
Solar Storm Brief

A short, practical field guide to the one grid-down event that is a statistical certainty over time. What a severe geomagnetic storm does, and how to be ready before it arrives.

THREAT CLASS: **Certain over time / severe**

WARNING TIME: **1 to 3 days**

EXPECTED DURATION: **Days to over a year**

This brief is one of three in the grid-down series: EMP, Cyberattack, and Solar Storm. Each covers a distinct threat with a distinct response. Read all three, because the failure modes differ but the foundation they share is what actually keeps you alive.

What a solar storm actually is

A severe geomagnetic storm is a coronal mass ejection, a burst of charged particles from the sun, striking Earth's magnetic field. Unlike an EMP, this is not a maybe. It is a certainty on a long enough timeline. The only open question is when.

This is the threat to take most seriously precisely because it is guaranteed to recur. The benchmark is the 1859 Carrington Event, the strongest solar storm on record, which set telegraph offices on fire and shocked their operators. A storm of that class hitting today's electrified world is the scenario this brief prepares for.

10-12%

Odds of a Carrington-class storm per decade (National Academy of Sciences)

9 days

How narrowly a Carrington-scale storm missed Earth in July 2012

93 sec

Time a weaker 1989 storm took to collapse the entire Quebec grid

THE KEY DISTINCTION

A solar storm primarily induces slow currents in long conductors like transmission lines, which destroy high-voltage transformers. It does not produce the fast pulse that fries small electronics directly. Your phone in a drawer likely survives the storm itself. The catastrophe is what it plugs into.

The transformer problem

The reason a solar storm can mean a year without power is not the storm. It is the small number of massive, custom-built transformers it can destroy, and how nearly impossible they are to replace quickly.

WHY RECOVERY RUNS LONG

- **High-voltage transformers are custom-built.** There are almost no spares, and lead time to manufacture a replacement runs 12 to 24 months under normal conditions.
- **The failure can cascade.** Regulators have identified a small number of critical transformers whose simultaneous loss, as few as nine in the wrong combination, could trigger a coast-to-coast blackout.
- **The scale outstrips repair capacity.** If many transformers fail at once, there is no way to build and install replacements fast. This is where grid-down stops meaning days and starts meaning a year or more.

A DOCUMENTED NEAR-MISS

In July 2012, a Carrington-scale coronal mass ejection crossed Earth's orbit and missed us by roughly nine days. Analysts estimated a direct hit could have caused around \$2.6 trillion in damage to the US alone, with a full recovery taking years. This is not theoretical. It nearly happened within the last two decades.

THE ONE ADVANTAGE YOU HAVE

Unlike an EMP, a solar storm gives warning. There is typically a 1 to 3 day gap between the initial solar flare and the arrival of the coronal mass ejection. Utilities that respond correctly, taking components offline to protect them, may save much of the grid. The collapse is possible, not guaranteed. But you should prepare as if the protective response fails.

What to do with the warning window

A solar storm's 1 to 3 day warning is an asset no other scenario gives you. Knowing what to do in that window, and what to have ready beforehand, is the core of solar storm preparedness.

BEFORE

Build the extended grid-down foundation. This is the primary defense. A solar storm outage can run from days to over a year, so your food, water, and power thinking must reach past two weeks toward renewable and repeatable.

BEFORE

Secure a renewable power source. Because the outage can run long, a source you regenerate beats a battery you drain.

ON WARNING

Fill water containers and fuel while the grid is still up, in the 1 to 3 day window after a major flare is reported.

ON WARNING

Unplug and disconnect sensitive electronics and backup equipment to reduce the chance of induced-current damage through the grid.

ON WARNING

Charge everything and top off any battery or power station before the storm arrives.

OPTIONAL SHIELDING OVERLAP

A solar storm mostly spares disconnected small electronics, so Faraday shielding is less critical here than for an EMP. But the same Faraday enclosure that protects against an EMP also protects against a solar storm's effects, at no extra cost. If you have already built one for the EMP scenario, your critical backup electronics are covered for this one too. You do not need to choose between the two threats.

