National Space Weather Response Plan

National Emergency Management Agency
Te Rākau Whakamarumaru

New Zealand Government

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Note: The National Space Weather Response Plan has been developed at pace to ensure New Zealand has operational readiness and response arrangements in place for the solar maximum. More work is required to better understand the specific implications for New Zealand, clearly define roles and responsibilities, develop technology and human capabilities, and implement such capabilities into the emergency management system. This Plan is a living document and will be updated as space weather arrangements progress.

Foreword

Space weather is a natural hazard that has always existed. But in today's interconnected world, bursts of solar energy thrown out by the Sun now have the potential to be catastrophic for societies on Earth. A significant space weather event will disrupt critical infrastructure and essential services, preventing communities from accessing essential goods, and potentially impacting the ability for society to function as we know it. Impacts may be on a global scale with long restoration times.

The modern nature of the space weather hazard means it is not well understood. We are beginning to understand the hazard and how it will cause impacts for New Zealand, but there is much still to do. New Zealand's unique geography and relative isolation means we need to find our own solutions. However, we have seen time and time again that in times of crisis, New Zealand bands together for each other and across communities.

In May 2024, a large space weather event reinforced the urgency of advancing our understanding of this hazard. We know that the forecast "solar maximum" – the period of high storm activity on the Sun's surface – is already under way, lending further urgency.

In June 2024, NEMA established our Space Weather Programme, to rapidly understand the hazard and inform operational readiness and response arrangements ahead of the solar maximum. We worked with stakeholders and partners across government, the emergency management sector, iwi/Māori, the private sector, and internationally.

We found that responding effectively to a significant space weather event will require complex decisions – balancing short-term disruptions to protect critical infrastructure from potentially devastating long-term impacts. These decisions must be made in an inherently uncertain environment, and the degradation of communication systems may further complicate rapid responses.

The publication of the National Space Weather Response Plan is a step forward for New Zealand. It facilitates the best use of the limited warning time to mitigate the impact on our communities across the country.

The best time to build a whare to protect the family is when the Sun is shining. So it is important that we plan collaboratively now, to ensure the safety of New Zealand and our communities.

Thanks to everyone who has given their time and expertise to this Plan. I continue to be humbled and impressed with the drive and commitment across New Zealand to unite, so we can address our biggest challenges.

John Price

Director, Civil Defence Emergency Management

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Approved by

This document has been approved by:

Name	Role	Version	Date	Signature
John Price	Director, Civil Defence Emergency Management	2.0	22 November 2024	

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Section 1

Introduction

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Section 1 Introduction

Background

'Space weather' refers to an array of phenomena originating from the Sun. Space weather occurs continuously, much like weather on Earth, and normally with no tangible effects. However, space weather in its more extreme forms may damage or disrupt New Zealand's complex interconnected system of critical infrastructure and cause widespread and enduring impacts to the community (referred to as a "significant space weather event" in this Plan).

This National Space Weather Response Plan builds on the **Interim** *Space Weather Response Plan v1.1* (published in August 2024). This Plan is the first hazard-specific response plan under the *National Catastrophic Event Handbook* (expected release in early 2025).

1.1 Purpose

Purpose

The purpose of this Plan is to enable effective emergency management during the response to a significant space weather event.

Scope

This Plan focuses on a specific hazard at the national level. It coordinates the actions of agencies and key stakeholders during the initial response phases of a space weather event.

To help achieve such coordination, this Plan:

- clarifies roles and responsibilities of key agencies and stakeholders
- presents operational phases for immediate response
- establishes a structure for developing situational awareness
- provides content for public information management.

Out of scope

This Plan does not cover:

- consequence management[1]
- sector-specific planning
- planning at the regional and local levels
- recovery from the event.

Agencies and key stakeholders should develop standard operating procedures and space weather response plans. They should also ensure their business continuity plans are suitable and meet the need for responding to space weather events, for what could be days if not weeks.

[1] Consequence management is managing the effects of an event on persons, society, the environment and the economy. These arrangements are set out in National Civil Defence Emergency Management Plan Order 2015 and in the *National Catastrophic Event Handbook*.

Activation criteria

This Plan will be activated to coordinate the national response after receiving a notification of a significant space weather event, if:

- the event is directed towards Earth
- significant disruptions are expected to critical infrastructure.

The actions taken to activate this Plan are presented in **Section 5.2**.

1.2 Context

Context

This Plan is complementary to a suite of planning products (see **Figure 1**). It is a hazard-specific plan under the hazard-agnostic *National Catastrophic Event Handbook*.

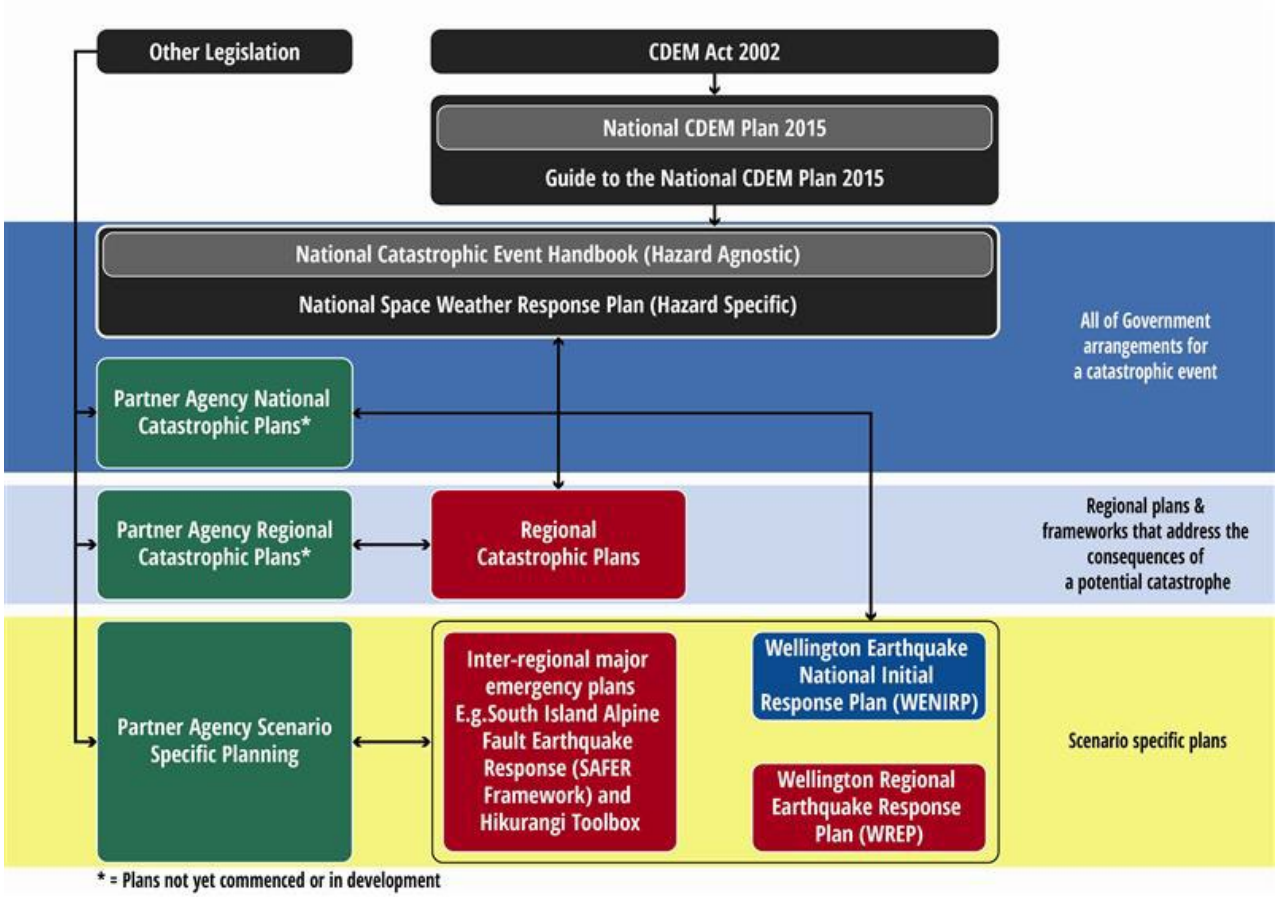

Figure 1. The National Space Weather Response Plan within the national planning framework.

Audience

The two primary audiences for this Plan are:

1. the National Crisis Management Centre (NCMC, led by the National Controller)
2. key agencies and stakeholders with roles and responsibilities in the Plan (see **Section 3**).

Review period

This Plan is designed to be iterative. Revisions will be made as emergency management arrangements for space weather evolve.

1.3 Objectives and intent

Response objectives and the National Controller's Intent will be established during the response to address the specific response context.

Objectives

The following objectives are from section 113 of National Civil Defence Emergency Management Plan Order 2015 and provide an indication of potential objectives for a space weather response. The objectives are:

- preservation of life
- prevention of escalation of the emergency
- maintenance of law and order
- provision of safety and security measures for people and property
- care of sick, injured and dependent people
- provision of essential services
- preservation of governance
- protection of assets
- protection of natural and physical resources and the provision of animal welfare
- continuation or restoration of economic activity
- putting into place of effective arrangements for the transition to recovery.

Further, the novel aspect of this hazard creates the need for effective public information management to reassure New Zealanders during a significant space weather event.

National Controller's Intent

The National Controller's Intent set out here is adapted from the *National Catastrophic Event Handbook*.

All levels of the emergency management response will mobilise, communicate and connect during the immediate response.

Immediate life-saving actions will be taken and welfare support provided to prevent loss of life and reduce impacts on affected communities.

