The Horrors of Nuclear War and How to Survive It!

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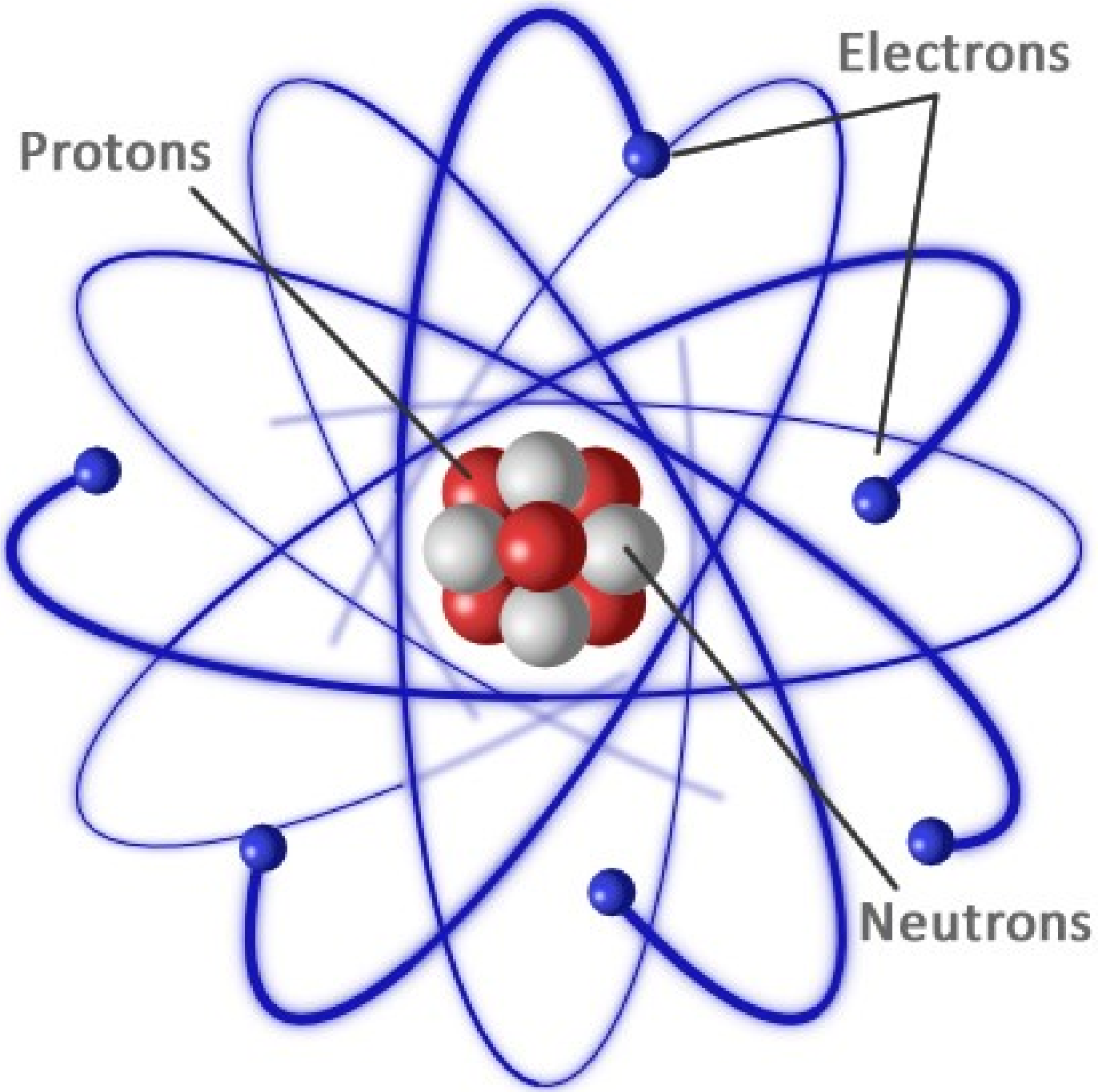
Section I

What is Radiation?

An Atom

An atom is made up of “essentially” three particles: electron, proton, and neutron. The electrons orbits a nucleus that contains the protons and neutrons.

For example a stable Carbon atom contains six orbiting electrons and a nucleus that contains six protons and six neutrons.



This is a picture of a typical atom.

Stable Atom

The nucleus of a stable atom has the same number of protons and neutrons.

For example a Carbon-12 has six protons and six neutrons.

Unstable Atom

A unstable atom has a different number of protons and neutrons. An atom does not want to stay at this configuration so it goes through neutron decay.

For example a Carbon-14 has six protons and eight neutrons. The extra two neutrons is what makes an atom radioactive and is called an isotope of Carbon.

Types of Energy Released During a Nuclear Explosion

- Neutron Decay (radiation)
- X-Rays
- Free Neutrons

During Neutron Decay

Three Types of Radiation are Given Off

- **α**-Alpha Radiation
- **β**-Beta Radiation
- **γ**-Gamma Radiation

α-Radiation

- Is a Helium Atom.
- Low Penetrating-a piece of paper or clothes can stop the helium atom.

β-Radiation

- Is an Electron.
- Somewhat Penetrating-can go through about a centimeter of tissue.

