather quickly by combining with hemoglobin in your blood that normally carries oxygen.

There are lots of non-fire alternatives for getting light into the shelter: battery lanterns, 12 volt lighting, hand crank lanterns. You'd be surprised how much light the 12 hour snap lights give off – plenty for ambient lighting in a bathroom or bedroom area. And you can fit bunches of them in a five gallon bucket. Batteries now store for several years. Fill a bucket with batteries (and consider getting as many things as possible that run on the same kind of battery so you only have to store AA and D batteries, for example). With the common availability of LED lighting there is very little reason to use fuel for a source of light.

Another person wrote in asking about the 5-gallon propane tanks used with a stove. Again, when proper precautions are taken, there should be no problem with using those in an underground. But you have to be conscientious: stupid mistakes are less deadly above ground than underground because of the limited ventilation and tendency for propane and butane to collect in low areas.

The propane tanks need to be secured so in the event of ground movement they are not crashing around. You need to verify that none of the tanks leak with a propane leak detector. When you connect them to the stove use a good hose and check for leaks on both ends of the hose with a leak detector. Have at least one or two extra hoses in case something happens to the one you are using. Make sure that the stove wouldn't fall off the table or counter if there is ground movement – if it fell it could potentially damage the connection of the hose at either end causing a leak.

Keep the tank valve closed when not in use to reduce the chance of a leak.

I hope this helps clarify a few of the questions. ●

However, 10,000 years is indeed a long period compared to documented human residency on this earth. In truth, it is possible that any disposal unit for radioactive or stable hazardous materials designed by humans may not sequester all the materials within the unit for ten millennia. Some of these materials may eventually escape. These materials will be subject to natural forces and events that disturb and disrupt the earth's crust. Earthquakes, tornados, hurricanes, glaciations followed by melting, surface and ground water transport, flooding, erosion, volcanism, meteor strikes, and even human intrusion could eventually release the contained materials to the biosphere.

But, despite the inability of man to accurately predict and correctly model the future action of these natural forces and events for disruption, one natural law that is irrevocable and will prevail throughout the lifetime of the universe, is the "Second law of Thermodynamics." The entropy of any closed natural system increases over time. That law translates into dilution, dispersion, advection, and diffusion of the materials contained within any disposal unit. The original concentrations of these waste materials will undergo natural dispersion and reduction.

The increase in entropy of the disposed waste produces a natural reduction in the concentration and spreading of these hazardous materials. Then the atmosphere, combined with surface and ground water as the cleansing agents, will transport these contaminants from where they are deposited, into the oceans.

The oceans serve as the depository for all nature's toxic substances. Because of the vast volume and mass of the earth's oceans, a cubic meter of hazardous material dissociated into sea water is reduced in concentration by a factor of 1E18. A kilogram of hazardous material is mixed within the ocean water mass and reduced by a factor of 1E21. Dilution to parts per million or less is generally adequate to contain the risks from nuclear waste and such dilution is the universal mechanism by which nature cleanses its contaminated land surface and discharges the waste into the ocean. Indeed, the radioactivity and concentration hazard of the nuclear waste produced by mankind will be rendered innocuous and the attendant risk dissolved in the vast oceans of the earth from which sprang life on the planet. Cohen [4] and many others have shown that oceanic disposal would likely provide the safest means of immediate disposal of nuclear waste. Nature will eventually transport this waste wherever it is initially deposited to the oceans, along with all the other natural and hazardous materials existing on the earth.

Consider the very hazardous, but ubiquitous material, lead (Pb). Lead is a known carcinogen and mutagen. It is particularly harmful for children through ingestion of lead paint. However, lead has been used as an additive for gasoline (~1900 to 1980) and is pervasive and universal in lead-acid batteries. The annual world production of lead if ingested by humans would kill more people than the entire inventory of plutonium existing in the world. Yet most lead waste is not properly disposed and is found in agricultural soils, ground water, and even some drinking water supplies.

Fortunately, nature intervenes and provides the dispersal and chemical degradation to render lead's bioavailability very low. But lead concentrations in the human biosphere are still much greater than the radioactive actinides. Interestingly, the ultimate radioactive decay product of the naturally occurring and man-made actinides is lead, and these actinides are similarly degraded and processed by nature.

