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A DISPOSABLE BATTERY STOCKPILING PLAN

SUMMARY

Disposable batteries will be needed for several important purposes in an emergency situation, including safe lighting. NICAD batteries are unsuited for this role. A modest stock of disposable batteries can easily be maintained in a household, increasing emergency preparedness and perhaps even reducing the cost of operation of battery-operated appliances and toys during normal circumstances. A description of a stockpiling plan is provided.

WHAT DO WE DO WITH BATTERIES IN AN EMERGENCY?

For the purposes of our discussion we will define an emergency as a loss of public utility power for a period of greater than 48 hours, or less than 48 hours when combined with some other problem such as fire, flood, severe weather, civil disorder, etc. 48 hours without electricity may not seem like that long to you, but if it is associated with loss of heat in wintertime, or the spoilage of all refrigerated foods and loss of water supply anytime, then perhaps you can begin to imagine the difficulties of maintaining a household under these circumstances.

Batteries cannot by any means solve all your problems under these conditions, but they can help. A battery-powered radio will allow monitoring of weather reports and other valuable information about the situation. *(Aside: Back in the old days, the nation's telephone system was run by a monopoly. One of the things the monopoly's management saw fit to do was construct the nation's telephone system in a way that would resist damage in an emergency, even including nuclear attack. Most of us have had the experience of finding telephones still working during a power outage in the past. Now that even local telephone service is being privatized, this reliability in time of crisis may or may not survive in your neighborhood depending on local utility regulations and the impact of decisions made by the private telephone company managers. Your ability to obtain information via a functioning radio will become more important if your telephone is out too, and of course your TV won't help either.)*

Most importantly, in order to deal with the many problems you will face coping with an emergency, you will need to see what you're doing. For this you will need light, and the humble flashlight now becomes a vital necessity. Repairing damaged shelters, water supplies and vehicles, securing potentially dangerous items upset by the emergency such as natural or propane gas supplies, first aid, and a host of other important tasks cannot be performed in the dark without light.

In our emergency we might not find that it is practical to just jump in our car and drive down to the Wal-Mart and buy some more batteries as we might under normal conditions, even if after the emergency arrives Wal-Mart still has any in stock. This means that when the lights go out, you're probably going to have to work with what you've got on hand. If what you've got on hand is old, corroded, or just plain not enough, then you have to do your work in the dark, not at all, or at least without flashlights.

This brings us to our next topic, which is safety. Battery-powered flashlights (and radios and most other battery-powered devices) are very safe. Unless you put them in a campfire or trash fire, they don't explode, they don't release poisonous gases, and I've never heard of disposable batteries starting a fire. This is in direct contrast to lanterns, which produce light by burning some kind of liquid fuel.

If you have such a lantern, and you find that it has become your only source of light, the temptation to use it where it shouldn't be used (such as indoors or near gas that may be spilled near a vehicle needing repairs) will become very strong. If you or a duller-witted member of your family or group yields to this temptation, the potential for your problems multiplying goes up drastically.

Putting out a gasoline fire inside your house or garage is bad enough. Doing so in the dark, with no water pressure, dead telephones, and unavailable or completely overloaded emergency responders will be much worse. Most likely you will have succeeded in making the transition from people coping with an emergency to disaster victims.

By the way, engineers call disposable batteries *primary* batteries, which of course distinguishes them from *secondary* batteries (rechargeables).

THE PROBLEM WITH NICADS

(OR, "But I'VE got RECHARGEABLES! I don't even need to worry!")

Perhaps you are one of those people who likes lots of battery powered stuff in their life, and not wanting to spend lots of money on batteries, decided that the solution was NICAD (rechargeable) batteries. Perhaps you have managed to save a "couple of bucks" over the years with your NICADS but there is a problem from the perspective of emergency preparedness.

The problem is that in a power outage you can't recharge your NICADS. The most cost effective way to use NICADS is to minimize the number you use with each of your battery-powered devices, and not use disposables at all. If you follow this strategy you'll find that when the balloon goes up the amount of usable time available on each of your devices is limited to the charge on the set of NICADS you have for it (and perhaps the battery pack you keep for swap-out). The usage you'll get from each set of NICADS is less than you would get from even an inexpensive set of disposables, and once it's used up, you're done.

Of course, in peacetime this isn't a problem – you probably don't use a whole charge in a day's activities, and at quitting time you plug'em back in to charge and next morning they're ready to go again. In an emergency this won't work unless you also have a generator set or some other means of recharging. Such strategies are great if you wish to invest the time and money to pursue them but they go beyond the scope of the simple strategy described in this article.

The point about NICADS is that in a power outage lasting more than a day, you may exhaust them. Then as the crisis lengthens, probably when you need battery juice the most, you're out. The lesson: Don't plan on powering your "critical" emergency tools (flashlights, lanterns, radios, radiation survey meters, whatever) during an emergency with NICADS.

