

# Emergency Electric Lighting

Electric lighting has several advantages over other types, and some drawbacks. It's more portable and safer than fire based light. It can be extremely light weight and reliable. It's major drawback is the requirement of a power source. The most portable and available power source we currently have on the market is the traditional battery.

## Emergency Lights

Light role	Minimum Recommended	Recommended
EDC	1 per kit	1 per person and kit with spares
Low Level	2 per family	2 per family with spares
Thrower	1 per family	1 per adult
Headlamps	1 per family	1 per adult
Small Lantern	1 per family	2-3 per family
Large Lantern	1 per family	2-3 per family

**Note**, some lights can serve in more than one role. Especially multi-level adjustable lights.

**EDC** Short for **Every Day Carry**. These lights should be small enough that you won't mind carrying it around everywhere with you. You never know when you might need a light in an emergency. There will likely be no power and having a flashlight on you will give you additional flexibility in where you can go and when. You don't need to always always have it with you, but it's nice to have that option. Ideally it will run off a single cell, or two small cells. Having a bright mode is nice, but not essential, it can be just a low mode light, or just a high mode light. This light can also be multi role, act as a low-level light and a thrower, maybe even a lantern when standing on it's tail indoors. There are some nice lights out there but they can get expensive quick. If you use flashlights be sure to use krypton or halogen light bulbs in them because they last much longer and give off several times more light than regular flashlight bulbs on the same energy consumption. Store at least two or three extra bulbs in a place where they will not be crushed or broken.

**Low Level** This light is what you can get away with when traveling through known territory, around camp, through your house, a night trip to the outhouse/latrine, reading at home base. Conserves batteries, last a long time. Size is probably not important. This is probably the role that will see the most use, this is the easiest to find and is also the most important.

**Thrower** This is your big light. You may need it for search and rescue, a security patrol around a camp site, illuminating an area a long distance away (hence the name, it “throws” light far). It probably won’t be in use every day, and it will eat batteries fast so you wouldn’t want to run it all the time anyway. It’s likely to be a larger light and only carried when a need is anticipated. Probably the least important, but when you need it you need it.

**Headlamp** This light will be used for night work or work in the dark where you need both hands free. If you’ve ever tried to do the dishes by hand, without power, or any other such similar task you will quickly appreciate what a headlamp can do for you. You may not have the ability to ask someone to hold a flashlight for you as you accomplish a task. It should be reasonably small and use small batteries. It is possible to rig up a flashlight to perform this role, for example, an EDC and a holder for it in a hat. A lantern can also perform this role to a degree, however, an actual headlamp still is a good idea.

**Small Lantern** Sometimes you need to light up a room to socialize or you need a small light to read by. It mostly gives light to a small group of people. Other possibilities are using a flashlight in “candle mode”, which is either with the bezel off the light exposing the lamp or just standing the flashlight on it’s tail and letting the light reflect off the ceiling.

**Large Lantern** When more light is required than a small lantern provides, allows a group of people to have light in a small, usually stationary, place. Eating a meal at night, or socializing would be good examples.

## **Types of lamps for lights**

**Incandescent/Halogen/Krypton.** These are not recommended for general flashlight use. They are not very durable, prone to break easily – especially when dropped. They are inefficient, consume batteries rapidly and generally get dim quite quickly with use. Really, they are only suitable for use in a thrower type of light, and even then, should probably be avoided due to their fragility.

**LED ( Light Emitting Diode)** These are excellent for most all uses, more efficient than incandescent/halogen bulbs. Highly durable and only get more efficient as batteries deplete. You get

what you pay for with these lights, really nice flashlights can be had. Do some research and get what fits inside your budget and meets your needs. They are getting better every year. Regulated lights are more efficient than the cheaper lights with resistors. As of July 2006, I have in my hands high power production LEDs that are just as efficient as Fluorescents (finally!). So in 4 to 6 months, I expect them to be on the shelves. Unfortunately, they are expensive currently, this will change with time.

**Fluorescent.** Probably the best choice for large lanterns on a budget. Last a reasonably long time, they are not very expensive so you should own a few. The major drawback is they cannot be dimmed to save power, and don't work so well in cold weather.

**Self Powered Lights.** These are generally not recommended for several reasons. They are usually bulky and prone to mechanical failure. This is especially true since they are very cheaply made, making them more of a novelty item than actually useful. If you're really interested in these, I would recommend a shake light. They appear quite durable; the mechanical part is only a loose magnet that goes back and forth inside a sealed container. Not prone to breakage, though the light level is low. Be aware that there have been reports of shake lights on the market that have coin cell batteries in them, they look nice and bright when you pick them up. Once the batteries die (a few hours) they run on shake power which is nowhere near as bright as the batteries were.

**Solar lights** are nice, but I would first buy a solar battery charger and not have to carry the bulk of a solar cell around with me when using the light. Internally a solar light is going to have a battery anyway.

## A short course in Battery Chemistries

**Primary Cells** (single use, disposable cell) The most common primary cells are Heavy-Duty and Alkaline, Lithium primary cells are also available but they can't always be used in devices that normally take Alkaline and Heavy-Duty batteries. Pure Lithium battery cells put out 3.0 volts rather than the normal 1.5. This requires either a different bulb or a "dummy" empty cell to be used to keep the overall voltage correct. But there are also new low voltage 1.5v Lithium batteries as well.

