

# The Horrors of Nuclear War and How to Survive It

By Micah J. Kimbrough  
Last Updated 12-30-2016

**Section I: What is Radiation?**

**Section II: Fallout and Types of  
Blasts**

**Section III: Radiation Detectors**

**Section IV: Biological Effects and  
Protection**

**Section V: Summation**

# **Section I**

What is Radiation?

# An Atom

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

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

# Stable Atom

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

For example 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 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.

# Neutron Decay

## Three Types of Radiation

- **$\alpha$** -Alpha Radiation
- **$\beta$** -Beta Radiation
- **$\gamma$** -Gamma Radiation

# $\alpha$ -Radiation

- Helium Atom
- Low Penetrating-a piece of paper or clothes can stop it



# $\beta$ -Radiation

- A Electron
- Somewhat Penetrating-can go through about a centimeter of tissue

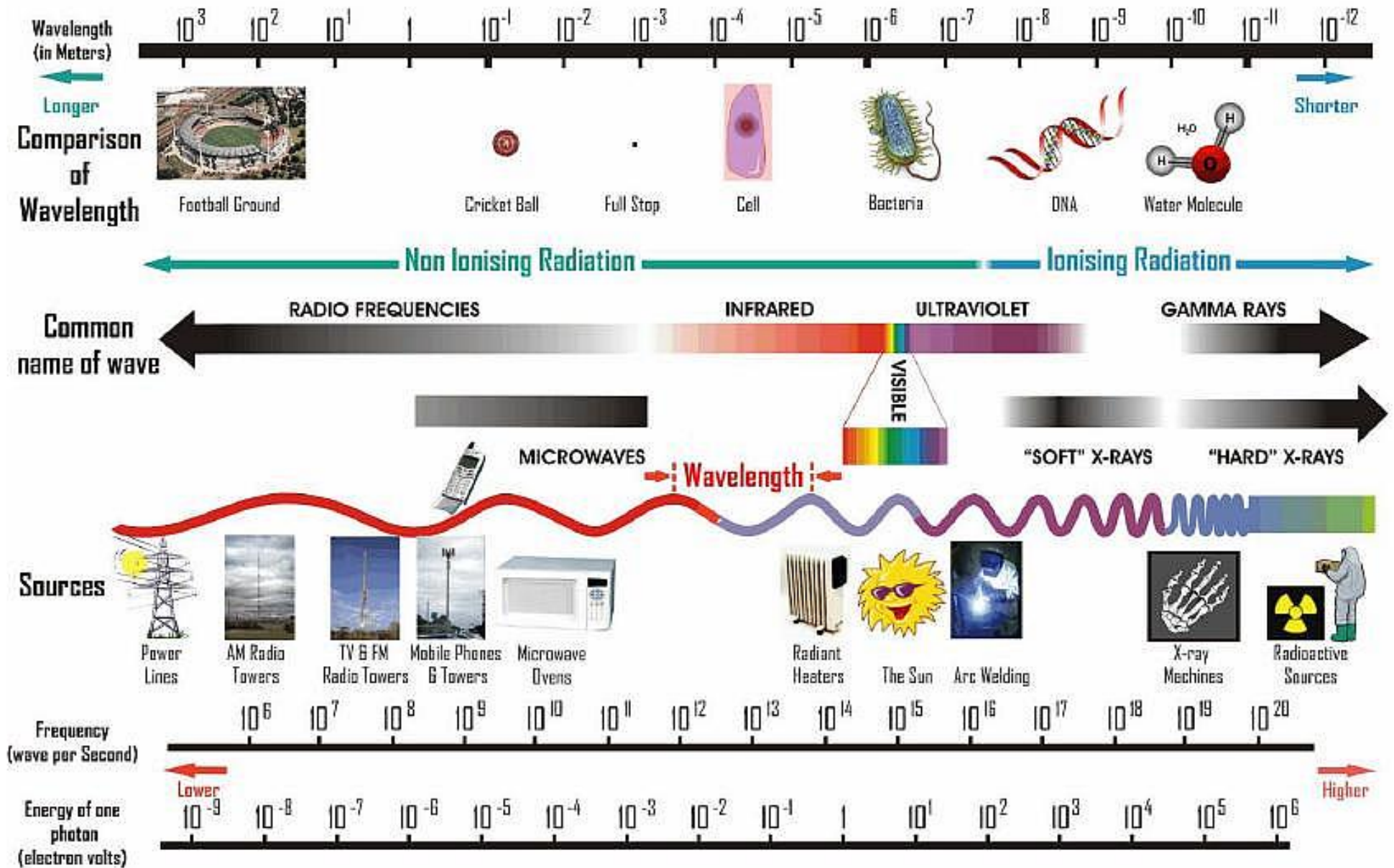
# $\gamma$ -Radiation

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

# X-Rays

- Photon of Electromagnetic Energy
- Highly Penetrating
- Can cause damage to genetic material

# THE ELECTROMAGNETIC SPECTRUM



# Neutrons

There are extra neutrons that are produced in an fission blast and not all the neutrons are used in the fission reaction. The extra neutrons can combine with the elements in the environment and make that material radioactive.