Responsible agencies and organisations will assess available resources, deliver critical functions, and start response activities. They will gain situational awareness and begin sharing this with partners to establish a common operating picture. This will be used to guide response actions and inform advice and messaging to the public and elected officials.

Resource gaps will be identified across the emergency management system, assistance sought to fill those gap and mitigate risks known and identified.

The NCMC provides national-level coordination that ultimately supports a whole-of-community approach to response.

1.4 Planning assumptions

The assumptions noted below were made when developing this Plan. They will be tested for validity and necessity, and confirmed during the response.

Response

The National Emergency Management Agency (NEMA) leads a coordinated response.

A State of National Emergency is declared.[2]

Agencies, stakeholders and Civil Defence Emergency Management (CDEM) Groups respond using their own response planning arrangements, in line with the roles and responsibilities outlined in National Civil Defence Emergency Management Plan Order 2015, as well as other existing plans, frameworks and relevant legislation.

The Officials Committee for Domestic and External Security Coordination (ODESC) is activated.

Critical infrastructure

The national electricity grid is affected, including disruption to supply and damage to assets.

Global navigation satellite systems and Earth observation satellites are partially lost, disrupting satellite communications.

Positioning, navigation, and timing systems are significantly degraded and unreliable.

High, very-high, and ultra-high frequency telecommunications systems are disrupted.

The range of Amplitude Modulation (AM) radio is significantly degraded, although it remains operational.

Cellular networks are disrupted and provide intermittent coverage.

All modes of transport operations are disrupted while assessments are made.

Many sectors suffer a broad range of impacts. Examples of sectors are government, emergency management, health, energy, water, aviation, communications, shipping, transportation, tourism, agriculture and defence.

Public information

Public awareness and understanding of space weather is low.

General emergency household preparations are effective for space weather.

Disruptions to critical infrastructure reduce the ability to deliver important information to the public.

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[2] This is the decision of the Minister for Emergency Management and Recovery, on advice from the Director of Civil Defence Emergency Management, National Controller, or both. This Plan is activated before a State of National Emergency is declared and can operate with or without such declaration.

Section 2

Space Weather Overview

2

Section 2 Space Weather Overview

'Space weather' is a collective term used to describe a range of phenomena originating from the Sun.

Space weather may affect critical infrastructure and technology. It may:

- cause strong variations of the Earth's magnetic field
- enhance electrical fields and currents in the upper atmosphere and on the ground
- increase the amount of radiation entering the upper atmosphere
- vary the density and stability of the upper atmosphere
- cause the upper-most atmosphere to expand outwards, changing the orbits of satellites in low Earth orbit.

2.1 Space weather phenomena

Space weather phenomena that can cause impacts on Earth are outlined below.

Solar flares

Explosions on the Sun's surface release solar flares with immense amounts of energy that result in electromagnetic emissions. These flares travel at the speed of light and arrive at Earth within 8 minutes.

Coronal mass ejections

Large portions of the Sun's outer atmosphere can be explosively blown into space, sending billions of tonnes of plasma in Earth's direction. These ejections take between 12 and 36 hours to reach Earth, with larger ejections travelling more quickly. They have their own magnetic field, resulting in geomagnetic storms.

Solar radiation storms

Coronal mass ejections and solar flares can accelerate charged particles. These particles arrive at Earth from every direction. The fastest of these particles can affect Earth tens of minutes after a solar flare occurs.

Geomagnetic storms

Geomagnetic storms are a temporary disturbance of the Earth's magnetic field and typically associated with stronger solar winds. Significant geomagnetic storms are caused by coronal mass ejections.

The greatest space weather disturbances are usually caused by solar flare and coronal mass ejections, and subsequent radio and geomagnetic storm activity.

Figure 2 illustrates these space weather phenomena.

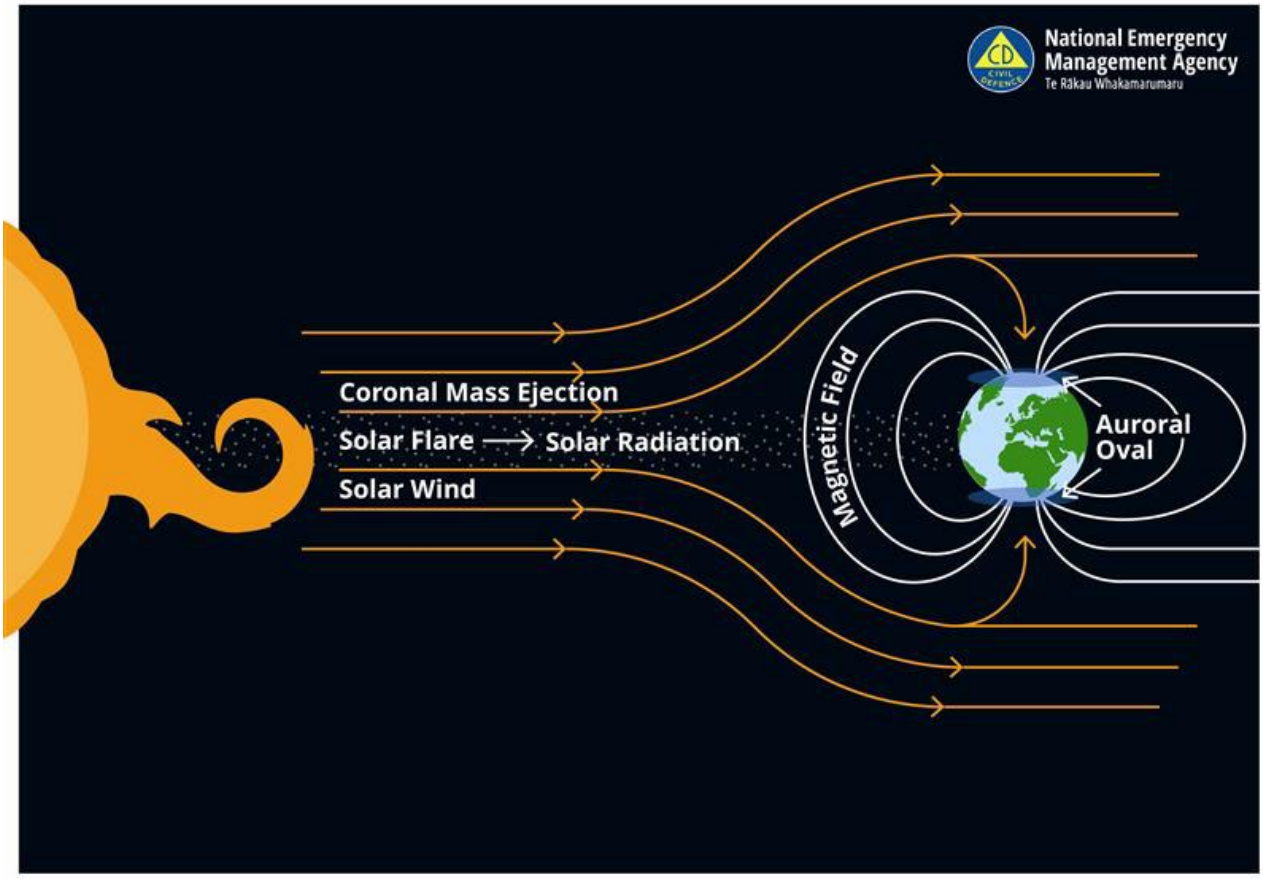

Figure 2. Space weather phenomena

Duration and frequency

A significant space weather event could last for an hour or a few days. Solar rotation may result in Earth being impacted again in 27 days.

The Sun's magnetic field has a cycle of about 11 years, with solar activity rising and falling. Space weather events happen more often at the solar maximum. The last solar maximum was in 2014, and the current one started in October 2024. However, significant space weather events can occur at any time during the cycle, so it is important the emergency management system is prepared to respond throughout the whole solar cycle.

2.2 Anticipated impacts

Significant space weather is a low-probability event, but it could have widespread and potentially catastrophic impacts when it does happen.[3]

As significant space weather incidents occur infrequently, the exact nature of the impacts is not well understood. However, it is known that critical infrastructure may be disrupted for long periods across New Zealand and the globe. Catastrophic impacts from such disruption are possible, with

[3] The *National Catastrophic Event Handbook* provides a definition for the term 'catastrophic' in this context.

cascading consequences across interdependent critical infrastructure sectors and communities. One result of society's increasing reliance on critical infrastructure and technology is an increased vulnerability to space weather.

Anticipated impacts to critical infrastructure and society are summarised below.

Satellite services

Solar radiation storms can disrupt and degrade positioning navigation and timing systems, global navigation satellite systems, and Earth observation satellites. Degraded services can lead to the disruption of dependent critical infrastructure systems and technology, including:

- energy networks
- transport systems
- communications networks
- water infrastructure
- financial services
- data centres
- meteorological weather forecasting
- emergency services
- dams (and subsequent hydroelectric generation activities)
- the food and agriculture sector
- national security
- defence sector.

Electricity

Geomagnetic storms from coronal mass ejections can induce currents into the transmission network. Transformers are particularly vulnerable to these currents, which can produce voltage instability and harmonics that threaten the security of electrical supply.

Electricity outages may occur because of instability, network damage, proactive grid reconfiguration, or proactive disconnection of vulnerable generation assets. Such outages will disrupt the complex interconnected system of critical infrastructure, causing potential outages to:

- other energy networks
- transport systems
- communications networks
- water infrastructure
- data centres
- health services
- financial services
- the food and grocery sector
- government services.

Communications

Solar flares release bursts of radio noise that can disrupt communications networks. This disruption occurs within minutes of the solar flare, and could last for tens of minutes.

Coronal mass ejections may cause further impacts on position navigation and timing services and the electricity network. These impacts would be noticeable within hours of the first coronal mass ejection arriving.

