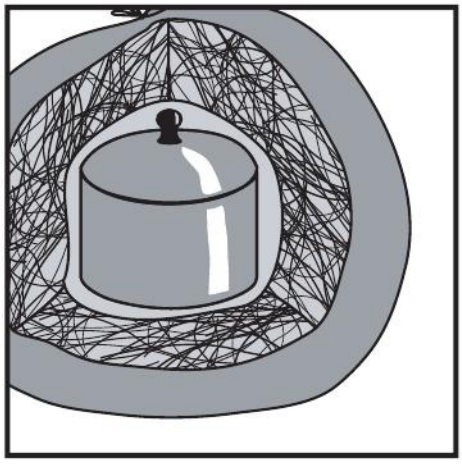
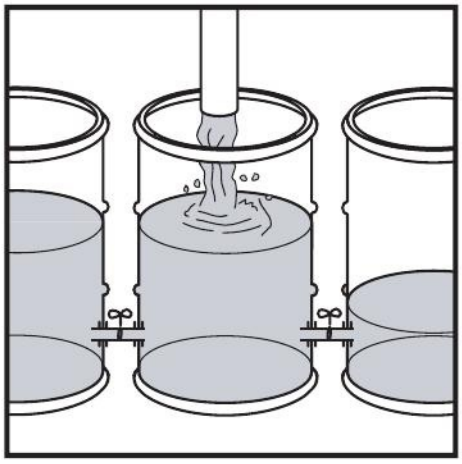
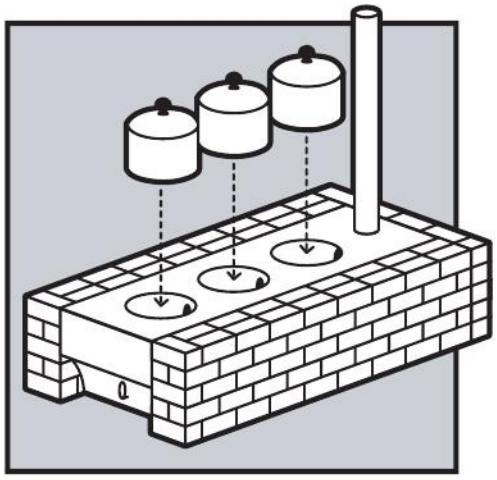
Tools for Gridcrash

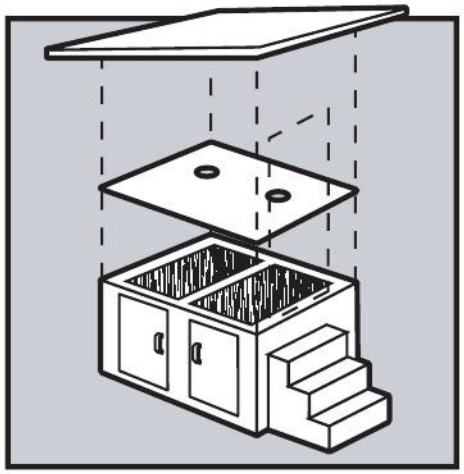






In The Wake

A collective manual-in-progress for outliving civilization



Excerpt Booklet 1

Aric McBay

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Introduction

This booklet is an excerpt from a larger book project lifetime division of labor, the mechanization of produc-which is in the works, called “In the Wake: A

tion, the magnifi cation of military power, the economic

Collective Manual-in-Progress for Outliving Civiliza-

exploitation of the weak, and the universal introduction

tion.” Th is project, and my writings and life in general,

of slavery and forced labor for both industrial and mili-

are based on the premise that industrial civilization is

tary purposes.”1

destroying the world and exploiting and murdering the

inhabitants of the world. I believe that industrial civi-

Anthropologist Stanley Diamond cuts to the chase, and

lization is not capable of doing anything else, whatever

says simply that “Civilization originates in conquest

political party (or corporation, or American-installed

abroad and repression at home.”2

military dictator) is “in charge”.

By “industrial”, I mean a society that is dependent on

I want to help to create communities which are equi-

machines for the basics of life. A society that needs

table, ecological, and sustainable. I also believe that we

tractors to grow food, trucks to transport it, factories to

can’t do this within the machinery of industrial civiliza-

synthesize fertilizers, and so on, is an industrial society. A
tion. More to the point, that machinery is insatiable,
society where people participate in the growing of their
imperialistic, and in the end, suicidal. Civilization is
own food and other basics by hand would not be indus-
destroying itself along with the world.
trial.
Th is introduction is necessarily brief, but I encourage
Put the two concepts together and you get industrial
you to look at some of the resources at the end of this
civilization. Th is is a society with an extreme disparity
introduction to learn more about the assumptions this
of power, and where machines are built, and humans
book is based on.
mechanized, in order to serve the needs of those in
power. Since those in power want, essentially, to become

Premises

more powerful, society is caught in the claws of powerful
people who constantly seek to accelerate and extend the
exploitation of human beings and the natural world. We
Let me be specifi c about what I mean by industrial
can see the eff ects of this in the intense global destruc-
civilization. For many people, the word civilization calls tion of the living world.
to mind words like “refi ned, safe, convenient, modern,

advanced, polite, enlightened and sophisticated." Of
Th at the world is being destroyed probably isn't news
course, these words are the words that civilized people
to you. You've probably heard that 90% of the fi sh in
use to describe themselves. For example, if you look
the ocean have been killed in the past 50 years, and
up the word "Christian" in the thesaurus, you will fi nd
that those remaining are signifi cantly smaller.3 You've
words like "fair, good, high-principled, honourable,
probably heard that the oceans are in a state of ecologi-
humane, noble, right, virtuous" and other words that
cal collapse. And that phytoplankton, the basis of the
Christians might use to describe themselves, but which
biosphere, has decreased in global population by 6% in
hardly apply to the Crusades, the Witch-Burnings, or
a mere two decades, and by as much as 30% in some
other such atrocities carried out by self-described Chris-
areas.4 Populations of krill, the tiny animals just above
tians.
phytoplankton on the ocean food chain, are down by
80% in three decades.5 You've probably read in the news
For a more unbiased defi nition of civilization, we can
that global warming will kill up to 37% of all species on
consider historian Lewis Mumford's use of the word

earth by 20506 (and you've probably noticed that the

civilization "to denote the group of institutions that fi rst estimates of these casualties from global warming seem took form under kingship. Its chief features, constant in to increase just about every week). In essence, you've varying proportions throughout history, are the centrali-probably noticed, even if you only read the corporate-

zation of political power, the separation of classes, the

owned newspapers, that the world is being ever more

rapidly destroyed. If you're paying attention, you don't

and infrastructure are required to drill deeper wells, to

even need the papers to tell you this.

pump water from further away, to construct and main-

tain irrigation systems. Th ings like this increase the

Many, if not most of us, realize that this rapid destruc-

"weight" of civilization. And those actions tend to cause

tion can not continue indefi nitely. A society which

their own problems, like depletion and salinization of

destroys the land will inevitably die, because all people,

the soil, which will require more and more energy in the

in the end, depend on the land for sustenance.

future. Th e weight just keeps on getting heavier.

Industrial civilization also depends on energy-hungry

Now, industrial civilization has managed to persist so

machines to survive. Some people seem to believe that

far because it keeps getting more and more ropes -- that

machines support our lives, that water comes from

is, it extracting more and more oil each year. But now

the tap and potatoes come from the grocery store. But

oil production has reached a plateau. Civilization has

machines only extract and centralize—I might go so far

as many ropes as it will ever have, but it keeps getting

as to say “loot and pillage”—the natural “resources” that heavier. Th e ropes are stretched taut, and soon they’ll be humans depend on. Machines don’t and can’t create life.

stretch to the breaking point. Some time around 2007

the gap between the demand for oil and the production

As peak-oil activists are publicizing, the amount of oil on will become “unbridgeable”. Th ere won’t be enough oil, the Earth is fi nite, and civilization is running out. More

or ropes.

than half of the extractable petroleum is gone. Demand

is skyrocketing because of continued growth and the in-

If you cut a rope in our strained example, maybe the

dustrialization of the so-called “Th ird World”. Th e sup-

other ropes will still be able to hold it up. But if you cut

ply of oil that runs and builds the machines of industrial another one, and then another one, eventually the re-civilization has peaked, and is now beginning the not-so- maining ropes will be overloaded. Th ey will all snap and slow process of running out. For a system dependent on the weight will fall.

growth, that’s a disaster.

But civilization isn’t a single object. A more accurate

A number of recent books examine the situation with

analogy would look at civilization as a set of weights,

great clarity, such as Matt Savinar’s “Th e Oil Age is

which are all hanging by ropes and connected to each

Over", and Richard Heinberg's "Th e Party's Over: Oil,

other by cables. Each of these weights is a segment of the

War, and the Fate of Industrial Societies".

interdependent industrial economy: synthetic fertilizer

production, oil extraction, natural gas distribution, mili-

Many peoples' fi rst impression is that we won't actually

tary arms manufacturing, and so on. And each of these

be in trouble until the oil actually runs out completely,

weights is connected to each other by cables because

several decades from now, but it's actually much more

they are interdependent. Fertilizer production requires

urgent than that. I'll use an analogy to explain.

ample supplies of natural gas, and reliable oil extraction

depends on a stable regime backed up by a well-armed

Imagine industrial civilization as a weight which is sus-

military. Once the ropes snap on one weight, it falls and

pended from a ceiling by many, many ropes. Th ese ropes pulls on the weights connected to it by cables. And then are the constant supplies of oil that keep civilization

one after the other their ropes snap too, and the entire

from crashing down.

apparatus falls in ruin.

Now imagine the weight of civilization as the energy

Th at's called a "cascading industrial collapse," and I

required to deal with all of civilization's needs to keep

think it's the most likely future for industrial civilization

existing -- energy to build and maintain the physical

within the next decade or so.

infrastructure, to transport and centralize materials and

resources, to engage in war and occupation to ensure

Th is knowledge is a shock that many people are unable

a constant supply of resources, to industrially produce

to cope with, so they ignore it. Or they cheer for or

food for a growing population, and so on. As those

work on energy technologies like fuel cells with which

needs increase, the weight gets heavier. For example, as

they hope to draw out the lifespan of civilization. But

the water tables in agricultural areas drop, more energy

at the same time civilization brings them their gasoline

and electricity, it also strips away the forests that used to our lifestyles. Th is is mere wishful thinking, but those in provide fuel and wood for anyone who lived near them.

power prefer it. If the truly dire nature of our situation

It poisons the air, water and soil, it empties the oceans

were universally recognized, the economy would collapse

of fi sh and destroys the sensitive balance of the Earth's

shortly thereafter. Who would buy stocks, who would go

climate. And as it reaches out, one foot already in the

to work, who would put their money in the bank, if they

grave, to pillage the last bits of remaining "resources" it

knew that in the coming years the collapse of industrial

displaces and murders those human communities that

civilization was inevitable?

have managed to survive as long as they can. Remaining

indigenous groups world-wide are displaced, threatened, Th e situation is clearly desperate. Th e upward energy and assaulted to obtain more oil and minerals. Rural

consumption trend and the downward availability trend

communities shrivel as agriculture, forestry and fi sh-

will collide catastrophically. Th e result will be the col-

ing become ever more mechanized, or simply cease to

lapse of industrial civilization, and there is nothing that

exist because of deforestation and the collapse of fi sher-

anyone can do to stop it.

ies. Even now, already a billion people, 1 out of every 6

people on the planet, live in squalid conditions in urban But there are things that people can do about it, during slums, and that number is likely to double within the

and after it. Which is what this book project is for.

next quarter century, according to the UN.7

Because some people identify very closely with industrial

Th e longer industrial civilization lasts the more human

civilization, the thought of its collapse seems like their

and living communities it will destroy. We know that it's own death. Th ey can not imagine that anything might going to come down one day, and probably soon. Th e

happen afterwards. But the collapse, in theory, doesn't

longer it exists, the worse shape we will be in. Knowing

necessarily have to be very violent, and could ideally

that, we realize that it is time to bite the bullet.

involve less deprivation and poverty than now exist. Th is

would require an honest look at the situation by every-

Industrial civilization needs to end as soon as possible.

one. It would mean scaling down industrial capacity as

rapidly as possible, and focusing eff orts on ensuring that

It is my starting point that if we want to have healthy

as many people as possible are fed and healthy, instead of

communities and landbases, which can recover from the trying to create hydrogen cars or other false hopes.

attacks they have faced, we must fi rst get rid of industrial

civilization. You can't heal from an assault until the as-

However, we know that governments and corporations

sault has actually ended.

are not going to do this. It would be very unpopular,

make very little profi t, and generally distribute wealth,

Th ose of us who are aware of the situation are often

power and self-determination, whereas industrialization

deluged by greenwash. Th ose in power want us to believe has concentrated the control of the basics of life in the that the situation can be remedied by minor fi xes, by

hands of very few people.

seamlessly replacing the dirty, industrial system with

a "green," solar and wind-powered equivalent. But it

Th e fundamental inability of the controlling institutions

doesn't work that way, as the references at the end of the of society to deal appropriately with the situation puts introduction examine in great detail. Th e "renewables"

us in a rather desperate situation. It's up to us as small,

off er only a tiny fraction of the energy required to pre-

face-to-face groups (the only groups which can really be

vent collapse. And once industrial civilization has col-

democratic or accountable, in my opinion) to do what

lapsed it will be next to impossible to produce industrial needs to be done to ensure that things turn out as well as

“renewables” like gigantic wind turbines.

possible.

For many industrialized people, the severity of this

situation is almost impossible to understand, accept,

The Purpose of this Booklet

or perceive. Some people will go to any intellectual or

emotional length to deny or ignore the situation, and

Many of us are very busy with making a living, taking

insist that we can simply use hydrogen cars and solar

care of ourselves and each other, doing activism and so

powered computers without fundamentally changing

on. We can’t all spend as much time as we’d like camping

in the forest, growing gardens, learning improvised wil-

Th ough it may seem ironic to some, I believe that this

derness fi rst aid, or learning other skills for collapse. And rapid collapse is probably the “best-case scenario” for the the likely timeline for collapse is staggeringly short. We

planet. I’m a bit of an optimist, despite the awful state of

can expect massive disruptions of global industrial and

things. So I'm planning for an optimistic scenario which

transportation systems starting between 2005 and 2010.8 involves near-term, rapid industrial collapse. It's a remote One of the reasons that I am writing this is for it to be a possibility that industrial civilization may continue for

"crash course" for the crash, a way of quickly introducing decades longer if it makes extensive use of destructive a variety of important skills and technologies to people

technologies like nuclear power and coal-seam gasifi ca-

who aren't familiar with them, as well as creating a refer-

tion. But if it does last that long we are seriously **fucked**.

ence and resource for those who are.

I doubt that many, if any, human beings would survive,

let alone most other species. And I'm not going to write

It's diffi cult to predict exactly how the collapse will play

a book for a world with no humans in it—who would

out (although Planning, Prediction and Preparation is

read it? So that leaves us with the urgency of a book for

the subject of the next In the Wake excerpt booklet).

the "optimistic" scenario of rapid collapse.

Th e collapse of various civilizations in history took years

or decades to collapse. So looking at those examples,

I wish to provide a handbook not just to help people

it's tempting to go back to sleep and say "don't worry,

survive industrial collapse, but to share some of the skills

we have plenty of time to fi gure out how to deal with

people will need to demolish the remnants of industrial

collapse. It will happen gradually." But that's far from

civilization, and civilization in general, and to build

guaranteed. Th ose civilizations took centuries or millen-

egalitarian and ecological communities of their own.

nia to reach their full extent. Th e dominant technologi-

cal civilization on the planet is dependent on machines

Th e techniques covered in this book project are chosen

that are only decades old. Th e time-scale of change has

by the following general criteria:

become profoundly compressed by rapid industrial

•Th ey must either apply broadly and generally to a vari-

change. We can expect the rate of collapse to refl ect that ety of bioregions, or have the potential to be exception-compression. Also, those historical civilizations were

ally benefi cial to people in some bioregions.

based on technologies that were much less interdepend-

•Th ey should permit a reduced impact and/or reduced

ent than ours. If the oil supply is interrupted, it becomes consumption, rather than increasing consumption.

impossible to maintain the electrical generation and

•Th ey should operate with “found resources” and rem-

distribution infrastructure. If the electrical infrastructure nant resources as much as possible, as opposed to culti-goes out, then almost all of the rest of the infrastructure

vation or metalworking, so as to maintain the wilds and

goes out immediately. Telecommunications may contin-

minimize labour.

ue temporarily by generator and battery power, but even •Th ey should be relatively simple, so that they can be communications are becoming electrically-dependent,

learned quickly.

and hence more brittle.