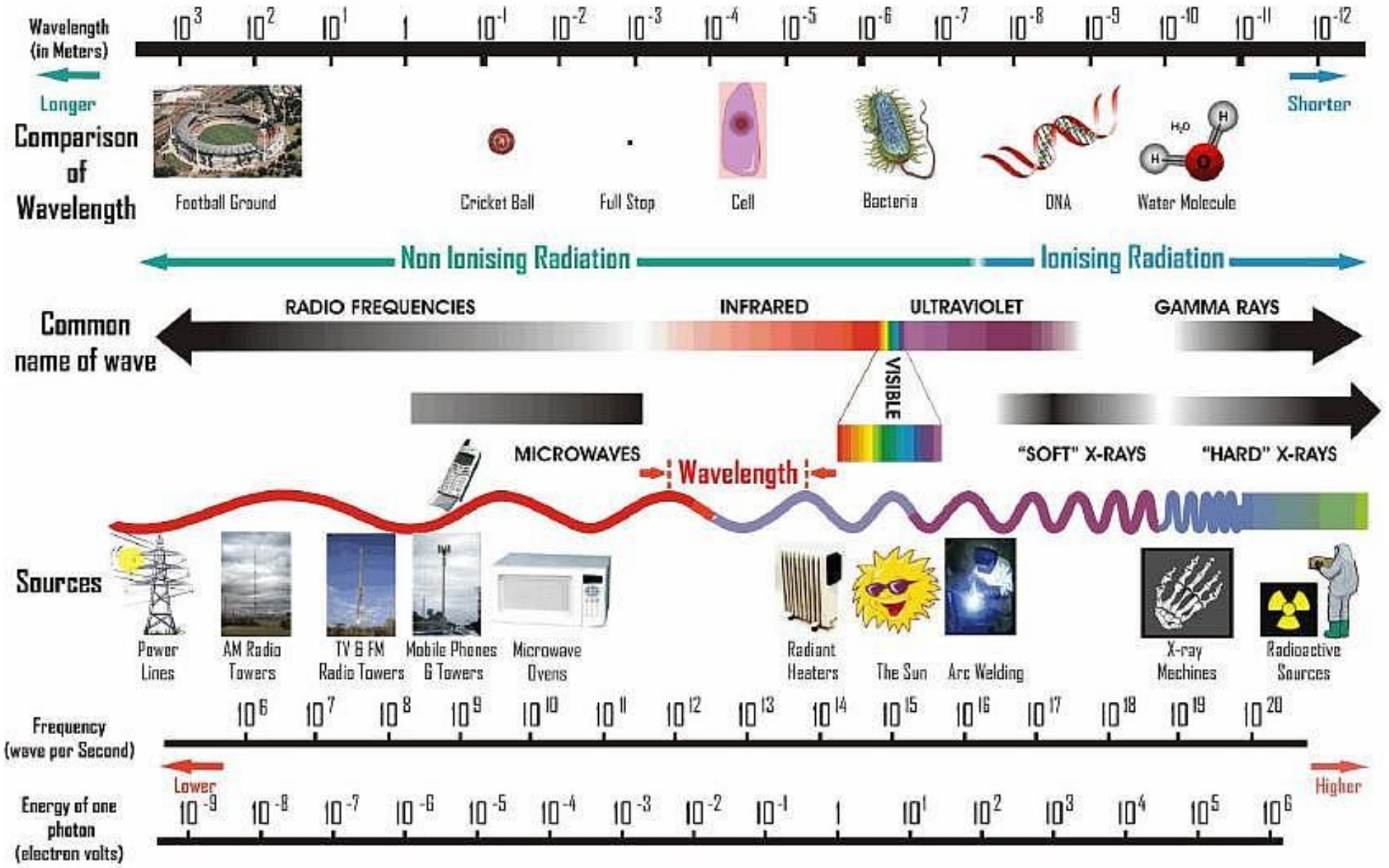
y-Radiation

- Is a photon of Electromagnetic Energy.
- Highly Penetrating-can go through a body and it takes concrete or a decent amount of earth to stop it.
- Can cause damage to genetic material inside of a cell.

X-Rays

- Is a photon of Electromagnetic Energy.
- Highly Penetrating.
- Can cause damage to genetic material inside of a cell.

THE ELECTROMAGNETIC SPECTRUM



Free Neutrons

There are extra high energy neutrons that are produced in an cascading fission reaction in a nuclear explosion that are not fissioned. The extra neutrons can combine with the contents of the environment which will make that material radioactive.

Half-Life

Half-Life is the length of time for the amount of radiation given off by an isotope to decrease by half. The radiation is continuous but will decrease by half by the half life.

The half-life of Plutonium-239 is 24,110 years and the half-life of Uranium-235 is 700 million years. Other isotopes have shorter or longer half-life's.

Uranium

Uranium-235 (U-235) is used in the making of a nuclear bomb. However, Uranium-238 makes up of over 99% of the rock excavated. The most common way to get the Uranium-235 out of a large amount of rock requires many sophisticated centrifuges.

Plutonium

Plutonium-239 (Pu-239) is not found naturally. It is a by-product of a nuclear reactor. The nuclear reactor can benefit others by producing electricity for homes and businesses.