Even naturally occurring radionuclides often pose greater risk than their much-maligned man-made cousins such as plutonium. For example, the inventory of naturally occurring radium (primarily Ra-226) in the oceans is estimated at 80 million tons. This vast quantity of radium is equivalent in toxicity to the ingestion of 100 billion tons of plutonium. However, the total world inventory of plutonium is only about 1000 tons. Significantly, ultimate disposal of this small mass of plutonium in the oceans would exhibit the equivalent radiotoxicity of less than 1 ton of radium or 0.000001% of the toxicity of natural occurring radium now contained in the oceans.

CONCLUSIONS

The facts relevant to the insignificant risks of low levels of radiation should be addressed and understood, first by the scientific community and then by the public. Ionizing radiation is not foreign to the human species, and indeed humans have evolved in a ubiquitous sea of radiation from both space and the planet on which humans reside.

Underground nuclear power plant siting and closing of the nuclear fuel cycle would further reduce the small risks from present surface siting of nuclear facilities, and would provide additional protection to above ground populations. This concept essentially eliminates all the concentrated hazards now sited above ground, particularly those hazards involving the movement of large quantities of radioactive materials and even the temporary siting of nuclear waste above ground.

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6) Sandquist, G.M., "The Fate of Hazardous Materials in the Biosphere, "Proceedings of ICONE 14," 2006, Miami, FL.
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LETTERS to the Editor

Dear Editor,

Is there anyone around the Rio Grande Valley who I could talk to at length about joining the group?

Thanks,
Chandler

Dear Chandler,

We do not know of any group in the Grande Valley area, that is actively holding civil defense meetings. We will post your letter in the journal and forward any requests to join you in your efforts. Any requests should be sent to our TACDA email address, and we will forward them to you. We would suggest that they give a first name and contact number, so you can visit with one another for compatibility, without divulging full identification.

Texas, as a whole, has been very supportive of civil defense efforts. You may want to consider starting a group yourself. Use the TACDA Academy (download from web site) as a basis for your lessons. Advertise in local papers of the time and place that you are meeting.

We have found that one meeting a month has worked nicely in our Utah group. Set a time and meet regularly, so the group can count on the time and place.

We set the time as the 2nd Saturday of every month at 7:00 pm. Start with friends that you trust, and hold the first meetings in a home until you get established. Read everything you can, and become well versed so you can answer questions with authority.

Once you get going, and know the group is willing to continue, look for a permanent meeting place where you can grow. You might ask to use a room of your library or city offices for your meetings. We call our Utah group "Civil Defense Volunteers of Utah". It has been meeting regularly for about 20 years. We share ideas and have a monthly lesson.

Good luck, and let us know how you are getting along.

Best Regards,
Sharon Packer
TACDA Board Member

Dear Editor,

Last week my wife and I found we had to help our daughter move to Lafayette, Colorado, and the National Weather Service said winds across Wyoming were expected to be 50-75m/h, and vehicles with light trailers were prohibited. We were in a pick-up truck that experiences some jostling by the wind, and we saw semi trucks that were swayed as they drove along, but the really surprising experience was when I got out of the truck in Rock Springs; the wind was fierce and blasted me as I stood holding on to the fuel nozzle to prevent it being blown away from its refueling position. I had an antenna blown down a month ago by the wind, also. I read that this April there were 875 tornadoes compared to 267 for the previous high for any April.

Thoughts?
John

This letter inspired us to research a bit of information on tornadoes. The following is from the Wikipedia (remember that the Wikipedia is a free-content encyclopedia and is written collaboratively by largely anonymous Internet volunteers who write without pay).

Tornado Records:
http://en.wikipedia.org/wiki/Tornado_records#Most_tornadoes_in_single_24-hour_outbreak

Most tornadoes in single 24-hour outbreak:
The Super Outbreak of April 3–4, 1974 spawned 148 confirmed tornadoes across eastern North America and resulted in the second highest death toll (319) for a tornado outbreak in the United States. Not only did it produce an exceptional number of tornadoes, but it was also an inordinately intense outbreak producing dozens of large, long-track tornadoes, including 6, F5 and 24, F4 tornadoes. More significant tornadoes occurred within 24 hours than any other week in the tornado record.

The April 25–28, 2011 tornado outbreak has broken the Super Outbreak's record. The National Weather Service reports that the outbreak produced approximately 336 tornadoes, with 190 of those in a single 24-hour period. 340 deaths have occurred in that same 24-hour time period. The outbreak has also helped smash the record for most tornadoes in the month of April with around 600 tornadoes, more than double the prior record (267 in April of 1974). The overall record for a single month was 542 in May of 2003, which has also been broken.