You say you've got a solar panel array/generator set/personal hydropower station/automobile power AC inverter/you-name-it, and by gum yer gonna keep on recharging yer NICADS for years after the complete collapse of Western Civilization? More power to you, knock yourself out – don't let my thoughts here stop you. Bear in mind that in any event NICADS have a service lifetime of only about 5 years, after which they'll lose the ability to hold a charge and you'll be

back to using alkalines again (if you can find them). Additionally, wonderful as all that gear may be, it's complicated and therefore subject to failure even under good conditions, much less an emergency. I would keep a stock of disposables anyway, just in case – the cost compared to a genset is small.

Enough about NICADs.

WHAT BATTERIES SHOULD I HAVE?

There's a seemingly bewildering array of batteries at the store. To stockpile batteries cost-effectively, we've got to sort through it all. We want to get the most use for the least bucks. Fortunately, you don't have to be an electrical engineer or a chemist to get good value for your dollar, or even a personal computer expert. Buying batteries is in fact just like buying milk: there are different shapes, different brands, and different flavors, but that's about it. Success is defined as buying a brand you trust, in the flavor you want, in the shape that you need at the lowest available price, whether you're buying milk or batteries.

THE FLAVORS: Just like milk comes in whole, 2%, 1%, and SKIM flavors, batteries come in flavors too. The most common right now are alkaline and zinc-chloride.

You've never heard of zinc-chloride batteries? No sweat. Zinc-chloride technology (or zinc-carbon-zinc chloride heavy duty Leclanche cell, if you want to sound like a geek) is what you're looking at when you go to the Tots'yurR'Busted toy store and see batteries labeled HEAVY DUTY, or something like that. Panasonic, Eveready, and Ray-o-Vac all make products in this category, and probably other folks too. (Hint: Don't ask the clerk for zinc-chloride at the fertilizer store). Zinc-chloride has improved over the years, and the manufacturers now claim a shelf life of 4 years from date of manufacture. My own experience is that if you wait that long, some portion of the batteries will be dead right out of the box, though others from the self same box will still be quite peppy. Such is life.

Alkaline batteries are very popular, even though they're not necessarily the best deal (you can amaze your friends by repeating the true statement "Alkaline batteries are based on a manganese dioxide, zinc, and caustic potassium hydroxide-zinc oxide electrolyte technology"). All the brands make an alkaline battery, and usually they're plainly labeled as alkaline, though Eveready calls theirs "Energizer". From a purely performance perspective, alkalines would seem to be the perfect solution. They have the longest shelf life, most "oomph" (ability to work under heavy loads), and last somewheres around twice as long (or longer, if you believe the claims of the manufacturers) as zinc-chlorides doing similar work. The shelf life of alkalines is now up around five years from date of manufacture, long enough to allow efficient stockpiling. This may be just bad luck on my part, but I also find them more prone to leakage than zinc-chlorides.

If you look carefully at the prices while you're at a store, you'll notice that if you keep everything else the same (brand, shape, number of batteries in the package) typically alkaline batteries cost about twice as much as zinc-chlorides. Zinc-chloride based batteries don't have as much "oomph" (an electrical engineer would say they become less efficient at high load currents) as alkalines. Most importantly they just plain don't have as much life. The rule of thumb that I use is that a zinc-chloride battery will last about half as long as an alkaline battery under similarly circumstances, so it contains about half as much "value". Interestingly, this means that if at a given store at (which is often the case), *then a given amount of money spent on either will purchase about the same value* (because for a given amount of money you can buy TWICE as many zinc-chlorides as alkalines). Chew on that the next time you're in a reflective mood.

Other facts to ponder when deciding between “Heavy Duty” (zinc-chloride) and alkaline: In an ideal world, alkalines would always be the best choice because they probably do last longer than twice what a zinc-chloride would. Frequently (especially if you live in a house with kids or a non-battery-conscious spouse) the leading cause of battery exhaustion is that somebody flipped the darn flashlight (or whatever) on, forgot it, and walked away. In this circumstance it doesn't matter what kind of batteries were in there, by the time you get to them they will be dead as doornails; hopefully they won't have burst. But assuming the batteries were fresh when you started, the loss with zinc-chlorides is *half* of what it would have been with alkalines, because the zinc-chlorides were only worth half as much to begin with. So your losses in this case are reduced with the zinc-chloride batteries.

Some notes on other and exotic flavors: Carbon-zinc batteries (or the zinc-carbon-ammonium chloride Lecianche cell, as the geeks refer to it) were what Grandpa was always swearing about being dead back in the 60's, because their service and shelf lives were so short they were invariably dead and frequently leaking. Eveready, Panasonic, and a few others still make these under the description “General Purpose,” hopefully with an improved shelf life characteristic. They are now seen infrequently and I have never seen them at a price lower than our friends the zinc-chlorides, which means they are a poor value and have no place in our stockpile.