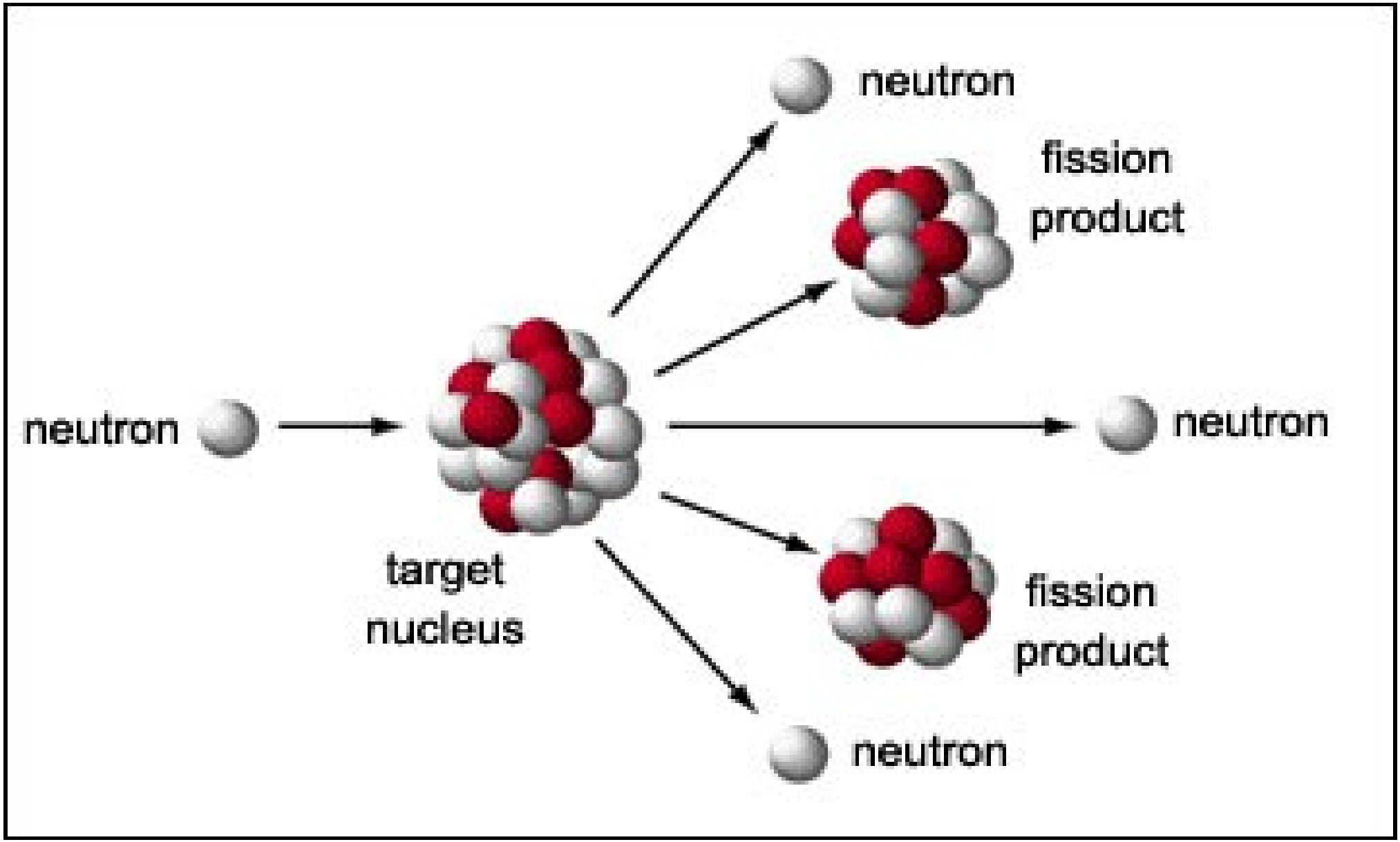
Section II

Fallout and Types of Blasts

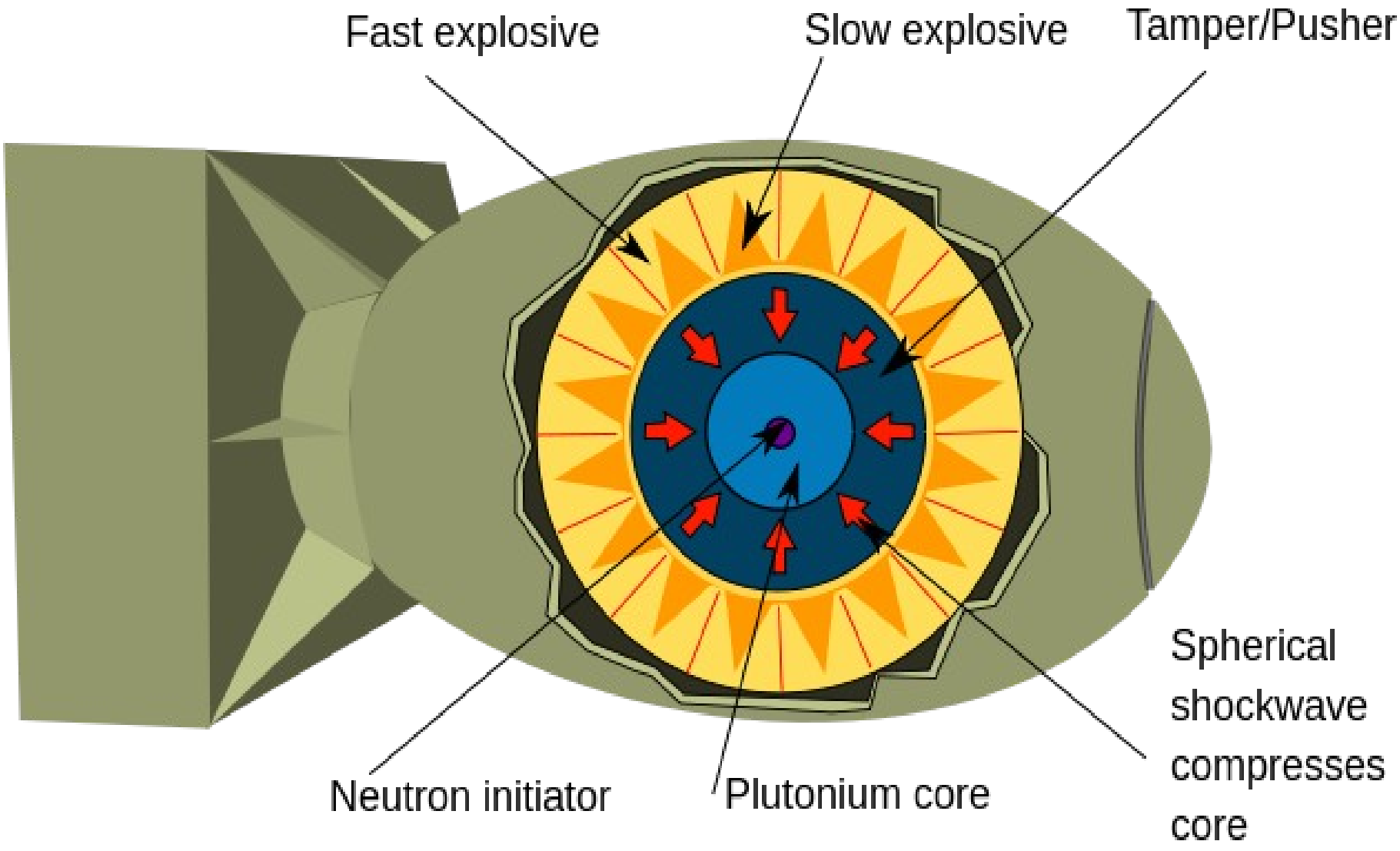
This picture is of the characteristic mushroom cloud.

Fission Reaction

During fission when one neutron is knocked out of the nucleus of an atom it can knock out 2 or 3 neutrons out of a atom next to it. This can set up a self-sustaining cascade reaction and is what causes the release of energy in a nuclear explosion. It takes about 92 cascades to keep a self-sustaining reaction. A stored core produces less until it is used as a bomb. An atomic bomb uses this type reaction.



This picture is of a fission reaction and its byproducts.



This picture is of a typical atomic bomb.

Thermonuclear Reaction

In a thermonuclear burst there is a combination of a primary **fission** and a secondary **fusion** reaction. It causes a greater release of energy due to both of the reactions occurring. It is called a hydrogen bomb because hydrogen is used in the reaction. The hydrogen is provided by Deuterium (H^2) or Tritium (H^3).

