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Department for Health and Wellbeing

South Australian Arbovirus Management Strategy

Government of South Australia

SA Health

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1.0	Health Protection Programs	Original version - South Australian Arbovirus Coordinated Control and Operations Plan	CPHO – Professor Paddy Phillips	September 2015
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Acronyms and abbreviations

ACDC	Australian Centre for Disease Control
ARCAG	Arbovirus Response Cross Agency Group
BOM	Bureau of Meteorology
BFV	Barmah Forest virus
CAP	South Australian Arbovirus Communication Action Plan
CDCB	Communicable Disease Control Branch, Department for Health and Wellbeing
CDNA	Communicable Diseases Network Australia
CHIKV	Chikungunya virus
CPHO	Chief Public Health Officer, Department for Health and Wellbeing
DAFF	Department of Agriculture, Fisheries and Forestry
DENV	Dengue virus
DEW	Department for Environment and Water
DHW	Department for Health and Wellbeing
DoH	Commonwealth Department of Health and Aged Care
DMB	Disaster Management Branch, Department for Health and Wellbeing
ENSO	El Niño - Southern Oscillation
ESCOSA	Essentail Services Commission of South Australia
FPoE	First Points of Entry
HoR	Hierarchy of Responses
HPP	Health Protection Programs, Department for Health and Wellbeing
IHR	International Health Regulations 2005
IMMP	Integrated mosquito management program
JE	Japanese encephalitis
JEV	Japanese encephalitis virus
NGO	Non-government organisation
NSW	New South Wales
MMP	Mosquito management plan
MVEV	Murray Valley encephalitis virus
NAMAC	National Arbovirus and Malaria Advisory Committee
OCA	Outback Communities Authority
OHSAWG	One Health South Australia Working Group
PHEMP	Public Health Emergency Management Plan
PHPA	Public Health Partnership Authority
PIRSA	Department of Primary Industries and Regions
RPHP	Regional public health plan
RRV	Ross River virus
SPHP	State Public Health Plan
SMP	Strategic management plan
WHO	World Health Organization
WNV	West Nile virus
WNV/KUN	West Nile virus – Kunjin strain
YFV	Yellow Fever virus
ZIKV	Zika virus

Definitions

The Act	*South Australian Public Health Act 2011.*
Alphavirus	Single stranded RNA viruses transmitted by arthropods, especially mosquitoes.
The annual report	The South Australian Arbovirus and Mosquito Monitoring and Control Annual report.
Arbovirus	Arthropod-borne viruses affecting humans.
Dead-end host	Humans/animals that do not develop high levels of arbovirus in their bloodstream and cannot pass the virus on to other biting mosquitoes.
Encephalitis	Inflammation of the substance of the brain.
Flavivirus	Enveloped, spherical positive stranded RNA viruses, the genus contains many arthropod-borne viruses that are distributed worldwide.
LG Act	*Local Government Act 1999.*
The monthly report	The South Australian Arbovirus and Mosquito Monitoring Report.
Pathogen	A bacterium, virus, or other microorganism that can cause disease.
The Plan	The South Australian Arbovirus and Mosquito Monitoring and Control Plan.
Reservoir	The reservoir of an infectious agent is the habitat in which the agent normally lives, grows, and multiplies. Reservoirs include humans, animals, and the environment.
The resource pack	The South Australian Integrated Mosquito Management Resource Pack.
Sentinel	An indicator for the presence of disease.
The Strategy	The South Australian Arbovirus Management Strategy.
The subsidy program	The South Australian Mosquito Management Subsidy Program.
Vector	A carrier of a disease-causing agent from an infected individual to a non-infected individual or its food or environment.

Strategy overview

Table 1: South Australian Arbovirus Management Strategy overview

SOUTH AUSTRALIAN ARBOVIRUS MANAGEMENT STRATEGY						
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- the One Health SA Working Group.
- members of the Arbovirus Response Cross Agency Group.
- the Local Government Association SA.
- local government representatives from environmental health and management.
- Environmental Health Australia SA.

Table 2: South Australian arbovirus management strategy strategic goals, priorities, and actions.

Goal	Strategic Priority (SP)	Key Action
1. Partnership working. To protect public health and well-being through collaborative, evidence-based approaches to arbovirus management.	**SP1:** Maintain and build strategic partnerships to share diverse expertise and resources, and guide risk-based responses to endemic, epidemic, and exotic mosquito-borne disease risks.	*SP1.1 Continue to develop and maintain relationships with key stakeholders and partners through effective, routine, planned and ad hoc engagement.* *SP1.2 Collaborate with the One Health South Australia Working Group (OHSAWG) to promote integrated mosquito management policies and programs within the public health, animal health and environmental sectors of government.* *SP1.3 Continue to convene planned and responsive Arbovirus Response Cross Agency Group (ARCAG) meetings.* *SP1.4 Develop a local South Australian exotic mosquito detection response plan and adaptive response framework based on the national best practice model.*
	SP2: Develop and maintain data management systems, data sharing mechanisms, and agreements to support effective monitoring of mosquito populations, and the prevalence of human and animal arboviral disease.	*SP2.1 Support the development and modernisation of data management systems and processes.* *SP2.2 Develop and maintain data management systems utilising DHW technical expertise.* *SP2.3 Expand the existing DHW/PIRSA Japanese encephalitis virus (JEV) data sharing agreement to include all mosquito-borne arboviruses that can cause disease in humans.*
	SP3: Build and maintain local capacity to enable stakeholders to respond to endemic, epidemic, and exotic mosquito borne disease risks.	*SP3.1 Launch the South Australian Integrated Mosquito Management Resource Pack (the resource pack).* *SP3.2 Deliver training to key partners to support increased local capacity to respond to endemic, epidemic, and exotic mosquito borne disease risks.* *SP3.3 Expand suite of online videos and training resources.* *SP3.4 Maintain, and update training resources based on the best available information and technology.* *SP3.5 Develop a training plan for councils at greatest risk of exotic mosquito incursions. [Link to SP1]*
	SP4: Produce policies, tools, and resources to support mosquito management programs.	*SP4.1 Engage with strategic partners to increase emphasis on climate risk in the context of mosquito borne disease in the State Public Health Plan (SPHP).* *SP4.2 Investigate opportunities to develop specific mosquito control policy or regulation under the South Australian Public Health Act 2011 (the Act).* *SP4.3 Engage with local councils to support the development of mosquito sensitive policies.* *SP4.4 Deliver the South Australian Mosquito Management Subsidy Program (the subsidy program) informed by epidemiological and environmental evidence and intelligence.* *SP4.5 Engage with councils to explore mosquito management funding opportunities through their strategic management plans (SMPs).*