# Half-Life

Half-Life is the amount of time for half the amount of radiation to decrease due to radioactive decay.

The half-life of Plutonium-239 is 24100 years. Other elements and isotopes have shorter or longer half-life's.

## **Section II**

# Fallout and Types of Blasts





# 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.

# Thermonuclear Reaction

A thermonuclear burst is a combination of **fission** and **fusion**. 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 fusion reaction. The hydrogen is provided by Deuterium ( $H^2$ ) or Tritium ( $H^3$ ).

# Fallout

During a nuclear blast the actual ground and objects near ground zero are vaporized and sucked up into a mushroom like cloud. This debris is mixed with unspent nuclear material from the bomb and the products of fission 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 larger area due to winds carrying the radioactive debris. The heavier debris falls out closer to the actual blast. 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 percentages are approximate.

# Secondary Effects

- Earthquakes
- Nuclear Winter
- Pooling of radioactivity in rivers, lakes, and ocean due to rain washing it out
- 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 products of uranium or plutonium fission



# Residual Radiation

- About 10% of the energy is given off as residual radiation
- The residual radiation is a combination of “unspent” uranium or plutonium and the products of the explosion

# Residual Radiation

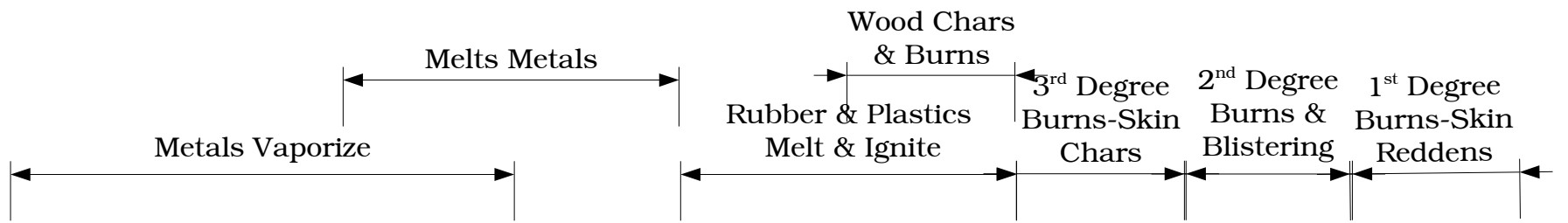
- The products of the explosion is the various isotopes left from the fission of the uranium or plutonium

# 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)
- Can be decreased by painting your windows with white paint

# Thermal Energy

- Photons are given off which can cause temporary blindness or permanent blindness
- The Thermal Radiation that is given off is one of the causes of combustible material to catch fire



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

# 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
- This can create high velocity projectiles that are dangerous to humans



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

# Important Types of Blasts

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

# High Altitude Burst

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

# 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

# Surface Burst

- A larger amount fallout
- A crater 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

# Other

- Water Burst
- Underground Burst

# MIRV's

Are multiple independently targetable re-entry vehicles. In other words it is an ICBM that carries multiply warheads that can hit multiply targets.

**Section III**  
**Radiation Detectors**





## Conversions

### Conversion Equivalence

1 curie = $3.7 \times 10^{10}$ disintegrations per second		1 becquerel = 1 disintegration per second
<hr/>		
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)
<hr/>		
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)	$3.7 \times 10^{10}$
millicuries (mCi)	megabecquerels (MBq)	37
microcuries ( $\mu$ Ci)	megabecquerels (MBq)	0.037
millirads (mrad)	milligrays (mGy)	0.01
millirems (mrem)	microsieverts ( $\mu$ Sv)	10
milliroentgens (mR)	microcoulombs/kilogram ( $\mu$ C/kg)	0.258
<hr/>		
becquerels (Bq)	curies (Ci)	$2.7 \times 10^{-11}$
megabecquerels (MBq)	millicuries (mCi)	0.027
megabecquerels (MBq)	microcuries ( $\mu$ Ci)	27
milligrays (mGy)	millirads (mrad)	100
microsieverts ( $\mu$ Sv)	millirems (mrem)	0.1
microcoulombs/kilogram ( $\mu$ C/kg)	milliroentgens (mR)	3.88

# Why Do I Need A Detector?

You need to be able to detect the amount of radiation to determine how much radiation you receive 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.