**Rechargeable Cells** (multi use cells) The most common today are probably NiMH cells. NiCd is an older technology. Lithium-ion is a newer technology, though it differs significantly from the more common cells.

<b>Cell Type</b>	<b>Shelf Life</b>	<b>Capacity</b>	<b>Sizes Available</b>	<b>Cycles</b>	<b>Cold Weather</b>
Heavy-Duty	8+ Years	Low	AAA, AA, C, D, 9V	1	Poor
Alkaline	8+ Years	Medium	AAA, AA, C, D, 9V	1	Poor
Lithium (Primary)	15+ Years	High	AAA, AA, C, D	1	Excellent
NiCd	3 Months	Med-Low	AAA, AA, C, D, 9V	1-2K	Good
NiMH	2 Months	Medium	AAA, AA, C, D, 9V	500-800	Poor
Lithium-ion	6 Months	High	R123A, other related sizes	300-500	Excellent

This table is a quick reference to some general comparisons of various cell types.

Other general notes on various cell types. Shelf Life improves if you store the batteries in a cooler environment. After a rechargeable battery loses its charge due to shelf life, a simple recharge will put you back in business. Cold weather is defined as sub-freezing temperatures, and all cell types that got a “poor” rating can be warmed up in a pocket, put in an appliance and be expected to work again until they get too cold.

Battery cells should be treated like fuel. Take care of them, do not get them wet, do not throw them in fires, try not to drop them or get them banged up and they should be quite safe. Get water proof carry cases for your kits for them. You probably shouldn't store cells in devices if they are going to be packed away. If you store quantities of Lithium batteries in a house, they should be stored in a fire proof box with vent holes drilled into a side of the box as a safety precaution (do not place vent holes near flammable objects). Do not store them in a tent. Don't get paranoid about Lithiums, you probably use them every day in devices like a cell phone, but you've probably hear a story or two of “exploding” batteries. What they really do is “vent rapidly with flame” (quite rare), use caution and don't buy knock offs.

Primary cells should be in your emergency kits as well as a small reserve for extended on the go emergencies, rechargeable cells will be more useful in a longer-term emergency when you can settle down a bit but power still doesn't exist. AA cells are the most available with the best prices, adapters can also be found to make them fit into devices that use C and D batteries. AA rechargeable also don't require nearly as long as D cells to recharge.

## **Heavy Duty (Single use, Disposable)**

Poor, not recommended. Cheap lights come with these batteries, it should also be taken as a sign that the light manufacturer has cut every conceivable cost in the production and shipping of his light. Avoid them.

**Alkaline** (Single use, Disposable) Good value. Costs are very reasonable, just stay away from poor brands as they are likely to leak and damage your devices and the residue is usually toxic. Duracell, Energizer, Rayovac, and most store brand names are fine (Costco, Rite-aid). Stay away from Western Family and unknown brands.

**Lithium** (Single use, Disposable) Expensive, but great cold weather performance for a primary cell, highest energy density. It would be good to have a few of these around for AA devices. Also in cases where weight, size, and capacity is more of an issue than cost.

**NiCd** (Rechargeable) Most durable type of rechargeable cell. There is a reason that in an era of NiMH and Li-ion batteries power tools and other such items that see regular hard use still use NiCDs. You can expect these cells to give you 5 years of use from the date of manufacture, if you care for them. And they do require care, suck them dry once every month or two and they'll hold out the longest. For longer term storage, put them in a cool place at about half charge. Not a bad value, good cold weather performance without a high cost. I would have some of these if you plan on using a standard rechargeable. Toxic, please use care when disposing of these cells.

**NiMH** (Rechargeable) Best value and convenience, an excellent value for what you receive with these batteries. They don't hold a charge long on the shelf but for regular battery use, they can't be beat. Some newer cells are available with a low self-discharge property at slightly reduced capacity (see Sanyo Eneloop or Titanium Enduro cells). They don't like the cold very much, so if it's cold outside you can put a flashlight in your pocket where it'll be warmer. Expect up to 3 years effective use from the date of manufacture, longer is possible but probably at reduced performance as the cell deteriorates.

**Lithium-Ion** (Rechargeable) Rather exotic and requires special care and attention. Special chargers are required, only really an option when you have a larger power source available to charge off of, like a car or off grid electrical system, or if you know how to build your own solar system to run the charger. Good cold weather performance, good power density (superior to even NiMH). However, they deteriorate

rapidly with time. Even 1 year will see reduced performance. You've probably noticed this with your cell phone and laptop computer batteries. Not the best long-term option.

**Lead Acid** Lowest self-discharge of the rechargeable cells. Also, the cheapest per unit of power.

However, they are also the least portable being the bulkiest. They can work well for area lighting and lanterns. Also, for recharging smaller cells.

Once you have a good idea what you want and have acquired a few items. Run a family home evening off your battery devices only. Spend 1, 2, or even 3 days without the grid electric lights, learn what your needs are and use this information to fill them. 2005 Brandon Mansfield