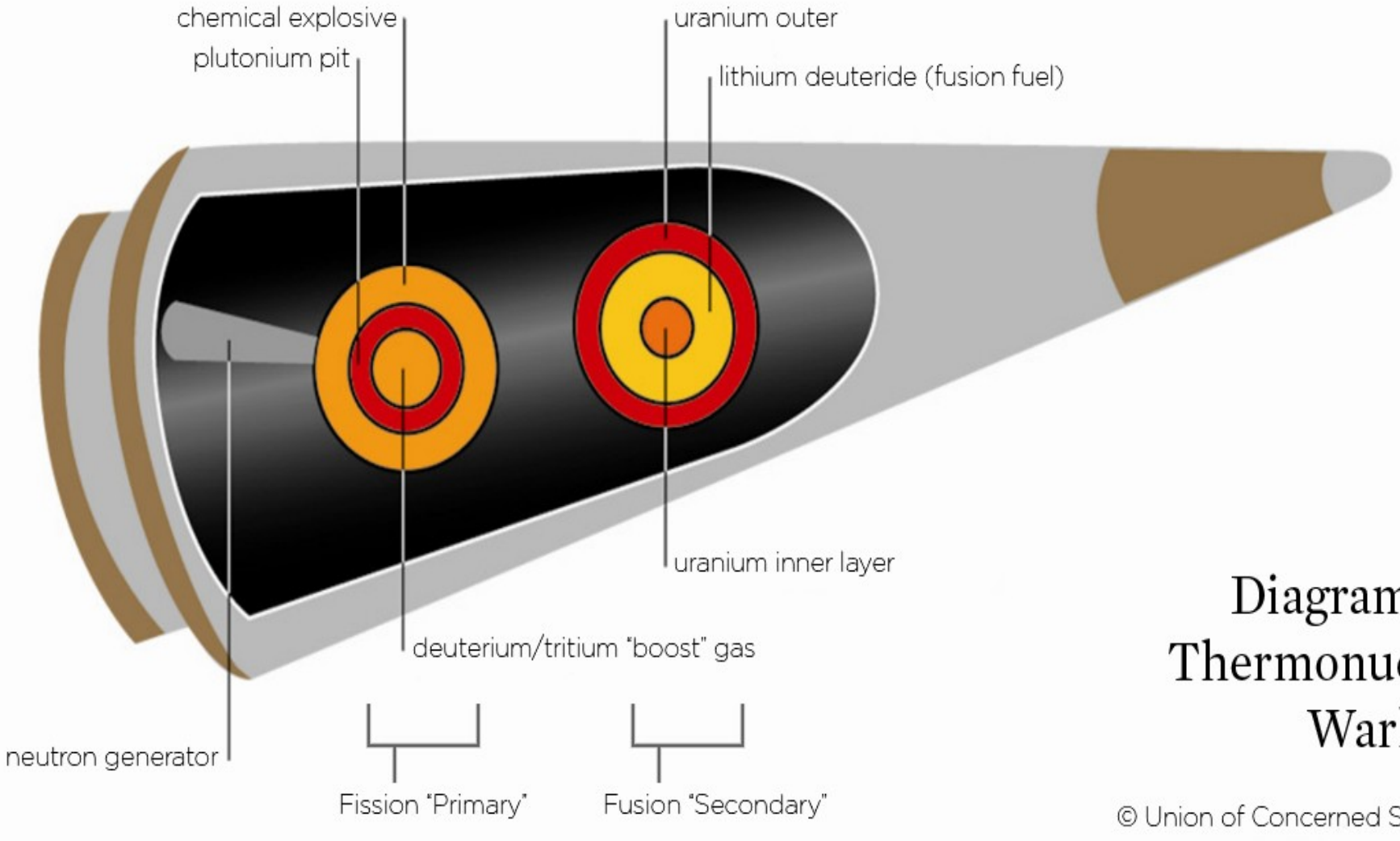
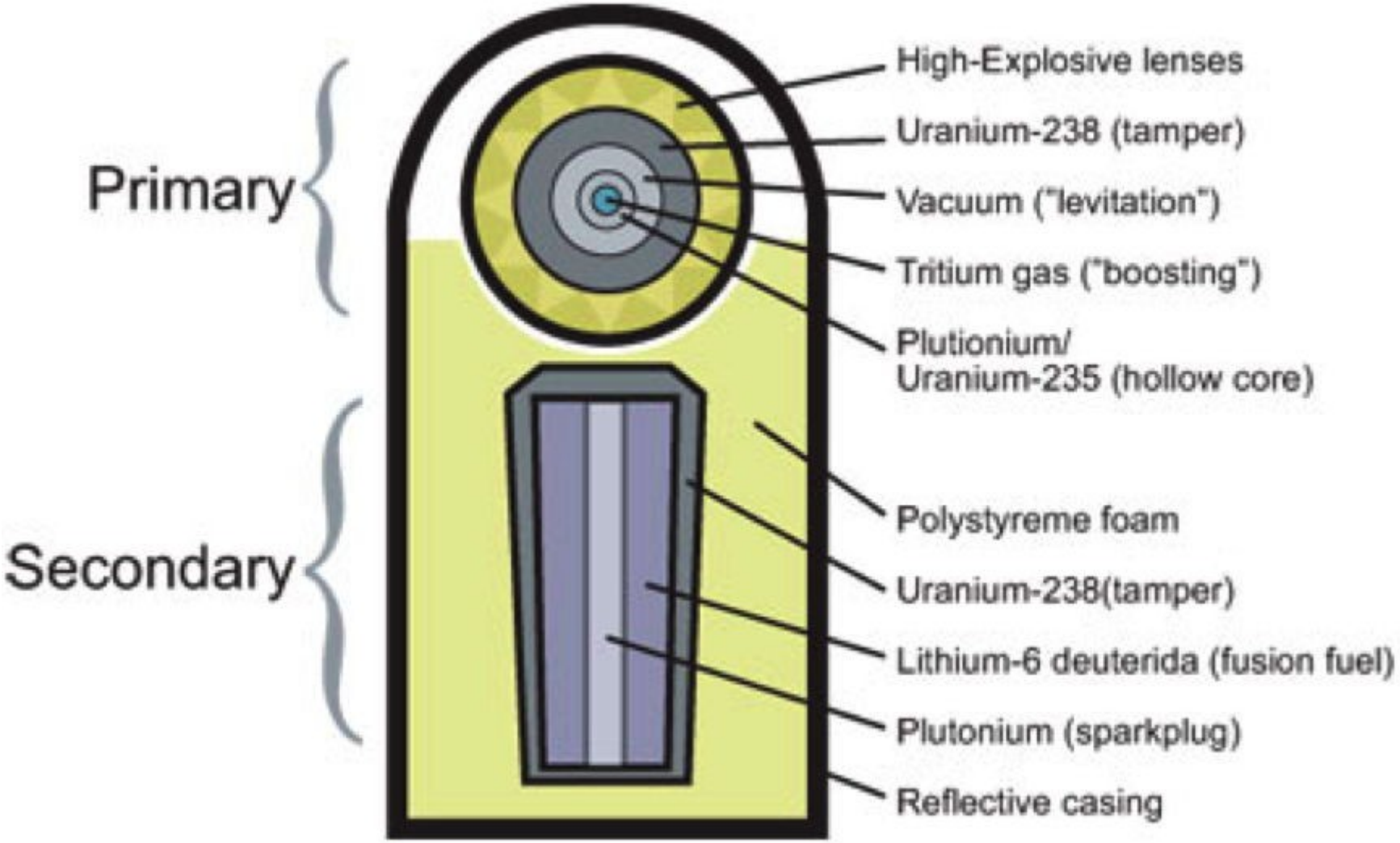


Diagram of a Thermonuclear Warhead



This is another picture of a different type of thermonuclear bomb.

Fallout

During a nuclear blast the actual ground and objects on and near ground zero are vaporized due to the heat and sucked up into a mushroom like cloud. This debris is mixed with unspent nuclear material from the bomb and the products of fission (even the products are radioactive) and are bonded together. As the temperature cools, the now bonded radioactive debris, falls to the ground as **Fallout**.

Fallout

Fallout is spread out over a large area due to the winds carrying the radioactive debris. The heavier debris falls out closer to the actual blast due to its heavy weight. However, the lighter debris can be carried over a larger area and it can be carried for years if it is in the higher altitudes.

Energy Released

- In a fission reaction, about 1 pound of fissile material can release about 8 KT of energy.
- In a thermonuclear reaction, 1 pound of the hydrogen isotope deuterium can release about 26 KT of energy.

Remember these are dependent on a number of conditions like the isotopes used.

Blast Characteristics

- Initial Radiation
- Residual Radiation
- Thermal Energy
- Over-Pressure
- Blast Wave

Remember the characteristics are dependent on a lot of factors like the type of explosion used like fission or thermonuclear . So the following percentages are approximate. Over-Pressure and Blast Wave are sometimes combined and called Shockwave. Initial Radiation and Residual Radiation are sometimes combined and called Radiation.

Secondary Effects

- Earthquakes
- Nuclear Winter
- Pooling of radioactivity in rivers, lakes, and ocean due to rain washing it out (Black Rain)
- Famine
- Pandemics
- Pestilence

Initial Radiation

- About 5% of the energy is given off as initial radiation.
- The initial radiation is in the form of gamma rays/x-rays and is the result of uranium or plutonium fission.