•Th ey should be as compact as possible, to maintain the

wilds (Th at is, a technique that allows a 1000 square foot

Additionally, there is reason to believe that industrial

garden to meet food needs sustainably, would generally

collapse may happen very rapidly because of deliberate

be preferred to a 1500 square foot garden which yields

attacks on industrial infrastructure, oil and electrical

the same amount of food, since the smaller garden leaves

infrastructure in particular. Th ese attacks are quite com-

more room for wilderness. Th at assumes that both gar-

mon in some areas of the world already, and are becom-

dens are equally sustainable).

ing increasingly common in North America. (However,

•Th ey should include easy to fi nd or make items, so as

they are not very publicized, probably because those in

to permit rapid scaling up, democratic application, and

power don't want people to realize how incredibly fragile reduced scarcity.

and vulnerable the infrastructure actually is.) If there was •Whenever possible, their use should be creative and a coordinated attempt to collapse the industrial system

fulfi lling, rather than repetitive.

by a small group of committed people, near-total indus-

•Th ey should be portable, and rapidly scaleable and

trial collapse could happen *ver*

v y quickly

y

, over a period of expandable.

weeks or even days.

•It should be possible for a small group to build and

maintain them.

Page iv

•Wherever possible, their use should involve the deg-

sion and essays, more links to web pages and books of

radation of remnants of the industrial system, and the

interest, as well as more information about relevant skills

rejuvenation of the land.

and strategies.

•Techniques chosen tend to make societies more egali-

tarian and distribute resources and power more fairly.

Th anks, and good skill.

I'd love to hear some of your thoughts about what sort

Aric McBay

of criteria you would think about, and what tools and

Occupied Detgahnyöhsráhdöh,

techniques you would use. I'll try to include them in the on the traditional lands of the Cayuga people
full book, in future updates of this booklet, and on the

October, 2004

website, as appropriate.

email: editorial@inthewake.org

Industrial collapse is a very big topic, and this booklet only covers a very tiny corner of it.

Introduction Footnotes:

1. Mumford, Lewis. *Th e Myth of the Machine: Technics and Human*

Th is particular booklet is about tools and techniques you *Dev*

D elopment

ev

, H

elopment

arcourt Brace Jovanovich, New York, 1966. Page

can use cope with industrial collapse, or “gridcrash”. In

186.

this booklet, I don’t write about some of the other eff ects 2. Diamond, Stanley. *In Search of the Primitive: A Critique of* of that, like rioting or violence. So the knowledge in this *Civilization*, Transaction Publishers, New Brunswick, 1993. Page 1.

booklet is quite handy in certain circumstances, and not 3. Myers, R. A. et al. (2003) “Rapid worldwide depletion of so handy in others. If you live on the outskirts of a small predatory fi sh communities” *Natur N*

e

atur 423, 280-283,

e

Letters to Nature

town, for instance, this information will be quite useful. 4. Gregg, W. W., and M. E. Conkright, (2002) “Decadal changes in global ocean chlorophyll” *Geophys. Res. Lett.* , 29(15), 1730

If you’re living on a 15th fl oor apartment in downtown

5. Atkinson, A. et al. (2004) “Long-term decline in krill stock and Los Angeles and the grocery stores are just about empty, increase in salps within the Southern Ocean” *Natur N*

e

atur 432, 100-103,

e

power is out, and it looks like it won't come back on

Letters to Nature

any time soon, this particular booklet won't be the most 6. Th omas, C. D. et al. (2004) "Extinction risk from climate useful for you right away. (I would suggest that if you

change" *Natur*

N

e

atur 427, 145-148,

e

Letters to Nature

can, you quickly get to a place where it would be useful.) 7. UN-HABITAT, *Th e Challenge of Slums: Global Report on Human* We'll get to those situations in further writings. In the

Settlements 2003, UN-HABITAT, 2003

meantime, I suggest that you (and everyone else) think

8. Duncan, Richard C., *Olduvai Cliff Revisited: Th e Olduvai*

about industrial collapse, what it means, and what you

Cliff

Cliff Ev

E ent: a. 2007

v

, M

ent: a. 2007

arch 5, 2001. (see online at http://www.

plan to do about it.

mnforsustain.org/oil_duncan_r_olduvai_cliff _revisited.htm)

Th ere are some basic tools that will be of use to people

Acknowledgements

in somewhat settled communities. Most house dwell-

Th ank you for the proofreading, comments and sugges-

ers would need tools to replace their faucets and taps

tions from MM, Tammy T., Melissa, Edward, Emily,

(Water, page 1), their toilets and drains (Latrines and

Andrea, Pig Monkey, Wabbit, Lori, Ken McWatters, and

Greywater, page 15), their refrigerator and freezer (Cool- several anonymous contributors. Th ank you to Alex and ing, page 22), their stove, oven, toaster and microwave

Jen for the illustrations credited on pages 23 and 2 &

(Cooking, page 27), their electric lights (Lighting, page 8, respectively. Th ank you also to the many people who 39) and their garbage and recycling pick-up (Rubbish,

off ered supportive comments and feedback.

page 42). Furnaces and other house-related topics will

be covered in more detail in future writings on the sub-

In the making of this booklet I used free, open-source

ject of shelter.

software including the text editor Vim, the word proces-

sor Open Offi ce, the vector drawing application Ink-

I hope that this information is useful to you. If you have scape, the raster image editing application GIMP, and any comments, or suggestions, or wish to contribute to

the desktop publishing program Scribus.

the project, please do contact us. You can also check out

the website at www.inthewake.org. Th ere you can see

more information about the book project, more discus-

Further Reading

the topic of Peak Oil. He has also written a book about

Civilization and Industrialism:

some of the options in response to the Peak Oil situation

Derrick Jensen's writings are some of the most insightful, called *Powerdown: Options and Actions for a Post-Carbon* intelligent, moving, and relevant works I have ever read. *Wor*

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or . (www

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.museletter.com)

I heartily encourage you to read his work starting with

Matt Savinar's book *Th e O*

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lent and readable introduction to the subject. Th ere

published) book, tentatively titled *Endgame: Th e Collapse* are also more articles and links at his website at www.

of Civilization and the Rebirth of Community. Derrick's

lifeaftertheoilcrash.net.

website at www.derrickjensen.org includes a subscription Excellent websites on the subject of Peak Oil include

"reading club" where you can read *Endgame*

E

and other

ndgame

E

www.wolfatthedoor.org.uk, www.dieoff .org, www.hub-

works currently in progress.

bertpeak.com, and www.oilcrash.com.

Anthropologist Stanley Diamond wrote the excellent

General Ecology and Overshoot:

book *In*

I Search of the Primitive: A Critique of Civilization. *Overshoot: Th e Ecological Basis of Revolutionary Change*, by William R. Catton, Jr., is an excellent book on ecol-Chellis Glendinning's *My Name is Chellis and I'm in Re-*

ogy and carrying capacity.

covery from Western Civilization is a moving and personal

book in which Glendinning examines her own child-

Th e website inthewake.org has more extensive listings

hood abuse and traces its roots to civilization itself. It's

and links on related subjects.

an incredible examination of the insanity of the domi-

nant culture, and the ways in which indigenous cultures Th e next two excerpt booklets will be on the subjects of are sane.

Planning, Prediction and Preparation, and *Shelter*. Visit the website for further information and up-to-date cop-Lewis Mumford is an incredibly prolifi c writer, histo-

ies.

rian and social critic. Some of his most relevant books

to these premises include the two-volume set *Th e Myth*

A note on references: Th e information in this book is

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achine: echnics and H

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elopment Th e

a combination of the experience of myself and other

Pentagon of Power: Th e Myth of the Machine, and *Th e City* contributors, and the print references listed. References *in History*.

that apply to a whole section are listed at the end of each

section, and references which apply to a specifi c subsec-

John Zerzan is the author of a number of great anti-civi- tion are listed at the end of a subsection.

lizational books, including *Running on Emptiness: Th e*

Pathology of Civilization, and also edited the excellent

book *Against C*

A

ivilization: R

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which

is available online at:

http://www.blackandgreen.org/ac/index.html

Daniel Quinn wrote the very readable stories *Ishmael*

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e S y of B about the origins of civili-

zation. (www.ishmael.org)

Extensive related writings by a number of authors are

available at:

http://www.insurgentdesire.org.uk/

http://primitivism.com/

Peak Oil:

Richard Heinberg's *Th e Party's Over: Oil, War, and Th e*

Fate of I

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ndustrial Societies

cellent introduction to

Water

Water is covered fi rst here for a reason. People can

W

pesticides and industrial chemicals, or natural chemicals

die in as little as thr

W

ee days without water. How

from rocks. DDT is a pesticide example, and salts and

much do you need? In a shortage situation, try to get

iron are examples of natural chemicals. (Of course, if you

at least 15-20 litres per person per day. Th e “absolute

were a fi sh living in the ocean, you wouldn’t consider salt

survival minimum” according to the United Nations is

a “contaminant,” so it is relative.)

7 litres per person per day for wash and drinking water.

People who are ill may need more. Some sources put

Physical contaminants are not usually harmful, but can

minimal drinking water requirements as low as 2-3 litres make the water unappealing to drink because of taste, per person per day for a healthy person in cool weather

colour or smell. “Cloudiness” (turbidity) is one example.

without strenuous physical exercise, but there may be

signifi cant health problems as a result of only drinking

Avoiding contamination in the fi rst place is always

such small quantities. Wash water is needed to avoid

preferable to having to treat water. In almost every

serious health problems from infections and disease. If

conceivable situation, it is easier to keep water clean than

you are unable to meet that demand in potable (safe

to clean it.

for drinking) water, you can use non-potable, brackish

or salty water for some wash purposes. However, you

should purify water used for washing the face or hands,

Sources of Water

or for brushing teeth.

Th ere are three main water sources: groundwater, rain-

Drinking alcohol, urine, blood, or salty water will in-

water and surface water. We will also look at survival

crease your water requirements and should be avoided.

sources which don't quite fi t into any one of those

Also, if you have extremely little to drink, consider

categories.

minimizing your protein intake, as protein takes water

to digest. If you have no water, you should not eat at all. **Groundwater**, as the name implies, is present in the On a limited supply of water, watch for signs of dehy-ground, below the surface. Th is includes water from

dration including: dark urine with a very strong odour;

wells and springs. As the water fl ows underneath the

dark, sunken eyes; low urine output; fatigue; loss of skin ground, it is fi ltered and purifi ed by the soil. Th e United elasticity; emotional instability; thirst; a "trench line"

Nations considers groundwater the preferred source of

down center of the tongue; and delayed capillary refi ll

water in refugee situations. A spring is considered the

in the fi ngernail beds. If you are in a survival situation

ideal source of groundwater, since you don't have to

without other sources of water, digging a well for water

dig a well. Groundwater is generally free of pathogens,

is not usually worth the energy and sweat.

although contamination can occur from latrines which

are too close.

Contamination

Rainwater is also an excellent source of water, since it

is generally free of contamination, although the supply

It doesn't matter how much water you have if the water

varies widely according to climate. Assuming that the

is too contaminated to be drinkable. Th e contamination containers, evestrough and roof are clean,
rainwater can of water can be pathogenic, chemical, or physical.

be used safely without treatment. (See page 4)

Pathogenic organisms are "disease-causing organisms",

Surface water can be a good source of water, but in

so pathogenic contamination refers to the presence of

most cases is contaminated from a variety of sources.

certain types of bacteria, amoebas, worms, or viruses.

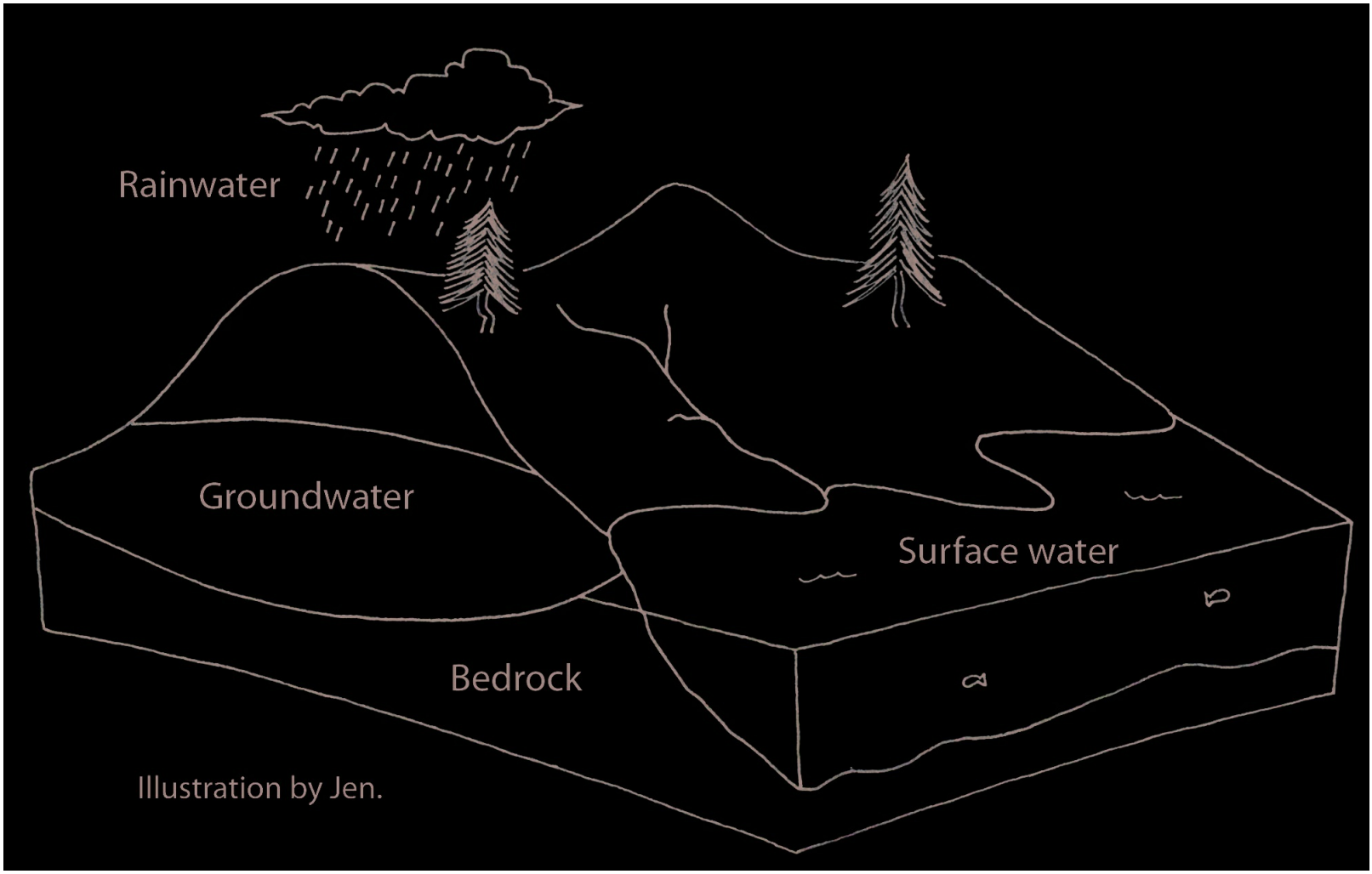
Th ough surface water is easily accessible in many places,

Giardia, or "beaver fever," and cholera, are examples.

it generally requires some sort of treatment.

Chemical contamination includes contamination from

Survival sources of water are sources which are present


Rainwater
Groundwater
Surface water
Bedrock
Illustration by Jen.















in small quantities, and often “embodied” in soil or

You can also place a wel near a river (but at least 15 m

plants. You might look at a lake and think “water”, but

away) which wil be “recharged” be the river water. How-

you can also get small quantities of water where it is

ever, you should never place a wel where it may be fl ooded

not visible. Th ese sources are not generally suitable for a by surface water, which could cause contamination.

large, concentrated population.