Affected communications networks may include:

- cellular communications
- degraded (but partially operational) AM radio
- high, very-high, and ultra-high frequency radio communications
- satellite communications (such as Starlink).

Social

The social impacts are less well understood because of the lack of recent events to learn from. However, the exotic and complex nature of the hazard means there may be impacts caused to communities beyond the physical impacts. The extent of social impacts may be influenced by concurrent events or recent emergencies which inherently reduces risk tolerance and the ability for communities to cope.

Social impacts are likely to include:

- confusion around the nature of the event and around warnings
- concern around personal security
- mental health impacts, including anxiety and social isolation
- physical health impacts, including reduced ability to heat or cool homes and delayed or interrupted health services
- impact on daily activities including payment services
- inability to go to work or fulfil employment responsibilities
- public health issues around food spoilage, drinking water and sewage
- increased crime and disorder
- increased domestic violence.

Effective public education aims to provide a level of public understanding. Public information messaging provided during response will need to be consistently worded across agencies and echo the language used in earlier public education.

2.3 Space Weather Alert System scales

New Zealand has no current bespoke space weather forecasting capabilities. Instead, it uses notifications from international space weather centres provided by:

- United States' Space Weather Prediction Centre (operated by the National Oceanic and Atmospheric Administration)
- Australian Space Weather Forecasting Centre (operated by the Bureau of Meteorology)
- United Kingdom's Met Office Space Weather Operations Centre.

This Plan adopts the Australian Space Weather Alert System to ensure consistency with the international space weather alerts.[4]

The alert system uses 3 scales:

- G-scale for geomagnetic storms
- S-scale for solar radiation storms
- R-scale for radio blackouts.

Each scale ranges from 1 to 5. An event of the weakest intensity is 1 and the strongest is 5.[5] An event at 3 or higher may require operators of technology systems in some space sectors affected by weather to mitigate risks. Also, the ranges can help to determine whether operational action is required when corresponding organisational thresholds are met.

The scale:

- provides agencies with insights into the potential for impacts on national infrastructure
- supports public warnings and the communication of preparedness information.

[4] The scales are adapted for Australian use, which are adapted from those produced by the United States National Oceanic and Atmospheric Administration. These scales are not formally agreed by the World Meteorological Organization, but are internationally accepted and used by many space weather monitoring agencies.

[5] Events in the highest category (5) can vary greatly in size, with impacts ranging from minor to catastrophic. The variance is similar to a magnitude 5 earthquake and all magnitudes above that. An international working group is currently reviewing these scales.

Section 3

Roles and Responsibilities

3

Section 3 Roles and Responsibilities

A significant space weather event will require a coordinated all-of government response. The primary responsibility of each agency and stakeholder is to ensure viability of their critical functions in an environment where communications and energy are degraded. Each agency and stakeholder should also enable inter-agency communication and coordination to enhance the national response – which is the purpose of this Plan.

Key agencies leading and supporting the response to significant space weather events are listed below with respect to their key roles and functions.

3.1 Lead agency (for response)

NEMA

NEMA is the lead agency for coordinating a space weather response.[6] NEMA's actions are noted below.

Monitor forecast and nowcast notifications about significant space weather.

Monitor and assess the situation.

Activate this Plan to coordinate the immediate all-of-government response at the national level.

Advise the Minister for Emergency Management and Recovery about declaring a State of National Emergency.

If a State of National Emergency is declared, support the Director CDEM and the National Controller as they carry out their powers.

Activate the NCMC.

Coordinate technical and science advice.

Coordinate the dissemination of public information that is consistent with that of international space weather centres and international partners.

Share notifications and information from international space weather centres with stakeholders, to inform situational awareness.

Hold one or more multi-stakeholder meetings to share information and develop situational awareness.

Work with the Department of the Prime Minister and Cabinet (DPMC) on the activation of the ODESC system via NEMA's Chief Executive.

[6] Using the powers of the Civil Defence Emergency Management Act 2002, and arrangements set out in National Civil Defence Emergency Management Plan Order 2015 and in the *National Catastrophic Event Handbook*.

Use existing plans and arrangements for consequence management (see **Appendix C**), including impacts to communities.

3.2 Support agencies

New Zealand government agencies

Supporting government agencies may take the following actions.

Implement business continuity arrangements.

Fulfil responsibilities under National Civil Defence Emergency Management Plan Order 2015.

Activate their respective National Coordination Centres (or equivalent) and establish contact with the NCMC.

Provide liaison officers and a surge workforce to the NCMC, as well as multi-stakeholder meetings.

Determine capacity and capabilities for after the impact has happened, and advise the NCMC of their ability to support the national response.

Coordinate with NEMA for public information management.

Brief their respective Minister about portfolio updates.

Support the response efforts to ensure the public maintains trust and confidence in the emergency management system.

Airways New Zealand

Share any space weather advisories issued by the International Civil Aviation Organization that affect the New Zealand and Auckland Oceanic Flight Information Regions.

Share updated aviation information to stakeholders, including the NCMC.

Civil Defence Emergency Management (CDEM) Groups

Activate Emergency Coordination Centres and establish contact with local Emergency Operations Centres and the NCMC.

Civil Aviation Authority (CAA)

Communicate with the International Civil Aviation Organization.

Update and support the Transport Response Team.

Consider issuing Notice to Air Mission[7] for the New Zealand and Auckland Oceanic Flight Information Regions, to advise pilots of space weather hazards along flight routes.

Department of the Prime Minister and Cabinet (DPMC)

Activate and coordinate the ODESC system response for strategic coordination.

Fire and Emergency New Zealand (FENZ)

Gather, analyse and share information to develop situational awareness.

Establish contact with Emergency Coordination Centres.

Source critical information requirements and communicate them to the NCMC.

Share public safety messages using available communication channels.

Support the International Assistance Sub-Function.

GNS Science

Provide data and information about the Earth's geomagnetic field and geodetic measurements.

Provide access to underpinning datasets, such as modelled crustal conductivity.

Facilitate the provision of science advice, if requested, and as available, work closely with science partners (notably the University of Otago).

Hato Hone St John

Update the NCMC about service delivery, to inform the Public Information Management function.

Land Information New Zealand (LINZ)

Hold a meeting of the National Positioning Infrastructure Coordination Committee, to monitor and assess risks and vulnerabilities to the global navigation satellite system.

Communicate alternate methods of positioning.

Maritime New Zealand

Update and support the Transport Response Team.

Monitor impacts on category 2 search and rescue operations, through Rescue Coordination Centre New Zealand.

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[7] Notice to Air Mission provides information about the establishment of, or condition or change in, any aeronautical facility, service, procedure or hazard. Distributing this information as quickly as possible to personnel involved with flight operations is essential.

Issue marine navigational warnings, as appropriate.

New Zealand Meteorological Service (MetService)

Share with Airways New Zealand any space weather advisories issued by space weather centres approved by the International Civil Aviation Organization.

Use briefing portals to make these advisories available to aviation operators.

Liaise with international meteorological services.

Support access to the space weather capabilities within space weather centres of partner nations.

Ministry of Business, Innovation & Employment (MBIE)

Lead sector specific policy advice, such as energy and telecommunications.

Ministry of Foreign Affairs and Trade (MFAT)

Provide consular support to New Zealand citizens overseas.

Maintain effective lines of communication with New Zealand's overseas missions and posts, and to foreign governments and international organisations.

Implement an international communications strategy, including briefing foreign missions, international news media, and monitoring international media.

Provide advice on international issues, foreign policy implications, international legal obligations and matters relating to foreign diplomatic and consular offices in New Zealand.

Coordinate offers of international assistance. Communicate decisions on international assistance to other nations via Third Party Notes.

Manage inquiries in relation to foreign nationals affected by a disruption via the Diplomatic Corps.

Support visiting Guests of Government, Partial Guests of Government, and Hosted VIP Visitors.

Coordinate bilateral and other messages of condolence.

Ministry of Health (MoH) / Health NZ

Update the NCMC about the health system response, including risks to medically dependent consumers.[8]

Ministry for Primary Industries (MPI)

Provide information about and to the primary sector.

[8] A medically dependent consumer is someone who relies on electricity or natural gas for critical medical support, and a loss of power could result in serious harm or death.

Update the NCMC about animal welfare.

Advise on food safety.

New Zealand Defence Force (NZDF)

Advise the NCMC on specific surge support capability.

Provide technical advice.

New Zealand Police

Update the NCMC about public safety, law enforcement, crime prevention, and community reassurance, to inform the Public Information Management function.

Monitor impacts to ongoing and emerging category 1 search and rescue operations.

New Zealand Space Agency (within MBIE)

If requested, establish operational connections with overseas space agencies and other institutions that have relevant capabilities.

Transpower

Lead the electricity sector's technical response to space weather events.

Advise the NCMC of the electricity sector's capabilities.

Wellington Free Ambulance

Update the NCMC about service delivery, to inform the Public Information Management function.

3.3 Sector coordinating entities

Sector coordinating entities coordinate emergency response activities through a single point of contact.[9] They are established during readiness and perform an operational role during response and recovery.

Response activities

In response, the Chairs of the sector coordinating entity liaise with the NCMC. They:

- coordinate and provide consolidated situational information about each sector
- contribute to planning activities
- distribute situational information from the NCMC to their sector
- coordinate requests for sector assistance
- coordinate with other affected sectors, particularly where dependencies exist

[9] This coordination is set out in National Civil Defence Emergency Management Plan Order 2015.

- facilitate solutions to sector-specific issues.

Some entities fulfilling the sector coordinating entity role will manage the impacts to their network (such as Transpower) at the same time.