2. Effective risk management. To mitigate or reduce the risk of mosquito-borne diseases in South Australia, using a comprehensive, evidence-based risk management framework.	**SP5:** Undertake risk assessments to identify hazards and potential outbreak areas and assess the risk of local transmission of arboviral disease.	*SP5.1 Continue to provide local councils with mosquito, arbovirus, and disease data in accordance with The South Australian Arbovirus and Mosquito Monitoring and Control Plan (the Plan). [LINK SP2]* *SP5.2 Provide all councils with a mosquito management plan (MMP) template as part of the resource pack. [LINK SP3]* *SP5.3 Require all councils to develop a risk based MMP under policy or regulation. [LINK SP4]*
	SP6: Maintain comprehensive surveillance and monitoring programs to assess potential trigger conditions, track mosquito and arbovirus activity, and identify potential outbreaks.	*SP6.1 Administer funding to support ongoing, risk-based, mosquito surveillance and management programs in South Australia including the related laboratory costs. [LINK SP4]* *SP6.2 Administer funding for the South Australian sentinel chicken program including the related laboratory costs.* *SP6.3 Maintain the local government subsidy program. [LINK SP4]* *SP6.4 Maintain the northern Adelaide mosquito trapping program and Globe Derby Park saltmarsh aerial larviciding program.*
	SP7: Employ integrated mosquito management strategies to reduce mosquito populations and minimise transmission risks.	*SP7.1 Provide training and resources to local councils to support integrated mosquito management programs (IMMPs). [LINK SP3]* *SP7.2 Provide resources to support the development of local council communication plans. [LINK SP3]* *SP7.3 Engage with government, non-government organisations (NGOs), community groups, and businesses to support integrated mosquito management. [LINK SP4, SP5]*
	SP8: Ensure a standardised framework for responding to arbovirus risks across South Australia, based on surveillance data, to enable informed decision-making and resource allocation.	*SP8.1 Continue to use the Hierarchy of Responses (HoR) operational framework to support responses to increase threat of human arbovirus infection.* *SP8.2 Develop a local South Australian exotic mosquito detection response plan and adaptive response framework. [LINK SP1]* *SP8.3 Implement the South Australian Arbovirus Communication Action Plan (CAP) to guide communication as required.*
	SP9: Ensure a standardised framework to support recovery from an arbovirus incident, outbreak, or emergency in South Australia.	*SP9.1 Implement the CAP to guide communication as required. [LINK SP8.3]* *SP9.2 Develop a standardised form for stakeholder feedback to obtain recommendations for future incident, outbreak, or emergency responses.* *SP9.3 Develop a standardised form for incident, outbreak, or emergency response reports.* *SP9.4 Continue to produce summary reports following responses to incidents, outbreaks, or emergencies, detailing recommendations to support the implementation of future responses.*
	SP10: Raise public awareness about arboviruses, their associated risks, and preventive measures to enable individuals and communities to protect themselves from serious arboviral disease.	*SP10.1 Develop and maintain the annual Fight the Bite campaign. [LINK SP8]* *SP10.2 Develop and maintain the annual standby Fight the Bite communications action plan.* *SP10.3 Continue to prepare and publish the annual South Australian Annual Arbovirus and Mosquito Monitoring and control report (the annual report). [LINK SP2]* *SP10.4 Continue to prepare and publish the monthly South Australian arbovirus and mosquito monitoring report (the monthly report). [LINK SP2]* *SP10.5 Continue to prepare and publish material on the SA Health website to inform local communities and key stakeholders. [LINK SP2]*

Background

Background

Mosquitoes are vectors of several arthropod-borne viruses (arboviruses) affecting humans and are the leading cause of morbidity and mortality in many parts of the world. South Australia has historically experienced a low incidence of serious mosquito-borne diseases. However, climate change-related threats, including rising global temperatures and extreme rainfall events, coupled with global trade and travel, are contributing to the increased risk of mosquito-borne arboviruses.

Endemic, epidemic, and exotic mosquito-borne arboviruses pose a significant threat to the health and well-being of South Australians. Understanding the distinctions between these is crucial for developing effective prevention and control strategies. Endemic arboviruses are continuously present in a particular region, with relatively predictable transmission patterns. Epidemic mosquito-borne diseases are characterised by sudden and rapid surges in transmission, potentially leading to outbreaks. Exotic mosquito-borne diseases pose a severe threat to public health due to their potential for rapid spread and severe illness in immunologically naïve populations.

Mosquito-borne arboviruses are classified as either flaviviruses or alphaviruses. In South Australia, endemic flaviviruses, including Murray Valley encephalitis virus (MVEV), West Nile virus Kunjin strain (WNV/KUN), and JEV, are of particular concern due to their potential to cause permanent neurological damage or death in humans. Alphaviruses, including Ross River virus (RRV) and Barmah Forest virus (BFV), are also a cause for concern in South Australia as they can cause chronic illness, with symptoms sometimes persisting for over a year or more. RRV is the most commonly notifiable mosquito-borne disease notified in South Australia.

South Australia's last major outbreak of RRV and BFV occurred in the summer of 2010/11, along with two reported cases of locally acquired MVEV, one of which was fatal. Many detections of RRV and BFV in trapped mosquitoes were reported in South Australia during the 2022/23 season. JEV was detected in South Australia for the first time during the summer of 2021/22 and nine locally acquired human cases were subsequently notified. There was one confirmed human case of MVEV reported in South Australia in May 2023.

There is currently no vaccine and no cure for RRV, BFV, MVEV or WNV/KUN. Personal and household protection against mosquito bites are the only evidence-based measures known to prevent individuals from being infected. In addition, nuisance biting can significantly affect community morale and reduce engagement in outdoor activities. Nuisance biting and arboviruses have significant health, economic and social implications.

There are several serious exotic arboviruses that have the potential to be introduced to South Australia, including Chikungunya virus (CHIKV), Dengue virus (DENV), Yellow Fever virus (YFV) and Zika virus (ZIKV). The vector mosquitoes for these diseases are particularly suited to urban environments, meaning that highly populated areas may be at risk of increased disease. Climate change, and associated human activity, increase the risk of local environments being conducive to mosquito breeding.

Not all diseases transmitted by mosquitoes are arboviral. Globally, malaria is one of the most devastating human diseases. Malaria is caused by protozoan parasites belonging to the genus *Plasmodium*. Despite eradication of the disease in Australia in 1981, pockets of risk persist near the Torres Strait Islands, where the primary vector mosquito, *Anopheles farauti*, is present in proximity to endemic zones, creating a potential pathway for reintroduction.

Modelling suggests that the effects of extreme precipitation and temperature changes arising from climate change are likely to create conditions to support the spread of malaria into eastern Australia by the end of the century, with a decrease in likelihood for northern Australia (Colón-González et al., 2022). This highlights the importance of continued vigilance and preventative measures.

In addition, Buruli ulcer, a chronic skin infection caused by the bacterium *Mycobacterium ulcerans* is increasing in prevalence in south-eastern Australia. Combe et al., 2017 suggest that local effects of global environmental changes have created conditions conductive to the pathogen's prevalence in the environment. Recent research findings indicate that endemic mosquitoes transmit the infection in south-eastern Australia and highlight mosquito control as a Buruli ulcer prevention measure (Mee et al., 2024).

Climate change and mosquito-borne diseases

Climate change has caused the planet to warm by approximately 1.2°C since pre-industrial times, with resultant changes in weather patterns and escalation of extreme weather events (Rocklöv, and Dubrow, 2020). Many of the changes in climate, such as heat, extreme precipitation events, flooding, and drought, have important implications for the epidemiology of mosquito-borne diseases (Thomson and Stanberry, 2022). This is due several factors, including effects on pathogens, hosts, and vectors. However, attributing changes in the epidemiology of mosquito-borne diseases to climate change is difficult. This is due to confounders such as changes in land-use, control measures and natural weather variability (Thomson and Stanberry, 2022), and drivers such as globalisation, sociodemographic changes, and development (or devolution) of public health systems (Rocklöv and Dubrow, 2020).

Climate projection models for south-east Australia predict increased and longer periods of drought, but also increases in the severity, frequency, and duration of extreme precipitation events (Hime et al, 2022). These changes in weather patterns may bring together vectors, hosts, and pathogens in different ways, spurring outbreaks of new mosquito-borne diseases in areas where they have not previously been prevalent (Thomson and Stanberry, 2022). Increase in the frequency and severity of extreme weather events drives changes in the distribution of *Aedes aegypti* and *Aedes albopictus*, both which are known to transmit RRV and DENV (Hall et al, 2021).