Wells should never be dug near latrines, rubbish dumps

Groundwater

or animal pens. Try to leave a distance of at least 30

metres (100 feet) from these possible sources of ground-

water pollution. Wells should be at least 100 metres (330

Wells

feet) from possible sources of industrial pollution.

A well is simply a hole dug or drilled down to the level

of the groundwater. Locating an appropriate site for a

Th ere are several techniques for well digging and drill-

well can be a challenge, especially since hand-digging

ing that are appropriate for an improvised situation.

a well is ***very labour intensive***, and you don't want to However, some methods require installing a pipe and

spend time and eff ort digging a dry well.

hand-pump to operate, which is beyond the scope of this

excerpt booklet. (For more information on simple drill-

If there is a dry season where you are, try to dig the well ing techniques, see WELL Technical Brief #43: Simple at the end of it. Th at is the time when the groundwater

Drilling Methods, available online. You can also refer to

level is the lowest. If you dig when the groundwater is

D.V. Allen's *Low-Cost H*

Lo

and Drilling

w-Cost H

, Consallen G

and Drilling

roup

high, it will move down in dryer weather, leaving your

Sales Ltd, 1993.)

well dry. Look for indicators of a good site, such as

healthy, green vegetation. Annual plants, such as ferns,

Th e most appropriate method for an improvised situa-

are not good indicators, because they come and go with tion is to simply dig a hole in the ground. A diameter the seasons. Look for year-round plants which grow

of at least 1.2 metres (4 feet) is needed for two people

where water is close to the surface, like willow and cedar. digging together. UNEP suggests digging a well with a height to width ratio of 2:1. Th e well can have a deeper

When siting a well, you want to try to fi nd a place where ratio if the soil around it is very cohesive, but if the soil the water table is as close as possible to the surface, so

is uncohesive it may need reinforcement. Dug wells

that your well will be easy to dig, but also where the wa-

have defi nite depth limitations, for safety and practical

ter table is deep, so that seasonal variations will not dry

reasons, and so if your water table is very deep, they may

your well. Refer to the image below, and to hydrological not be appropriate. However, the deeper a well is, the and topographical maps for your area.

better the quality.

Mark out a 1.2 metre (or larger) circle at the appropri-

ate location, and begin digging. After you've dug about

one metre (3 feet), place a tripod or anchored log over

the well opening as you dig. Th is can be used with a

rope and bucket to remove soil from the bottom

of the well. Ideally, the well will be dug two

metres (6.5 feet) below the top of the

water table. Stop digging when the

well has reached that depth, or

when it's not safe to dig

any deeper. If possible,

use sections of culvert or

concrete rings to reinforce

the walls as you dig, to

prevent collapse. Th ese can

slide down the walls as you

dig deeper.

Page 2

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Page 3

When fi nished, place a layer of gravel at the bottom of

recommend “improving” springs to prevent contamina-

the well, if possible. It is generally suggested that you

tion. Th is may or may not be suitable for your needs

disinfect a well before using, or after possible contamina- depending on the population density of your area, the tion, with a chlorine solution (which you can make from nature of the pathogens present, and other factors.

bleach).

Th is “improvement” usually means encasing the spring

Wells can be improved for safety, sanitation, and longev- itself in a container (usually concrete) to prevent direct ity. Place a cover on the well so that people and debris

access by humans or other animals. Th e water comes

cannot fall in. Always use a clean bucket to draw water

from a spout which is installed on the container. Th is

from the well. If people physically enter the well, there is way, pathogens can’t be deposited into the spring itself, a danger of the well collapsing on them, or them causing where they might breed. However, there are some less contamination of the well.

invasive methods described in WELL Technical Brief

#34: “Protecting springs: an alternative to spring boxes”

If possible, line the walls of the well so that the walls do

(see notes).

not cave in or shed soil into the water over time. You can

use bricks and mortar, concrete rings, or whatever sturdy,

non-toxic materials you have available.

Rainwater and Snow

You can also install a windlass or handpump, to make it

Collection

easier to raise water.

Rainwater is a great source of clean water, so try to col-

To avoid puddles of water forming around the well,

lect as much rainwater as possible. Allow the fi rst runoff

which cause mud and can breed mosquitoes, you can

after a long dry spell to fl ow away, to clean dust and

install a stone “apron” which will drain water away from such from the roof or catchment. According

to UNEP

the well.

the ideal roofi ng for a water source is smooth, dense and

non-toxic. Th ey suggest that this includes “corrugated

Well notes:

aluminium and galvanized iron, concrete, asphalt or

Lifewater Canada, at http://www.lifewater.ca/Section_Tutorial.htm, fi breglass shingles, tiles with a neoprene-based coating, has a 100 page manual on wells available online, as well as other

information on water.

and mud”. Th ey suggest avoiding the use of “natural”

materials such as thatch as a source of drinking water,

Water

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W , b

ell y Bob Mellin covers drilling

well with a hand-auger.

because such roofs may attract insects and rodents, and

Wells and Septic Systems, by Max and Charlotte Alth

yield contaminated and discoloured water. Th ey also

suggest that fl at ground surfaces, such as runways, can be

Springs

used as long as they are fenced off to prevent access and

Springs are generally an excellent source of clean water.

contamination from human and non-human animals.

However, in some situations water from a contaminated

surface source can travel a short distance in an under-

One millimetre of rainfall will yield about 0.8 litres of

ground channel and only *appear* to be a spring.

appear

You may water per square metre of catchment area. (In US impe-

want to check.

rial units, that means that each inch of rain will give

about 6.4 gallons per square yard.) Loss is due to evapo-

Springs appear in areas where the water table reaches the ration, and varies by climate. In cooler climates you will surface, generally on the side of a hill or other slope. Th e get closer to a full litre per square metre (or 8 gallons per water is forced out to the surface. Check maps of your

square yard).

area for known spring sites. Also, spring-fed streams may

be fuller in the dry-season than rain-fed streams. If you

Water storage containers should *always* be co

always

vered to

can identify spring-fed streams, you can follow them

prevent contamination. Also, pipes or openings to the

back to the source.

tanks (except the faucet) should always be screened to

prevent the access and breeding of mosquitoes or other

Development and Refugee agency handbooks generally

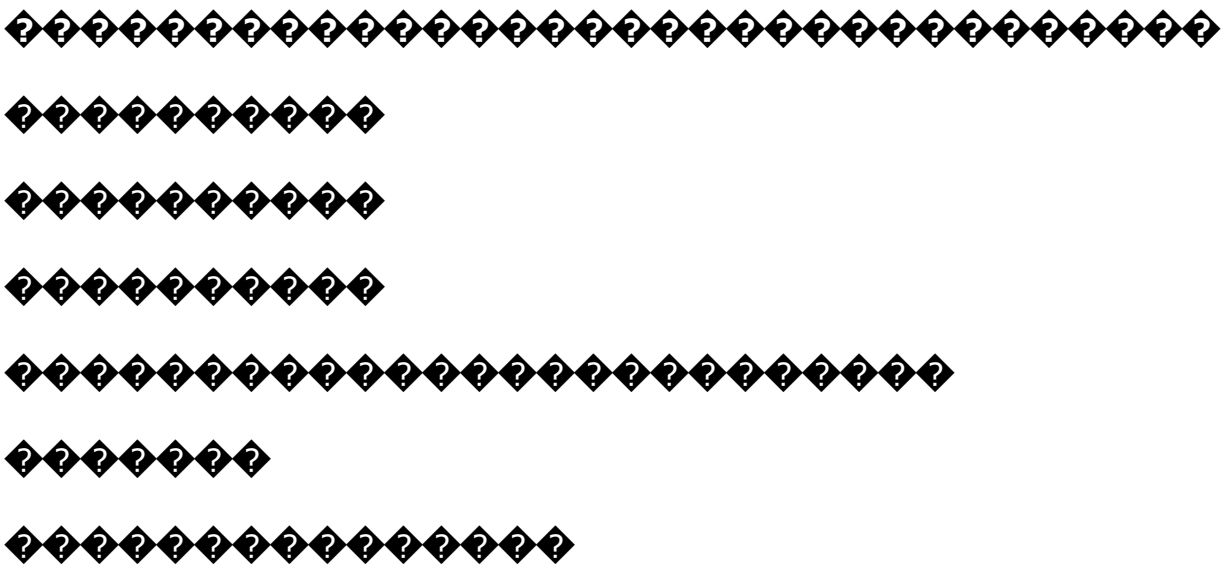
insects. See the illustration for examples of several rain-

water catchment options.

Page 4



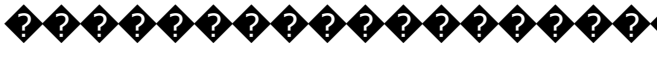




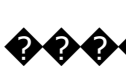












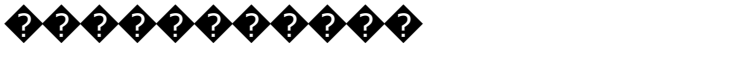


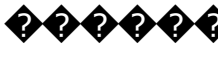


























Page 5

Snow can also be used as a source of water, but should

Remember that snow is only as safe as the water it comes

be gathered from clean sources away from animal traffi c

from, so treat it if you have any doubts.

(including humans) to avoid possible contamination.

Ten portions of snow will yield about one portion of

Rainwater collection notes:

water, so if you are melting snow in a container on a fi re UNEP, Sourcebook of Alternative Technologies for Freshwater for drinking, keep topping up the container so that the

Augmentation in Small Island Developing States, http://www.unep.

water doesn’t boil and evaporate. (Unless you believe the

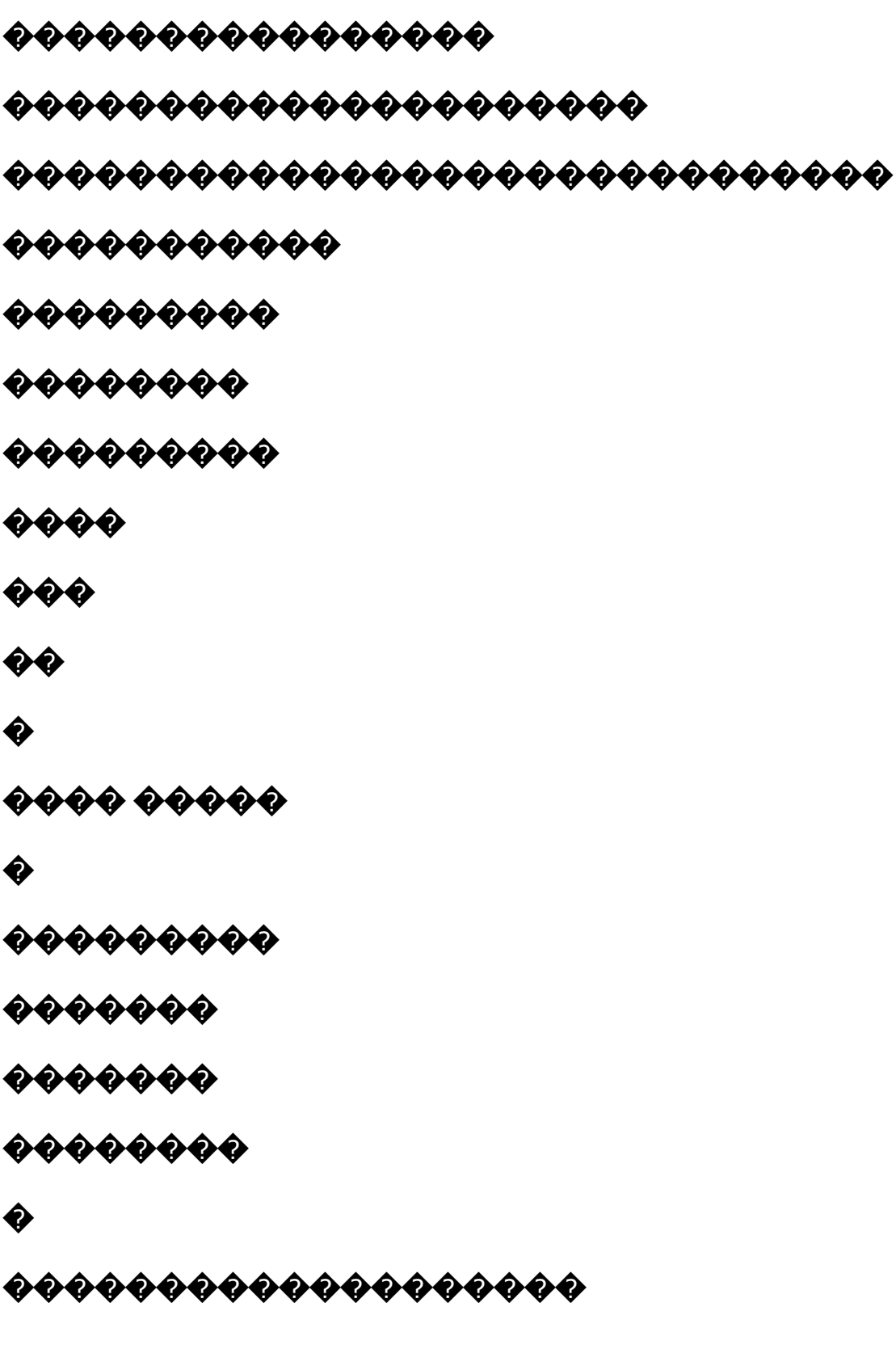
or.jp/ietc/Publications/TechPublications/TechPub-8d/

water is suspect and want to boil it.) Don’t try to melt

snow in your mouth. In cold climates, this will rob your

body of too much valuable heat. If water is cold, just sip

it, don’t gulp.



Surface Water Collection

When collecting water from surface sources, try to check for possible sources of contamination. Contamination can come from agricultural and industrial chemicals, soil erosion (especially in areas with industrial farming and logging), feces from humans and animals, garbage, from humans or other animals entering or washing in the water and tracking in contaminants or pathogens, or from dead animals in the water. Development and Refugee agency handbooks off er a variety of suggestions on how to prevent the contamination of surface water.

Th ese include fencing ponds and rivers to keep farm

animals out and discouraging people from entering or swimming in sources of drinking water. Generally, they

recommend keeping swimming/washing and drinking water sources separate. To prevent the need to enter water, they suggest building ramps or platforms, into the ***Transpiration*** water, which also reduces erosion in places where soil may run into the water.

Trees and plants naturally release water through their leaves as they breathe. You can put a transparent bag,

Lively, bubbling streams or rivers with rapids and white

such as a clear garbage bag, over a branch as shown, be-

water are great sources of drinkable water. Th e aeration

low and seal it air tight. Water will condense and collect

purifi es it in a distance of about 10 m.

at the corner of the bag. You can make a small hole or slit to drain the water, and then tie or seal it shut again.

Surface water notes:

Don’t bag the branch for too long in hot weather, or it may die. **Do not use poisonous plants.**

WELL Technical Brief #47: Improving Pond Water

Survival Sources

Dug Still

One of the simplest ways to get water in a dry area is to



dig a hole, as shown at above right, and place a container in the middle. Th en place a clear plastic sheet over the



hole, with a stone in the middle and weighting on the edges. Th e water that evaporates out of the soil will



condense and drip into the container. You can also use



a fl exible hose to suck water out of the container. You might be able to add succulent leaves or vegetable matter into the hole, to provide more water for evaporation.

Dew and Condensation

Look for the best spot to dig a hole like this, such as In the early mornings or in cold, sheltered spots, you depressions or valleys, areas with green plants, or areas may be able to fi nd dew on rocks, metal and vegetation. which look damp. However, also try to place the still Use an absorbent cloth to sponge it up, and then wring in a sunny spot, so that you get more evaporation and it out into a container. You can tie cloth around your condensation.

ankles and walk around in dew-covered grass before

sunrise.

Page 7

Straining Water



Illustration by Jen.

Straining Water


Illus



Water in Plants

Bamboo, banana and plantain trees, palms, and other plants contain water in their stems that you can access by cutting them. Consult local knowledge or books, and don't kill a tree unless you have to.

Observing other Animals

Watch animals like fl ies, mosquitoes, bees, doves and pigeons. Th ey need to travel to sources of water regularly to survive, and you may be able to follow them.

Survival water notes:

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al Tom Brown Jr.

US Army Survival Manual: FM 21-76

Water Treatment

If you are in doubt, treat the water. You can die a lot faster or be sick for a lot longer from drinking a drop of contaminated water than you can from drinking no water at all. See the table below for a comparison of the eff ectiveness of diff erent methods.