Chairs of the sector coordinating entity

The Chairs of the sector coordinating entity[10] are:

- Broadcasting: Ministry for Culture and Heritage (MCH)
- Cash: Reserve Bank of New Zealand
- Electricity: Transpower
- Fuel: MBIE
- Transport: Ministry of Transport (MoT)
- Water: Water New Zealand and Taumata Arowai
- Telecommunications: New Zealand Telecommunications Forum.

3.4 Governance and elected officials

Lead minister

The Minister for Emergency Management and Recovery is the lead minister for a space weather response.

After receiving notification of a significant space weather event that requires the activation of the Plan, the lead minister may:

- inform the Prime Minister and Cabinet of developments
- coordinate with relevant Ministers, including the Minister of Transport, Minister for Energy, Minister for Media and Communications
- consider advice on whether to declare a State of National Emergency
- operate as the lead Government spokesperson.

Lead senior officials

The lead senior official is the Director CDEM. They may delegate certain functions and powers to the National Controller.[11]

The **Director CDEM** is responsible for taking the actions noted below.

Activate this Plan by following the process set out in the **elevated threat** phase (see **section 5.2**).

Advise the lead minister, agencies, and other senior decision makers to ensure streamlined coordination.

Attend the appropriate level of ODESC system meetings and briefings about:

[10] NEMA is currently confirming the Chairs for the gas sector, and is investigating potential Chairs for three other sectors: payments, fast-moving consumer goods, and disaster waste.
[11] This authority to delegate is as set out in section 10(1) of the Civil Defence Emergency Management Act 2002.

- the situation and nature of the response
- key strategic risks
- resource requirements
- plans for coordinated communications and messaging.

Lead key public communications and share useful and informative communications products from other agencies as appropriate.

Communicate with international counterparts.

The **National Controller** is responsible for taking the actions noted below.

Ensure coordination arrangements are activated.

Ensure response activities are coordinated and across the New Zealand government, with any conflict between activities resolved.

Chair multi-agency meetings to coordinate the response efforts of the New Zealand government.

Activate and lead the NCMC.

Officials Committee for Domestic and External Security Coordination (ODESC)

All-of-government strategic coordination occurs through the ODESC system. ODESC system meetings and efforts will focus on the actions noted below.

Ensure a consistent understanding of the situation.

Ensure coordination of agency activities.

Identify key strategic risks and implications, and ensure that these are being managed.

Ensure that the lead agency and support agencies have the resources they need.

Prioritise resources and response activities.

Ensure appropriate communication arrangements (to Ministers, other stakeholders, and the public) are in place.

Identify triggers for escalation.

Section 4

Coordination Arrangements

4

Section 4 Coordination Arrangements

This section sets out the coordination arrangements used during the response to a significant space weather event.

All-of government operational coordination

NEMA will lead the all-of-government operational coordination through the NCMC (see **Section 5**).

All-of-government strategic coordination

The ODESC system will manage all-of-government strategic coordination to provide collective leadership and set strategic direction. DPMC will initiate this as the steward of the ODESC system.

Possible coordination mechanisms arranged in advance are:

- Watch Group (senior officials) meetings
- ODESC (chief executives) meetings
- inter-agency working groups
- inter-agency specialist groups.

Multi-agency meetings

Multi-agency meetings bring together stakeholders for coordination, communication and collaboration. These stakeholders include:

- national, regional and local government officials
- the private sector
- industry bodies
- not-for-profit organisations
- subject matter experts.

The Director CDEM or the National Controller activates and chairs these multi-agency meetings.

National coordination groups

NEMA maintains several coordination groups at the national level, to facilitate shared situational awareness (see **Table 1**).

Table 1. Membership of National Coordination Groups

National Coordination Group	Members
Inter-Infrastructure Coordination Group	NEMA Chairs of each sector coordinating entity. These Chairs also facilitate national coordination arrangements for their sector.

National Coordination Group	Members
National Public Information Management Coordination Group	Agencies with a significant role in supporting and delivering public information management and its sub-functions.
National Recovery Coordination Group	Agencies with a significant role in supporting and enabling recovery activities.
National Welfare Coordination Group	Agencies responsible for, or that support, the sub-functions of welfare services.

National Warning System

The National Warning System provides a mechanism to promptly issue warnings to many stakeholders at the same time.

NEMA provides national warnings about natural hazards to CDEM Groups, central government authorities, local authorities, emergency services, lifeline utilities, and broadcasters.

All-of-government situational awareness

The NCMC will establish all-of-government situational awareness during space weather events. Information requirements to enable situational awareness are outlined in each operational phase (see **Section 5**).

Public Information Management

NEMA will coordinate national emergency communications during space weather events. These include all-of-government talking points about the response activities undertaken in line with the Plan and the release of Emergency Mobile Alerts.

NEMA will activate the Broadcast Memorandum of Understanding (MoU) to facilitate Public Information Management. Current partners include Radio New Zealand, Television New Zealand, TV3, Radio Broadcasters Association, and Association of Community Access Broadcasters.[12]

Coordination of science advice

NEMA is scoping a space weather science advisory panel for coordination of science advice. This will be used to support planning and (potentially) response decision-making. The panel may include representation from crown research institutions, government agencies, universities and research programmes (including the Solar Tsunami Endeavour Programme). More information will be provided in further updates of this Plan.[13]

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[12] Whakaata Māori and iwi radio are anticipated to sign this Broadcast MoU.
[13] New Zealand's space weather science capacity and capability are limited. The available expertise depends on a small number of key individuals and a single research programme. New Zealand does not have the necessary domestic monitoring and forecasting capabilities, so relies heavily on international partners to provide this expertise.

Section 5

Response

5

Section 5 Response

This Plan uses operational phases to sequence actions through the initial response to a space weather event.

This section:

- describes the operational phases
- outlines the actions within each phase in response to a significant space weather event[14]
- presents information requirements within each phase in response to a significant space weather event.

Operational phases

This Plan adopts the operational phases from the *National Catastrophic Event Handbook* (see **Table 2**; also see **Appendix C** for operational phases overlaid against other space weather response plans and advisories).

Table 2. Operational Response Phases

Operational phases	
0	Operational readiness
1	Elevated threat
2	Credible threat
3	Immediate response
4	Initiate coordinated response
5	Sustained response
6	Transition to recovery
7	Medium to long-term recovery

5.1 Operational readiness (0)

Phase description

This Plan is maintained at a response level of **operational readiness**. During this phase, agencies and stakeholders undertake readiness activities, such as:

- response capability development
- training and exercising
- establishing response systems and protocols
- public education.

[14] This Plan outlines actions for specific space weather hazards. The NCMC will undertake other response tasks using relevant plans and arrangements.

Solar activity

Solar conditions are non-damaging and do not meet activation thresholds.

Response actions

During this **operational readiness** phase, NEMA will take the actions noted below.

Monitor space weather alerts through the Monitoring Alerting and Reporting (MAR) Centre.

Undertake business continuity and contingency planning.

Train and exercise to ensure this Plan is fit for purpose.

Develop public information messaging templates that are consistent with those of partner nations.

Deliver public education campaigns.

Assess, with agencies and stakeholders, potential space weather risks, impacts, and vulnerabilities.

5.2 Elevated threat (1)

Phase description

The MAR Centre receives a notification indicating:

- a risk of a significant space weather event directed at Earth
- that such an event may have widespread and significant impacts which near or exceed national declaration thresholds.

The **elevated threat** phase extends from the initial notification of potentially significant space weather through to the confirmation of the size and characteristics of the one or more coronal mass ejections arriving at the L1 satellites.[15] The likely arrival time is between 12 and 36 hours after the initial notification.

Due to time shortages, some actions usually carried out in the later **credible threat** phase must be carried out in this earlier **elevated threat** phase instead.

[15] The Lagrange Point 1 (L1) satellites are situated between the Sun and Earth. They provide space weather forecasters with an uninterrupted view of the Sun. L1 satellites collect critical information during space weather. For instance, this information can confirm the polarity, size, and other characteristics of the coronal mass ejection shortly before its arrival on Earth.

Solar activity

Significant solar flare and solar radiation conditions are detected. The impacts of these solar phenomena may already be observed. A coronal mass ejection is observed and G5 conditions are forecasted. Yet the impacts, such as exact size and characteristics, remain unknown.

Plan activation

This Plan may be activated when a significant space weather event is forecasted to impact New Zealand and its dependencies. The alerting scale is a starting point for assessing the risk (G4, S5, R5 conditions). But the Plan is only be activated after science advice and technical advice are collected and assessed as indicating a significant risk (or at the discretion of the Director CDEM or National Controller, if information collection is not possible).

Figure 3 outlines the information collection and decisions from the initial notification through to activation of this Plan. The Director CDEM or National Controller activates this Plan and authorises transition between the phases.