Climate change may affect arboviral disease transmission by increasing survival of vectors and increasing biting rates, increasing replication of pathogens, decreasing reproductive rates, and increasing the length of the transmission season (Colón-González et al, 2022). Positive impacts on mosquito growth are seen from increased heat, humidity, and rainfall (Hall et al., 2021). When water temperature rises, mosquito larvae mature more quickly and have a greater capacity to produce offspring. In warmer weather, female mosquitos feed more frequently and digest blood more quickly, up to an upper threshold of around 34°C (Githeko et al, 2000).

Globally, there has been an increase in the prevalence of DENV, malaria, and West Nile virus (WNV) over the previous few decades (Thomson and Stanberry, 2022). Specifically, Australia has seen several emerging infectious diseases over the last few decades, predominantly caused by climate change and eco system disruption; this will continue to increase as weather extremes become more frequent (Nogrady, 2022).

Due to the unpredictability of climate change, patterns of spread of mosquito-borne diseases are now also less predictable than before, and it is likely that Australia will see incursion of arboviral diseases that previously had not been detected or endemic on this continent such as malaria and WNV (Jose, Claughton and Condon, 2022). Australia is not immune to incursion of these pathogens as the climate changes, noting the recent emergence of JEV throughout southern Australia.

As with all health impacts of climate change, there is an inequitable distribution of harm and risk, with marginalised and vulnerable populations bearing the greatest burden. This includes those living in poverty, women and children, older adults, and those with barriers to education and employment. Socio-Economic Indexes for Areas is a known risk factor for arboviruses (Kulshov et al, 2022).

Extreme weather events and mosquito-borne diseases

The El Niño-Southern Oscillation (ENSO) is a substantial contributor to the variability of climate across the globe, and one of the key climactic drivers for Australia. Changes in the ENSO may drive increases in average temperature, and above-average rainfall, and subsequent changes in mosquito survival and life cycle. The impact of climate change associated with ENSO was seen throughout Australia in 2021-2022, when Australia experienced two consecutive years of increased rainfall and subsequent widespread flooding. Research suggests that more intense and frequent El Niño and La Niña events should be expected, as should more frequent swings from a strong El Niño to a strong La Niña the following year (Cai and Santoso, 2023).

Severe weather such as flooding has an impact on the spread of mosquito-borne diseases. In 2022, following significant flooding, Japanese encephalitis (JE) was detected in Southern Australia for the first time, with cases occurring in Victoria, New South Wales, and South Australia (Nogrady, 2022). The most recent incursion on to the Australian mainland had occurred in 1998 and was isolated to far North Queensland and the Torres Strait; there was no precedent for the geographic spread that was seen in 2022.

Effects of heat and drought

Increase in the duration, intensity and frequency of warm weather have impacts both on the behaviour and physiology of pathogens and vectors, and of the number and behaviour of reservoir and definitive hosts (Thomson and Stanberry, 2022). This does not always mean an increase in the risk for mosquito-borne diseases in an area; and may indeed mean that vectors no longer carry a pathogen and disease risk is decreased.

Drought is a risk factor for arboviral diseases such as DENV, as households that lack access to piped water may store water around the house in open containers, which provides a breeding ground for *Aedes aegypti* mosquitos. Drought can prove to be advantageous for certain mosquito species, in other ways as large pools of water become shallower and velocities of rivers decrease, which can increase the extent of water sites (Brown, Medlock and Murray, 2014).

Rapid 're-wetting' can also cause an increase in population of mosquitoes. This occurs when wetlands that are intended to always remain wet dry out, with resultant loss of mosquito competitors and predators. Subsequent water inundation into these areas can lead to a significant and rapid re-colonisation of mosquito species (Brown, Medlock, and Murray, 2014). This effect is mitigated by prolonged droughts, as vectors may not be able to survive these prolonged periods.

Effects of extreme precipitation and temperature changes

Extreme precipitation is a risk factor for arboviruses such as DENV, as water may pool and collect and provide an ideal breeding ground for *Aedes aegypti*. This is only true to a point, after which flushing and flooding can destroy the breeding sites. Equally, vector and pathogen traits will increase up to an optimum maximum temperature, after which point, they will decline (Rocklöv, and Dubrow, 2020).

Temperature, rainfall, and humidity all affect the length of the transmission season and the geospatial spread of the vectors for both DENV and malaria. Rainfall and temperature are the most significant risk factors for DENV, BFV and RRV and relative humidity the second most common factor for DENV and RRV (Kulshov et al, 2022).

Epidemiological studies in South Australia show that nearly 40% of RRV cases occur along the River Murray. Research suggests a complex interplay between environmental factors and disease transmission. Rising minimum and maximum temperatures, increased rainfall, a positive Southern Oscillation Index, and increased River Murray flows all favour disease spread, while higher humidity may mitigate the risk (Bi et al., 2009).

Urbanisation, migration, and population movement

The geographic distribution of mosquito-borne diseases such as dengue has changed significantly over the last 20 years, because of globalisation and a decline in vector control programs; by 2030 it is predicted that climate change will overtake these factors as the greatest cause for the expansion of arboviral vectors (Thomson and Stanberry, 2022).

Urbanisation has already shown a change in vector geospatial distribution in Australia. Human mobility and transportation options led to prevalence of dengue fever in urban areas in Australia. This changed as piped water, refrigeration, and movement from steam to diesel locomotion limited the ability of the vectors to breed in these areas. Likewise, RRV has traditionally been most prevalent in rural areas. However, cases have been increasing in capital cities since the 1980s (Kulshov et al, 2022).

There is a significant link between rapid urbanisation, poverty, and the occurrence of mosquito-borne diseases such as dengue. A lack of necessary infrastructure for the safe storage or water, lack of control over water distribution and barriers for effective wastewater disposal, leads to an ideal breeding environment for mosquito species.

Changing distribution of reservoir hosts

There is precedence that a change in the distribution of reservoir hosts could contribute to changes in the geospatial distribution of mosquito-borne diseases in Australia. In other countries, birds are the host for WNV, and there is evidence that changes in migration patterns due to climate change is affecting the transmission of this virus from *Culex* mosquitos to humans (Rocklöv, and Dubrow, 2020). There is evidence for the impact of this locally also; it is suggested that a determining factor in the

2022 outbreak of JE in Australia was the flight further south of migratory birds (Jose, Claughton and Condon, 2022).

Finally, deforestation occurs in concert with climate change, as part of the planetary crisis. Encroachment of habitats by humans leads to alteration of species balance and a change in vector-host-parasite relationships. As human migration occurs due to climate change, there is a significant risk that habitat encroachment will escalate, and new vector borne diseases will emerge (Sutherst, 2004).

Governance and legislative context

Existing governance and legislative frameworks

In Australia, communicable disease control is a shared responsibility between the Commonwealth, state, territory, and local governments. Each level of government has its own role to play, and they are all supported by relevant governance and legislative frameworks. These frameworks provide the legal basis for the collection of data, the investigation of outbreaks, and the implementation of control measures.

State and territory health departments have the primary responsibility for communicable disease prevention and control programs. They also have the responsibility to respond to notifications of all notifiable diseases. Local governments play an important role in communicable disease control by providing services such as mosquito surveillance and control, and public health education.

International governance and frameworks

One Health approach

International recognition is growing that protection of human health requires an agile, collaborative approach to tackle problems at the interface of human, animal, and environmental health. The One Health approach promises improved disease prevention, control, and preparedness, as evidenced by recent endorsements from the G20 Health Ministers and the Quadripartite organisations. (Steele et al., 2022).

One Health is an approach which recognises that human health is closely related to animal health and the health of our shared environment. It can be defined as a multi-disciplinary and multi-sector collaboration which aims to achieve optimal health outcomes, acknowledging the inter-dependant relationship between animals, humans, and the environment.