Eff ectiveness of diff erent treatment methods:

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ineff ective

somewhat eff ective very eff ective

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dour

urbidity

Method

dirt. It can also remove certain tiny organisms (like cope-

pods) that may carry pathogens, though such organisms

Straining

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are not present in all climates. Straining turbid water

Aeration

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will improve the eff ectiveness of most other treatment

Storage

S

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~

~

methods, and is a good fi rst step.

Boiling

+

Chlorine

+

Aeration

Solar Disinfection

+

Aeration adds air to water and reduces the concentra-

Distillation

+ +

+

+

tion of “volatile” substances like hydrogen sulfi de, which

Slow Sand Filter

+

+

+

aff ect the taste and smell of water. It can also oxidize and

Rapid Sand Filter

~

+

immobilize elements like iron and manganese, which

For a more detailed comparison, see WELL Technical Brief #48.

can cause taste and smell problems with water if present

in excess. (Th ey also stain clothes if the water is used for

Simple Treatments

laundry.)

To aerate water, just shake a partly fi lled container of

Straining

water vigorously, or pour it through a perforated tray

Straining turbid (cloudy) water through a clean handker- containing small, clean pebbles.

chief or other fi ne, cotton cloth is a good way of strain-

ing out larger particles of suspended contaminants like

Page 8

Storage

Disinfection by Boiling

Just storing untreated surface water will improve its qual- You can kill the pathogens in water by boiling it. At sea ity. Particles settle out, and parasites that may be present level, water simply brought to a boil is safe, but add one will die, usually within a few days, without access to a

minute to the boiling time for every additional thousand

host. Storing water for only 24 hours will kill about half metres (3300 feet) in altitude. (It's something of a myth of the bacteria in it. Th e improvement in quality will be that water has to be boiled for fi ve or ten minutes to be greater at higher temperatures and over longer periods.

safe—this is just a waste of fuel. See Miller below, and

If you are leaving turbid (cloudy) water to settle out, re-

other sources.) Be sure to strain out any larger particles

member to take your water from the top layer, once the

by straining through a cloth, fi rst. If it tastes "fl at", pour

visible particles have settled.

it back and forth between two containers a few times to

aerate it. You can also add a chunk of charcoal from your

Water containers should always be covered to prevent

fi re, or some pine needles, during boiling, and remove

contamination.

them before drinking, to improve taste.

WELL (see water notes) suggests using a three container **Boiling notes:** system. Th e fi rst container is used to put new water

Miller, DeWolfe, ‘Boiling drinking-water: A critical look’,

into, and the water may be strained as it is poured into

Waterlines, Vol.5, No.1, IT Publications, London, 1986.

this container. After one day, this water is poured into

the second container, being careful to leave sediment or

Chemical Disinfection

cloudy layers behind to be discarded. Using a tube to

Disinfection by adding chlorine (usually in the form of

siphon water to the next container can help to leave the

bleach) is also an option. However, it isn’t ideal, because

sediment undisturbed. Th e next day, water from the sec-

the proper amount of chlorine to use can be diffi cult to

ond container is poured into the third. Th e water in the

determine, as well as because of the unpleasant taste and

third container has sat for at least two days, and is used

possible health side eff ects of ingesting chlorine. How-

for drinking water. WELL suggests occasionally rinsing

ever, it is a *ver*

v y eff

y ective disinfectant.

this container with scalding water to sterilize it.

Th e strength of chlorine compounds varies widely, and

Glass containers are good for maintaining water qual-

depends on storage conditions. Household bleach will

ity, but are heavy and can break. You can look for food

rapidly lose its strength over time, though powdered

grade plastic containers for storing water. Th e preferred

chlorine (calcium hypochloride) will last longer, up to

types of plastic for food are “Polyethylene Terephthalate” ten years under ideal storage. Use *only* pur *only*

e bleach. Do

(PETE) or “High Density PolyEthylene” (HDPE). Look not use bleach with fabric softener, or other laundry ad-for the letters “PETE” or “HDPE” or the recycling num- ditives, because they are very likely poisonous.

bers “1” or “2” stamped on the bottoms. However, keep

in mind that some chemicals stored in the containers

To disinfect clear water with liquid bleach, fi rst look at the

originally may leach into the drinking water stored in-

concentration of chlorine you have in your bleach. For

side. For example, the toxic aspartame in containers used 1%, use 10 drops per litre, for 2-6% try 2 drops per litre, in diet pop may leach into the drinking water, so such

for 7-10% use 1 drop per litre, and let sit for at least 30

containers should be avoided if possible. **Nev**

N er

ev r

er euse a

minutes. For slightly cloudy water, use at least double the

plastic container that has stored toxic chemicals.

number of drops. Th ere should be a slight chlorine odour

after. Otherwise, repeat the dose and wait another 15

Disinfection

minutes. Let it sit to reduce chlorine taste and smel .

Aerating chlorinated water after disinfection will also

Disinfection kills the pathogens in the water. It is most

help the taste, as will adding a pinch of powdered vita-

eff ective if the water is relatively free of sediment and

min C, which will neutralize the chlorine.

organic materials, so it should be the fi nal stage in water

treatment, after other contaminants have been removed. You can use household, medical iodine to purify water as well. For 2% USP strength, add 5 drops to clear water

and 10 drops to cloudy water.

Page 9



Chemical disinfection notes:

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“Be Prepared with a 3-Day Emergency Food Supply,” by E. Schafer,

C. Hans, E. Jones Beavers and D. Nelson, Iowa State University

Cooperative Extension, November, 1997

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Solar Disinfection

Solar disinfection works by a combination of exposing the water to the ultraviolet rays of the sun and raising the temperature, which kills microorganisms present. Th is technique is most eff ective in areas between approximately 35°N and 35°S, areas which receive large amounts of solar radiation each year. Th e American Southwest is an area in North America which also re-

ceives a lot of solar radiation.

In this method, containers of water are placed in direct sunlight, for a period of at least six hours. Th e water must be relatively clear, and shallow, to allow penetration of UV rays.

Glass containers can be used (but not window glass,

which does not transmit UV radiation very well), but they are heavier, can break, and take longer to heat up. Plastic bottles made of PETE (polyethylene teraphtalate) or PVC (polyvinyl chloride) are both good choices, but PETE is preferable, since it is not likely to leach harmful additives into the water. Bottles made of PVC often

have a bluish tinge, and when burned, smells strong and

unpleasant. PETE burns more easily, and has a sweetish

hour in the middle latitudes, it is safe. Placing the bottles

smell.

on corrugated metal roofi ng will keep them in place and

help to increase the temperature.

Bags of water can also be used, and can be more eff ective

since they can store water more shallowly.

Using refl ectors to concentrate sunlight on the water

vessel will increase the eff ectiveness of this method by

Aerating the water by shaking it before placing it in the

increasing the amount of UV radiation the water is ex-

sun will signifi cantly increase the eff ectiveness of this

posed to, and increasing the temperature.

method of disinfection. When bottles become old and

scratched, and start to become opaque, they should be

Solar disinfection notes:

replaced. Newer bottles will transmit UV light better.

Swiss development agencies have a large amount of information

about solar disinfection at www.sodis.ch.

Th e Swiss development agencies EAWAG and SANDEC

recommend leaving the water out for at least six hours

Distillation

on sunny or partly cloudy days, or two consecutive days Distillation works by evaporating water from a suspect in cloudy weather. Th is primarily applies to very sunny

source, which then condenses, leaving distilled water.

regions, so solar disinfection is not a reliable method in

Th is is an excellent way to get drinking water from sea-

less sunny regions.

water, and is the only method described here which will

remove salt.

Painting bottles black on one side (the side placed down)

will help to heat the water up. If the water reaches a

You can make a stove-top still, like the one shown, very

temperature of more than 50°C (122°F) for at least one

easily. You place the still on top of a pot which is cook-

**
**
**

vide enough water. Th ey use solar radiation to evaporate water from a contaminated or questionable water source. To make a solar still, make a small greenhouse out of the materials you have available. See the Cloche Style still for



an example using windows or plastic. Make a container for the source water lined with black, so that the water

will heat up as much as possible in the sun. You may use it as a still to provide drinking water in the summer, want to insulate underneath the source container if you and then to dry the produce in the fall.) You can make are going to place the still on the ground. Th en place a this kind of still (dehydrator, coldframe) from 3’ by 6’ shallow trough along the lower edge to capture the con- patio door windows, which are regularly replaced at densed droplets as they slide down the glass. many apartment buildings. You may be able to buy them cheaply by the hundred. Admittedly, you might not be Plastic sheeting can also be used, but some people report able to use them all yourself, but your neighbours will that droplets usually do not cling to plastic as well as thank you when you share. (If you store glass in such glass, so they may drop back into the source container. numbers, be sure to store the panes with spacers so that

However, the “clinginess” can be improved by lightly

they don’t touch - water trapped between them will etch

rubbing sandpaper over the interior surface of the plas-

and mar the glass permanently.) For discussion on the

tic. If you do use plastic, make sure that it is pulled tight glass’s best angle see page 34.

over the frame, or the wind may fl ap and tear it.

You can also make a lightweight, portable version, like

You can make a solar still with a sloped glass covering

the one shown on the previous page. (Design from the

like the one shown below. Th is same device can be used

excellent “Survival Scrapbook” volume three). Th is de-

as a solar food dehydrator, or a cold frame for gardening. sign would also work well on a rooftop.

(Th is is an example of how you can create equipment ap-

propriate to your bioregion and climate: for example, if

A still can produce about 4 litres of water per square me-

you have rainy springs, hot dry summers, and moderate

tre (1.26 litres per square yard), per day, on a good day.

autumns, you can use this device to start your vegetables

in the spring, while you are drinking rainwater, and then Th e upside of the solar still is that you can put your wash water back into the still to get drinking water again. You

could even put urine in.

For stills, keep in mind that the distilled water produced

also has no trace minerals present, so it is not ideal as

the sole drinking water source for young children over

extended periods of time.

Exercise: Build a solar still for you and your family or housemates. Can you live off of the product for a week? How much of your water needs can you meet?

Sand Filters

Slow Sand Filters

In slow sand fi ltration, the source water fl ows slowly through a bed of fi ne sand. To work, the water must be relatively clear, and the fl ow relatively constant. Th e water fl ows through at a rate of about 10 to 20 centimetres per hour (4 to 8 inches per hour). Th e minimum acceptable depth of sand to function eff ectively is 65 centimetres (25.6 inches).

Th e slow sand fi lter works because of a biologically active microbial fi lm that forms on the top layer of the sand, known as the “schmutzdecke”. Th e schmutzdecke

captures and “eats” organisms in the water. Th e schmut-

wtprimer/slowsand/slowsand.html

zdecke takes about one to two weeks to form, and so

http://www.esemag.com/0500/sand.html

water coming from the fi lter before that should not be

WELL Technical Brief #59: Household Water Treatment 2

used for drinking.

To get a quantity of fi ne, uniform sand, you can try sift-

General Water Notes

ing it through a mosquito net or other fi ne screen.

Th ere are a few methods which I skipped over in this section,

because they didn’t fi t into the requirements. Solar pasteurization is Th e fi lter should be fi lled from the bottom up, to prea treatment method which is distantly related to solar disinfection, but slightly more diffi cult. Essentially it involves elevating the vent the formation of air bubbles in the sand which

temperature of water to more than 65ºC (149ºF) for more than

would slow the fl ow of water.

six minutes, using sunlight (or other sources). Th e advantage is

that it does not require UV radiation for disinfection and is more

Eventually the sand fi lter will need to be cleaned, be-

appropriate for non-equatorial latitudes. For more information,

cause the schmutzdecke will thicken and slow the fl ow

check out:

of water excessively. Fortunately, this thickening will not http://solarcooking.org/docs.htm#W

http://solar

ater%20P

cooking.org/docs.htm#W

asteurization

ater%20P

impair the safety of the fi lter. To clean, drain the water

Th ere are also numerous commercial, small scale means of water

to slightly below the top of the sand, and scrape off

treatment which aren't appropriate for improvised situations, which

you can fi nd out more information about for yourself. Th ese include the very top layer. Th en fi ll up from the bottom. It will

halozone tablets, and other chemical treatment methods, which you

require another one or two weeks for the schmutzdecke

can get at pharmacies or camping / outfi tting stores.

to regrow.

Th ere are other general sources for learning more about drinking

water below, which I used writing this section.

Rapid Sand Filters

Th e IRC International Water and Sanitation Centre has an extensive

Rapid Sand Filters work to remove particles and turbid-

online database of water-related publications: www.irc.nl/ircdoc/

ity in water, but do not form a schmutzdecke, and are

UNHCR Water Manual for Refugee Situations

not eff ective against pathogens.

UNHCR Handbook for Emergencies

Th ese and other UN refugee references are available online at:

One type of rapid sand fi lter that you can make is simply www.the-ecentr www

e.net/r

.the-ecentr

esour

e.net/r

ces/e_librar

esour

y/index.cfm

a barrel with a thick layer of sand on top of a perfo-

WELL Technical briefs, available at: www.lboro.ac.uk/orgs/well/

rated metal plate, on top of a layer of stones, similar to

resources/technical-briefs/technical-briefs.htm

the slow sand fi lter. However, the water travels upward

Water for the World Technical Notes

instead of downward, and can travel at a faster rate;

www.life

www

water.org/wfw/wfwindex.htm

water

has an extensive number of

about 0.5 to 1.5 metres per hour (20 inches to 60 inches technical briefs on water and sanitation.

per hour). Th e sand in this fi lter is at least 30 cm thick.

Th e Drinking Water Book, by Colin Ingram

Th e rapid sand fi lter needs to be “backwashed” (that is,

fl ushed of sediment by letting the water fl ow in the op-

posite direction) regularly, perhaps as often as every day,

depending on the turbidity of the water and the amount

of spare water available for fl ushing.

Since slow sand fi ltration requires clear water, and rapid

sand fi ltration provides clear water, you can put them

in a gravity-fed sequence, as shown. Additionally, since

the maintenance downtime for the slow sand fi lter is so

long, you may wish to have several slow sand fi lters run-

ning simultaneously, so that you will always have at least

one working.

Sand fi lter notes:

http://www.refugeecamp.org/learnmore/water/slow_sand_fi lter.htm

http://www.ce.vt.edu/program_areas/environmental/teach/

Latrines and Greywater

Latrines

you will need a pit volume of at least 1 m3 (35 cubic

feet) per year of use. (25 x 0.04 m3 = 1.00 m3)

In the event of an infrastructure failure, dealing with

feces—shit—is an important priority. Feces contain

Leave an additional 50 cm of depth from the surface in

and potential y transmit a variety of pathogens, including calculating the pit volume. You will need this space to bacteria, viruses, and worms. Exposed feces also attract

put dirt back into, so make sure to set the dirt aside in a

fl ies, who may spread diseases. Latrines are structures that pile to put back in later.

col ect feces in one place, prevent access by insects, keep

water from being contaminated, gives some privacy to the Build a basic structure of some sort on top of the pit users, and in some cases, provide useable fertilizer.

with the materials that you have available. One sugges-

tion is shown in the illustration on the following page.

It is important to have a close-fi tting cover for the pit

Siting Latrines

to reduce odours and keep out fl ies. Elevated seats are

Due to potential groundwater contamination, latrines

common in the culture I'm from. However, many people

should be a *bare minimum* of 30 metres (100 feet) from

fi nd it more comfortable to poop from a squatting posi-

any well, body of water, or potential drinking water

tion. Th ere is some evidence that this is healthier for

source (though this is less of a problem with most com-

you, and it is certainly easier to make a simple hole in a

posting toilets). Medicins Sans Frontieres recommends

board. However, this may be less appropriate for people

a distance of at least 50 metres (164 feet) from water.

who have diffi culty standing up from a squatting posi-

Th ey should also be a reasonable distance from dwell-

tion. If small children are afraid of falling into the hole,

ings—no less than about 5 metres (16.4 feet) (because of you can make a “hole cover” with a smaller hole in it, or possible smell problems) or more than about 50 metres

simply make a second, appropriately-sized hole in the

(for convenience). Latrines should also be downwind of

fl oor.

dwellings, especially the improvised types.