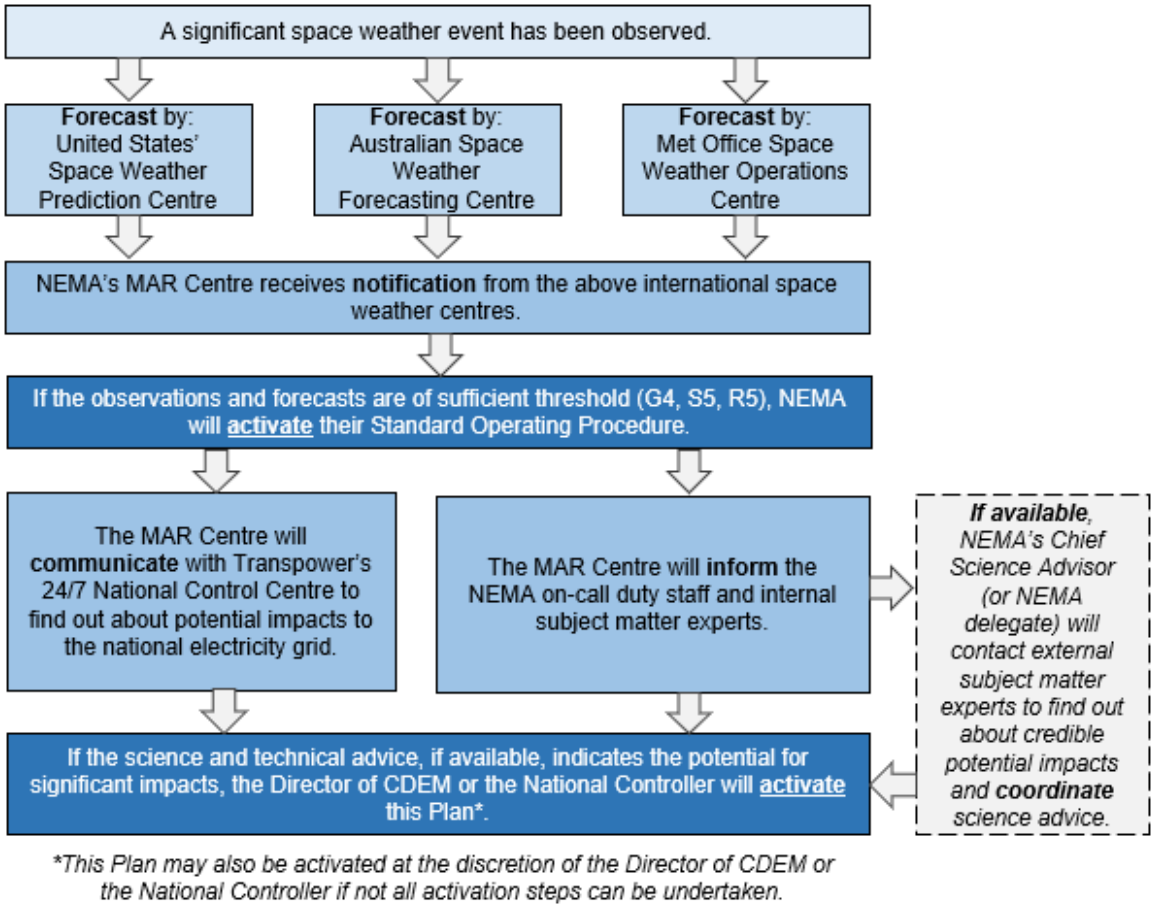

Figure 3. Information collection that leads to this Plan's activation

(**Note**: Information collected during this phase has a high level of uncertainty.)

Response actions

NEMA will coordinate the response through the NCMC. Actions at the **elevated threat** phase anticipate the impact from a space weather event and its related disruption to communications.

Table 3 outlines the **elevated threat** response actions specific to space weather. It indicates the likely NCMC function and the supporting agency or group likely involved in completing the action. Agencies may also be involved in completing agency response actions as set out in the National Civil Defence Emergency Management Plan 2015 and *National Catastrophic Event Handbook*.

Table 3. Actions for the elevated threat phase

Function	Supporting Agency or Group	Response actions
Control	NEMA	Activate this Plan (see **Figure 3**). Activate other relevant supporting plans and arrangements. Activate the NCMC.
Welfare, Lifeline Utility Coordination, Public Information Management, Recovery	See **Table 1**.	Activate the National Coordination Groups.
Science Desk, Lifeline Utility Coordination	NEMA, Inter-Infrastructure Coordination Group, International space weather centres, GNS Science, MetService	Coordinate science and technical advice related to the specific space weather threat.
Operations	NEMA	Use the National Warning System to notify key agencies and stakeholders of the situation, activation of the NCMC, and activation of this Plan.
Control		Hold multi-agency meetings to establish situational awareness and coordinate mitigation actions.
Governance, Strategic Communications	NEMA	Back brief the lead minister about the themes that emerge from the multi-agency meeting or meetings.
Intelligence	NEMA	Monitor for space weather notifications through the MAR Centre. Hand over the reporting of such notifications to the Intelligence Function.
Operations	NEMA	Request responsible agencies and stakeholders to provide liaison officers. Such officers must be located in the NCMC.
Governance, Control	DPMC	Activate the ODESC System.
Policy, Legal	All agencies with relevant Ministerial portfolios	Prepare material for the anticipation of a declaration of State of National Emergency. (The declaration would come in the next operational phase.)

Function	Supporting Agency or Group	Response actions
Control, Operations	NEMA, CDEM Groups	Communicate with CDEM Groups to establish the activation status of regional Emergency Coordination Centres.
	MFAT	Communicate proactively with nations within the response area of interest – primarily Pacific Island nations and countries undertaking activities within New Zealand's search and rescue region in Antarctica and the Southern Ocean.
Intelligence	All	Establish and share situational awareness.
Planning	NEMA	Start the development of a National Action Plan for space weather, informed by the specifics about the event.
Public Information Management	All	Update website and social media channels with event details (see **Appendix A**).
Public Information Management	NEMA, Transpower	Send an Emergency Mobile Alert, informed by event specifics, to advise of the elevated threat and that NEMA and other government agencies are assessing appropriate actions to take (see **Appendix A**).
Public Information Management, Legal	NEMA, DPMC	Prepare the public information for a State of National Emergency (see **Appendix A**).
Public Information Management, Science Desk, Lifeline Utility Coordination	NEMA, DPMC, Transpower, National Public Information Management Coordination Group, GNS Science, MetService, MFAT	Consult with stakeholder to refine public messaging about potential space weather impacts and consequences. Such messaging must be targeted yet consistent across all messaging.
	MFAT	Implement an international communications strategy that includes briefing foreign missions and monitoring international media.
Public Information Management	NEMA, DPMC, MFAT, Minister's Office	Deliver public messaging to New Zealand citizens in country and those located overseas. This may include messaging for a press conference. This action may involve working with the Prime Minister, lead minister, as well as other elected and senior officials.
Public Information Management	NEMA, Transpower	NEMA will share Transpower's messaging about the electricity system where appropriate.

Information requirements

Information requirements to establish shared situational awareness during the **elevated threat** phase are outlined in **Table 4**.

Table 4. Information requirements for the elevated threat phase

Function	Supporting Agency or Group	Information requirements
Science Desk	NEMA, International space weather centres	Specific event characteristics, including the estimated time of arrival and the geographic extent of impact.
Lifeline Utility Coordination	Transpower	Anticipated damage to the national electricity grid. Actions that Transpower and commercial operators are taking to mitigate or reduce damage. Potential consequences of those mitigating actions.
Lifeline Utility Coordination	Inter-Infrastructure Coordination Group	Anticipated disruption to interdependent critical infrastructure. Actions that operators and sector-coordinating entities are taking to mitigate or reduce damage. Potential consequences of those mitigating actions.
Welfare	Health NZ / MoH	Status of medically dependent consumers, and resource requirements. Actions taken to mitigate loss of life and ease suffering.
Welfare	Health NZ / MoH, NZ Police, Maritime NZ	Status of other health and public safety risks possibly impacted by disruptions to critical infrastructure. Two examples are critical surgeries, and search and rescue missions.
Lifeline Utility Coordination	MoT, Maritime NZ, CAA, Airways NZ, MBIE, MPI	Status of aviation and maritime operations. Status of potential disruption to flights and voyages. Details about whether consequent diversions are expected.
Liaison Officers	NZ Police	Status of law, order and security in the community.
Liaison Officers	Police, FENZ, Hato Hone St John	Status of emergency services. Operational outlook of the emergency services.
Science Desk, Intelligence	GNS Science, MetService	Likelihood of natural hazard events that may happen during the space weather response. Status of operational capabilities to detect, monitor, alert, and communicate with responsible agencies about other natural hazards.

Function	Supporting Agency or Group	Information requirements
International Assistance, Planning, Intelligence	MFAT	Response actions and intentions of partner nations, including Australia, the United Kingdom, and the United States of America.
Intelligence, Public Information Management	NEMA	International media coverage that is available and useful for the specific public information requirements.
Liaison Officers	All	Response and recovery capabilities and requirements of agencies and stakeholders.

5.3 Credible threat (2)

Phase description

This Plan progresses to the **credible threat** phase with confirmation that the space weather event is imminent.

This phase extends from the confirmation of the size and characteristics of the coronal mass ejection at the L1 satellite through to the coronal mass ejection's arrival at Earth. Arrival is generally expected in 15 to 60 minutes, with larger events generally arriving earlier.

This phase usually includes:

- pre-activating the system
- pre-positioning resources
- communication of life safety messaging.

Given the short timeframe, some of these actions may be undertaken during the earlier **elevated threat** phase for space weather. As a result, this phase has few response actions.

Solar activity

The impacts of any solar flare and solar radiation storm continues to be observed. Additional solar flares and solar radiation storms may occur. The coronal mass ejection has reached the L1 satellites, providing an indication of size and characteristics as well as potential for significant impacts on Earth.

Response actions

If the size and characteristics indicate the event will be significant, the response actions set out in this Plan continue. The NCMC may take the actions outlined in **Table 5**.

Table 5. Response actions for the credible threat phase

Function	Supporting Agency or Group	Response actions
Science Desk, Lifeline Utility Coordination	NEMA, Inter-Infrastructure Coordination Group, International space weather	Coordinate science and technical advice related to the space weather threat.