The approach brings together multiple sectors, disciplines, and communities at varying levels of society to work together. One Health involves the public health, animal health and environmental sectors of government. The One Health approach is particularly relevant for food and water safety, nutrition, and the control of zoonoses, such as arboviruses.

The responsibility for human and animal response to arbovirus outbreaks across respective departments at a national and jurisdictional level are clearly defined. Human health control measures must be governed using public health legislation and will be reported through existing public health committee structures. Likewise, animal disease control measures are governed using animal biosecurity legislation and reported through animal biosecurity committee structures. Each jurisdiction and sector (national, state, animal, human and environment) have a commitment to sharing:

- surveillance data across jurisdictions and nationally to enable a clear picture of the risk of arbovirus disease.
- lessons identified and strategies implemented for prevention and control, and response measures undertaken.

International Health Regulations 2005

As a member state of the World Health Organization (WHO), Australia must comply with the International Health Regulations 2005 (IHRs). These regulations help countries manage public health risks that may cross international borders. The IHRs were adopted by the WHO Assembly in May 2005. The IHRs are designed to prevent, protect against, control, and provide a public health response to the international spread of disease in ways that are commensurate with, and restricted to, public health risks, and which avoid unnecessary interference with international traffic and trade (Commonwealth Department of Health and Aged Care, 2023).

Global Arbovirus Initiative

The WHO launched the Global Arbovirus Initiative in 2022, which is intended as a strategic plan to tackle arboviruses such as CHIKV, DENV, YFV and ZIKV globally. This initiative was created in response to the significant risk that arboviral diseases pose as the source of current morbidity and mortality worldwide, and their potential risk for future pandemics; it seeks to strengthen and integrate local and global responses (Balakrishnan, 2022).

National

Biosecurity (Listed Human Diseases) Determination 2016

Under the *Biosecurity Act 2015*, and in line with the IHRs, the Commonwealth Department of Health and Aged Care (DoH) administers the Biosecurity (Listed Human Diseases) Determination 2016. DoH set vector monitoring policy for Australia and the Commonwealth Department of Agriculture, Fisheries and Forestry (DAFF) monitors for the presence of exotic mosquitoes at over 90 air and seaports determined as first points of entry (FPoE) to Australia. Monitoring by DAFF is conducted up to 400 metres from facilities used in operations involving international travellers, conveyances, containers, cargo, and postal articles.

The DOH's 'Response guide for exotic mosquito detections at FPoE' is intended to provide a nationally consistent approach to the management and control of exotic mosquitoes at FPoE. It contains information regarding the roles and responsibilities of stakeholders to strengthen responses to exotic mosquito detections at Australia's borders.

National Arbovirus and Malaria Advisory Committee

In Australia, nationwide recommendations are provided by the National Arbovirus and Malaria Advisory Committee (NAMAC). NAMAC is a technical advisory group to the Communicable Diseases Network Australia (CDNA). NAMAC is responsible for making recommendations to the CDNA on arbovirus and malaria surveillance, strategic arbovirus and malaria disease management, and vector control. NAMAC also provides expert technical advice on arboviruses and malaria to assist in the detection, management, and control of real or potential outbreaks of arboviral and malarial disease. The Department for Health and Wellbeing (DHW) has representatives on both NAMAC and CDNA.

The Australian Centre for Disease Control (ACDC)

The ACDC is expected to be launched on 1 January 2026. It will be a key partner through the national surveillance, prevention and control of arboviruses which are nationally notifiable diseases.

South Australia

The comprehensive legal and administrative framework in South Australia ensures that public health, including the management of endemic and epidemic arboviruses, is effectively coordinated, and managed at both the state and local government levels, with clear roles and responsibilities defined for various authorities and stakeholders.

The South Australian Public Health Act 2011

DHW is the lead control agency in South Australia for human disease epidemics including outbreaks of serious human arboviruses. The *South Australian Public Health Act 2011* (the Act) is the primary legislation that promotes and provides for the protection of the public and the reduction of preventable illness, injury, and disability in South Australia. All arbovirus infections detected in humans in South Australia are notifiable under the Act and the South Australian Public Health (Notifiable and Controlled Notifiable Conditions) Regulations 2012. As the relevant public health authority for their area under the Act, local councils are responsible for ensuring appropriate mosquito management on public land, including Crown Land, within their jurisdictions.

The Emergency Management Act 2004

The *Emergency Management Act* 2004 establishes strategies and systems for managing emergencies within the State. The Public Health Emergency Management Plan (PHEMP), written in accordance with the Act, outlines the legislative obligations of DHW to prepare for and respond to public health incidents and emergencies. The PHEMP also guides incident management across the prevention, preparedness, response, and recovery phases of an emergency.

The PHEMP outlines and informs public health emergency management arrangements at a strategic/state level. It will be the main reference document used if the Chief Public Health Officer (CPHO) determines that HPP lacks the resources to manage a state coordinated response to an outbreak of serious arboviral disease in humans.

Public Health Partner Authorities

Section 51(18) of the Act allows for the establishment of Public Health Partner Authorities (PHPA). DHW is a member of OHSAWG which operates under a formal PHPA agreement between DHW, the Department of Primary Industries and Regions, South Australia (PIRSA) and the Department for Environment and Water (DEW). PHPA agreements provide a basis for parties to work in partnership to protect the health and wellbeing of the community and the environment by contributing to the intended outcomes of the Act.

State Public Health Plan

The SPHP meets the requirements of Section 50 of the Act. The SPHP is developed in consultation with public health partners with the objects and principles of the Act at its core. The SPHP 2019-2024 provides a framework to work together to take early action to protect health, prevent illness, and promote physical and mental health and wellbeing for all South Australians. The SPHP 2019-2024 (pp.52) notes other relevant Acts (for example relating to planning, climate change etc.) that have implications for public health.

One of the key priorities in the SPHP 2019-2024 is 'to promote against public and environmental health risks and respond to climate change'. In the context of mosquito borne disease risk, the SPHP 2019-24 identifies key public health risks, opportunities and emerging issues including:

- diseases that spread between animals and people and other infectious diseases.
- responding to the dynamic nature of the impact of climate change.
- diseases that may emerge or increase in prevalence with climate change.

Regional Public Health Plans

Pursuant to the Act, local councils in South Australia prepare, maintain, and report on a Regional Public Health Plan (RPHP) that is consistent with the SPHP and responds to public health challenges within their local area or region. The planning process can be used to formalise local partnerships and facilitate commitment to public health strategies across other relevant organisations working in the region.

Strategic Management Plans under the *Local Government Act 1999*

Section 122 of the *Local Government Act 1999* (the LG Act) requires councils to prepare SMPs. These plans must address, amongst other things, the economic, social, physical, and environmental development and management of its area; partnerships with other councils, state, and national governments; and the role of local government in coordinating the planning and delivery of services with other partners.

The South Australian Arbovirus and Mosquito Monitoring and Control Plan (the Plan)

The Plan outlines the roles and responsibilities of key stakeholders in relation to mosquito management and their legislative obligations in South Australia. It provides a framework for risk-based surveillance and control of endemic and epidemic mosquitoes and arboviruses.

Hierarchy of Responses (HoR)

The Plan details the HoR which guides decision making to support appropriate responses to the risk or incidence of serious human arboviral disease. It provides risk-based guidance and outlines the responsibilities, authorities, and mechanisms to scale up, manage, and scale down responses to arbovirus incidents, outbreaks, or emergencies in South Australia.

Introduction

Introduction

The South Australian Arbovirus Management Strategy (the Strategy) builds on the successes and learnings from the South Australian Arbovirus Coordinated Control and Operations Plan. The Strategy highlights emerging issues and identifies opportunities to progress in protecting the South Australian community from serious arboviral disease. It acknowledges the importance of a coordinated and collaborative approach to effectively manage arboviral disease risks in South Australia.