If the water table is too high, or the soil too shallow or

Choose a site which is not going to fl ood. When digging tough to dig in, you can dig the pit in an elevated earth a pit, leave at least 1.5 metres (5 feet) between the bot-mound and/or use a barrel with a perforated or removed

tom of the pit and the top of the water table.

bottom and elevate the structure above it.

For hygiene purposes, there should be a source of soap

Depending on your soil type, and the shape and depth

and washwater near all latrines.

of the pit, you may need to line it with rocks or old

drums (tops and bottoms cut off) to prevent it from

Pit Latrines

collapsing. However, the lining should be porous at the

Th e simplest type of latrine is a pit, with some covering. bottom to allow liquids to leave the pit.

In a wilderness setting, with few people, feces can simply

be buried shallowly in the soil, at least 30 metres (100

After use, when there is only 50 cm left between the sur-

feet) from water. Th is way the poop will be broken down face and contents of the pit, move the structure on top by soil organisms easily.

to a new site, and fi ll the full pit in with the dirt.

In a setting with a denser population, a larger pit is re-

If smel s are a problem, users can put earth, wood ashes, or

quired. Sizing the pit is important. Th e amount of poop sawdust into the pit after each use. Wood ash (hardwood that each person produces per day varies widely based

ash especial y) is eff ective at limiting smel and fl y problems.

on diet and other variables. A good general estimate is to

assume that one person will give 0.04 m3 (1.4 cubic feet) ***Trench Latrines***

of solids per year. (Th e water content is less important,

Extend the basic pit latrine out into a line and you have

since it will drain out or evaporate). So for 25 people,

a trench latrine. It’s pretty self-explanatory.

Page 15

Trenches can be dug in rows to increase density. Zig-

pipe traps fl ies inside, where they die. Th e interior of the

zagging dividers can be put up for privacy. Th e trench

shelter should be relatively dim, so that fl ies are attracted

latrine is generally considered an emergency measure,

to the light from the pipe. Th is latrine does not include

suitable for high population densities. Both it and the

a lid for the hole, since air is constantly drawn through,

pit latrine should be upgraded as soon as possible to a

keeping smells to a minimum, but you may need to use

more hygienic system, such as the Ventilated Improved

one anyway in less windy areas.

latrine (VIP).

Other Options

Ventilated Improved Pit Latrines

Additional options, such as the pour-fl ush latrine, ex-

Th e VIP latrine is an enhancement of the basic pit

ist. Th e pour-fl ush latrine has a U-shaped water seal

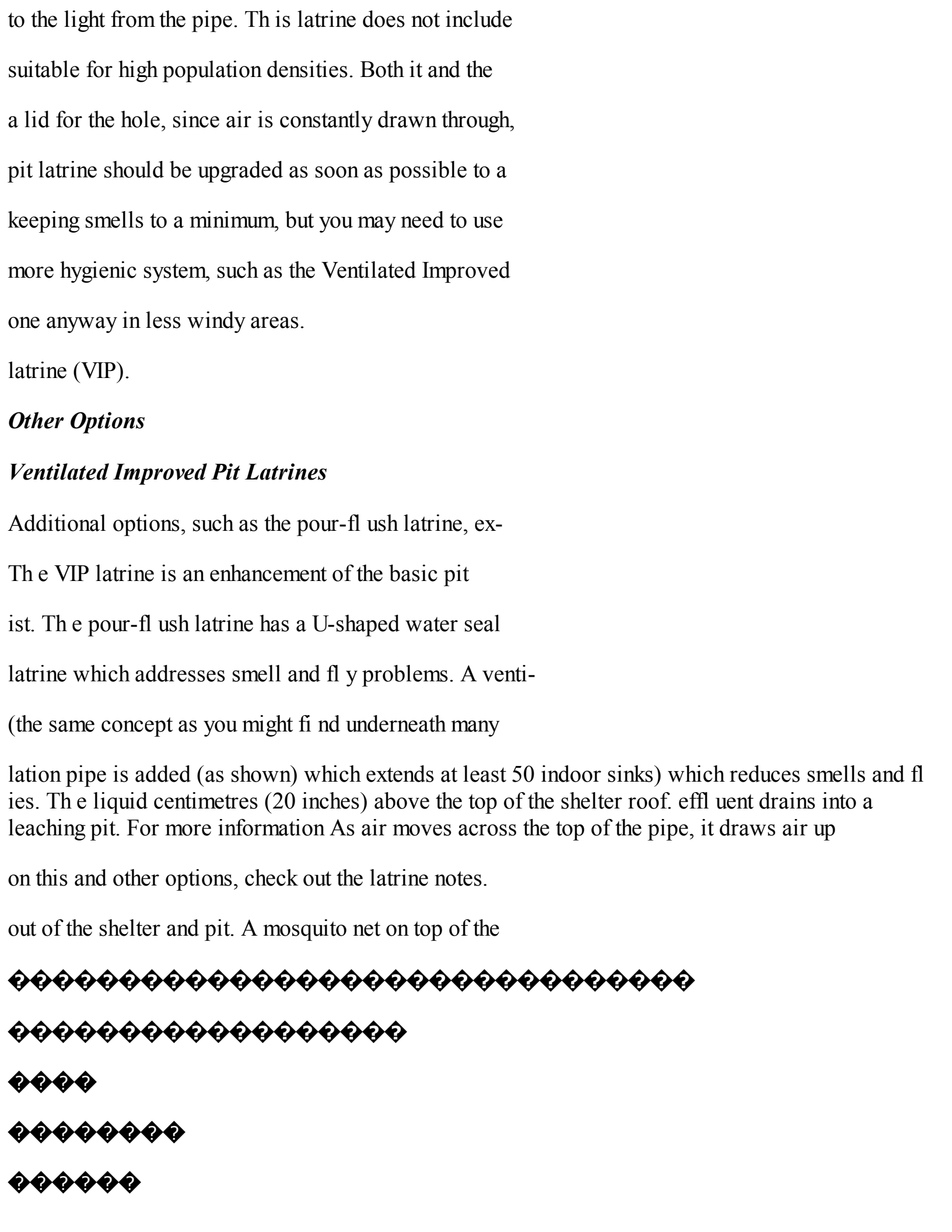
latrine which addresses smell and fl y problems. A venti-

(the same concept as you might fi nd underneath many

lation pipe is added (as shown) which extends at least 50 indoor sinks) which reduces smells and fl ies. Th e liquid centimetres (20 inches) above the top of the shelter roof. effl uent drains into a leaching pit. For more information As air moves across the top of the pipe, it draws air up

on this and other options, check out the latrine notes.

out of the shelter and pit. A mosquito net on top of the



Page 16

Th e pit/trench and VIP latrines can be constructed

have to handle material containing human feces. Th is is

quickly and easily. Th ey are relatively safe, provided that a valid concern, but it shouldn’t be a problem if proper they are not close to a food or water source. Sanitation is handwashing and other simple precautions take place.

aided by the fact that no one has to handle the feces and After all, most of us are quite literally full of poop all the urine, the hole is simply refi lled.

time, and use the toilet on a regular basis, and it doesn’t

harm us. As long as you wash properly, a composting

However, they are likely to introduce pathogens into

toilet is no more dangerous than any other kind of toilet.

the groundwater, even if the pathogens are only near

to the latrines. Th e breakdown of the feces is mostly an

For extensive information on the subject of composting

anaerobic (without air) process that produces a variety of toilets, please read the well-written and thoroughly re-unpleasant gases such as methane and hydrogen sulfi de

searched Humanure Handbook, by Joseph Jenkins. You

(which smells like rotten eggs). And the nutrients in

can visit his website at www.jenkinspublishing.com/hu-

the feces and urine are lost in the pit, which means that

manure.html, where the entire text is available online.

gardeners must fi nd alternate sources of valuable nutri-

He uses the term "humanure" to refer to human poop.

ents like nitrogen. On a farm about 80% of the nitrogen

comes from animals. Soils have already been mined of

Composting is a process in which microorganisms,

nutrients, and they need the nutrients in our poop. Be-

normally present in the soil and all around us, break

sides, for many people during collapse, the only source

down organic materials like kitchen scraps, straw, poop,

of animal manure for gardening will be their own.

and so on. Essentially, they eat it. As they do this, they

also generate heat, the same way that our bodies generate

Th e main alternative to the pit toilet is the composting

heat all the time. Th is heat builds up in the pile, and the

toilet.

increased temperatures kill pathogens present. Th ere is a

special class of microorganisms called "thermophilic mi-

General Latrine Notes

croorganisms.” Th ese microbes love high temperatures.

World Health Organization briefs:

If you can get the pile up to thermophilic temperatures,

www.who

www

.int/docstor

.who

e/water_sanitation_health/onsitesan/ch04.htm

.int/docstor

above 45°C (113°F), these microbes will love it. Th e

www.who

www

.int/water_sanitation_health/hygiene/om/en/

.who

composting process will happen very rapidly, and all

linkingchap8.pdf

pathogens will quickly be killed.

WELL Technical briefs, available at:

www.lbor

www

o

.lbor .ac.uk/orgs/w

o

ell/r

.ac.uk/orgs/w

esour

ell/r

ces/technical-briefs/technical-

esour

A well made compost will not smell, and will be quite

briefs.htm

warm. Th e essential ingredients of a good compost are

UNHCR Handbook for Emergencies

suffi cient moisture, **oxygen**, a **warm enough tempera-UNHCR Water Manual for Refugee Situations**

ture, and a good balance between carbon and nitro-

gen.

Composting Toilets

Th e compost should *not be too dry, or too wet*. If it is too dry, the microorganisms will not be able to grow proper-Composting is an aerobic process—it takes place with

ly, and valuable nitrogen will be lost to the air. If it is too

the presence of air. Th at means that properly operating

wet, than the air won't be able to get in, and the compost

composting toilets do not produce unpleasant smells

will become anaerobic (and smelly). A compost should

or gases. Th e temperatures reached inside the compost,

be about as damp as a wrung-out sponge. If your com-

along with the time the compost spends "curing", kill

post is too dry, just add household wastewater. If it is too

the disease organisms that might be present. Compost-

wet, you need to add more bulky material like straw, or

ing toilets also conserve the nutrients in the feces and

other roughage materials discussed below.

urine, so that they can be returned to the land. Compost

itself contains valuable organic matter that does wonders Giving a compost pile *oxygen* means giving it air. Th is for soil life and gardens, a topic which will be expanded

is why bulky materials are so important. You can use

on in future writings on gardening.

sawdust, leaf mould, peat moss, weeds, hay, straw, leaves,

rice hulls, shredded paper or cardboard, or similar mate-

Some people are worried about the fact that one might

rials. If something in the compost pile smells bad, cover

it with this bulky material.

The Jenkins Sawdust Toilet

Described by Joseph Jenkins in the Humanure Hand-

Temper

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tant because the thermophilic com-

book, the sawdust toilet is a convenient method of com-

posting microbes need a certain minimum temperature

posting your humanure while still having a toilet inside

to operate, and because the elevated temperature kills

your home. Th is method consists of two parts, a toilet

pathogens (just as a fever kills pathogens in our bod-

receptacle inside, which is fi lled with sawdust or other

ies). In cold climates, they will sleep over winter, but the roughage, and regularly emptied into a set of compost-compost pile will come alive again in the spring. Th is

ing bins outside.

freezing also kills some pathogens. You can continue to

add compost to the pile even if it is frozen.

Th e toilet receptacle inside is simple to construct, and

can be made in a variety of diff erent ways. Using 5-gal-

A good *carbon to nitrogen* ratio helps the compost to

lon buckets as the receptacle is easy, since they are so

heat up, by giving the microbes a healthy, balanced diet. common. Jenkins recommends not using a larger size Th e bulky materials listed above are very high in carbon. than that, since the contents would be very heavy to Adding manure and urine equalize the nitrogen ratio.

carry out to the pile. You can build a toilet seat on top of

You want to have a ratio of carbon to nitrogen some-

it, or a platform to squat on.

where between 20:1 and 35:1. If you have too much

nitrogen in your compost, it will release that nitrogen as

ammonia gas, which you don’t want. Not only will you

lose nitrogen, but it smells bad.

Many people do not pee in their composting toilets, be-

cause it causes a smell for them. Th is smell comes from

excess nitrogen and water, and adding roughage com-

pensates. Jenkins recommends including urine in a well-

balanced compost, but most of the people I know simply

apply their urine (diluted with 3 to 6 parts of water) to

their garden or orchard. (Urine is almost universally free

of pathogens. Only urinary schistosomiasis can be spread

by urine, and it exists only in a few tropical locations.)

See what works for you with your climate and soils. If

putting urine in your composting toilet isn’t working,

your nose will tell you quickly.

Separating urine may also be a good idea in situations

where the nitrogen content is required immediately for

After each “deposit”, add roughage to cover the feces and

gardening, and the gardener can not wait several years

urine. Th is toilet does not require an airtight or fl y-proof

for the compost to cure.

lid, since the roughage keeps out fl ies and cuts smells.

See the books in the notes at the end of this section for

When the receptacle is full (or almost too heavy to carry)

comprehensive tables of the carbon and nitrogen con-

it can be dumped in the compost bin and buried in the

tents of diff erent foods and organic materials.

top layer of the compost pile.

Th ere is a wide variety of home made and commercial

Th ere are a number of designs for the compost bins,

compost toilets, but, of course, we will discuss those you many of which vary by climate. People in hot, dry cli-can make yourself.

mates, may need to dig a pit to put their compost in to

conserve valuable moisture. People in very rainy climates

Th e two discussed here are the two-chamber mouldering may need to build a roof over their compost pile to keep toilet, and the Jenkins sawdust toilet.

it dry enough, and prevent nutrients from leaching away.

Jenkins suggests a simple rotating multi-bin system, as

off , the other is in use. After each deposit, roughage is

shown. Remember that you will need at least two bins,

dropped into the chamber.

one for this year’s compost pile (still being built), and

one for last year’s which is composting. If climate or

You can make the chamber out of cement, wood, or

other constraints prevent your compost pile from reach-

other materials that you have available. However, it

ing thermophilic temperatures, you will want to add a

need not be air or fl uid-tight. You will need a door on

third bin to let the compost mature for a full two years.

the “back” to access the compost for checking on it

You may also want an extra, sheltered bin to keep rough- and eventually emptying the chamber.
You may need age such as straw, grass, or hay in.

to smooth the pile, check the moisture, and add more

roughage.

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When starting a new humanure compost pile, put down

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at least 18 inches of roughage. Th is “sponge” will soak

up any fl uid leaching from the pile to prevent contami-

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nation.

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If you don’t have any smells, hopefully you won’t have

any trouble with animals digging into the pile. If this is

Variations

a problem, you should put wire or other barriers around Th ere are plenty of variations on simple and homebuilt the pile, to prevent animals from accessing the pile and

composting toilet designs. To increase the composting

spreading pathogens.

temperature, some toilets use solar energy to heat the

pile and accelerate decomposition. You can enhance

The Two Chamber Toilet

the two-chamber design above by facing the chambers

Th is composting toilet is essentially an outhouse version towards the south and placing glass or translucent plastic of the general system described above. Th e "bathroom"

on the wall to let in sunlight. You could even include

is located directly above the composting chamber, as

refl ectors to heat things up even more.

shown. Th ere are two seats (or holes, if you prefer to

squat), one for each chamber. Th e chambers are used one Some designs also include perforated pipes or other at a time. While one chamber is composting and closed

means of increasing the air supply to the compost pile.

Others creatively incorporate reused barrels or other

Greywater Pit

materials in their toilets. You can check out a variety of

Th e simplest way to get rid of greywater, and one very

designs on the web, and experiment for yourself.

appropriate for camping or wilderness situations, is to

dig a pit about 1 foot wide by 2 feet deep. You can put

criss-crossed sticks and long grasses over the top to act as

www.compostingtoilet.org/

a grease trap, which will fi lter out some grease and food

Th e Humanure Handbook, by Joseph Jenkins

scraps. You can then regularly burn the grasses in your

Th e Toilet Papers, by Sim Van Der Ryn

fi re.

More information on composting in general will be

You can build a larger pit as well, such as one made out

covered in future writings. In the meantime, check out

of a drum with large holes punched in it, or the bottom

excellent books on the subject like “Th e Real Dirt: Th e

cut out. Th e barrel can be partly fi lled with stones and

Complete Guide to Backyard, Balcony, and Apartment

gravel, which prevent access by rodents.