Function	Supporting Agency or Group	Response actions
	centres, GNS Science, MetService, MBIE	Ensure direct contact with critical infrastructure providers, including Transpower.
Intelligence	NEMA, International space weather centres	Monitor space weather notifications through the MAR Centre. Hand over reporting to the Intelligence Function.
Control	NEMA	Authorise the phase change of this Plan.
Policy, Legal	All agencies with relevant Ministerial portfolios, Minister's Office	Advise the lead minister on the declaration of a State of National Emergency. Ensure all associated Ministers are informed (cross-ministerial).
Operations	NEMA	Use the National Warning System to notify key agencies and stakeholders of event updates, whether a State of National Emergency will be declared and the phase change of this Plan.
All	All	If a State of National Emergency is declared, support the Director of CDEM and National Controller as they carry out their powers.
	MFAT	Communicate with nations within the response area of interest – primarily Pacific Island nations and countries undertaking activities within New Zealand's search and rescue region in Antarctica and the Southern Ocean.
Intelligence	All	Establish and share situational awareness.
Public Information Management	Broadcast MoU partners	Activate Broadcast MoU.
Public Information Management	MFAT	Implement the international communications strategy, including briefing foreign missions, international news media, and focusing on New Zealand citizens overseas.
Public Information Management	Broadcast MoU partners, CDEM Groups	Release as early as possible any approved public messaging that is consistent with global communications (see **Appendix A**).

NEMA will take actions to stand down the response if:

- the size and characteristics detected at the L1 satellites indicate the event will not be significant
- the solar radiation storm and solar flare impacts are also non-damaging.

Examples of stand-down actions include:

- reverting this Plan back to the **operational readiness** phase
- moving to NEMA Operating Mode 1[16]

[16] These activities will be determined by NEMA's Standard Operating Procedures.

- structured handovers.

Information requirements

Information requirements to establish situational awareness during the **credible threat** phase are outlined in **Table 6**.

Table 6. Information requirements for the credible threat phase

Function	Supporting Agency or Group	Information requirements
Science Desk	International space weather forecasting centres	Space weather event characteristics, including the estimated time of arrival and the geographic extent of impact.
Lifeline Utility Coordination	Transpower	Anticipated damage to the national electricity grid. Actions that Transpower and commercial operators are taking to mitigate or reduce damage. Potential consequences of those mitigating actions.
Lifeline Utility Coordination	Inter-Infrastructure Coordination Group	Anticipated disruption to interdependent critical infrastructure. Actions that operators and sector coordinating entities are taking to mitigate or reduce damage. Potential consequences of those mitigating actions.
Liaison Officers	All	Status of order and security in the community. Identify any areas of significant risk.
International Assistance, Intelligence	MFAT	The response actions and intentions of partner nations, including Australia, the United Kingdom, and the United States of America.
	MFAT	Impacts and likely needs of New Zealand citizens overseas.

5.4 Immediate response (3)

Phase description

The **immediate response** phase includes the immediate actions after the first damaging coronal mass ejection arrives at Earth.

As infrastructure outages are anticipated, response agencies will conduct actions as set out in the *National Catastrophic Event Handbook* and National Civil Defence Emergency Management Plan Order 2015. The response agencies will also refer to guidance in this Plan.

Response agencies are expected to take the appropriate response measures when communications are compromised.

This operational phase extends from the initial arrival of the coronal mass ejection through to the reinstatement of the communications infrastructure[17] and the start of the **initial coordinated response**.

Solar activity

The impacts of any earlier solar flare and solar radiation continue. The coronal mass ejection has reached Earth and is causing widespread impacts.

Response activities

After the initial arrival of a coronal mass ejection, the NCMC may take the actions outlined in **Table 7**.

Table 7. Actions in the immediate response phase

Function	Supporting Agency or Group	Response actions
Logistics	All	Establish (if possible) alternative communications between national, regional, and local coordination centres.
All	All	Support the Director CDEM and National Controller as they carry out their powers.
Intelligence	All	Complete a Holistic Consequence Analysis.[18]
Planning	All	Develop subsequent planning products to enable a unified response.
Policy	NEMA, DPMC, All agencies with relevant Ministerial portfolios	Prepare briefing material for the lead minister and for cross-ministerial briefings.
Public Information Management	NEMA, DPMC, MBIE, Transpower, National Public Information Management Coordination Group	Develop talking points and public messaging about the space weather event for the New Zealand Government.
Lifeline Utility Coordination	Inter-Infrastructure Coordination Group	Assess impacts on critical infrastructure and service delivery.

Information requirements

Only limited information may be available because the **immediate response** phase occurs during potential communication outages.

[17] Communications infrastructure may be intermittently disrupted, enabling limited coordination. This should not be misinterpreted as the end of the event.
[18] This will be based on assumptions of the event and will inherently be uncertain. Assumptions should be validated after the communications infrastructure is reinstated.

Some critical factors may be evident, such as whether electricity has been disrupted. Other factors may remain unknown, such as the geographic extent, restoration times, and cause of the electricity outages (from space weather, protective action or otherwise).

5.5 Initiate coordinated response (4)

Phase description

During the **initiate coordinated response** phase, communications infrastructure may be partially restored that allows coordination of inter-agency actions.

Two key activities are developing the event-specific National Action Plan and coordination between agencies.

Solar activity

Some solar activity may continue, but the predominant impacts of the solar flares, solar radiation storms and coronal mass ejections have occurred.

Response actions

During this phase, the NCMC may take the actions outlined in **Table 8**.

Table 8. Actions in the initiate coordinated response phase

Function	Supporting Agency or Group	Response actions
Control	NEMA	Authorise the phase change of this Plan.
Operations	NEMA	Use the National Warning System to notify key agencies and stakeholders of the phase change of this Plan.
All	All	Take actions in line with supporting plans and arrangements.
All	All	If a State of National Emergency is declared, support the Director CDEM and National Controller as they carry out their powers.
Intelligence	NEMA, International space weather centres	Monitor for space weather alerts through the MAR Centre. Report using the Intelligence Function.
Intelligence		Revise the information collection plan to support a sustained response and transition to recovery.
Intelligence	All	Establish and maintain situational awareness about events during communications outages. Identify expected events and consequences for the short, medium, and long term.
Science Desk, Lifeline Utility Coordination	NEMA, Inter-Infrastructure Coordination Group, International space weather	Coordinate science and technical advice about the space weather event.

Function	Supporting Agency or Group	Response actions
	centres, GNS Science, MetService	
Operations	NEMA, CDEM Groups	Communicate and coordinate with the CDEM Groups.
Control		Hold one or more multi-agency meetings to coordinate information flow. Use these meetings to also establish situational awareness of impacts and consequences, and to establish the actions of key agencies and stakeholders after the impact.
Governance	NEMA	Brief the lead minister and develop cross-ministerial briefings about themes that emerge from the multi-agency meeting or meetings.
Public Information Management	Broadcast MoU partners, NZ Telecommunications Forum	Adapt life safety advice, and then circulate it through available channels.
Public Information Management	Transpower, MBIE	Build on earlier messaging. Include details about the impacts of the space weather event.
Public Information Management	NEMA, DPMC	Support the Director CDEM and lead minister with their additional press conferences. Arrange regular media interviews with the Director CDEM, the lead Minister, or both.
Welfare	National Welfare Coordination Group	Develop all-of-government factsheets for those involved with welfare support.
Public Information Management	MoU partners	Circulate all-of-government factsheets through available channels. Ensure the flow of information reaches Broadcast MoU partners.
	MFAT	Communicate with nations within the response area of interest – primarily Pacific Island nations and countries undertaking activities within New Zealand's search and rescue region in Antarctica and the Southern Ocean
Planning	NEMA	Develop and share the National Action Plan for space weather events.

Information requirements

Information requirements to inform situational awareness during the **initiate coordinated response** phase are outlined in **Table 9**.

Table 9. Information requirements for the initiate coordinated response phase

Function	Agency or Group	Information requirements
Science Desk	International space weather centres	Event characteristics, including further anticipated solar activity.

Function	Agency or Group	Information requirements
Lifeline Utility Coordination	Transpower	Damage to the national electricity grid. Actions that Transpower is taking to repair and restore the network. Indicative restoration times.
Lifeline Utility Coordination	Inter-Infrastructure Coordination Group	Disruption to interdependent critical infrastructure. Actions that critical infrastructure operators are taking to repair and restore their networks. Indicative restoration times.
Intelligence		Immediate requirements for critical facilities, including hospitals.
Welfare	Health NZ / MoH	Status of medically dependent consumers. Immediate resource requirements. Further actions to mitigate loss of life and ease suffering.
Intelligence Liaison Officers	Maritime NZ, NZ Police	Status of health and public safety risks. Two examples are critical surgeries, and search and rescue missions.
Lifeline Utility Coordination	MoT, Maritime NZ, CAA, Airways NZ	Status of aviation and maritime operations. Details of whether flights or voyages have been disrupted or aborted prematurely. Details of whether consequent diversions have occurred.
Liaison Officers	All	Status of order and security in the community. Details of any areas of significant risk.
Liaison Officers	NZ Police, FENZ, Hato Hone St John	Operational status of emergency services.
All	All	Response and recovery capabilities and requirements of key agencies, stakeholders and CDEM Groups.
Science Desk, Intelligence	GNS Science, MetService	Whether natural hazard events are occurring, or likely to occur, at the same time during the space weather response. Operational status of capabilities to detect, monitor, alert, and communicate with key stakeholders and the public.
	MFAT	Response actions and intentions of partner nations, including Australia, the United Kingdom, and the United States of America.
	MFAT, MBIE	Status of foreign nationals and tourists in New Zealand, as well as New Zealanders away from their homes. Actions for repatriation or care in place.
Intelligence, Public Information Management	MFAT	International media coverage that is available and useful, for the specific requirements of public information.