In line with the SPHP 2019-24, the Strategy recognises that partnership between all relevant state and local jurisdictions responsible for public health, disease management, animal health, and natural resources management is fundamental to achieving positive public health outcomes. The Strategy provides a framework to support proportionate responses to mitigate or reduce risks to public health based on accurate and timely data and resource allocation.

Prevention and control strategies for endemic and epidemic arboviruses primarily focus on vector control, including larvicide treatment, environmental management, and public education on mosquito bite avoidance. While disease control is the primary focus, reduction in social and economic impacts of mosquitoes improves community wellbeing. The Strategy acknowledges that eradication of mosquitoes or mosquito-borne disease may be unrealistic depending on the situation.

When human arbovirus cases arise or indicators suggest an elevated risk, prompt and coordinated state government-led mosquito control programs are essential to safeguard public health. Coordinated state government mosquito control responses to elevated risk of arboviruses require substantial resources that exceed the capacity of local councils. They also necessitate significant planning and preparedness to ensure an appropriate response to the risk or incidence of serious human arboviral disease.

The Strategy acknowledges that to support the delivery of risk-based responses to endemic, epidemic, and exotic mosquito borne disease, local stakeholders must be actively engaged, informed, and adequately trained and resourced. Prevention and control strategies for exotic vector control require more intensive interventions.

The Strategy sets out the principles which guide the operational framework as described in the Plan and supports the development of a South Australian Exotic Incursion Response Plan. The South Australian Integrated Mosquito Management Resource Pack (the resource pack) provides practical resources and technical guidance to support the implementation the Strategy and the Plan.

To ensure a consistent, risk-based approach to arbovirus management, the Strategy and its supporting documents and resources aim to achieve the following goals and strategic priorities:

Goal 1: Partnership working

To protect public health and well-being through collaborative, evidence-based approaches to arbovirus management.

Strategic priorities

1. Maintain and build strategic partnerships to share diverse expertise and resources, and guide risk-based responses to endemic, epidemic, and exotic mosquito-borne disease risks.
2. Develop and maintain data management systems, data sharing mechanisms and agreements to support effective monitoring of mosquito populations and the prevalence of human and animal arboviral disease.
3. Build and maintain local capacity to enable stakeholders to respond to endemic, epidemic, and exotic mosquito borne disease risks.
4. Produce policies, tools, and resources to support mosquito management programs.

Goal 2: Effective risk management

To mitigate or reduce the risk of mosquito-borne diseases in South Australia using a comprehensive, evidence-based risk management framework.

Strategic priorities

5. Undertake risk assessments to identify hazards and potential outbreak areas and assess the risk of local transmission of arboviral disease.
6. Maintain comprehensive surveillance and monitoring programs to assess potential trigger conditions, track mosquito and arbovirus activity and identify potential outbreaks.
7. Employ integrated mosquito management strategies to reduce mosquito populations and minimise transmission risks.
8. Ensure a standardised framework for responding to arbovirus risks across South Australia, based on surveillance data to enable informed decision-making and resource allocation.
9. Ensure a standardised framework to support recovery from an arbovirus incident, outbreak, or emergency in South Australia.
10. Raise public awareness about arboviruses, their associated risks, and preventive measures to enable individuals and communities to protect themselves from serious arboviral disease.

Goal 1: Partnership working

To protect public health and well-being through collaborative, evidence-based approaches to arbovirus management.

The partnership principle, as described in the Act, promotes collaboration, partnership, and joint action across all levels of government, NGOs, wider stakeholders, and communities. DHW works with a range of partners through formal and informal networks to plan for and manage the risk of mosquito-borne disease in South Australia.

Strategic Priority 1 (SP1)

Maintain and build strategic partnerships to share diverse expertise and resources, and guide risk-based responses to endemic, epidemic, and exotic mosquito borne disease risks.

One Health South Australia Working Group

OHSAWG is a government cross-agency information sharing and advisory group, established in 2009, which includes members from DHW, PIRSA, and DEW. Members provide and share relevant environmental, human, and animal health information relating to arbovirus risk and surveillance to ensure appropriate targeting of mosquito control programs (in conjunction with local councils), education of animal owners, and community education initiatives. DHW contributes to national research and programs and provides data to support the One Health approach.

Arbovirus Response Cross Agency Group

ARCAG is a key partner group which aims to help facilitate communication through the various agencies involved in mosquito management and control. The purpose of ARCAG is to provide a mechanism for effective communication amongst key stakeholder agencies and organisations on all aspects of the planning and implementation of integrated mosquito management programs. ARCAG membership can be found in appendix 1.

ARCAG considers the preparedness of representative agencies, other organisations, and the state to support a state coordinated response, should it be necessary. ARCAG assists DHW by:

- providing advice (technical, operational, and strategic).
- facilitating access to intelligence, information, and resources.
- facilitating communication and decision making within the representative agencies, where required, to ensure an effective and timely response.
- providing appropriate recommendations to support an effective and timely responses.

The Outback Communities Authority

The Outback Communities Authority (OCA) is responsible for facilitating a hybrid governance model incorporating aspects of local government and community self-management for the approximately 4500 people that occupy the 625,000 km^2 of unincorporated South Australia, also known as the unincorporated areas. Traditional local council models would be impractical for this area.

OCA community development officers work across outback South Australia and maintain up to date contact details for community groups and progress associations in the unincorporated areas. Such groups may be able to assist by undertaking health related activities in communities and are best placed to assist with reporting or response relating to incidents.

Local government/councils

As local public health authorities for their areas, local councils are responsible for ensuring appropriate mosquito management on public land, including Crown Land, within their jurisdictions. To achieve the best possible public health outcomes, councils are encouraged to implement integrated mosquito management programs incorporating a considered balance of surveillance, mosquito

control, and health promotion activities. Where mosquito control activities are deemed necessary, these are targeted in locations which most directly impact on residents and visitors.

Australian Department of Agriculture, Fisheries and Forestry

South Australia has multiple ports and airports that serve as FPoE for international travellers and cargo. Surveillance at FPoE is undertaken by DAFF. *Aedes aegypti* and *Aedes albopictus* are the two most common mosquito species found in cargo and international conveyances inspected at FPoE. This is because these species have adapted to live in urban areas near humans and lay eggs that can survive drying out in container habitats, including those used to transport goods to Australia. Both species are known to transmit diseases, with *Aedes aegypti* being the primary vector for CHIKV, DENV, ZIKV and YFV.

In South Australia, there are no existing exotic mosquito surveillance programs or response plans outside areas of Commonwealth responsibility. New South Wales (NSW) Health has developed a draft plan to support their state's local response to exotic mosquito incursions. They identified that in the context of exotic mosquito incursions, a 'one size fits all' operational response framework is not realistic; an adaptive framework is required.

In South Australia, a local plan would identify key stakeholders and define responsibilities, support the preparation of an operational framework, formalise preparation, and identify capacity building needs.

Key actions

SP1.1 Continue to develop and maintain relationships with key stakeholders and partners through effective routine planned and ad hoc engagement.

SP1.2 Collaborate with OHSAWG to promote integrated mosquito management policies and programs within the public health, animal health and environmental sectors of government.

SP1.3 Continue to convene planned and responsive ARCAG meetings.

SP1.4 Develop a local South Australian exotic mosquito detection response plan and adaptive response framework based on the national best practice model.

Strategic Priority 2 (SP2)

Develop and maintain data management systems, data sharing mechanisms and agreements to support effective monitoring of mosquito populations and the prevalence of human and animal arboviral disease.