Panasonic also markets a product they call an “Extra Heavy Duty”. According to their literature, it has slightly longer life (geek speak: “better discharge characteristics”) than their plain Heavy Duty (zinc-chloride). They also say it's more leak resistant than their alkalines or regular plain Heavy Duty's. In the unlikely event you should meet them on a store shelf that entitles them to a small price premium I suppose. I would emphasize “small”.

Then there are *lithium* batteries (I won't try to give the scientific description, there's too many different lithium chemistries). Now we've entered the battery equivalent of high earth orbit. Lithium chemistry batteries have just started to enter the traditional flashlight and transistor radio arena. Eveready makes lithium “AA” cells under the “Energizer” name labeled “high energy lithium.” Kodak (the camera people) makes a 9-volt lithium battery under their “Ultralife” name. You can think of lithiums loosely as relating to alkalines the way alkalines relate to zinc-chlorides. They have great shelf life (10 years, according to the Ultralife literature) and can last up to 4 times longer than alkalines. They also have a wider operating temperature range and weigh in at about the same as zinc-chlorides (if you care). You're gonna pay, of course, for these virtues: about 3-8 times as much as alkalines.

THE SHAPES: You actually already know these: Most consumer gizmos sold in the U.S. today use size “D”, “C”, “AA”, “AAA”, or “9V” batteries, you've seen'em all a million times, and that's pretty much it. You may have a lantern that takes 6 volt lantern batteries, but all the stuff so far about battery chemistry and storage applies equally to them.

THE BRANDS: The most common brands that I find in stores are DURACELL, EVEREADY, RAY-O-VAC, and PANASONIC. No doubt you will encounter some of these in your travels, and others as well. Radio Shack has a store brand, which they probably have made for them by a battery manufacturer of their choosing.

Duracell is the biggest producer of alkaline batteries worldwide, with nearly 50% of the U.S. market share in that category to itself. I have had poor luck with Duracell. Their product is heavily advertised, and carries a premium price compared to other brands, at least where I live. The Duracell advertising implies that their batteries last longer than other brands. Perhaps it's even true to some small extent, but *personally* can't imagine it's worth the 100% or more price premium given that most alkaline battery chemistries are similar. I have also had Duracells start to leak, even when the flashlight was stored at room temperature and appeared to be working. If I had had more experience

with battery companies at the time I would have attempted to return the flashlight to Duracell for credit, but I didn't. If you can get Duracells economically where you are and have good luck with them, great. These days I just don't buy them unless they're the only brand available.

Eveready has been around making batteries for as long as I can remember. These days they are a division of Ralston-Purina, the dog food people. I have had good luck using them when I have had occasion to, but I can usually find one of the other brands on sale cheaper. Maybe this is because Eveready, like Duracell, has a large advertising budget they must cover. I've never tried to return a battery-damaged product to Eveready, because I've never had one of their batteries leak.

Ray-o-Vac is another old battery company that's been around forever. I've used hundreds of Ray-o-Vac "D" cells with decent luck. Some of them have leaked on me when they were exposed to cold temperatures with a partial charge. Ray-o-Vac replaced the damaged flashlights promptly without a squawk; I've never sent anything costly back to them, so I can't say how they would react to that. Ray-o-Vac has the advantage of being the brand I see on sale at the big discount stores most often, and that (especially combined with a factory rebate program if one is running) frequently gives them a big price advantage. I routinely use these sales to stock up, sometimes with discounts of 50% (or effectively even more with rebates).

Panasonic is a division of the giant Japanese industrial conglomerate Matsushita (pronounced "Mat-shoe-stuh"). I have never seen Panasonic brand batteries advertised, but they are frequently seen at discount stores and convenience stores nonetheless, often at very favorable prices (especially if combined with a factory rebate). Over the years I've used hundreds of them, especially "AA"s and had very good luck with them as far as leaking goes. This past summer I had a set of partially discharged (but not exhausted) Panasonic Heavy Duty "AA"s leak in a big way into a tired and battered old radio receiver that was under the seat of my truck during some hot (but not blistering) weather. I returned it to Panasonic along with the batteries and an explanation. To my astonishment they eventually refunded my entire original purchase price on the receiver, which was \$150.

MAKING & EXECUTING A PLAN

Now to the crux of the matter. To formulate what to put in your battery stockpile, the first thing you have to do is figure out what battery-powered items would be really important to you in an emergency. Then make a list of all the different types of batteries they use. Suppose, for example, that you had three different flashlights, but they all use "D" cells, and two different radios that use "AA" cells. Then the only battery types on your list are "D" and "AA".

Now make an estimate of how many batteries in each of these types you might use altogether in a typical year, *including* all your non-emergency devices. Initially you'll just be making an educated guess, but that will do for a start. Consider whether or not you typically use alkaline or zinc-chloride.