Composting” by Mark Cullen and Lorraine Johnson.

Th e downside of the simple pit system is that the one

Greywater

area receives a lot of water and nutrients, maybe too

much, while other areas aren’t getting enough. You can

improvise a branching greywater system to distribute

Greywater is the water from sinks, washing dishes,

greywater to a larger area, such as an orchard.

showering, and so on. It does not contain nearly as many

nutrients as humanure or urine, but *it can contain some*

Branching System

***pathogens*. Greywater should be treated with reasonable**

Th is system works using a downhill grade. Water is

caution. It can also contain food scraps which might

channelled from the house, washing site or dump site, to

attract rodents and other animals, or produce smells. To mulch covered troughs.

avoid these problems, it's good to get the water under

the soil as fast as possible.

Th e channels may be simple improvised, shallow

trenches in the surface, depending on conditions. Better

Because it can contain pathogens, i *t should not be applied* yet, they may be covered, fi lled in with gravel and small *directly to v*

dir

egetables

ectly to v

which will be eaten. H

egetables

owever, it can stones, or replaced by pipes. Th ese channels must slope be applied to trees or berry bushes, which is an excel-downhill continuously, or the water will back up or pool.

lent way of reusing the nutrients and water. Greywater

should not be poured into streams or bodies of water.

Th e destinations are shallow depressions or trenches full

Greywater pits should be built a safe distance from water

of mulch. Th e water may go directly into the mulch,

sources

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ces

sour

eams and wells, at least 30 m depending on or into a gravel fi lled container, which then releases the soil conditions.

water into the mulch. Alternately, water could be poured

directly into the gravel bucket, as an improved pit sys-

Depending on how much greywater you produce, you

tem.

can pour at least part of it into the top of your compost

pile, assuming that this won't make the compost too wet. *Greywater Notes*

Th at is one of the best ways to deal with it.

Create an Oasis with Greywater: Your Complete Guide to

Managing Greywater in the Landscape, by Art Ludwig. You can visit

In cold climates, you may have trouble with greywater

the author's site at www.oasisdesign.ne

www

t

freezing in the winter, or snow covering the greywater

Th e Humanure Handbook, by Joseph Jenkins

pit. If possible, put the pit behind a windbreak (so that

the prevailing winds will not drift snow over top of it)

and pour the water in. Th e heat from washwater, and

the heat of the soil should help except in extremely cold

areas, in which case you will simply have to wait for the

water to thaw in spring. Th e branching system described

below is not ideal for very cold climates in winter.

A Note on Heat

Whenever we talk about cooking and cooling, we

W

When designing a device for heating or cooling, we want

ar

W e talking about the movement of heat. We are to consider the concepts of heat gain, heat loss and heat talking about the devices we make gaining, losing, and

storage. Heat gain just means heat is moving into or being

storing heat. Heat storage is the same as thermal mass. A generated in the device, heat loss means heat moving out massive, heavy object, like a steel anvil, a barrel of water, of it. For cooking, we want to maximize heat gain and or a brick wall, can absorb and store a lot of heat. It

heat storage (within reasonable levels) and minimize heat

takes a lot of heat gain to heat them up, and a lot of heat loss. For cooling food to keep it fresh, we want to maxi-loss to cool them down. In contrast, air has very little

mize heat loss and heat storage, and minimize heat gain.

thermal mass, and heats or cools easily. (Th is is also why

being in air at 100°C is merely uncomfortable, while

being in water at 100°C is lethal. Th ere is a lot more heat stored in each litre of water than in air, and the water conducts that heat into your body more easily.)

Heat moves through convection, conduction, and radiation.

•Convection is the movement of heat by circulation in a fl uid (a gas or liquid). Air over a heater warms and rises, which draws in cool air from nearby, which also warms and rises. As the air gradual y gives its heat to the ceiling, it sinks down to start again. Many people think that heat rises, but heat itself wil go in any direction; it is warm fl uids, like air, which tend to rise. Th e heat within those fl uids is then released into the cooler things that they touch.

•Conduction is the direct movement of heat through an object. When you stick a metal rod into the fi re, heat moves along it by conduction, and gradual y heats up the other end.

•Radiation is the movement of heat directly from a warm body outward, like the light from the sun, or the heat

from a fi re.

Th is is important because we want to alter the move-

ment of heat in our devices. When you want to stop the movement of heat away from the food you are cooking to conserve fuel, or the movement of heat into food you want to keep cool, consider how heat moves and how you can slow its movement. To slow heat loss by convection, minimize or eliminate air pockets or gaps in which air can circulate. (Air wil not circulate in gaps less than about 1 cm or 3/8″ across.) To slow heat loss by conduction, insulate with a material that has many tiny air pockets, which slow the movement of heat. To slow heat loss by radiation, use a “radiant barrier” like aluminum foil, which refl ects heat.

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Cool Food Storage

Keeping food cool, as we al know, extends the storage

Kl

Kife. Idealy, this means reducing food wastage, and Meats: Large, solid, whole pieces of meat from mam-hopeful y reducing negative impacts on the landbase.

mals, like rump roasts will last the longest. Uncured sausage lacks preservatives, and may spoil. Chopped,

In keeping things cool, we want to minimize heat gain

raw meats, like hamburger will spoil quickly, and should

to our cooler, maximize heat loss, and maximize heat

be eaten as soon as possible; even if kept relatively cool,

storage.To minimize heat gain, we want to keep our

they may spoil in as little as twelve hours.

cooler in the shade to avoid heat gains from sunlight.

We also want to keep it away from hot objects - obvi-

Dairy: Hard cheeses will last a long time at room tem-

ously, you shouldn't put your icebox right next to your

perature. Soft cheeses like cream cheese will spoil more

wood stove. Keep it in the coolest place that you can.

quickly – watch for bad fl avour or mold. Unrefrigerated

Insulation around the cooler is important, since it stops

milk spoils quickly, but sour milk can be used for bak-

heat from getting in to warm the food.

ing, or to make cheeses.

Th ere are a few diff erent techniques to maximize heat

Custard, gravies, creamed foods, chopped meats, poultry

loss. Evaporation is an excellent way to carry heat away

and seafood sandwich fi llings are foods which will spoil

from your cooler, the way that sweat carries heat away

very quickly when brought to room temperature.

from your skin to cool you down. Modern refrigerators

use a fl uid which is evaporated and condensed in pres-

Canned food which has been frozen may still be edible,

surized coils, which is a variation on this basic idea. Heat if it looks and smells good. However, do not taste it!

can also be carried away by conduction, such as by a cool Food from cans which are burst or punctured should not stream in which jars of food are placed, or by cool, moist be eaten. If you do eat food from cans which are suspect earth underground. Adding ice is another way to get rid but probably safe, you should still boil the food for at of heat. Th e ice cools the compartment, and as the ice

least 10 to 20 minutes to avoid botulism.

melts, the draining trickle carries the heat away.

Food Safety Notes:

Maximizing heat storage, within reasonable limits, is

"Safety of Refrigerated Foods After a Power Failure," University of

important to moderate temperature variations that hap-

Florida Institute of Food and Agricultural Sciences, 1997.

pen because of short term changes in weather, like cool

nights and warm days, or because of the opening of a

Water Immersion

cooler door. Cold holes and root cellars use the thermal

A "spring house" is a shed or insulated chest built over or

mass of the earth itself, which absorbs away extra heat.

adjacent to a spring or small, cold stream. Inside, the wa-

We will discuss tools which use all of these approaches.

ter fl ows through a tray, in which you place containers of

food to be kept cold. A similar system could work at the

edge of a cold lake or river - water could be channelled

Without regular, industrial refrigeration, people may be

into the tray, or a covered cage could be securely placed

confused about just how safe diff erent sorts of food are.

in the water. Watertight jars are very helpful in this kind

of cooler. Shade will also help on sunny days.

Smell food to check for spoilage, but remember that

food that smells fi ne isn't necessarily safe.

Cold Room

A cold room is just a room in your house which is kept

Fruits and Vegetables: Do not generally need to be

as cold as possible. It should be on the shady side of the

refrigerated, but should be kept as cool as possible. Ap-

house. I have seen very eff ective, insulated cold rooms

ples and some other fruits release a gas (ethylene) which which have vents that are opened at night to let cold air causes ripening, so many fruits and vegetables will keep

in, and closed in the day to keep warm air out. Th ese

longer if kept separate from apples.

cold rooms can be as eff ective as refrigerators most of the

year in cooler climates, and are much more spacious. An example is illustrated at right.

In-ground Cooling

Root cellars, cold cellars, and cold holes all use the cool-ness of the earth.

A cold hole is simply a well-like tunnel dug down into the earth. Th e sides can be secured with old metal bar-rels, stacked on top of each other with the tops and bottoms removed. The container has a top which closes tightly enough to keep out rodents. And put a deep layer of leaves or straw overtop, to insulate and keep snow off . You may need to

bottoms removed. Th e food is put into a crate or bucket, put boards, a tarp, or chicken wire overtop of the insula-and lowered on a rope into the hole, which is kept cov-

tion to keep it in place.

ered. It can be as little as a few feet deep, or ten or more,

as appropriate. Th e depth of the water table is a limiting If you have access to bales of hay or straw, you can make factor.

a wire or metal box on the ground, to keep out rodents,

and stack square bales around it. You can also line the

A cold cellar, also called a root cellar, is a room built into box with styrofoam or other extra insulation.

the ground often part of a house.

Keep storage fruits and vegetables separate, and they will

Small scale improvised “root cellars” are actually very

last longer. Many vegetables can be stored in root cellars

easy to make. If you have an old refrigerator, you can

including potatoes, carrots, beets, turnips, salsify and

remove the electrical connections (and anything else you parsnips. Diff erent vegetables have diff erent temperature might want to salvage or keep out of the ground) and

and humidity requirements. Please see below. Asterisk

bury it, back side down, in the ground. Leave just a few

(*) means short term storage only.

inches and the door above ground. Th e shelves form

ready-made vegetable storage compartments. For cli-

Cold and Very Moist:

mates with very cold winters, pile straw, leaves, or other

(0-5ºC / 32-40ºF and 90-95% relative humidity)

mulches on top of the “cellar”.

Carrots

Beets

Parsnips

Rutabagas

Turnips

Celery

Any large containers buried in the ground can serve the

Chinese Cabbage

Celeriac

Leeks

same function. Try barrels, or garbage cans. However,

Salsify*

Winter Radishes

Kohlrabi

make sure to keep them away from moisture and pud-

Collards*

Broccoli*

dles, because you don’t want water to seep in and freeze

Horseradish*

Jerusalem Artichokes

Cold and Moist:

(0-5ºC / 32-40F and 80-90% relative humidity)

Potatoes

Cabbage

Apples

Oranges

Grapefruit

Pears

Grapes* (5ºC / 40ºF)

Caulifl ower*

Cool and Moist:

(5-10ºC / 40-50ºF and 85-90% relative humidity)

Cucumbers*

Cantaloupe

Muskmelon

Sweet Peppers* (7-13ºC / 45-55ºF)

Watermelon

Eggplant* (6-10ºC / 50-60ºF)

Ripe Tomatoes*

Cool and Dry:

(0-10ºC /32-50F and 60-70% relative humidity)

Garlic (keeps best around 50% humidity)

Onions

****

Green Soybeans in the Pod*

Moderately Warm and Dry:

(6-10ºC / 50-60ºF and 60-70% relative humidity)

****

Dry Hot Peppers

Pumpkins

****

Sweet Potatoes

Winter Squash

****

Green Tomatoes (as high as 70% humidity)

midity

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Root cellar

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notes:

oot cellar

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An excellent resource is “Root Cellaring: Natural Cold Storage of

Fruits and Vegetables” by Mike and Nancy Bubel.

Ice Caves / Ice Houses

In climates where a signifi cant amount of ice forms in the winter, or even where a decent amount of snow falls, this technique might be applicable. Ice caves and ice houses are designed to stor

e ice from winter for use later on.

Ice caves can be dug into the northern side of hills (in the northern hemisphere), or a very well insulated shed

or shack can be built. In either case, insulation such as straw is put onto the ground and between the blocks

of ice. You may want to provide a drainage channel of some sort for meltwater, depending on your design and

climate conditions.

Historically, ice was usually cut from bodies of water and dragged to the storage space. If you don’t have access to a body of water which freezes over with enough ice, you can pile up snow and walk on it with snowshoes

and boots to tramp it down. Try to compress it as much

as possible, and then leave it for a few hours to solidify. Th en cut blocks and store them as with ice. However,

the compressed snow blocks will not last as long because they are much less dense (any given volume of snow is 90% air), and probably won't be as clean as the ice blocks.

Ice Boxes

An ice box is a simple, insulated box or cooler, into which ice is placed. Th e ice will last longer if there is a tube to drain water away from the ice as it melts. Th e ice usually has a tray or compartment at the top of the cooler, if possible, since the cold air sinks down.

Vapour Pantry / Pot-in-pot Cooler

Th ese two techniques work by evaporative cooling, the same way that sweating cools you down.

You can build a simple vapour pantry by using a (prefer-

ably waterproof) container, such as a small cupboard, or a barrel with an access door cut in the side. Place a tray of water on top of the container. Affi x the edges of several (damp) towels in the tray, and let them hang over the sides of the container. Th e water in the tray will be “wicked” into the towels, keeping them damp.

Th e pot-in-pot fridge was recently adapted and popular-

ized by Mohammed Bah Abba. It's very simple. Place one pot inside a larger pot. Fill the space in between them with wet sand (which is rewetted regularly), and cover the top with a wet cloth. If the outside pot is un-glazed, water can evaporate through it more easily.

Both of these techniques will work best in relatively dry and well ventilated, preferably windy, areas. You can try putting these outside (but in the shade) so that they are exposed to more wind. Alternatively, you can put a device working by evaporation in the wall of your house, so that you can access the food from inside and protect it from scavengers, but let the wind outside help with the cooling.

You can also use a system with two buckets, one full of water, and the other full of food. Th is can be hung from a (shady) tree, with the water bucket on top. A cloth is draped over both buckets, with part of it immersed in the water. It works in much the same way as the fi rst

example above.

Salvaged and Modifi ed Refrigerators

It is possible to modify some refrigeration equipment so that it does not need to run on electricity, but can run directly off of some other motive force. I have seen a chest freezer which runs (quite well) with the compressor running off of a water wheel, using no electricity. However, this wouldn't be appropriate for most people, so I won't go into any more detail here.

Th ere is another type of refrigerator that would be appropriate for salvaging. Th e type of fridge used in RVs does not have any moving parts, and runs on the heat from burning propane or gas. Th is type could be modifi ed to run off of a fi re created by wood, biodigested methane, or any other source of suffi cient heat. A fridge working on this principle could even be solar powered.

For information on RV-type refrigerators (ammonia type) see http://www.nh3tech.org/absorption.html

http://www

or a

book on refrigeration.

Cooling Notes

Th e Encyclopedia of Country Living, by Carla Emery.

Fieldbook for Canadian Scouting, Boy Scouts of Canada, 1986

Cooking

There are a few basic concepts involved in cooking, such as chili, in the haybox before adding other ingredi-and in designing cookers that will cook as rapidly,

ents, since some beans must be boiled for at least 10 to

effi ciently and conveniently as possible. Th ese include

15 minutes to make them safe to eat.

heat gain, heat loss, and heat storage.

Hayboxes can also be used to raise bread or incubate

Heat gain is the heat that actually enters the cooker from yogurt or tempeh. Place a container of hot water in the solar energy, either by direct sunlight, or through the so-haybox to keep the temperature up.

lar energy released by burning wood and other potential

fuels. Heat loss is heat that escapes through the means

You can use a cooler as part of a haybox, but you will

of heat movement discussed above.

probably want to add more insulation. You can make a

For wood cooking, remember that smoke is uncombust-

ed fuel. A very effi cient fi re is almost smokeless, which

means that fuel and trees are being conserved, and that

air pollution is minimized. To make a fi re effi cient, you

want to keep the temperature of the fi re as high as pos-

sible, above 600°C (1100°F). Th is means regulating and

warming the supply of air, if possible. It may also mean

insulating the combustion chamber, and using low-mass

materials for building the stove so that the heat is con-

tained and concentrated.