5.6 Sustained response (5)

Phase description

During the **sustained response** phase, the NCMC is coordinating the central government response in support of regional and local delivery. The basic needs of communities have been met. The main effort is restoring critical infrastructure.

This phase begins after the first National Action Plan is distributed.

Solar activity

Solar conditions are reasonably benign.

Response actions

The NCMC will undertake response actions in line with the National Action Plan.

The NCMC may also continue taking these actions.

- Notify key agencies and stakeholders of the situation and Plan phase change.
- Monitor for space weather notifications through the MAR Centre.
- Manage and deliver public information (including updates on restoration times, actions taken, and life safety information).
- Establish and share situational awareness.

Information requirements

Information requirements to inform situational awareness during the **sustained response** phase are outlined in **Table 10**.

Table 10. Information requirements for the sustained response phase

Function	Agency or Group	Information requirements
Science Desk	International space weather centres, MetService, GNS Science	Event characteristics, including anticipated solar activity from solar rotation or newly developing solar instabilities.
All	All	Status of response efforts at community, local, regional, and national levels as they use up the supplies. Examples of supplies are fuel, food and other essential goods, medication, and emergency water supplies.
Lifeline Utility Coordination	Transpower	Restoration progress for the national electricity grid and interdependent critical infrastructure.
Welfare	Health NZ / MoH	Status of medically dependent consumers. Actions to mitigate loss of life and ease suffering.
Welfare	MPI	Status of animal welfare.

Function	Agency or Group	Information requirements
		Actions to prevent unnecessary unreasonable pain or distress to animals.
	NZ Police, Maritime NZ	Status of health and safety risks. Two examples are critical surgeries, and search and rescue missions.
Welfare	Health NZ / MoH	Psychosocial implications and actions taken to ease suffering.
Welfare Liaison Officers	CDEM sector and supporting agencies	Status of schooling and education. Actions taken to reduce disruptions.
Liaison Officers	All	Status of corrections. Disruptions that have potential concerns for law and order.
	MBIE	Status of unexpected arrivals after impacts to aviation or maritime.
	MFAT	Response progress of partner nations, including Australia, the United Kingdom, and the United States of America.
	MFAT	Impacts to other countries, impacts on New Zealand overseas, and early indications of consequences to New Zealand (such as disruptions to supply chains).
Lifeline Utility Coordination	Transpower, MBIE	Status of national strategic infrastructure.
Governance	All	Status of government, and its ability to meet legislative requirements when critical infrastructure is disrupted.

5.7 Transition to recovery (6)

Phase description

The focus is shifting from response to recovery activities, with an emphasis on:

- restoring key infrastructure
- providing necessities to communities for a new normal.

The NCMC is collaborating with the integrated National Recovery Office to hand over ongoing work.

Solar activity

Solar conditions are reasonably benign.

Recovery actions

Transition to recovery actions are out of scope for this Plan. These actions will be taken in line with other supporting plans and arrangements.

5.8 Medium to long-term recovery (7)

Phase description

In the **medium to long-term recovery** phase, recovery agencies collaborate to ensure community recovery needs are being met across all impacts.

Response agencies have returned to **operational readiness** activities while also supporting the integrated National Recovery Office.

Ongoing recovery needs are coordinated through multi-agency support.

Recovery work is embedded in the ongoing arrangements of agencies.

Solar activity

Solar conditions are reasonably benign.

Recovery actions

Medium to long-term recovery actions are out of scope for this Plan. These actions will be taken in line with other supporting plans and arrangements.

Section 6

Appendix

6

Section 6 Appendices

Appendix A
Public Information Management – message packs and templates

Appendix A sets out public information through message packs and templates sequenced by operational phase.

NEMA is the intended user of these message packs and templates. Users should use material relevant to the phase.

The intended use is at the national level.

NEMA should modify these message packs and templates to reflect the specifics of each event.

Other response entities are encouraged to create their own templates or modify these templates to align with their specific risk assessments and requirements.

A.1 Space Weather Message Pack

Operational readiness phase

About space weather

'Space weather' is caused by activity on the surface of the Sun. Storm-like activity can throw out bursts of electromagnetic radiation and solar material which can impact Earth-based infrastructure systems, especially electricity generation and distribution.

Extreme solar storms are rare but can be damaging. They can damage or destroy electricity infrastructure. They can also severely affect the operation of satellites used for positioning systems, telecommunications and more.

Space weather is linked to solar activity. This activity rises and falls across a cycle that ends about every 11 years. The current 'solar maximum' (a period of high solar activity) started in October 2024 and increased solar activity is expected over the next few years, but significant space weather events can happen at any time.

Two recent extreme events that impacted Earth's magnetic field are the Carrington Event in 1859 (an intense geomagnetic storm) and the severe space weather event of May 1921. The world's increased reliance on technology means these events would be far more damaging today.

Plans are in place for these events. The focus of these plans is to:

- minimise the impact to New Zealand's electricity infrastructure
- allow New Zealand's electricity sector to switch off some or all of their vulnerable equipment, to minimise long-term damage.

How New Zealand monitors space weather

NEMA's 24/7 MAR Centre monitors space weather forecasts from the United States National Oceanic and Atmospheric Administration and Australia's Bureau of Meteorology.

There are three main types of event: radio blackout, solar flare, and coronal mass ejection.

Warning times that New Zealand can expect

Coronal mass ejection event: at least 12 hours, but arrival times vary: the bigger the event; the less advance warning.

Satellites can tell us more about the size and type of event between 15 and 60 minutes before the event impacts Earth.

Radio blackout event: from minutes to hours

Solar flare: from minutes to hours, or no warning.

If a significant storm is detected, NEMA's MAR Centre will contact Transpower and other stakeholders, and activate NEMA's standard operating procedures for a space weather event. These procedures focus on the impact to New Zealanders from a major infrastructure failure.

What NEMA is doing to counter the impact from a space weather event

NEMA's planning revolves around the potential impact of a space weather event. In a severe event, this could involve widespread power outages, as well as impacts on radio and navigation systems.

As with any major infrastructure failure, NEMA will coordinate a response to help manage the impacts and consequences.

NEMA is involved in regular discussions with Transpower, the Civil Aviation Authority and other government agencies, as well as local and international scientists.

NEMA's public education focus will centre on the impacts to New Zealanders, advising them what will happen, how long the event will last and what they can do to prepare.

What will the public impacts be, what can the public do to prepare?

The most likely impacts to New Zealanders will be:

- Power cuts for the duration of the event, which could last for approximately 6 days.
- Rolling power cuts that may last days or weeks after the event.
- Internet, cell phone services, TV and radio outages.

In the period leading up to an event, you should:

- Keep cell phones on so you can receive alerts. If you have cell phone service, only make calls and texts in emergencies to prevent networks becoming overloaded.
- Listen to the radio for updates. AM radio frequencies are likely to remain operational.
- If you are medically dependent on power, consider activating your backup plan.

Once power has gone out, remember:

- You can use home generators and solar power systems – these will not be affected.
- You can use your car to charge your phones and other devices.
- Eat food from your fridge first, then your freezer.

- Always wash and dry your hands before preparing food – if water is in short supply, keep some in a bowl with disinfectant. Click here for the latest food safety advice during a natural hazard event.
- Do not use outdoor gas appliances such as patio heaters, camping cookers and barbecues indoors. Outdoor gas appliances can produce dangerous levels of carbon monoxide.
- If you are dependent on medical equipment that is electrically powered, activate your backup plan.
- Share this information with family, neighbours and friends.

This is a timely reminder to prepare your whare and whānau for emergencies – power outages can happen anywhere at any time.

Make sure you have emergency supplies including torches and a solar or battery powered radio, and food that does not need to be cooked. Find out more at our Get Ready site

A.2 Space Weather Response Templates

Elevated threat phase (phase 1)

Use this template in the **elevated threat** phase (phase 1).

Emergency Mobile Alert

SPACE WEATHER EVENT

The National Emergency Management Agency advises a large solar weather event has been detected. This may have impacts on New Zealand's infrastructure within the next 12 to 18 hours, particularly the national electricity grid, and cell phone and internet services. NEMA and other government agencies are assessing what actions may need to be taken to protect electricity networks.

The space weather event will not harm humans or domestic animals, but you could be without power for approximately 6 days. Prepare your emergency kit and ensure you have water and food for your household. Keep cell phones on so you can receive alerts.

We will update this advice within @@*time*@@ hours.

www.civildefence.govt.nz

National Warning Systems

This is a Warning for all New Zealand.

A large ejection of energy from the Sun has been detected by international monitoring agencies. This may have impacts for New Zealand within the next 12 to 18 hours.

Space Weather events can cause severe damage to New Zealand's infrastructure, particularly the national electricity grid and cell phone and internet services.

Plans are in place for an event like this. These have been activated and all agencies are responding.

To protect New Zealand, Transpower and other agencies may turn off some networks until the event has passed. This could mean you have no electricity, cell phone or internet for some time.

The solar flare energy will not harm humans or domestic animals.

By @@*time*@@ we will know more about what will happen and we will provide an update.

You should:

- Keep cell phones on and charged so you can receive alerts.
- Prepare for a possible lengthy power cut. Check your emergency supplies including water.
- If you are dependent on medical equipment that is electrically powered, check you have a backup plan in place.
- Listen to the radio and/or TV for updates or check www.civildefence.govt.nz.
- Share this information with family, neighbours and friends.

This Warning has been issued following an assessment of available information. The National Emergency Management Agency will continue to assess the threat and provide an update at @@*time*@@

This warning will remain in effect until the National Emergency Management Agency issues a cancellation message

Social media and website

At @@*time*@@ today a large ejection of energy from the Sun was detected by international monitoring agencies. This may have impacts for New Zealand within the next 12 to 18 hours, including disruptions to the national electricity grid and cell phone/internet services. Find out more about space weather @@here@@.