Data collected from adult mosquito trapping and the South Australian sentinel chicken program is reviewed regularly to determine trends to inform the arbovirus risk in South Australia. Data is used to guide resource allocation and appropriate mosquito management and control measures, including public health messaging, and for planned and ad hoc reporting.

Data management systems

Funding received under the Federal Funding Agreement in response to the JE outbreak during the 2021-22 mosquito season enabled the development of a data management system managed by a data analyst within HPP. The data management system begins with a SharePoint-based master spreadsheet, serving as a centralised repository for crucial data. SharePoint provides a collaborative platform, ensuring version control and organised document management. The SharePoint system is complemented by Power Automate by automating workflows. SharePoint centralisation enhances collaboration, while Power Automate reduces the risk of errors and enables real-time updates.

Councils use an online iApply form that directly loads trapping reports into the master spreadsheet via Power Automate. This automated integration streamlines the reporting process for councils, minimising errors associated with manual entry. The iApply form ensures standardised reporting across councils and accelerates the overall workflow, enabling efficient contributions to the master dataset. iApply provides a user-friendly interface facilitating efficient on-site data collection and standardised reporting.

Integration results in improved data accuracy, streamlined processes, and increased efficiency. Challenges associated with automate and integrated systems primarily lie with the limited access to

technical support to effectively manage and sustain these systems. Data management systems need to be further developed and embedded into operational practice.

Data sharing

DHW and PIRSA are custodians of critical data which may be used to support the delivery of risk-based approaches to mosquito management in South Australia. To support the delivery of the Strategy, and in accordance with the One Health approach, timely data sharing with a focus on reducing the risk to human health is critical.

All arbovirus infections detected in humans in South Australia are notifiable under the Act. DHW's Communicable Disease Control Branch (CDCB) receives laboratory notifications for all positive arbovirus tests and medical notifications from doctors. PIRSA undertakes surveillance and responds to notifications of arbovirus in domestic and native animals.

In response to the detection of JE in South Australia, as per the One Health approach, DHW and PIRSA established a JEV specific data sharing agreement. Data sharing between PHPAs is underpinned by sound data sharing principles.

Key actions

SP2.1 Support the development and modernisation of data management systems and processes.
SP2.2 Develop and maintain data management systems utilising DHW technical expertise.
SP2.3 Expand the existing DHW/PIRSA Japanese encephalitis virus (JEV) data sharing agreement to include all mosquito-borne arboviruses that can cause disease in humans.

Strategic Priority 3 (SP3)

Build and maintain local capacity to enable stakeholders to respond to endemic, epidemic, and exotic mosquito borne disease risks.

Training is an essential component of effective mosquito management and control. It provides the knowledge and skills necessary to prepare for, respond to, and control mosquito-borne diseases. This capacity can significantly contribute to reducing the burden of mosquito-borne disease and protecting public health. Investment in training for mosquito management and control is fundamental to the success of the Strategy.

Stakeholder capacity

DHW works to build local capacity to support key partners. This is achieved through the provision of training, resources, advice, and information as required.

Key elements of capacity building in relation to mosquito management and control include:

- understanding mosquito species and their habitats.
- understanding mosquito biology and ecology
- undertaking effective risk assessments.
- implementing mosquito control measures
- assessing the effectiveness of control measures.
- understanding work health and safety considerations.
- maintaining effective records.
- developing effective public education campaigns.
- emergency management.
- preparedness including:
    - stakeholder engagement and relationship management [Link to SP1].
    - planning framework [Link to SP1].
    - education, exercising and training.

The resource pack was developed to support effective mosquito management in South Australia. DHW also has a suite of online instructional videos and materials for this purpose.

Key actions

SP3.1 Launch the resource pack.
SP3.2 Deliver training to key partners to support increased local capacity to respond to endemic, epidemic, and exotic mosquito borne disease risks.
SP3.3 Expand suite of online videos and training resources.
SP3.4 Maintain, and update training resources based on the best available information and technology.
SP3.5 Develop a training plan for councils at greatest risk of exotic mosquito incursions. [Link to SP1]

Strategic Priority 4 (SP4)

Produce policies, tools, and resources to support mosquito management programs.

South Australia does not currently specifically regulate the control of mosquitoes. Under the current legislative framework in South Australia, a relevant authority may issue a notice under section 92 of the Act to secure compliance with the general duty under part 6 of the Act.

Development of new policy

The development of new legislative tools to prevent, abate, or eradicate the threat of transmission of mosquito borne disease would strengthen protections afforded to the South Australian community, and could support the control of arboviruses by:

- establishing obligations on owners and occupiers of premises to take reasonable steps to control mosquito breeding grounds and abate conditions conducive to their establishment.
- applying specified obligations to land owned/managed by both the public sector or government, or private residents, businesses, and organisations.
- enabling more rapid responses to emerging and potential disease threats such as CHIKV, DENV and ZIKV.
- setting standards or procedures to be observed to protect public health in the planning, maintenance, and inspection of new and existing developments and infrastructure.
- requiring all relevant authorities to have a risk-based mosquito management plan.

Options could include:

- the development of a public health policy under part 5 of the Act.
- the development of mosquito control regulations under section 109 of the Act.

State Public Health Plan

The SPHP 2019-2024 is currently under review, providing an opportunity to engage with strategic partners to contribute to the SPHP 2025-2031. This would facilitate a mosquito sensitive lens on each of the priority areas within the SPHP. These would feed into RPHPs allowing for local resource allocation and inclusion in SMPs.

Resourcing

Local council ability to manage routine mosquito control and surveillance programs and respond to emerging threats can be limited due to financial and human resources. DHW provides assistance to local councils in high-risk areas to support local mosquito management programs through the subsidy program. Local council mosquito management programs receive funding from DHW under the subsidy program. To achieve the best possible public health outcomes, councils are encouraged to implement integrated programs incorporating a considered balance of surveillance, mosquito control, and health promotion activities. Where mosquito control activities are deemed necessary, these are targeted in locations which most directly impact on residents and visitors.

The subsidy program provides financial assistance to local councils in specific high-risk mosquito breeding areas of South Australia, where the cost of effective mosquito management exceeds available local council resources. The subsidy program is administered by DHW's Health Protection Programs (HPP) team.

Under the new Local Government Advice Scheme established through the LG Act, the Essential Services Commission South Australia has released advice for the first 15 of the State's 68 councils. Of the 15 councils listed, six regional councils have been identified as potentially unsustainable (ESCOSA, 2023). Financial constraints on local councils in high mosquito risk locations may negatively impact the sustainability of local mosquito surveillance and control programs.

Key actions

SP4.1 Engage with strategic partners to increase emphasis on climate risk in the context of mosquito borne disease in the SPHP.

SP4.2 Investigate opportunities to develop specific mosquito control policy or regulation under the Act.

SP4.3 Engage with local councils to support the development of mosquito sensitive policies.

SP4.4 Deliver the South Australian Mosquito Management Subsidy Program (the subsidy program) informed by epidemiological and environmental evidence and intelligence.

SP4.5 Engage with councils to explore mosquito management funding opportunities through their SMPs.

Goal 2: Effective risk management

To mitigate or reduce the risk of mosquito-borne diseases in South Australia, using a comprehensive, evidence-based risk management framework.

The Precautionary Principle, as described in the Act, determines that if there is a perceived material risk to public health, lack of full scientific certainty should not be used as a reason for postponing proportionate measures to prevent, control or abate that risk. There are approximately 30 species of mosquitoes in South Australia, several which are serious pests and/or disease vectors.

Effective mosquito management can help to minimise the public health risk and improve amenity associated with mosquitoes. Mosquito management is only necessary if people and mosquitoes come into contact in residential or recreational areas that are within the dispersal range of mosquito breeding habitats. The overall aim of mosquito management is to reduce pest or vector mosquitoes to a level where the impact on the adjacent human population is kept to an acceptable level.