For cooking in general, you can save a lot of fuel (and

cooking time) by cutting food into small pieces, grind-

ing up grains, pre-soaking dried beans overnight, and

using minimal water. Th e food will cook more quickly if

steamed rather than boiled, because the water will absorb

a lot of the heat. Always use a lid when cooking.

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Hayboxes

A haybox is an insulated container which can make

signifi cant fuel savings - up to 70%! Just bring the food

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to a boil, place the pot inside the haybox, and cover. Th e

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haybox will contain the heat in the food so that it will

continue cooking without using extra fuel. In terms of

our three heat concepts, a haybox works by maximizing

heat storage and minimizing heat loss. A haybox is ideal

for foods with a high water content like soups, stews,

rice, boiled eggs and more. Foods which lose a lot of

steam on the stove can be cooked with less water using a

haybox.

You can precook the beans and legumes in some recipes,

haybox from all sorts of local materials, such as a basket

Effi cient Wood-Burning

fi lled with dried grass and covered with a bag or pillow-

case of dried grass on top.

We can save fuel, trees, time spent gathering wood, and

also reduce air pollution by using fuel effi cient stoves.

Cooking times:

Stove effi ciency is based on two main factors. One, an ef-

Food:

Boil time: Haybox time:

Rice

5 min

1-1.5 hours

fi cient stove converts as much of the energy in the wood

Potatoes

5 min

1-2 h

as possible into heat. Two, an effi cient stove transfers as

Soup and stock

10 min

2-3 h

much of the heat as possible into the food being cooked.

Green Lentils

10 min

3-4 h

If we say that a given stove is 10% effi cient, that means

Pintos

10 min

3 h

10% of the energy in the burning wood goes into the

Split Peas

10 min

2 h

food.

Quinoa

5 min

1.5 h

Millet

5 min

1 h

Not all woodstoves are very effi cient. Some lose enor-

Polenta

1 min

1 h

mous amounts of heat by heating up large metal bodies,

Winter Squash

5 min

1-2 h

which then lose more heat to the ground and air around

Steamed bread

30 min

3 h

them. If you want to boil a 2 kg pot of beans, there is no

Chicken

6 min

2-3 h

need to heat up 300 kilograms of steel as well.

Beef

13 min

3-4 h

We will look at open fi res, which can be between 8%

Haybox Notes:

and 18% effi cient, or better, depending on the skill of

Aprovecho's Guide to Hayboxes and Fireless Cooking, by Peter

the fi re builder, the type of fi re, and the windiness. We

Scott, et al. Aprovecho Research Centre. (Brochure)

will also look at the Winiarski Rocket Stove, which can

Fireless Cooking, by Heidi Kirschner, Madrona Publishers. 1981.

be more than 24% effi cient, and the Dona Justa Stove,

which can be more than 40% effi cient. *Please exercise*

caution and be safe when building fi res or stoves.

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Open Fires

You can also wrap food (such as potatoes) in aluminum

foil, and place them near the fi re, in the coals, or even

Building an open fi re

bury them in the coals of the fi re and cook them over-

To build a fi re, you want to start with very fi ne, dry

night. If you don't have foil, you can cut the ends off of

pieces of fl ammable materials, called "tinder". Th is could two aluminum cans, place the food in one, and then jam include moss, shredded paper, birch or cedar bark, or

the other over as a cover.

wood shavings. Th is material is the easiest to light. On

top of that you loosely stack larger materials, "kindling", Another improvised way of cooking is to make a fi re in such as pencil-diameter sticks and twigs or rolled-up

a pit, and burn it down to a coal bed. You may want to

newspaper. Th en on top of that you put the largest

place rocks inside as well. Cover the coals with a thick

pieces of wood, the "fuel". You can also make a "fuzz-

layer of non-poisonous leaves. Th en put on a layer of the

stick" with your knife by making wood shavings from a

food you want to cook, then another layer of leaves, and

stick, and leaving them attached. In very wet weather,

then dirt or sands as a cover. Th e heat and steam will be

you can split open a log which is dry inside, and make

trapped inside, cooking your food.

"fuzz" from the interior.

Remember, ***never use rocks from a riverbed or other wet***

Th ere are two easy ways to stack the materials when

place **to put in or near your fi re. Th ey may have water**

starting a fi re, "log cabin" or "tipi" style. A log cabin pile trapped inside, which could boil and cause the rocks to has the tinder at the bottom inside, and the kindling

explode.

stacking criss-crossed, as shown. A tipi style has the

sticks leaning into each other, or some with their ends

stuck into the ground for stability. One advantage is that ***Hearth variations***

the sticks will fall into the fi re as it burns. For both types Th e effi ciency of the open fi re drops a lot when it is you need to leave spaces for air fl ow. Firemaking is a skill windy. Th ere are a number of ways to deal with this. You that takes practice, and you'll get better and better at it

can lay two logs down on either side of the fi re, or make

as you do it more.

a "U" shaped hearth with rocks. Wind blowing into the

hearth will feed the fi re with air. You can also dig a shal-

low trench a few feet long, about a foot deep, and wide

Three stone fi re

enough for your pots to straddle the opening.

If you have long logs for fuel, don't waste time and energy sawing or chopping them. Just put three large stones around the fi re to refl ect and retain heat, and then stick the ends of the logs in. As they burn, push them in further and further, until they are gone.

Th ere are a lot of ways to cook on an open fi re. You can place a grill on top, and cook meat or some vegetables. You can place pots or pans on the grill. You can hang pots from a "crane" or "spit". Just drive two forked sticks into the ground, and place another stick between them. If you are more of an expert at building up a coal bed, you can rake the coals out of the fi re, and cook meat or vegetables right on top of them.

In very improvised circumstances, you can make a hole in the ground and line it with some waterproof membrane. Put in water (and food). Th en heat rocks in the fi re and drop them into the water or "stew" so that it boils.

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Fire hole

A bit more elaborate, and probably the best style of fi re

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for high winds, is this fi re hole. Dig a U-shaped hole, as shown, and start a fi re in one end. You can feed in fuel through the other. Place your pot, elevated on sticks to allow air fl ow, over the side with the fi re.

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Effi cient Woodstoves

Th ere are a lot of diff erent designs for improvised stoves out there, some better than others.

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You can make a very simple improvised stove with a

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metal paint can. Remove the lid, and punch several large holes at the bottom of one side and the top of the other.

Turn the side with the holes on the bottom into the

wind, and place your pot on top.

However, there are more effi cient stoves to use. We will

look at two stoves designed by the Aprovecho Research

Center, in Oregon.

Winiarski Rocket Stove

Th e brilliant Rocket Stove was developed by Dr. Larry

Winiarski and the Aprovecho Research Center.

Th is excellent design is a combination of a number of

design principles:

•Insulation around the fi re keeps the fi re burning hot

(above 600°C or 1100°F), which is more effi cient.

•Insulation around the chimney increases the draft,

which provides a constant supply of air.

•Low mass materials are used, so that the heat produced

is absorbed by the food cooking instead of the stove.

•Wood burns at the tip, and wood is shoved into the

tremendously, because it will force the hot gases to rub

fi re, controlling the burn rate and reducing smoke.

against more of the pot, as shown. Th e skirt should be

•Th e air/fuel mixture is controlled, since too much air

about 1 cm from the pot.

will only cool the fi re.

•A skirt around the pot maximizes heat contact and

Starting a Rocket stove is a little bit diff erent from start-

transfer into the food.

ing an open fi re. Try putting your tinder on the shelf,

•Cooking occurs directly on top of the chimney for

igniting it, and then pushing the fuel in.

effi cient heat transfer. Th is is possible because the stove

burns at high temperatures and is nearly smokeless.

Dona Justa Stove

Th e Dona Justa stove is an extension of the rocket stove

Th e Rocket stove design is a very versatile design which

concept, and is another Aprovecho design. It is designed

can be improvised with a variety of diff erent materials.

to be used inside, so there is a long chimney which vents

the (minimal) smoke outside. Th e hot gases from the

Th e heart of the stove is an elbow-shaped, insulated

combustion chamber move up and across the bottom of

combustion chamber. Th e fuel, in the form of sticks or

a metal cooking surface. Th e underside of this passage

narrow pieces of wood (or even tightly rolled-up paper,

is insulated to retain heat. Th e smoke then goes up the

if that's all you have), is fed into the fi re on the shelf, as

chimney and outside.

shown. Th e air enters into the fi re underneath the shelf.

Because the combustion chamber is insulated, the fi re

Th e downside for effi ciency of this stove is that the metal

can get very hot, and burn very effi ciently.

cooking surface will release heat into the air wherever

it is not touching a pot. You can improve the effi ciency

To build a rocket stove, you will need a larger housing

of this stove by making holes in the surface so that the

container, such as a coff ee can. Make a hole to put the

pots can be put into the channel where the hot gases

fuel in through.

travel. Th is contact improves heat transfer. You can build

a form-fi tting channel, as shown, so that the gases are

For the elbow-shaped chamber you can use stove-pipe,

forced to go as tightly as possible against the pots.

scrap metal, or a pair of cans put one into the other. An

improvised can chamber will last for about 3 months.

See the following page for an illustration.

Plastering the inside with castable fi rebrick will improve

the lifespan. A taller chimney will be more smokeless.

However, a shorter chimney will let the fl ame touch the

bottom of the pot, and transfer heat more effi ciently to

Solar cooking

the food.

Heat gain in solar cooking comes from a few main

Place the elbow joint inside of the larger container. You

sources:

may need to place a brick or other material underneath

•Th

e Greenhouse eff ect, where light travels though the

to help keep the placement. Th en fi ll the space between

glass or transparent plastic and hits objects inside, but

the elbow and the housing with fi reproof insulation.

the heat is unable to get back out through the glass.

Th is insulation could include wood ash, vermiculite,

•Glass orientation (glazing) is another consideration.

perlite, pumice rock, dead coral or air-trapping layers of More light will travel though the glass if it is at a right aluminum foil.

angle to the light coming in. Otherwise, part of the light

will refl ect away.

You will need to make a shelf for the fuel wood to put in •Refl ectors direct more light towards the pot or oven.

the elbow joint. You can pound a can fl at, and cut it to

fi t.

Th ere is a wide variety of creative solar collectors for use

in cooking, and I encourage you to check out diff erent

You may want to make a wire grill to place on top of the varieties to see what might work best for you.

housing, to rest the pot on.

Tips for solar cooking:

Adding a metal skirt will also help the heat transfer

•Use dark pots with lids.

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•Don’t open the pot while cooking. Th

e temperature is

lower than other types of cooking, so you don’t need to

stir because sticking and burning is rare.

•Put the food on early, because solar cooking takes longer

than other sorts of cooking.

•Adjust the solar cooker regularly to follow the sun.

If you double the scale of a solar cooker design, you

increase the amount of light captured by a factor of four.

For solar refl ectors, you can use whatever materials you

have available to you. You can paste aluminum foil onto

corrugated cardboard. Make sure that the foil is on

smoothly because wrinkles will impair the focus. Con-

tact cement seems to work well as an adhesive, though

other improvised glues will be covered in future writ-

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ings. You can also use polished sheet aluminum or other polished sheet metals, or aluminized mylar.

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Simple folding solar cooker

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Th is is the simplest, most portable, and lowest temperature cooker of the solar cooker designs here. However, it can be built quickly and easily out of basic materials, and will still work well on brighter days or in brighter latitudes.

If you place a black pot in a clear plastic bag as shown, you will have better heat-retention. A simple wire frame can prevent the bag from touching (and melting) on the pot. It will also keep the pot off of the ground, reducing heat losses from conduction.

Th is solar design (as well as the others) can be used to boil or disinfect water for safety (see Treating Water, p.9)

If you have time and access to materials it might be a good idea to build a larger and more eff ective model.

Solar Oven

Th is is the next simplest design. It requires a small glass pane, which can be salvaged from any number of sources. Th is design is derived from the work of Dr. Maria

Telkes, a 1950's solar pioneer and appropriate technologist.

You'll need to make an insulated box like the one in this illustration. For improvised insulation, you can use alternating layers of aluminum foil and corrugated cardboard. You can also use wood ash, charcoal, etc. Th e top of the box is an angled window, and the back has a door

to access the food. You can use plywood for the main

structure of the box, or any other improvised material.

To decide the ideal angle of the glass for this cooker (and the solar still in the section on water) take your latitude and subtract it from the number 90. Th is is the noontime average annual angle of the sun in the sky. Add 23.5 to get the sun's noontime angle on the summer solstice, and subtract 23.5 to get the sun's noontime angle at winter solstice. Pick the best angle, considering that the glass would ideally be at an angle of 90 degrees to the sun. If you mostly cook in the summer, then you will want to use an angle between your average and summer solstice noon-time angles.

Ideally, the interior of the oven is lined with black-painted metal, to absorb as much light as possible and turn it into heat. Use water-based paint. (Before using your oven, let it “bake” empty in the sun for a couple of days to get rid of harmful gases from the paint.)

Th en mount refl ective panels as shown to refl ect the sunlight into the oven. An angle of about 30 degrees from the sun (or 120 degrees from the glass), as shown, works best.

You’ll want to have a relatively easy way to adjust the position of the collector to follow the sun. Th e oven illustrated is simply mounted on skids. You’ll probably want to adjust it about every 15 minutes or so. Experiment to see what works for you.

Parabolic cooker

Th e parabolic cooker is a bit more complicated, but

works quite eff ectively if you can manage it. You can fry on a parabolic cooker. Here we will look at a few varia-

tions on the basic idea.

Th e basis of the parabolic cooker is the parabola, a curve which, as illustrated, will refl ect incoming parallel rays (such as from the sun) onto a small point. Th is permits very high temperatures to be created. For this reason, there is an important warning: Do not look directly into

the refl ected sunlight. Th is could cause severe eye dam-

age. For safety, make sure to put the focal point inside the cup of the refl ector.

You can draw a parabola using a right-angle as shown

at right, without any knowledge of mathematics. (Geo-

metrically, a parabola is defi ned as a curve on which any point is the same distance from the focal point as it is

from a base line, the “directrix”.) Place the nail where

you would like the focal point to be. Always keep one arm of the right-angle against the nail, and the corner against the baseline. Start with the corner directly below the nail. Move the corner a little bit away from the centre each time, and draw a line from the baseline out towards the edge of the cardboard. Eventually you will have many lines which intersect along a curve. Th is thick composite curve is your parabola.

If you want, you can use the concave (cave-shaped) section of the parabola as a frame template for a collector like the one shown in the top right corner of the illustration on the following page. Th is is appropriate for heating water, or for cooking hot-dogs or shiskabobs.

However, you may get a lot of heat loss from the food being cooked, since it is exposed, and has a lot of surface area. Th is loss can be reduced by sheltering the collector from the wind, and insulating the side of the food facing away from the collector.

If you use the convex section of the parabola, you can rotate it in clay to produce a mold, or make a framework like a spider's web, with radial, parabolic arms, and then curved struts connecting them.

Once you've built your refl ector, you will need to build a base which you can mount it on to rotate the refl ector to follow the sun. You will also need some kind of pot holder, like the grille shown. Also, an alignment indi-

cator (which can be as simple as the circle with a post shown) will help you to line up your parabolic cooker with the sun. Just mount the post at 90° to the cooker. When the post casts no shadow, the collector is properly aligned.

If you make a template out of corrugated cardboard, you can fold it in the middle, as shown in the centre of the illustration, to make a template for a folding parabolic collector. Th is will not be as accurate as a true parabola, but it will probably be good enough for cooking. Lay a piece of aluminized mylar, or other shiny, relatively stiff material (even thin, polished sheet metal) over the template. Cut off the excess and leave tabs for attaching the

other segments, as shown. You can copy the other segments from this original. Make the angle that you fold the template appropriate to the size of material you have

available to you, but make sure that it will divide evenly in a circle. For instance, if you want to make a folding collector with six segments, divide 360° by six (to get

60°) and angle the two halves of the template 60° apart.

For eight segments, use 45°, and so on.

It's worth noting that satellite dishes are also parabolic refl ectors (for radio waves.) So if you can fi nd one of the appropriate size (and especially one which can be adjusted for tracking) you may be able to cover it in refl ective material and use the existing structure.

You can make the parabolic refl ector out of a number of

materials. Th ey don’t have to be aluminum foil - pol-

ished metal will do, and mirror pieces are even better.

In general, collectors larger than 2 metres (6.6 feet)

across are considered unwieldy, but you can manage it if

you have a sturdy mounting and avoid high winds.