Residual Radiation

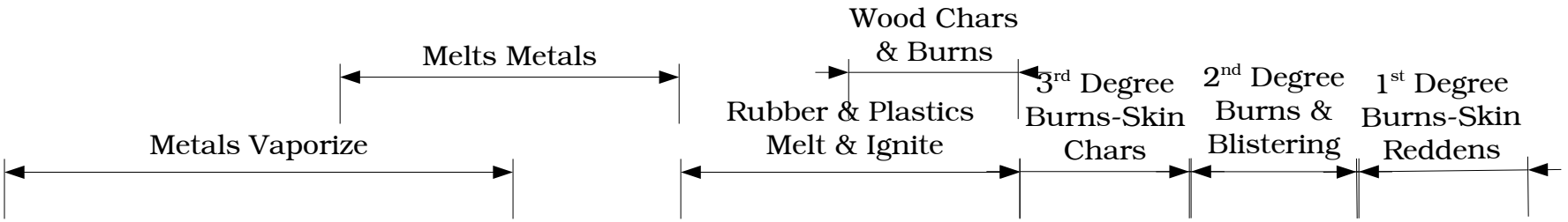
- About 10% of the energy is given of as residual radiation.
- The residual radiation is a combination of “unspent” uranium or plutonium and the products of the explosion (byproducts can be radioactive too).

Thermal Energy

- About 35% of the energy is given off as thermal radiation.
- The thermal radiation is in the tens of million degrees in the fireball (equal to the center of the sun).
- Some resources say the thermal energy that gets through your glass windows is to paint them with white paint. If your that close I wouldn't think it would matter.

Thermal Energy

- Photons are given off which can cause temporary or permanent blindness.
- The thermal radiation that is given off is the cause of combustible materials to catch fire and cause residual fires.



Weapons Yield									
10 KT	783 ft	1107 ft	1566 ft	2215 ft	3132 ft	4521 ft	1.2 mile	1.7 mile	2.9 mile
20 KT	1107 ft	1566 ft	2215 ft	3132 ft	4430 ft	1.2 mile	1.7 mile	2.2 mile	3.8 mile
50 KT	1751 ft	2476 ft	3502 ft	4953 ft	1.3 mile	1.9 mile	2.7 mile	3.6 mile	6.0 mile
100 KT	2476 ft	3502 ft	4953 ft	1.3 mile	1.8 mile	2.7 mile	3.6 mile	5.0 mile	8.5 mile
200 KT	3502 ft	4953 ft	1.3 mile	1.8 mile	2.6 mile	3.6 mile	5.0 mile	8.0 mile	11.9 mile
500 KT	1.0 mile	1.4 mile	2.0 mile	2.8 mile	3.9 mile	5.5 mile	8.5 mile	10.5 mile	18.5 mile
1 MT	1.5 mile	2.0 mile	2.8 mile	3.9 mile	5.9 mile	8.3 mile	10.7 mile	15.0 mile	25 mile
10 MT	4.3 mile	6.0 mile	8.5 mile	11.9 mile	16.0 mile	24.5 mile	33.0 mile	46.0 mile	80.0 mile
100 MT	13.0 mile	18.0 mile	25.5 mile	35.0 mile	50.0 mile	75.0 mile	112.0 mile	150.0 mile	255.0 mile

This woman has burn patterns left from the clothes she was wearing.

This picture is of the “shadow people”. The flash from the burst burned the there shadow into the ground.

Over-Pressure

- About 50% of the energy creates the over-pressure and blast wave.
- Creates an increase in pressure usually given in pounds per square inch (PSI).

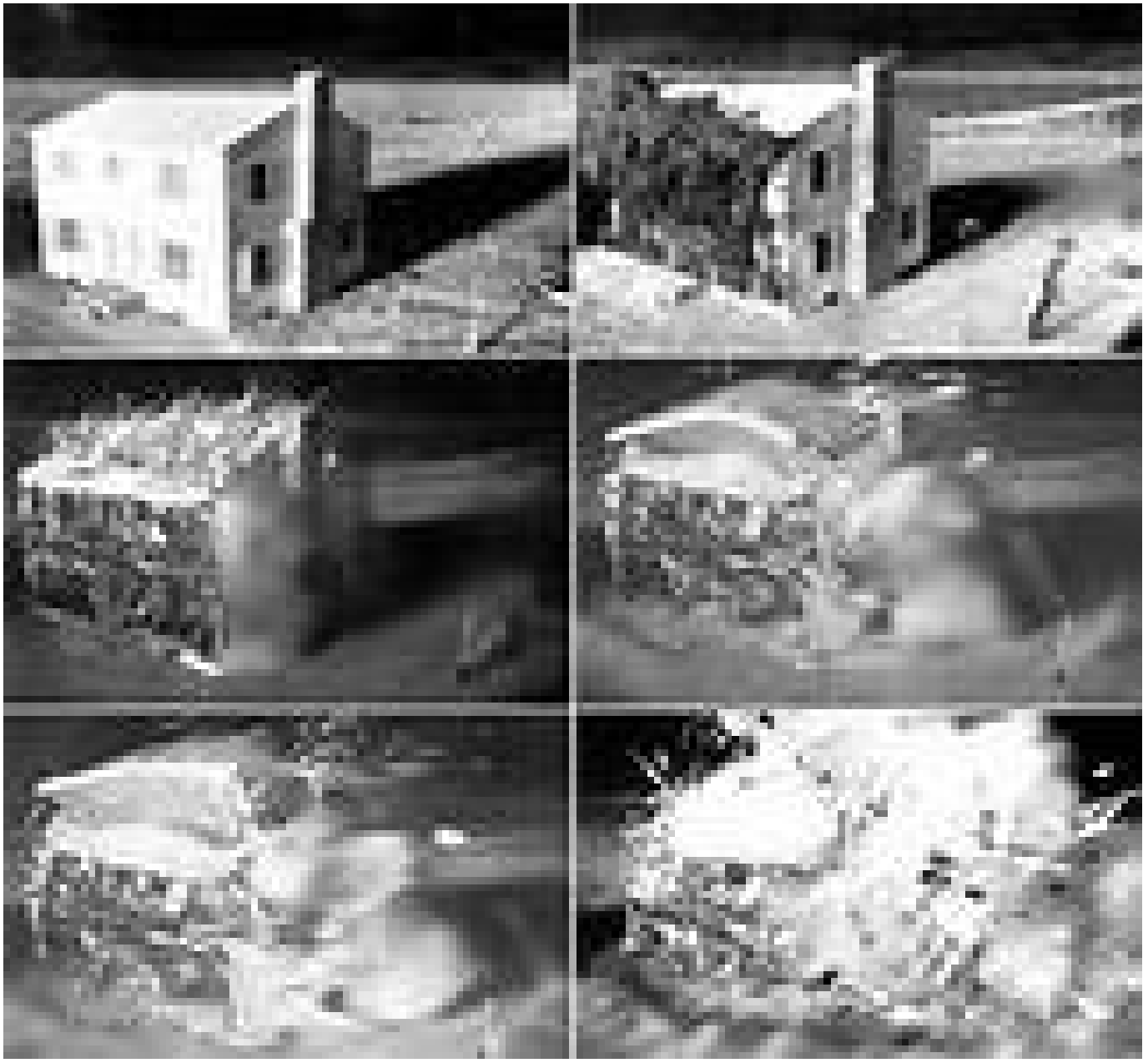
Over-Pressure

- Can create OVER 20 PSI near the blast and goes outward crushing buildings, etc.
- Is somewhat analogous to the crushing pressure on objects deep in the ocean.