Strategic Priority 5 (SP5)

Undertake risk assessments to identify hazards and potential outbreak areas and assess the risk of local transmission of arboviral disease.

Public health risks, such as those associated with mosquitoes, can be difficult to prevent given that there are many associated factors beyond immediate control such as weather patterns, animal migrations and human behaviour. Risk assessments identify, analyse, and evaluate new and emerging hazards and, where possible identify ways to mitigate risks to human, animal, and environmental health. The location and frequency of, and responsibility for, surveillance activities vary depending on identified spatial or temporal risk or legislated responsibilities.

Assessment of arboviral disease risk involves monitoring a broad range of data and anticipating the risk of disease based on known or potential trigger conditions. Risk assessments inform actions at state and local level levels, guiding informed decision-making, public health interventions, and resource allocation, whilst enabling targeted control measures to be implemented at agreed threshold levels.

DHW collects data from a broad range of partners and sources. This data is used to determine the state arbovirus risk threat level in accordance with the HoR as detailed in the Plan. At a local level, councils perform risk assessments to identify, analyse and evaluate the level of risk posed by mosquitoes to the community during any given season.

Councils play an important role in managing public health risks through mosquito management activities. Mosquito managements plans (MMPs) provide a framework to support local councils in meeting their obligations under the Act to protect the health of their communities through mosquito and arbovirus management, prevention, control programs and community engagement.

The development of a MMP provides a risk profile for local council areas and identify key strategies and actions to reduce the local incidence of mosquito borne disease in the community in line with the varying levels of risk for each season.

MMPs provide a mechanism to assist local councils in identifying, planning for, and achieving strategic priorities as identified in a RPHP whilst supporting business planning and resource allocation. MMPs also enables council to consider the types of surveillance, management, and intervention strategies available and appropriately cost the agreed measures.

Key actions

SP5.1 Continue to provide local councils with mosquito, arbovirus, and disease data in accordance with the Plan. [LINK SP2]

SP5.2 Provide all councils with a MMP template as part of the resource pack. [LINK SP3]

SP5.3 Require all councils to develop a risk based MMP under policy or regulation. [LINK SP4]

Strategic Priority 6 (SP6)

Maintain comprehensive surveillance and monitoring programs to assess potential trigger conditions, track mosquito and arbovirus activity, and identify potential outbreaks.

Surveillance methods for endemic mosquitoes and subsequent control programs differ from those used for exotic mosquitoes, due to their ecology and habitat preferences. Coordinated programs and on-going monitoring for both endemic and exotic mosquitoes are necessary for effective risk management in the long term.

In South Australia coastal saltmarsh areas, tidal inundation patterns significantly impact mosquito abundance. The broad areas of flood plain associated with the River Murray provide breeding opportunities for *Culex annulirostris*, the main vector mosquito associated with MVEV and JEV. This is particularly significant after a period of high and prolonged river flow, when floodwaters recede and during times of high spring and summer rainfall.

Adult mosquito surveillance is undertaken in high-risk areas by local councils in South Australia with enumeration, species identification and viral screening providing data to support risk-based responses. DHW funds the laboratory costs for identification, enumeration and viral screening of all mosquitoes trapped by local councils. DHW supports local councils to implement mosquito control programs and community education programs to prevent or reduce human cases of infection through the subsidy program. Many regional areas have limited human and/or financial resources to enable effective responses to the increased threat of serious cases of human arboviral disease.

DHW has a longstanding involvement in mosquito management in the highly mosquito prone areas of Torrens Island and Globe Derby Park. Formal mosquito management activities date back to the 1960s following industrial action in relation to Torrens Island power station workers experiencing severe mosquito biting, and HPP continues to undertake routine adult mosquito surveillance and coordinate aerial larvicide applications in this area. Mosquitoes present in these areas have a substantial impact on the local amenity and are known vectors of RRV and BFV. Significant areas nearby Globe Derby Park have been earmarked for re-zoning to include residential and light commercial developments.

There has been significant residential development in areas adjacent to known saltmarsh mosquito habitats in recent years, including Riverlea Park and Buckland Park in the City of Playford. These developments are increasing the interface between humans and mosquito vectors. Local councils in these areas undertake mosquito surveillance and control activities supported by the subsidy program.

Environmental surveillance includes the South Australian sentinel chicken program which consists of backyard chicken flocks established in strategically selected locations in South Australia. The South Australian sentinel chicken program is funded by DHW and delivered by HPP. Blood samples are collected from the chickens during peak mosquito season. DHW funds the laboratory costs for serological testing of sentinel chicken blood samples for MVEV, WNV/KUN and JEV. Blood sampling frequency varies depending on identified spatial or temporal risk. Chickens are a good indicator of flavivirus risk to the community, as they readily produce antibodies to these viruses if infected, without developing symptoms. The South Australian sentinel chicken program commenced in 2011 and flaviviruses have been detected in sentinel chicken flocks each season since February 2020.

Key actions

SP6.1 Administer funding to support ongoing, risk-based, mosquito surveillance and management programs in South Australia including the related laboratory costs. [LINK SP4]

SP6.2 Administer funding for the South Australian sentinel chicken program including the related laboratory costs.

SP6.3 Maintain the local government subsidy program. [LINK SP4]

SP6.4 Maintain the northern Adelaide mosquito trapping program and Globe Derby Park saltmarsh aerial larviciding program.

Strategic Priority 7 (SP7)

Employ integrated mosquito management strategies to reduce mosquito populations and minimise transmission risks.

Integrated mosquito management

Mosquito control involves a combination of strategies to reduce mosquito populations and minimise the risk of mosquito-borne diseases. By using the best available chemical, physical, and biological methods within a broader context of educational and planning strategies, control measures can be initiated based on evidence and informed by predetermined action thresholds. These strategies have regard for environmental, economic, public health and societal considerations. Effective control measures should be guided by information and data received from local intelligence sources and partners. Applying any mosquito control measure on a pre-determined schedule absent a documented need is not acceptable practice in any integrated mosquito management program (IMMP).

Chemical controls

Larvicides are chemicals or biological agents used to target mosquito larvae in their aquatic breeding habitats, such as standing water in ponds, puddles, or containers. Adulticides are chemicals or biological agents used to control adult mosquitoes, especially when there is a high mosquito population or a disease outbreak. Thresholds for adulticiding are subject to a high level of consideration due off-target impacts.

Engineering controls

Engineering controls are physical barriers or modifications to the environment that aim to prevent contact between humans and mosquitoes, thereby reducing the risk of mosquito-borne diseases. These methods offer a proactive and long-term approach to mosquito management, complementing other control strategies such as biological and chemical control.

Biological controls

Biological control is a method of controlling mosquito populations using natural enemies or organisms. This approach aims to reduce mosquito numbers by introducing or enhancing the populations of predators, parasites, or pathogens that target mosquitoes. Biological control methods offer a more environmentally friendly and sustainable alternative to traditional chemical insecticides. Biological control strategies can target different stages of the mosquito life cycle.

Community controls

Human behaviour is a critical aspect of mosquito control. Individuals can take preventive measures to protect themselves from mosquito bites, and community education campaigns often highlight these practices to encourage widespread adoption. Good communication is crucial to reduce public anxiety, inform relevant actions, and improve the effectiveness of any response.

Industry engagement

Engagement with government, NGOs and businesses is critical, particularly in the context where their operations may contribute to the creation of mosquito breeding or virus amplification, or where their operations increases the human vector/ interface (e.g., schools, campgrounds, football clubs, wineries etc.). As owners or occupiers of premises, they should be encouraged to take reasonable steps to mitigate any mosquito-borne risk arising from their operations.