We will know more about the size and severity of this event in the coming hours. Plans are in place for space weather events. These have been activated and all agencies are responding.

To protect New Zealand, Transpower and other agencies may turn off some networks until the event has passed. This could mean you have no electricity, cell phone or internet for some time. The solar flare energy will not harm humans or domestic animals.

By @@*time*@@ we will know more about what will happen and we will provide an update.

In the meantime, keep cell phones on and charged so you can receive alerts.

Prepare for a possible lengthy power cut. Check your emergency supplies including water.

If you are dependent on medical equipment that is electrically powered, check you have a backup plan in place.

Listen to the radio and/or TV for updates or check www.civildefence.govt.nz.

Share this information with family, neighbours and friends.

Credible threat phase (phase 2)

Use this template in the credible threat phase (phase 2).

Emergency Mobile Alert

The National Emergency Management Agency advises a large solar flare will have impacts on New Zealand. Transpower will take action at @@*time*@@ to protect severe damage to our national electricity grid.

The solar flare energy will not harm humans or domestic animals, but you could be without power for approximately 6 days. Keep cell phones on so you can receive alerts. If you have cell service, only use your phone in emergencies. AM radio frequencies are likely to be operational, so listen to the radio for updates.

www.civildefence.govt.nz

National Warning System

This is a Space Weather Warning for all New Zealand.

A large ejection of energy from the Sun is expected to have impacts on New Zealand within the next 15 minutes.

Space weather events can cause severe damage to New Zealand's infrastructure, particularly the national electricity grid, and cell phone and internet services.

Transpower advises it will take action to protect damage to our national electricity grid. The grid will be switched off at @@time@@ and will not be reactivated until the event is over. You could be without power for at least three days.

The solar flare energy will not harm humans or domestic animals.

You should:

- Keep cell phones on so you can receive alerts. If you have cell phone service, only make calls and texts in emergencies to prevent networks becoming overloaded.
- AM radio frequences are likely to remain operational. Listen to the radio for updates.
- Eat food from your fridge first, then your freezer.
- Do not use outdoor gas appliances such as patio heaters, camping cookers and barbecues indoors. Outdoor gas appliances can produce dangerous levels of carbon monoxide.
- If you are dependent on medical equipment that is electrically powered, activate your back up plan.
- Share this information with family, neighbours and friends.

This National Warning has been issued following an assessment of available information. The National Emergency Management Agency will continue to assess the threat and provide an update within an hour.

This warning will remain in effect until a cancellation message is issued by the National Emergency Management Agency.

Social media and website

A severe space weather event is expected to affect New Zealand within the next 15 minutes. Transpower advises it will take action to protect damage to our national electricity grid by @@*action*@@

Space weather is caused by flares of energy from the surface of the Sun, and it can have severe impacts on power networks. To protect our power supply, the grid will likely be switched off at *@@time@@* and will not be reactivated until the event is over. You could be without power for approximately 6 days.

Keep cell phones on so you can receive alerts. If you have cell phone service, only make calls and texts in emergencies to prevent networks becoming overloaded.

AM radio frequences are likely to remain operational. Listen to the radio for updates.

Eat food from your fridge first, then your freezer. Do not use gas-powered heaters or barbecues indoors.

If you are dependent on medical equipment that is electrically powered, activate your backup plan.

Listen to the radio and/or TV for updates or check www.civildefence.govt.nz.

Share this information with family, neighbours and friends.

Declaration of a State of National Emergency

Social media post

The New Zealand Government has declared a state of national emergency to assist in the response to the severe space weather event at @@*time*@@ today.

The declaration applies to *insert names of regions/localities or all of New Zealand.*

What does a State of National Emergency mean?
Under a State of National Emergency, the Director of Civil Defence Emergency Management and National Controller have authority to direct and control the response under the Civil Defence Emergency Management Act 2002.

It means we can support the impacted regions by coordinating additional resources where they are most needed and set the priorities across the country for the response at a national level.

You can still go about your daily business under a state of emergency but make sure you listen to and follow any instructions from civil defence and emergency services.

Website banner

The New Zealand Government has declared a state of national emergency to assist in the response to the expected space weather event at @@*time*@@ today.

The state of national emergency is for *insert names of regions or all of New Zealand.*

Space weather events occur when storm on the surface of the Sun cause flares of energy which can reach Earth.

Space weather events can cause severe damage to New Zealand's infrastructure, particularly the national electricity grid, and cell phone and internet services. Plans are in place for an event like this. These have been activated and all agencies are responding.

To protect our power supply, the some of the national electricity grid will be switched off at @@*time*@@ and will not be reactivated until the event is over. You could be without power for approximately 6 days.

You should:

- Keep cell phones on so you can receive alerts. If you have cell phone service, only make calls and texts in emergencies to prevent networks becoming overloaded.
- AM radio frequences are likely to remain operational. Listen to the radio for updates.
- Eat food from your fridge first, then your freezer.
- Do not use outdoor gas appliances such as patio heaters, camping cookers or barbecues indoors. Outdoor gas appliances can produce dangerous levels of carbon monoxide.
- If you are dependent on medical equipment that is electrically powered, check you have a backup plan in place.
- Share this information with family, neighbours and friends.

Media release

State of National Emergency declared for Extreme Space Weather event

The New Zealand Government has declared a state of national emergency to assist in the response to the expected space weather event at @@*time*@@ today.

Minister for Emergency Management and Recovery, @@name@@, signed the declaration at @@*time*@@.

Prior to signing the declaration, @@he/she/they@@ advised the Prime Minister, and the Opposition spokesperson for emergency management, who were both supportive of the declaration. @@*Delete or update as required*@@.

The declaration will apply to all of New Zealand. It is the @@*number*@@ time in New Zealand history that a State of National Emergency has been declared.

“This is a potentially significant event that could cause major impacts across New Zealand,” @@name@@ said.

“Plans are in place for an event like this. These have been activated and all agencies are responding.

“This declaration will ensure the government can make available all the support and resources needed to respond in the shortest possible timeframe.”

Space weather events occur when storms on the surface of the Sun cause flares of energy which can reach Earth. If no action is taken, these can severely damage electricity transmission equipment.

“Transpower have informed me they intend to take action to protect the national grid from damage. This will mean turning off the power from @@*time*@@ for @@hours@@,” @@name@@ said.

“This is a difficult decision as we know it will be a great inconvenience to people, businesses and communities around the country, but if we don’t do this, the damage to our grid could take years to fix.”

Under the Civil Defence Emergency Management Act 2002, today’s State of National Emergency declaration allows the National Controller to direct and coordinate personnel, material, and other resources, and provides access to other extra-ordinary powers that will support delivery of an effective and timely national-level response.

“Follow any instructions from civil defence and emergency services. They are working to support you and keep you safe,” @@name@@ said.

“This is an extremely challenging time, but we will get through this together. Look after yourselves and help others if you can.”

ENDS

What people should do:

- Keep cell phones on and charged so you can receive alerts.
- Prepare for a possible lengthy power cut. Check your emergency supplies including water.
- If you are dependent on medical equipment that is electrically powered, activate your backup plan.
- Listen to the radio and/or TV for updates or check www.civildefence.govt.nz.
- Share this information with family, neighbours and friends.

Appendix B
Some related legislation, plans and arrangements

Appendix B lists some related legislation, plans, and arrangements. Some items link to their online source.

Civil Defence Emergency Management Act 2002

Coordinated Incident Management Systems Third Edition

Interim Australian Government Space Weather Event Plan 2024

National Catastrophic Event Handbook (expected December 2024)

National Civil Defence Emergency Management Plan Order 2015

National Fuel Plan 2024

Appendix C
Operational phases overlaid against other plans

Appendix C overlays operational phases against other plans.

Operational phases are mapped against other plans and sources plans to enable translation of international activity and forecasts into the New Zealand context (see table below and **Section 5**). Two examples of such international activities and forecasts are:

- Interim Australian Government Space Weather Event Plan
- Advisories from the United States' Space Weather Prediction Centre (operated by the National Oceanic and Atmospheric Administration).

Response Phases		Australian Interim Plan	Advisories
0	Operational readiness	Standby	Regular notifications (G/S 1-3)
1	Elevated threat	Alert	G4-5 Watch
2	Credible threat	Active – pre-impact	G/S 4-5 Warning/Alert
3	Immediate response	Active – post-impact	G/S 4-5 Alert
4	Initiate coordinated response		
5	Sustained response		
6	Transition to recovery	Standby	Regular notifications (G/S 1-3)
7	Medium to long-term Recovery		

Appendix D
List of acronyms and initialisms

Appendix D is a list of acronyms and initialism used in this Plan.

AM	Amplitude Modulation (radio)
CAA	Civil Aviation Authority
CDEM	Civil Defence Emergency Management
DPMC	Department of the Prime Minister and Cabinet
FENZ	Fire and Emergency New Zealand
GNS Science	Institute of Geological and Nuclear Sciences
MAR	Monitoring Alerting and Reporting
MBIE	Ministry of Business, Innovation & Employment
MCH	Ministry for Culture and Heritage
MetService	New Zealand Meteorological Service
MFAT	Ministry of Foreign Affairs and Trade
MoH	Ministry of Health
MoT	Ministry of Transport
MoU	Memorandum of Understanding
MPI	Ministry for Primary Industries
NCMC	National Crisis Management Centre
NEMA	National Emergency Management Agency
NZDF	New Zealand Defence Force
ODESC	The Officials Committee for Domestic and External Security Coordination