# Types of Detectors

There are a number of different types of detectors 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. Isotope determination is not necessary and will cost a lot. The cheapest and most common way to detect radiation is to use Geiger-Mueller Tube.

# Types of Detectors

In “Nuclear War Survival Skills” by Cresson H. Kearny there are directions on how to build a homemade Kearny Fallout Meter (KFM) or you can buy one from <http://www.ki4u.com>. You can buy a RADTriage 50 and NukAlert from <http://www.amazon.com>.

# Units

- curie (becquerel)-amount of activity
- Roentgen-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.

# 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. 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 ( $\alpha$ ,  $\beta$ ,  $\gamma$ ) to the energy they impart in materials.

$$1 \text{ Gy} = 1 \text{ J/kg}$$

$$0.01 \text{ rad} = 1 \text{ J/kg}$$



# 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 different types of radiation.

## **Section IV**

# Biological Effects and Protection

# Triad

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

# How long?

**Nobody knows for sure!!**

- **Rule of thumb**-every seven hours the radioactive should decrease by 10 percent. Number of  $R/10$
- Wait in shelter for two weeks
- Use your radiation detector to determine how long. **Most accurate**

# Where?

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

Leave the cities!

# Major Biological Systems

- Exterior-cover yourself and keep dust off your skin
- Respiratory-cover your mouth and nose
- Ingestion-clean off the packaging of dust and then can eat packaged foods. Filter water of radioactive particles.
- Thyroid-Iodine tablets will help protect

# Doses

- Less than 200 R-you have a chance for radiation poisoning
- Between 200 R and 650 R-radiation poisoning and chance for death
- Greater than 650 R-likely-hood of death

Everybody is different and it depends on your current health. The estimates are based on no medical intervention.

# Early Radiation Sickness

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



# Later Radiation Sickness

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

# Later Radiation Sickness

- Insomnia
- Restlessness
- Blisters
- Spontaneous Abortion

# Severe Radiation Sickness

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

# Timetable

It is hard to determine the exact time of symptoms because everybody is different. It should be noted that a person can get sick, then get better, and then get sick again. 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 be susceptible to illnesses. The reduction in RBC's will mean that you have anemia.

# Protection

- Time
- Distance
- Shielding

# Time

The amount of radioactivity will decrease with time. The longer the amount of time you can spend in your shelter will help you survive. The smaller your shelter 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 less fallout there will be. Remember the heavier and more radioactive fallout will fall closer to the blast. The closer you are to the blast the more you have to worry about over-pressure and thermal radiation and you have to plan accordingly.



# Shielding

- Earth
- Concrete
- Steel

# Diet

You should keep a bottle of vitamins in your kit. Take them when you eat whatever you have. It can help prevent things like scurvy. Make sure your vitamin also has iron for the production of RBC's. You will also need to grow some food for

# Diet

yourself so some non-hybrid seeds are helpful as well. 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 radioactivity. Remember to use filtered water. When

# Diet

you come out of the shelter, if you have a greenhouse, or you can build one, that may work best. Anti-oxidant vegetables are very good. During your confinement you could read a book on gardening to help pass the time if you do not know how.

# Plants and Herbs

Since it may be difficult to get medicine I would suggest that you have some knowledge/books about medicinal plants and herbs. It is difficult to know which plants or herbs are best because the ingredients are not listed with the concentrations on the plants. I would

# Plants and Herbs

try them out before you rely on them. This also gives you a chance to make sure your not allergic to them. I have also looked mine up on at least two sources to make sure the information is at least the same. When I think I have found a good one I order the seeds by genus/species. Then I

# Plants and Herbs

can experiment with them after I  
grown them.

# Disease

Antibiotics would be nice to have in your kit but not always possible. The best way to keep disease down is 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 keep from getting infections. I have baby wipes in my kit to help for a little while.

# Section V Summary

Use of Nuclear Weapons has political and moral problems. Nuclear war has consequences for the whole globe. Even a limited nuclear war would cause radiation to show up in other countries. If you use nuclear weapons first, for whatever reason, you probably can expect no help from other countries. It is indiscriminate. It kills civilian and military personnel alike. It affects people for generations not just

for the duration of the war. The amount of deaths and suffering is unfathomable. It would be a crime against humanity. If the public has knowledge about what to do during an attack, then that is a little bit of deterrent right there.

# 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



# Reference

- “Effects of Nuclear Weapons”, by Samuel Glasstone, 1962, United States Atomic Energy Commission. ISBN 978-1-2587-9355-5
- “Nuclear War Survival Skills”, by Cresson H. Kearny, 1987, Replenishing Press. ISBN 978-0-9676190-2-6
- FEMA Emergency Management Institute class, “Radiological Emergency Management”, IS-3
- “Additional Plates” from the web site:  
<http://www.dankalia.com/delloro/sda/index.htm>