If a parabola is too diffi cult, for boiling water you can

also make a simple conical cooker. Cut a shape out of

sheet-metal, or cardboard to glue aluminum foil on to.

Remove 105.5° of the circle. Bring the edges together,

as shown, to form a cone. Th e focus of the collector is

a line along the center of the cone. You can use a black

pipe of water as the container, or make a long black

metal sleeve, and put the kettle in the top.

Solar Cooking References:

www.solarcooking.org

Capturing Heat booklets One and Two, by Dean Still et al,

Aprovecho Research Center. (www.aprovecho.net)

Biodigested Methane

Methane produced by decomposition in a chamber may Please remember that many beans can not be eaten be a suitable source of cooking fuel for some people.

safely without cooking, and that sprouting is only safe if

Essentially, manure, straw, and other organic materials

clean drinking water is used.

with a high energy content are allowed to decompose

under controlled circumstances. It's like composting, but Capturing Heat booklets One and Two, by Dean Still et al, without air.

Aprovecho Research Center.

Th e Aprovecho "Fish Camp" Stove book, by Dean Still.

Th is may be a good option for people who have limited

Th e Aprovecho Research Center website is www.aprovecho.net.

access to fi rewood, but plenty of biomass.

Check out their stove page at http://aprovecho.net/at/atindex.htm.

Fieldbook for Canadian Scouting, Boy Scouts of Canada, 1986

Th e subject is too extensive to cover in this excerpt

Th e Journey to Forever Woodstove page:

booklet, although it will eventually be covered in the full http://journeytoforever.org/at_woodfi re.html book.

Th e Home-Made Stove Archives, at:

http://wings.interfree.it/html/main.html

Cooking Notes

Th e extensive Renewable Energy Policy Project's Biomass Cooking

Th ere are a number of improvised cooking measures that Stoves page: aren't covered here, largely because of their dependence

http://www.repp.org/discussiongroups/resources/stoves/

on petroleum-derived fuels. However, those options can be excellent temporary or emergency measures. Semi-solid fuels like paraffi n, gelled alcohol or "Sterno" cans are safe and easy to use, although they don't generally burn as hot as other sources. You can fi nd gelled, spill-proof fuels in camping or hardware stores, sometimes sold as "Canned Heat," or "Warming Gel," and some "environmentally friendly" products are made from sugar cane by-products. Liquid fuels like denatured alcohols or methyl hydrate can be used relatively safely in impro-vised stoves of a diff erent type than here. You can use a simple shallow cup with a small amount of alcohol for quick burns, or a "plumber's stove," a can fi lled with cotton balls and alcohol. Liquid fuels like kerosene and gasoline *can* be used for fuel, but are volatile and dif-fi cult to use safely, since they can explode, and produce dangerous gases in an enclosed area. For more info on alcohol burning improvised stoves, look at:

http://home.comcast.net/~agmann/stov

http://home.comcast.net/~agmann/sto e/S

v to

e/S v

to es.htm

v

It is also possible to prepare most grains and seeds with-

out cooking them by soaking and sprouting them. Once

the grains sprout they can be eaten raw. All you need is

dried seeds, clean water, and a place to sprout the seeds.

You put the seeds in a screen bag, a jar with a cloth over

the mouth, or even a simple tray. Rinse the seeds in fresh

water several times a day to keep them wet, and let the

excess water drain off . In a few days the seeds will grow

into sprouts. You can fi nd out more about raw foods on

the internet at websites like www

w .living-foods.com

ww

.

Quick Lighting and Heat

Lighting

general historical shape was much like a tea kettle, with

a cotton, hemp, or other fi brous wick coming out the

Oil Lamp

“spout”. Th e oil was poured in through the top. A saucer

can be placed underneath to catch drips. All sorts of oil

Th e oil lamp is a very old form of lighting. Th e original

and fat are used.

oil lamps could be as simple as a cup or bowl fi lled par-

tially with oil, with a wick to soak up the oil. Th e wick

You can also make a relatively safe improvised oil lamp

can be as simple as a piece of twisted moss. More wicks

like the one shown, derived from a design in Cresson

mean more light.

Kearney's Nuclear War Survival Skills (available online

at: http://www.oism.org/nwss/).

You can use pottery to make more complex shapes. Th e

Some sources suggest that olive oil and sunfl ower oil

are the best vegetable oils for lamps, and corn oil is the

worst.

Candles

For a long time, Europeans made tallow candles for

their lighting. Tallow is simply rendered animal fat (fat

with meat and other impurities removed by melting and

straining). To render fat, the fatty animal tissue is boiled,

and then cooled. A layer of fat forms on the surface of

the water, which is scooped off and used for fuel. To remove all impurities, you may need to boil the fat/water mixture, strain it and then boil again repeatedly. After the mixture has been boiled, let it sit and cool. If you can get it cold enough, the fat will solidify and you can remove it in a block, and pick off any remaining meat from the bottom. Keep in mind that overheated fat may catch fi re. Watch the rendering fat at all times, do not

overheat, and keep a tight-fi tting lid nearby to contain

and extinguish the fi re in an emergency.

Th en, wicks are dipped in and out of a heated vat of tallow. Historically, this was smelly, unpleasant, and diffi cult. It could take 50 coats to make a decent-sized candle. Molds are easier, but more expensive.

Compared to modern paraffi n (petroleum derived) candles, tallow candles smell bad, sputter and drip, produce sooty smoke, don’t burn for very long and melt easily at a low temperature (around 27°C or 80°F).

European colonists in North America found that bayber-

ry or wax myrtle could be boiled to obtain wax, which

had a preferable smell and could be added to the mix.

Adding wild ginger and other spices also help.

Beeswax candles are preferable in smell and longevity,

but it is diffi cult to get large amounts of wax.

Can you improvise an oil lamp or candle out of materials

that you can fi nd in your home? What oils do you fi nd

To get larger amounts of lighting you can put a number work best? Would these oils be more valuable for food of candles in the dirt in a fl owerpot, with a refl ector on

and cooking or for lighting? What materials work best

one side. A plastic fl owerpot is lighter, but also more

for the wick? Is the smoke produced excessive or sooty?

likely to melt or burn if the fl ame touches it.

How can changing the wick or confi guration improve

those properties? What works well as a refl ector? Experi-

Rush Light

ment and have fun. Let us know what you fi nd out.

Another option for lighting is the “rush light.” Rushes

As the culmination of these exercises, try taping all of

are picked, and the husks removed to leave the soft inner the lightswitches in your house in the “off ” position for pith, which is dipped in melted fat. Th e rush lights burn a week. Use only refl

ected sunlight during the day, and very quickly.

only home-produced candles or oil lamps at night. How

does this change your daily routine? Are there some tasks

Buddy Burner

which you can only do during the day? Do you go to

bed and get up earlier? Does it aff ect how you feel?

Th e “Buddy Burner” is a simple improvised candle or

Caution: Please do not burn yourself or your house

stove, which can be used for lighting or for heat. Th e

down while doing this. Candles or oil lamps should not

housing is a tuna can or similar container, with a card-

be left burning unattended. Not only is it dangerous, but

board spiral inside. Melted paraffi n, or other fat, is

it’s a waste of wax, oil, and your working energy.

poured in to saturate the cardboard. Once it is burning,

more fat or wax can be put on top, which will then melt ***Lighting Notes***

and burn as well. Place this burner on the ground or on

Obviously, for most cases a fl ashlight would be safer and

a hot-pad, since the container will get quite hot when

simpler, although not as long lasting in some cases. You

the contents are mostly burned away. Placing a wick in

can buy fl ashlights that charge by solar power, cranking

the centre may help it to get started. Th is is an excellent

or shaking, which are suitable for off -the-grid use. You

way to burn up the ends or drippings of other candles

can also make a fairly simple improvised electrical system

without having to make whole new candles.

out of car parts and scavenged household electronics, but

that is an extensive topic for later writings.

Refl ectors

Heating

In all of these cases, refl ectors can be used to direct more

usable light onto the desired area. Refl ectors don't neces- We'll look extensively at this topic in writings on shelter.

sarily have to be shiny or mirrored, only light-coloured.

Refl ectors are also a good, simple way of getting more

In the mean time, though, you can use a Dona Justa

light indoors. At my home in the winter, sunlight refl ects or other effi cient, improvised stove to heat your house.

off of the white snow, and then up through the windows You can replace a window with a metal sheet, and run and off the white ceiling, and very deep into the house.

the stovepipe through it. However, if you burn anything

During the day in winter, it is just as bright as it is in the larger than candles in your house, make sure to provide summer, without any source of artifi cial light.

adequate ventilation. Try opening a window a crack on

each side of the room, to avoid carbon monoxide poi-

soning. If you feel drowsy or have a headache, your body

Improvisation Exercises

could be warning you of inadequate ventilation.

Assuming you live in a house, do you need to use artifi -

cial lighting in your house during the day? If you were

When using a fi re, someone should always stay awake

making candles for all lighting yourself, you would prob- to make sure that it does not get out of hand, and that ably want to save energy by only using them at night.

ventilation is adequate. Keep fi re-fi ghting materials at

Can you set up your workspace, position refl ectors or

hand, such as buckets of water or sand, baking soda, salt,

paint surfaces white, so that you don't need to use artifi -

a heavy blanket or tarp, or a chemical fi re extinguisher.

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Wear as much extra clothing as you need, and use extra

blankets on your bed. Sleep close to other people and

animals.

You can also make "thermal curtains", which are essen-

tially thick blankets, to put over your windows. You can

also put layers of plastic over your windows to have the

same eff ect. Th is will reduce heat loss, especially at night.

Try to fi nd drafts and block them, but do *not* make y

not

our

house air tight. You want to be able to regulate ventila-

tion, but you need air to circulate to remove carbon

dioxide and other gases that might build up and become

toxic.

Choose one room to concentrate the heat in, and close off the others. You can use partitions made out of blankets, drapes, cardboard, plywood or several layers of plastic sheeting. Choose a room on the side of the house away from prevailing wind, and one that is well insulated and has few or small windows. An interior bathroom may work well, unless you are using a stove, in which case you need a window to vent. A basement may be a good choice, since the earth is somewhat warmer than the surface air in winter, and has an insulating eff ect.

If you do live in a cold climate, and have to go without a heated house, you will gradually get used to it. Th e colder temperatures will become more comfortable. (After spending six weeks in tents on a mountainside late one winter, "room temperature" in houses started to feel scorching hot to me.)

In cold weather, make sure that you get enough water. Cold air is relatively dry, and you may not be aware that you are becoming dehydrated. If you are slightly dehydrated, your metabolism slows signifi cantly.

You will probably need to eat more fat and calories as well, to ensure that your body has enough energy to keep itself warm.

Heating Notes

“Staying Warm in an Unheated House: Coping With a Power

Outage in Winter,” University of Wisconsin Extension, 1996.

Th e Encyclopedia of Country Living, by Carla Emery.

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Rubbish

Garbage and Recycling

steel can be recycled into more machines, or made along

with glass into containers to bring the products of global

Collection

industrial agriculture to the homes of “consumers”.

If you’re in a rural area you may already have to get your Is it really in our best interests to make anything easier own garbage and recyclables to the dump. But if you’re

for civilization than it needs to be? Do we really want to

like most people in the industrialized world, you’re an

give it some of the few resources that we have under our

urban dweller, and your garbage is picked up and taken

control? Th ese are challenging questions.

away on a regular basis.

In any case, you have plenty of options to reuse materials

Th ere are a lot of events that could disrupt that service.

that you would otherwise recycle industrially. Th is is a

Industrial and economic collapse are obviously big ones, topic that will be covered in depth in later writings, un-but strikes are not uncommon either. A long-term col-

der the subject of what I like to call “Remnant Resourc-

lapse in garbage collection would probably happen at the es”—resources that industrial society

produced, but can same time as a collapse in the consumption of disposable not be produced by ecological and egalitarian commu-items, so this may not be much of a problem for some

nities. Th ese are resources that are around for now, but

people. However, it's still relevant for the present time.

will eventually run out because of use and degradation.

In the mean time, here are some suggestions for how to

I actually have pretty mixed feelings about recycling as it handle diff erent materials: is. One major problem is the fact that some people who

recycle think that it is all that they could be expected to

Organics

do: "I recycle, I help the environment, what more can

Kitchen scraps and other organic materials can be com-

you ask of me?" However, recycling barely diminishes

posted to add to your garden, or simply returned to the

the negative eff ects of industrial civilization. In fact, by

earth.

providing a cheap source of refi ned metals, pulp, glass

and plastics, recycling increases the effi ciency and the

Plastics

longevity of civilization.

Plastic jars and bottles can, of course, be reused as

containers. As described in the Solar Disinfection and

I think one of the primary characteristics of civiliza-

Water Storage sections, PETE and HDPE containers are

tion is its tendency to extract and centralize resources.

preferred for food and water storage.

Centralized resources can be controlled, defended and

manipulated more easily than distributed resources. Th e Plastic pop bottles, the large ones in particular, can be centralization is necessary in a machine culture—an in-used as irrigation systems for your garden. Tammy T.

dustrial society—because high concentrations of resourc- suggests poking about twenty small holes in a pop bottle es are required to feed the ravenous machines. Distrib-and burying it so that only the mouth is visible. You can

uted resources are fi ne for living creatures, because living bury them every few feet or so, depending on your soil creatures adapt to the conditions wherever they are.

and climate. Th en you can fi ll them up (with a funnel

if it helps) every few days, and the water will gradually

Resources are redistributed in a controlled way through

trickle directly to the roots of the plants.

consumables. Many modern consumables are intention-

ally designed to be non-reusable, and to have disposable Unfortunately, Tammy notes, plastic milk jugs are not packaging to increase consumption. Th ese resources

well suited for this or other long-term storage uses. Th ey

are recentralized for civilization by recycling collection.

tend to become cracked and brittle in about six months.

Th is provides an extra supply of raw resources which can

be used. Th e paper can be recycled into propaganda to

Plastic shopping bags are present in incredible numbers,

rationalize the actions and beliefs of those in power. Th e and if allowed to blow into the wild they are a menace.

However, they can be very useful for carrying things

use only papers printed with black and white, soy-based

while they are intact. Th ey can also be cut down the

inks. Colour inks and other types of ink include toxins

sides and included in shelter or clothing as improvised

that you don't want to introduce to the soil. Layers of

water-proofi ng or vapour barrier. Melting shopping bags corrugated cardboard can make a decent insulation, with a fl ame will give an improvised hot glue, and can

as do layers of newspaper stuff ed into your clothing,

also be used as improvised caulking. For instance, they

though both are fl ammable.

can be used to seal the openings around pipes in the bar-

rel of the slow sand fi lter described in the water section.

Polycoat

Th ey can also be made into cordage.

Tetrapaks and other modern packaging often consists of

multiple layers of plastic, foil, and paper, called "poly-

However, if there is any other option, styrofoam and

coat". Th is can be diffi cult to deal with. You are best off

plastics should not be burned. In many cases, their burn- trying to reuse the containers. However, many people I ing releases a variety of toxic chemicals, including dioxin. know simply burn off the plastic and paper, and fi sh the So, while burning plastic rubbish is a way of getting rid

foil out of the ashes.

of plastic where you are, it simply spreads the pollution

into the air and water, where it can not be contained. If

certain plastics are no longer useful, put them in a dry,

out-of-the-way place and store them indefi nitely. (Better but more complex solutions than this will be discussed in later writings.) One situation where it may be appropriate to incinerate plastics is to dispose of very contagious medical waste. However, *never burn plastic inside or in a poorly ventilated area*, as the gases produced are harmful.

Metal

Steel cans can be reused for any number of purposes. Th ey can be made into cooking stoves, pots, drinking and storage containers. If you have no aluminum foil, you can cut the tops off of two cans, place cut vegetables inside of them, jam them together, and cook the container in the fi re. Th e non-enameled types may rust over time, depending on storage conditions. However, aluminum cans, including most beer cans, will not rust. Th us they are good for storing water. Slit down the side and fl attened out, they can be used as waterproof, long-lasting improvised shingles.

Glass

Glass jars and bottles can be used, of course, as containers, and will last a long time. Th ick glass can be used for knapping (chipping to create arrow-heads or other tools).

Paper and Cardboard

Paper and cardboard can be used for fuel for your stove.

Th ey can also be used for mulching and composting, but