MONITORING THE WARNING

Space weather is tracked and forecast publicly. Knowing that a severe geomagnetic storm watch has been issued is what activates your warning-window actions. A battery or hand-crank radio that receives weather and emergency broadcasts is the tool that tells you the window has opened.

Preparing for the long version

Most outages are short. A severe solar storm is the scenario that forces you to plan for the long version, because the transformer problem means recovery may not come on any timeline you can wait out passively.

TIMEFRAME	WHAT IT DEMANDS
Days 1 to 3	Stored water and food, light, a way to stay warm or cool. Standard short-outage readiness.
Weeks 1 to 4	Water purification for ongoing supply, deeper food stores, sanitation plan as services stop, medical continuity.
Months and beyond	Renewable power, ability to produce or resupply food and water, long-term sanitation, community cooperation, non-electric skills.

THE SHIFT MOST PEOPLE NEVER MAKE

The difference between surviving a solar storm and being defeated by it is whether you planned for days or for the aftermath. A stockpile handles the first phase. Only a setup that renews itself, power you can regenerate, water you can keep purifying, food you can resupply, handles the phase where the grid simply is not coming back soon.

SANITATION, THE QUIET KILLER

In any long grid-down event, disease spreads once water and sewage systems stop. Historically, sanitation failure kills more people in prolonged disasters than the initial event. A plan for human waste, clean water, and basic hygiene is not optional in a multi-week or multi-month outage. It is a survival priority equal to food.

What a solar storm shares with every grid-down event

The warning window and long duration are solar-storm-specific. The foundation below is what carries you through all three scenarios in this series, and it is where the majority of your effort belongs.

Whether the transformers are destroyed by a solar storm, the electronics fried by an EMP, or the control systems corrupted by a cyberattack, the shared consequence is identical: no grid power for an extended, unknown period.

- Water:** stored supply plus a way to filter and purify more. One gallon per person per day, minimum.

- Food:** shelf-stable staples that need no refrigeration, enough for weeks to months, not days.

- Heat and cooling:** a grid-independent way to stay warm in winter and manage heat in summer, that produces no dangerous indoor exhaust.

- Sanitation:** a plan for when the toilets and water stop, disease is a leading disaster killer.

- Medical:** backup for anyone dependent on refrigerated medication or powered devices.

- Power:** a renewable source you can regenerate, not just a battery bank you will drain.

- Light and comms:** non-grid lighting and a way to receive space-weather and emergency information.

THE SINGLE MOST IMPORTANT SHIFT

Think past the two-week mark. A severe solar storm is not a long camping trip, it is potentially a period where grid power does not return for a year. What matters is whether any part of your setup renews itself without the grid. A source of power you can regenerate is the line between preparing for a blackout and preparing for its aftermath.

Solar storm brief, one page

FACTOR	SOLAR STORM
Probability	Certain over time. Roughly 10 to 12 percent per decade for a Carrington-class event.
Warning time	1 to 3 days between flare and impact.
Failure mode	Destroys high-voltage transformers. Mostly spares disconnected small electronics.
Duration	Days to over a year, depending on transformer damage.
Unique defense	Use the warning window: fill, disconnect, charge. Plan for the long version.
Shared defense	Extended grid-down foundation: water, food, heat, sanitation, medical, renewable power.

THE THREE ACTIONS THAT MATTER MOST

1. **Build the extended grid-down foundation** with duration in mind, this scenario can run past a year, so plan for the aftermath, not just the outage.
2. **Secure a renewable power source**, because the transformer problem rewards regeneration over storage more than any other scenario.
3. **Know your warning-window actions** and keep a weather-capable radio to tell you the window has opened.

READ THE OTHER TWO BRIEFS

A solar storm is the certain scenario. The EMP brief covers the least likely but harshest threat, the one that destroys electronics directly, and the Cyberattack brief covers the one most credible assessments rank as most probable. The same foundation serves all three.

This brief is for general preparedness education. It is not emergency, medical, or engineering advice. Figures on storm probability, grid recovery, and historical events are drawn from public scientific and reliability sources and represent general estimates, not guarantees. Adapt all guidance to your own circumstances and consult qualified professionals where appropriate.