Largest outbreak in the fall
Most tornado outbreaks occur in the spring, but there is a secondary peak of

tornado activity in the fall. In 1992, 95 tornadoes broke out in 41 hours of continuous tornado activity from November 21 to 23. Many other very large outbreaks have occurred in the fall, especially in November and early December.

Longest continuous outbreak
Under most definitions, the November 1992 tornado outbreak is also the longest continuous tornado outbreak, and among the largest in geographic scope, as well.

Most tornadoes spawned from a hurricane
The greatest number of tornadoes spawned from a hurricane is 117 from Hurricane Ivan in 2004.

Deadliest single tornado in world history
April 26, 1989 - Bangladesh - A massive tornado took 1,418 lives.

Deadliest single tornado in US history
The “Tri-State Tornado” of March 18, 1925 killed 695 people in Missouri (11), Illinois (613), and Indiana (71). The outbreak it occurred with was also the deadliest known tornado outbreak, with a combined death toll of 747 across the Mississippi River Valley.

Most damaging tornado
Similar to fatalities, damage (and observations) of a tornado are a coincidence of what character of tornado interacts with certain characteristics of built up areas. That is, destructive tornadoes are in a sense "accidents" of a large tornado striking a large population. In addition to population and changes thereof, comparing damage historically is subject to changes in wealth and inflation. The “St. Louis-East St. Louis Tornado” of May 27, 1896 incurred the most damages adjusted for wealth and inflation, at an estimated $2.9 billion (1997 USD). In raw numbers, the "Oklahoma City Tornado" of May 3, 1999 is the most damaging.

LARGEST AND MOST POWERFUL TORNADOES

Highest winds observed in a tornado
During the F5 tornado that moved into Oklahoma City on May 3, 1999, a Doppler On Wheels situated near the tornado measured winds of 301 +/- 20 mph (484 +/- 32 km/h) momentarily in a small area inside the funnel approximately 100 m (330 ft) above ground level.

Winds were measured at 257-268 mph (414–431 km/h) using portable doppler radar in the Red Rock Tornado during the “Andover, Kansas Tornado Outbreak”. Though these winds are possibly indicative of an F5 strength tornado, this particular tornado's path never encountered any significant structures and caused minimal damage. Thus it was rated an F4.

Longest damage path and duration
The longest track single tornado is the “Tri-State Tornado”, which traversed ≥219 miles (≥352 km) across southeastern Missouri, southern Illinois, and southwestern Indiana in about 3.5 hours. Though there has been some discussion as to whether this was a single tornado or a tornado family, recent and ongoing detailed re-analysis has found no break in the path and in fact that the tornado began 15 mi (24 km) before previously thought.

Longest path and duration

tornado family
What at one time was thought to be the record holder for the longest tornado path is now thought to be the longest tornado family, with a track of at least 293 miles (472 km) on May 26, 1917 from the Missouri border across Illinois into Indiana. It caused severe damage and mass casualties in Charleston and Matton, Illinois.

What was probably the longest track supercell thunderstorm tracked 790 miles (1,271 km) across six states in 17.5 hours on March 12, 2006 as part of the March 2006 Tornado Outbreak Sequence. It began in Noble County, Oklahoma and ended in Jackson County, Michigan, producing many tornadoes in Missouri and Illinois.

Widest damage width
The widest tornado (defined as damage path, not condensation/debris cloud or radar measurements) on record is the "Wilber-Hallam Nebraska" tornado during the outbreak of May 22, 2004, with a width of 2.5 miles (4 km) at its peak.

The widest tornado as measured by actual radar wind measurements was the Mulhall (1999) tornado in northern Oklahoma which occurred during the 1999 Oklahoma tornado outbreak. The diameter of the maximum winds (over 110 meters per second (250 mph)) was over 1600 m as measured by a DOW radar. Although the tornado passed largely over rural terrain, the width of the wind swath capable of producing damage was as wide as 4 miles (7 km), making the actual wind field of the Mulhall tornado likely twice as wide as that of the Hallam tornado (the wind field of which was not measured), even though the Hallam tornado resulted in a wider damage path.

Highest forward speed
73 mph (117 km/h) from the Tri-State Tornado (other weak tornadoes have approached or exceeded this speed, but this is the fastest forward movement observed in a major tornado).

Greatest pressure drop
A pressure deficit of 100 millibars (2.95 inHg) was observed when a violent tornado near Manchester, South Dakota on June 24, 2003 passed directly over an in-situ probe. In less than a minute the pressure dropped to 850 millibars (25.10 inHg), which is the lowest pressure ever recorded at the Earth's surface when adjusted to sea level.