Blast Wave

- This is the high velocity winds created by the over-pressure and is given in miles per hour.
- This can create high velocity projectiles that are dangerous to humans, animals, plants, and buildings. These winds can cause all kinds of injuries.

Weapons Yield	30 PSI 670 mph	20 PSI 470 mph	15 PSI 380 mph	10 PSI 290 mph	7 PSI 225 mph	5 PSI 160 mph	3 PSI 116 mph	2 PSI 70 mph	1 PSI 48 mph
10 KT	1665 ft	2010 ft	2297 ft	2872 ft	3590 ft	4310 ft	1.0 mile	1.2 mile	2.1 mile
20 KT	2098 ft	2533 ft	2894 ft	3619 ft	4523 ft	1.0 mile	1.3 mile	1.6 mile	2.7 mile
50 KT	2848 ft	3438 ft	3928 ft	4912 ft	1.1 mile	1.3 mile	1.7 mile	2.1 mile	3.7 mile
100 KT	3587 ft	4330 ft	4947 ft	1.1 mile	1.4 mile	1.7 mile	2.2 mile	2.7 mile	4.6 mile
200 KT	4522 ft	1.0 mile	1.1 mile	1.4 mile	1.8 mile	2.2 mile	2.8 mile	3.4 mile	5.9 mile
500 KT	1.1 mile	1.4 mile	1.6 mile	2.0 mile	2.5 mile	3.0 mile	3.8 mile	4.7 mile	8.0 mile
1 MT	1.4 mile	1.8 mile	2.0 mile	2.5 mile	3.1 mile	3.8 mile	4.8 mile	5.9 mile	10.0 mile
10 MT	3.1 mile	3.8 mile	4.3 mile	5.4 mile	6.8 mile	8.2 mile	10.3 mile	12.8 mile	21.7 mile
100 MT	6.8 mile	8.2 mile	9.3 mile	11.7 mile	14.6 mile	17.6 mile	22.3 mile	27.5 mile	46.9 mile



These are pictures of what happened to one of the building during a test. This demonstrates how much damage the pressure and winds can cause.

Important Types of Blasts

- High Altitude Burst
- Air Burst
- Surface Burst
- Other

A High Altitude Burst

- Can cause an electromagnetic pulse (EMP) over a large area. This causes a transistor to short out which effects radios, computers, cars, and other electronic devices.
- It is a burst over 100,000 feet high.

A Air Burst

- The greater the initial radiation as compared to a surface burst or high altitude burst.
- The bigger the difference between the fireball and the ground, the less fallout there will be due to the smaller amount of material being sucked in the mushroom cloud.

A Surface Burst

- Causes a larger amount fallout.
- Causes a crater that will be left after the burst.
- A burst on the surface produces the greatest over-pressure at very close ranges, but less over-pressure than an air burst at somewhat longer ranges. This is because more of the energy is being absorbed at ground zero.

This is an actual crater left from a nuclear explosion from a test.

Other Types of Blasts

- Water Burst-Can cause a lot of steam and when cooled will come down as radioactive rain. If exploded in the ocean away from a port it can cause a tsunami.
- Underground Burst-There is a treaty preventing above ground testing due to the spreading of radioactivity and other hazards.

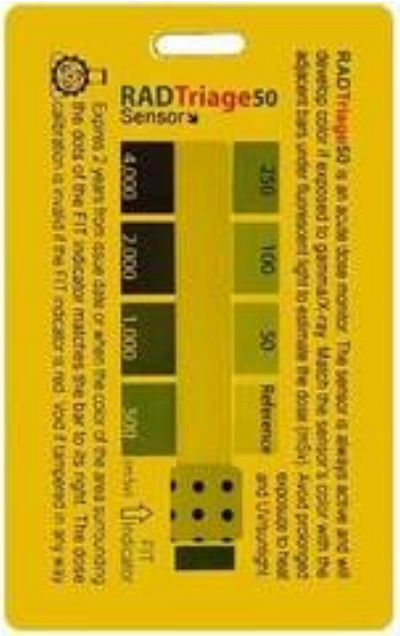
MIRV's

Are (M)ultiple (I)ndependently targetable (R)e-entry (V)ehicles. In other words, it is an ICBM that carries multiple warheads that can hit different targets. There are also decoys to make sure that the actual bombs reach there target.

This is a picture of a MIRV. What a scary thought.

Section III

Radiation Detectors



These are pictures of my radiation detectors.

Conversions

Conversion Equivalence

1 curie = 3.7×10^{10} disintegrations per second		1 becquerel = 1 disintegration per second
1 millicurie (mCi)	=	37 megabecquerels (MBq)
1 rad	=	0.01 gray (Gy)
1 rem	=	0.01 sievert (Sv)
1 roentgen (R)	=	0.000258 coulomb/kilogram (C/kg)
1 megabecquerel (MBq)	=	0.027 millicuries (mCi)
1 gray (Gy)	=	100 rad
1 sievert (Sv)	=	100 rem
1 coulomb/kilogram (C/kg)	=	3,880 roentgens

Conversion Factors

To convert from	To	Multiply by
Curies (Ci)	becquerels (Bq)	3.7×10^{10}
millicuries (mCi)	megabecquerels (MBq)	37
microcuries (µCi)	megabecquerels (MBq)	0.037
millirads (mrad)	milligrays (mGy)	0.01
millirems (mrem)	microsieverts (µSv)	10
milliroentgens (mR)	microcoulombs/kilogram (µC/kg)	0.258
becquerels (Bq)	curies (Ci)	2.7×10^{-11}
megabecquerels (MBq)	millicuries (mCi)	0.027
megabecquerels (MBq)	microcuries (µCi)	27
milligrays (mGy)	millirads (mrad)	100
microsieverts (µSv)	millrems (mrem)	0.1
microcoulombs/kilogram (µC/kg)	milliroentgens (mR)	3.88

Why Do I Need A Detector?

You need to be able to detect the amount of radiation being given off to determine how much radiation you have received or how much you are going to receive when you leave your shelter. This knowledge can save your life and the life of your loved ones by telling you when you have reached harmful or lethal doses.