Watch for a sale or just a good price on these batteries, and buy a two-year supply based on your estimate of your ordinary annual usage. When price shopping, consider the advantages and disadvantages of the various battery chemistries, and always consider the cost per battery for a given package. Usually, the more batteries in the package, the lower the per battery cost. Until you really get the hang of it, you may want to battery shop with a calculator in hand. Don't forget to look at the date codes; you want expiration dates as far away as possible, at least three years. Panasonic stamps its date codes right on the batteries in such fine print you may need a magnifying glass to see them.

Having made your initial purchase, you have accomplished two things. One, you now have your emergency stockpile, and two, you just purchased all the batteries you're likely to need (at least of the types you bought) for the next two years at a good price.

Then go ahead and use the batteries as you normally would to replace those that get exhausted, *including* use in non-emergency items like toys. After a year, check how your actual usage matched your planned usage, and replenish your stockpile to replace the consumed batteries. Even if you overestimated your usage, by planning for a two-year supply you'll probably still manage to use all the batteries you bought before they expire in three to five years.

Supplying non-emergency items like toys and portable cassette decks from your stockpile, and then replenishing it every year or so allows you to turn over your inventory and keep it fresh. This is important, because a stockpile of batteries that were fresh six years ago ain't worth much (unless you sprung for lithium!).

Obviously practicing FIFO (first in, first out), that is, using the oldest batteries first, will be helpful in keeping your stockpile fresh. This is another reason why the date codes are important.

As time goes by and you get a better handle on your battery usage, you may want to increase your stockpile to a 3-year (or ever more) level. Obviously, the more batteries you have, the longer you can continue to function in an emergency. As long as your stockpile never gets so big that you won't use it all before the batteries expire, your stockpile plan is actually saving you money because you are only buying batteries at favorable prices in advance of when you actually need them.

A drawer works OK as a stockpile location. According to my friends at a certain state emergency management agency (they deal with enormous numbers of batteries for all their radiation survey meters) a refrigerator is even better, if you have room in it, because the cold helps hold off that actual day of expiration (a nerd would say it reduces the self-discharge rate).

If, like me, you have a device that you would like to have fresh batteries for in an emergency, but whose battery type is one you don't use at all under normal circumstances, then your only choice is to decide what the minimum number of batteries you could do with in an emergency is for that device and buy them. You then must resign yourself to the fact that if life remains without emergencies, you'll just have to throw them away when they expire and replace them every 3-5 years.

That's it. Now you have all the necessary intellectual tools in hand to successfully manage your own, forever fresh, convenient, cost-saving, emergency battery stockpile.

OTHER BATTERY LORE & KNOWLEDGE

One thing you don't want to do is inadvertently store exhausted batteries. You can put a battery in the device you normally use it in and then see how it works, but judging how much life there is left in the battery based on that criteria alone is tricky.

If you're ready to start getting gung-ho about batteries, you can go to Radio Shack and buy a battery tester. They have several models. I bought Radio Shack cat. No. 22-096 which has a little meter to give an indication of relative change. It was \$10, a coupla years back, and tests almost all the batteries we've discussed.

(Note for geeks & nerds: the battery testers are much superior to a simple voltmeter, because the tester checks the batteries under load. To a voltmeter, even a very tired battery can still look fresh

because it can only measure the no-load voltage. You'll probably want to build your own battery load tester anyway.)

In general, temperature extremes are hard on batteries. You will find that partially discharged batteries will leak when exposed to temperature extremes. Cars are a big culprit here.

I keep flashlights in all the family trucks as emergency items. Since freezing wintertime temperatures in New England will make partially discharged batteries leak, I use only previously unused batteries straight from the stockpile, and tell my spouse the lights are only to be used when they're really needed. After a year's "tour of duty" on the vehicles, the next stop is the kid's toys or my daily use Mag-Lite, then into the disposal bin when they're kaput.

Exhausted batteries WILL leak sooner or later – the only question is when. If you know or suspect they're dead, get them OUT of your personal GPS system (or whatever costly gizmo it is) immediately, and put them someplace where they can leak without causing damage.

If an item is used infrequently, don't store it loaded with batteries. If you do, then the inevitable result will be you'll go to use it one day (hopefully not in an emergency) and it will be completely consumed by corrosion from one or more leaking batteries. Store it without the batteries. If trouble is coming, you've got the batteries, and the item is serviceable, you'll have time to put batteries in it and light it up.

CONCLUSION

I hope you have found this little treatise on the humble, common flashlight battery helpful. I have tried to put down everything I have learned over the past half dozen years or so regarding flashlight batteries that might be useful.

When the next Big One hits, I don't wanna hear any of you cursing the dark. Not for a few weeks anyway.

Happy stockpiling!