On April 21, 2007, a 194 millibars (5.73 inHg) pressure deficit was reported when a tornado struck a storm chasing vehicle in Tulia, Texas. However, the pressure instrument was inside a vehicle which experienced winds greater than 50 metres per second (110 mph) and therefore this measurement was likely contaminated substantially by dynamic effects. The tornado was relatively weak and caused only EF2 damage as it passed through Tulia. The reported pressure drop far exceeds that which would be expected based on theoretical calculations (Lee, W.-C. and J. Wurman, 2005: The diagnosed structure of the Mulhall tornado, J. Atmos. Sci., 62, 2373-2393.)

There is a questionable and unofficial citizen's barometer measurement of a 192 millibars (5.67 inHg) drop around Minneapolis, Minnesota in 1904.

Earliest known tornado in Europe
The earliest recorded tornado in Europe struck Rosdalla, near Kilbeggan, Ireland on April 30, 1054. The earliest known British tornado hit central London on October 23, 1091 and was especially destructive.

Earliest known tornado in the Americas
An apparent tornado is recorded to have struck Tlatelolco (present day Mexico City), on August 21, 1521, two days before the Aztec capital's fall to Cortés. Many other tornadoes are documented historically within the Basin of Mexico.

First confirmed tornado and first tornado fatality in the U.S.
August 1671 - Rehoboth, Massachusetts
July 8, 1680 - Cambridge, Massachusetts - 1 dead

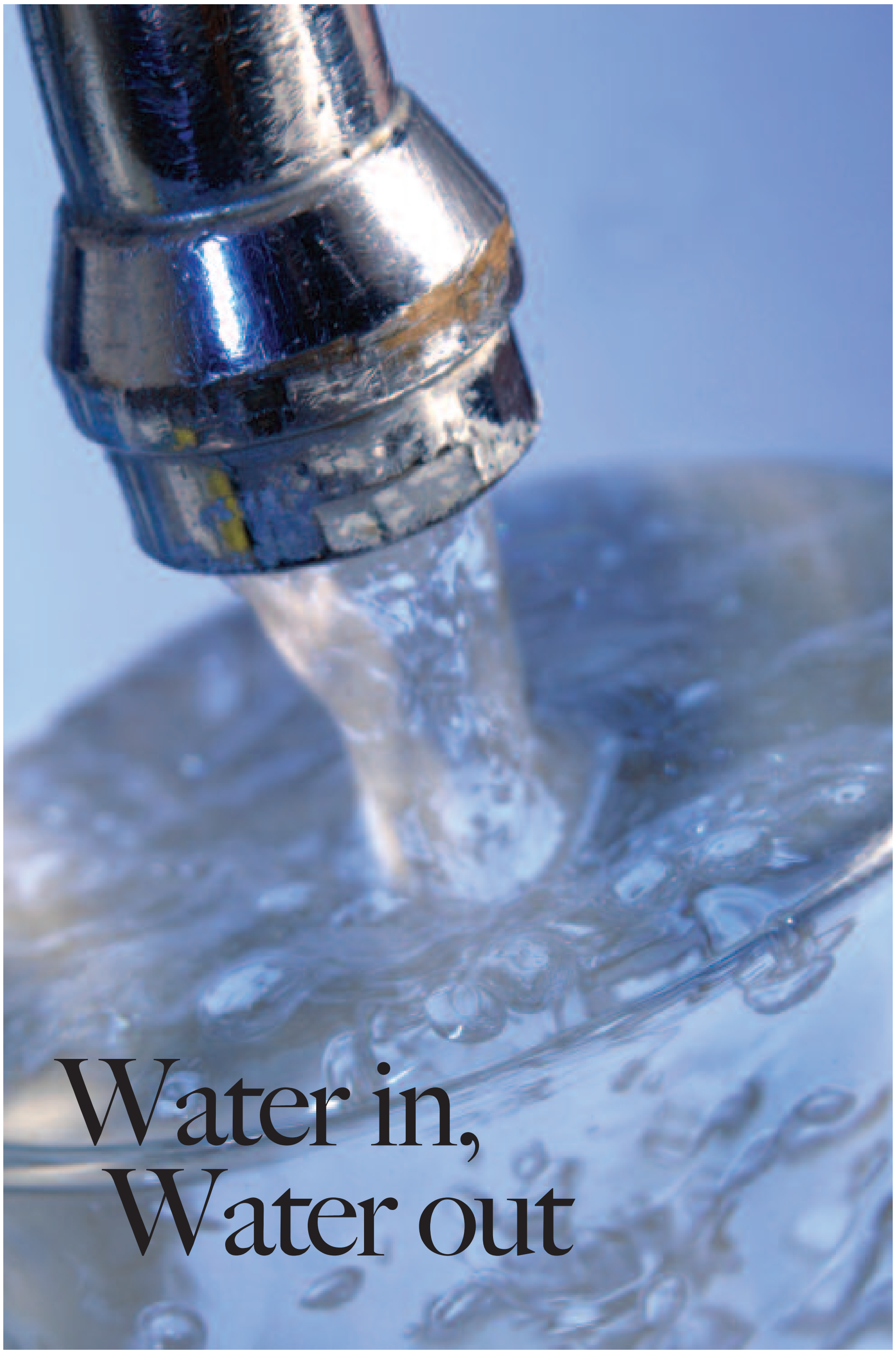
Longest span without a tornado rated F5 or *EF5
*EF designations for tornadoes are based on the "Enhanced Fugita Scale", which is a designation of not only intensity, but of damage done.