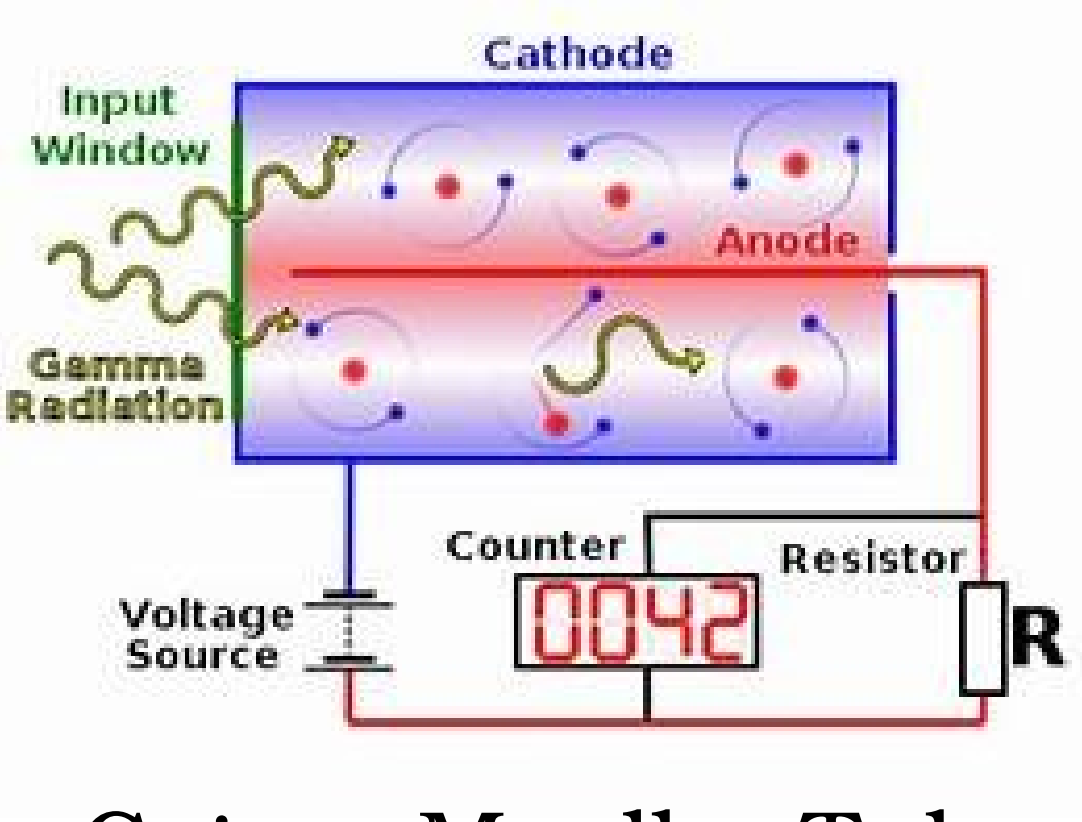
Types of Detectors

There are a number of different types of detectors (dosimeters) that you can choose from with different costs. Your detector should be able to detect gamma rays and x-rays since they are the most dangerous you will be exposed too. The cheapest and most common way to detect radiation is a instrument that uses a Geiger-Mueller Tube.

Types of Detectors

You want at least one detector (dosimeter) to be non-electronic because of the EMP. X-Rays are given off in the initial blast but they will not be residual or to be continual.

In “Nuclear War Survival Skills” by Cresson H. Kearny contains his directions on how to build a homemade Kearny Fallout Meter (KFM). You can buy a RADTriage 50 and NukAlert from http://www.amazon.com.



Geiger-Mueller Tube

Kearny Fallout Meter (KFM)

Units

- curie (becquerel)-amount of activity
- Roentgen (R)-amount of exposure
- rad (gray)-amount of absorbed dose
- rem (sievert)-equivalent dose

My GMC-320 Plus radiation detector can give me R/hr or Sv/hr in which I can look up in a table to see what the damage to my body will be.

Amount of Exposure

Roentgen is the unit used to express the amount of gamma radiation exposure an individual receives. It is the cumulative gamma radiation exposure. In other words, if you are exposed to 50 R one hour and 25 R a different hour, you are exposed to 75 R.

Absorbed Dose

Relates the different types of radiation (**α, β, γ**) to the **energy** they impart into a body or materials.

1 Gy = 1 J/kg

0.01 rad = 1 J/kg

Equivalent Dose

It is a unit that relates the dose of any radiation to the biological effect of that dose.

Equivalent Dose (H) = Absorbed Dose X radiation weighted factor (w_R)

Different tissues are more or less susceptible to radiation. Your lungs will be more susceptible to radiation then say your skin exposed to the same amount of radiation.

Interpretation

You need to be able to relate what units your detector gives to something meaningful. If your detector gives R/hr or Sv/hr what does that mean? Am I going to be sick? Or really sick? Can I leave my shelter or will it kill me? There are different tables in different units that relate the amount of radiation to the risk. We will be going over the risk in the next section.

Section IV

Risk, Biological Effects, and Protection

Our (and theirs) Nuclear Triad

- **Submarine**-about 5 to 10 minutes
- **ICBM's**-about 20 to 30 minutes
- **Bombers**-up to two hours

Where?

- **Primary**-Our ICBM sites, Airports (long enough for bombers), Major Military Installations
- **Secondary**-Major Cities, Ports, Remaining Military Sites
- **Tertiary**-Everywhere else

Leave the cities! It is your best guess so choose wisely. I would like to be at least 100 miles from any target.

How Long Do I Shelter?

Nobody knows for sure!!

- **Rule of thumb**-every seven hours the radioactive should decrease by 10 percent. (Number of R)/10
- Or wait in your shelter for two weeks.
- Or use your radiation detector to determine how long. **The most accurate!**

Protection Of Major Biological Systems

- **Exterior**-cover yourself and keep dust off your skin (duck tape ends of your pants and your shirt).
- **Respiratory**-cover your mouth and nose with shirt or handkerchief (P100 mask or NBC gas mask is best).
- **Ingestion**-clean off the packaging of fallout and then you can eat the contents of packaged foods or drink bottled water. **Filter** water of radioactive particles if from outside sources.
- **Thyroid**-take Iodine tablets.

Harmful or Lethal Doses?

- **Less than 200 R**-you have a chance for radiation poisoning
- **Between 200 R and 850 R**-radiation poisoning and chance for death
- **Greater than 800 R**-likely-hood of death

Everybody is different and it depends on your current health. The estimates are based on no medical intervention. Different sources give different values so these are my ball park figures. 800 R is in-between 6-10 Sv.

Chest X-ray	0.1 mSv
Average background exposure in one year	3 mSv
Abdominal X-ray	4 mSv
Living on the Colorado Plateau for one year	4.5 mSv
Typical yearly dose for a uranium miner	5-10 mSv
Full-body CT scan	10 mSv
Lowest dose for any statistical risk of cancer	50 mSv
Mild radiation sickness (headache, risk of infection)	0.5-1 Sv
Light radiation poisoning (mild to moderate nausea, fatigue, 10% risk of death after 30 days)	1-2 Sv
Severe radiation poisoning (vomiting, hair loss, permanent sterility, 35% risk of death after 30 days)	2-3 Sv
Severe radiation poisoning (bleeding in mouth and under skin, 50% risk of death after 30 days)	3-4 Sv
Acute radiation poisoning (60% fatality risk after 30 days)	4-6 Sv
Acute radiation poisoning (bone marrow destroyed, nearly 100% fatality after 14 days)	6-10 Sv
Acute radiation poisoning (symptoms appear within 30 minutes, massive diarrhea, internal bleeding, delirium, coma)	10-50 Sv
Coma in seconds or minutes, death within hours	**50-80 Sv**
Instant death*	**>80 Sv**