Before the Greensburg EF5 tornado on May 4, 2007, it had been 8 years and one day since the US has had a confirmed F5 or EF5 tornado. The last confirmed F5 or EF5 hit southern Oklahoma City and surrounding communities during the May 3, 1999 event. This is the longest interval without an F5 or EF5 tornado since official records began in 1950.

Longest distance anyone carried by a tornado
Matt Suter of rural Fordland, Missouri, according to Thomas P. Grazulis, holds the record for the longest known distance traveled by anyone picked up by a tornado who lived to tell about it. On March 12, 2006 he was carried 1307 feet (398 m), according to National Weather Service measurements.

Exceptional coincidences
Codell, Kansas: The small town of Codell, Kansas, was hit by a tornado on the same date three consecutive years. A tornado hit on May 20, 1916, 1917, and 1918. The U.S. has about 100,000 thunderstorms a year; less than 1% produce a tornado. The odds of this coincidence occurring again is extremely small.

Tanner, Alabama: A small town in northern Alabama, Tanner, was hit by an F5 tornado on April 3, 1974 during the Super Outbreak and was struck again 45 minutes later by at least a high-end F4 (some sources say F5), demolishing what remained of the town. Thirty-seven years later, on April 27, 2011, during what some meteorologists have dubbed Super Outbreak II, Tanner was hit yet again by the EF5 Hackleburg tornado, producing high-end EF4 damage in the southern portion of town.



Water in, Water out

Courtesy of Bank of America

Water and sewage problems can be costly and inconvenient to repair. That's why proper maintenance to prevent problems is so important. Here are some tips you may want to consider:

Plumbing

Periodically check the main water supply and fixture shutoff valves to ensure they are not stuck in the open position. Both these valves must be operable so water can be turned off in an emergency or when plumbing repairs are necessary.

Annually inspect distribution and drainage pipes for leakage or signs of weakness. Look for rust, corrosion, greenish deposits and mineral deposits around fittings, valves, fixtures and along the length of the pipe. (Note: Water from small holes can evaporate before a drip forms, leaving only a telltale whitish or colored deposit.)

Repair leaking faucets as needed. If faucet is a washer-type, replace washer and check washer seat for roughening; smooth if needed. If faucet does not have a washer, consult an installation manual or your local plumbing or hardware store for replacement procedures.

In the fall, remove garden hoses from all outside faucets to prevent the valves from freezing and bursting during winter months.

Well

If you have a well, the water should be analyzed for bacterial contamination and chemical pollution every three to five years, or more often if water becomes discolored, has an unusual taste or an odor problem occurs.

You should also have the well pump serviced annually to ensure the motor is clean and in good working order and that the water level in the well has a sufficient water table to use.

Septic tank

As a rule, septic tanks should be inspected and pumped every three to five years to help prevent costly replacement of the filter field. If a garbage disposal is connected to the septic tank system, it may require more frequent cleaning.

Do not depend on chemical compounds or septic tank cleaners poured down drains to eliminate the need for periodic cleaning.

In the spring, inspect the leaching field of the septic system for strong odors or frequent wet spots, which may indicate that the soil field is unable to absorb the septic tank effluent. Consult a professional to have a perk test performed if the condition persists or reoccurs regularly.

When it comes to home maintenance, a little prevention can save you time and money.

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