1 Sv = 1 J/kg = 1 joule of radiation energy into 1 kg of tissue ~ 5.5% chance of cancer.

* Actually, an instant death would be ideal. There have been a couple of recorded cases where people have been exposed to levels over 100 Sv and lived for hours or days. **1 Sv = 100 rem.**

Early Radiation Sickness

- Nausea
- Vomiting
- Diarrhea
- Anorexia
- Burns and skin irritation
- Hair Loss

Latent Radiation Sickness

- Malaise
- Fatigue
- Drowsiness
- Weight Loss
- Fever
- Abdominal pain

Latent Radiation Sickness

- Insomnia
- Restlessness
- Blisters
- Spontaneous Abortion

Severe Radiation Sickness

- Excitability
- Lack of Coordination
- Breathing Difficulty
- Occasional Periods of Disorientation
- Death

Timetable For Symptoms

It is hard to determine the exact time of symptoms because everybody is different. It should be noted that a person can get sick (early), then get better, and then get sick again (latent). Your body is great about repairing itself but if the dose is high enough it will kill the

Timetable

cells in your bone marrow that produce your RBC's, WBC's, and platelets. The reduction in platelets causes bleeding. The reduction in WBC's means you will susceptible to illnesses. The reduction in RBC's will cause anemia and breathing problems.

Protection

- **Time** or duration of exposure.
- **Distance** from the source of radiation.
- **Shielding** is the amount of material between you and the source of radiation.

Time

The amount of radioactivity will decrease with time, so, the **longer** you can spend in your shelter the **better.** The smaller your shelter is, the harder it will be to stay in your shelter. So, having games or books will help you pass the time.

Distance

The farther away from the blast you are, the more likely the lesser fallout will be in your area. Remember, the heavier and more radioactive fallout will fall closer to the blast, but you still **do not want to be downwind of the blast**. That means the wind is blowing the radiation towards you. The closer you are to the blast, the more you have to worry about over-pressure and thermal radiation so you have to plan accordingly.

Shielding

Generally speaking, the thicker and denser the material the better the protection. Put as much material as you can between you and the radiation. You can download or find floor plans to build shelters. Tornado shelters are better than nothing and since I live where we do not have basements will work in a pinch. Remember, it is to late after a war.

Materials Used For Making Shelters

- Wood
- Aluminum
- Earth
- Concrete
- Steel

Diet

You should keep a large bottle of vitamins in your kit. Take them when you eat whatever it is you have to eat to prevent stomach upset. Vitamins can help prevent things like scurvy, etc. Make sure your vitamins also have iron for the production of RBC's. If you are vomiting and have diarrhea you will be loosing your electrolytes (vitamins) more quickly so they need to be replaced and drink plenty of fluids (not alcohol).

Diet

You will also need to grow some food for yourself. You will need some non-hybrid seeds. I keep mine in the freezer because they last a few years that way. Otherwise, rotate them annually. You should grow them inside to avoid contamination with fallout. Remember to use filtered water when watering them or they will uptake the radiation with the water and nutrients.

Diet

When you come out of the shelter, if you have a greenhouse, or you can build one, that will work best. That will help keep radioactive rain off your food. Anti-oxidant vegetables are very good to help fight cancer. During your confinement you could read a book on gardening to help pass the time if you do not know how. Growing food before requiring it is best so you can get the experience.

Plants and Herbs

Since it may be difficult to get medicine for a while I would suggest that you have some knowledge/books about medicinal plants and herbs. It may be to dangerous to go to the cities where the pharmacies would be (radiation or gangs). Prescription medicine is very likely better than the plants or herbs so you have to weigh the risks. I would

Plants and Herbs

try them out before you rely on them by buying them now. This gives you a chance to make sure your not allergic to them and that they work for you. I have also looked mine up on at least two sources to make sure the information is at least the same. When you think you have found a good herb or plant then you have to order the

Plants and Herbs

seeds by genius/species. Then you can experiment growing them. Another reason for learning about gardening.

Disease

Antibiotics would be nice to have in your kit but not always possible. The best way to keep disease down is to keep up with your sanitation. You can keep your waste in trash bags until full and then throw them outside your shelter. You should bury the bags once it is safe to go outside.

Disease

Also you may have to use some of your precious water to clean yourself. It can help you from getting infections. I have baby wipes in my kit to help keep me clean for a little while and soap for later. You should remember that outdoor water sources may contain a lot of radioactivity so be careful where you choose to take a bath.

Section V

Summary

Nuclear war would not be isolated. Radiation would cover the globe. It would cause hardships for everyone living on the planet. Even if it started off between two adversaries it could lead for others to get involved. For instance, if any country attacks a NATO country then the other NATO counties have agreed that that is an attack on them. Thus, leading them into the battle. The countries that have nuclear weapons also would probably use them or lose them. There is also a large number of nuclear weapons between the nuclear

states. Enough that would probably make this planet uninhabitable. Mutual Assured Destruction or “MAD” is not a guarantee to keep the nuclear weapons from being launched because the threat from terrorist is very real and would cause nuclear retaliation. Also, there has been a few times due to one reason or another that they came very close to shooting them off by accident. Even if there is only a few that were launched the pain and suffering is unimaginable. It causes permanent physical and emotional wounds and its effects last for many generations. So that one act of anger could have lasting

Effects on mankind. It is a scary topic and is depressing just thinking about it. However, it is a possibility and should not be dismissed. One good thing is if you are prepared for a nuclear exchange then you are probably prepared for many other types of earth shattering events. Including a nuclear meltdown of a nuclear power plant. The radiation is nearly the same and so is the protection. The main thing to be worry about is radioactive steam being release. So take heart. Be Prepared.

Appendix A

72-hour Emergency Kit:

Emergency Kit (Backpack)

- Water Container (~36 ounces)
- Spoon and Fork
- Can Opener
- Bottle Opener
- Head Flashlight
- Mosquito Repellent
- Water Purification Tablets
- Hand Saw (Wire)

- Glucose Tablets
- Lighter with Fuel
- Pocket Knife
- Four in one Tool (Whistle,Thermo.,Compass,Mag.Glass)
- Pepper Spray
- Boy Scout Mess Kit
- Rope (Climbing, Crossing Water)
- First Aid Kit
- Emergency Clot (Celox Granules)
- Snake Bite Kit
- Sterno
- Portable Stove (Uses Sterno)
- Emergency Blanket
- Emergency Tent (Tarp w/Twine)
- Emergency Poncho
- Hand Warmers
- Duct Tape

- AM/FM Radio
- Tooth Paste
- Toothbrush
- Thyro Safe Iodine Tablets
- Compass
- Walkie Talkie
- Vitamins
- Work Gloves
- Anti-Microbial Wipes (Personal Hygiene)
- N95 Masks
- Water Pouch
- Texas Map
- Extra Batteries
- Eye Glass Repair (Small Screw Driver,Screws)

Car

- Bible
- 5 Gallon Collapsible Water Container
- Gasoline Container
- Folding Shovel
- Water
- Food
- Dish Soap
- Trash Bags
- Wagon
- Toilet Paper

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