Key actions

SP7.1 Provide training and resources to local councils to support IMMPs. [LINK SP3]

SP7.2 Provide resources to support the development of local council communication plans. [LINK SP3]

SP7.3 Engage with government, NGOs, community groups, and businesses to support integrated mosquito management. [LINK SP4, SP5]

Strategic Priority 8 (SP8)

Ensure a standardised framework for responding to arbovirus risks across South Australia, based on surveillance data to enable informed decision-making and resource allocation.

Hierarchy of Responses (HoR)

The HoR guides decision making to support appropriate responses, proportionate to the risk or incidence of serious human arboviral diseases, and identifies when additional coordination and resources are required. The HoR is dependent upon ongoing data and trends identified by surveillance and control activities, weather forecasting, and disease notifications. DHW is responsible for ensuring outputs from all sources of intelligence are regularly collated, analysed, and distributed.

In addition to human and animal disease notification data, environmental data is monitored in the assessment of mosquito-borne disease risk by signalling conditions associated with previous outbreaks of arbovirus infection in humans. Meteorological data including rainfall patterns, temperature, and river flows are examined. Weather conditions and the ENSO forecaster are monitored via the Bureau of Meteorology (BOM).

The HoR, as detailed in the Plan, is an operational framework which is agile and responsive. It outlines approaches for risk-based interventions, and includes guidance in relation to communication, scaling up, and scaling down responses according to arbovirus threat level indicators. There are three levels of response outlined in the HoR which are informed by response level indicators. It details a framework for response at each risk level including:

- level 1 (low) - business as usual operations
- level 2 (medium) – enhanced surveillance and control operations
- level 3 (high) –heightened or emergency response.

Response level indicators specified in the HoR will not always happen sequentially, meaning that conditions specified at one level may not necessarily precede those at the next level. If the response level indicators for level 2 or level 3 of the HoR are met, DHW, in collaboration with ARCAG, makes recommendations on the response options to be activated. This approach allows for flexibility, as appropriate responses can be determined based on the specific circumstances and the level of risk indicated by the response level indicators. It ensures that the response is tailored to the situation and the level of threat presented by mosquito-borne diseases.

Key threat level indicators and roles and responsibilities associated with response levels to endemic or epidemic mosquitoes are detailed in the Plan. Once developed, the South Australian exotic mosquito detection response plan and adaptive response framework will complement the existing Plan.

Communication

A critical element of scaling up any response is clear, consistent, and timely communication with stakeholders. The communications action plan (CAP), as detailed in the Plan, provides a framework to guide effective communication during the scaling up of any response.

Communication between state and local government agencies and other key stakeholders is primarily via ARCAG. ARCAG members are encouraged to develop their own internal communications plans for implementation. State and local government maintain effective communication with other stakeholders to increase preparedness and ensure an efficient and coordinated response can be made to any mosquito-borne disease outbreak. DHW provides support to stakeholders to develop, plan and implement coordinated mosquito control programs as required.

Transition to the Public Health Emergency Management Plan

If DHW believes the risk of human arbovirus risks are beyond the capacity of ARCAG to effectively manage, then the transition to PHEMP may be activated by the CPHO. ARCAG will help with the transition to the PHEMP if/when a public health incident or emergency is declared under the provisions of the Act. Classification of a public health incident and emergency can be found in the PHEMP.

The purpose of the transition to the PHEMP is for the state government to assume direct responsibility for the resourcing and implementation of all mosquito control programs, and to ensure control resources can be applied to the highest priority areas within the shortest possible timeframe. There may be an increased emphasis on the use of adulticides at this stage.

Key actions

SP8.1 Continue to use the HoR operational framework to support responses to increase threat of human arbovirus infection.
SP8.2 Develop a local South Australian exotic mosquito detection response plan and adaptive response framework. [LINK SP1]
SP8.3 Implement the CAP to guide communication as required.

Strategic Priority 9 (SP9)

Ensure a standardised framework to support recovery from an arbovirus incident, outbreak, or emergency in South Australia.

Scaling down a response

As with scaling up, scaling down the HoR level involves review of multiple sources of data to assess whether the risk of transmission has declined sufficiently for a reduction in the threat level to be declared. Data from all surveillance systems is analysed and key stakeholders are consulted to determine the presence or absence of response level indicators.

Data sources may include:

- human notification data.
- sentinel chicken data.
- mosquito surveillance and viral analysis data.
- environmental data, particularly climatic conditions.
- opportune data (e.g., wild, or domestic animal flavivirus detections).
- interstate surveillance data.

When a scaling down is under consideration, ARCAG members will be given an opportunity to make recommendations regarding a transition to a lower level of response. The Plan details the scaling down process and the transition between each level of response, in accordance with the HoR. The Plan also identifies stakeholder responsibilities in relation to the scaling down of any response. The CAP, as detailed in the Plan, provides a framework to guide effective communication during the scaling down process.

Transition from Public Health Emergency Management Plan

Scaling down from the PHEMP will include the Disaster Management Branch, Department for Health and Wellbeing (DMB), HPP and ARCAG and will be managed in accordance with the recovery processes detailed in the PHEMP and the SA Health Major Incident Community Recovery Arrangements.

Recovery is the recognised term for the phase that relates to the support/effort provided by organisations and services to return those affected by an event, disaster, or incident to a state of “normality”. Recovery operations may commence during the response phase of an incident. However, recovery may last weeks, months or even years after an incident or event response.

Debriefs and Reporting

The purpose of debriefing and reporting is to analyse all information regarding the scaling up and scaling down of any response to an incident, outbreak, or emergency. The process involves feedback from all relevant stakeholders involved in the response to identify what worked well and what could be improved in preparation for future seasons or events. The process also considers and evaluates the effectiveness of community education and awareness campaigns. Debriefs assist in the development of recommendations to support the implementation of future responses.

Key actions

SP9.1 Implement the CAP to guide communication as required.

SP9.2 Develop a standardised form for stakeholder feedback to obtain recommendations for future incident, outbreak, or emergency responses.

SP9.3 Develop a standardised form for incident, outbreak, or emergency response debriefs and reports.

SP9.4 Continue to produce summary reports following responses to incidents, outbreaks, or emergencies, detailing recommendations to support the implementation of future responses.

Strategic Priority 10 [SP10]

Raise public awareness about arboviruses, their associated risks, and preventive measures to enable individuals and communities to protect themselves from serious arboviral disease.

Pursuant to the Act, the Minister for Health and Wellbeing and DHW have statutory obligations to promote proper standards of public and environmental health in South Australia.

Risk based communication

As part of its responsibility under the Act, DHW uses risk-based communication to advise and inform all South Australians about the health risks associated with mosquito bites and how individuals can reduce their risk of acquiring an arbovirus. Effective communication, stakeholder engagement, and proactive education campaigns are critical components of effective public health strategies for managing mosquito-borne diseases.

These strategies aim to raise awareness, educate the public, and engage stakeholders to reduce the risks associated with mosquitoes. The CAP is a key component of the Plan. Key aspects of the CAP include:

Proactive education campaigns

DHW provides health promotion information and resources through the annual ‘Fight the Bite’ campaign. The campaign highlights the adverse effects of mosquito bites on human health and encourages individuals to adopt protective measures to reduce the likelihood of being bitten by mosquitoes and acquiring a mosquito borne disease. In addition to raising awareness about the health issues associated with mosquito bites, the campaign also aims to raise awareness about the importance of eliminating or effectively managing environments where mosquitoes live and breed.

The campaign provides resources and social media, radio, and venue advertisements for the public on how best to protect against mosquito-borne diseases. Campaign resources are distributed to relevant councils that then disseminate them through their regular communication channels. Radio advertising is broadcast on local radio stations in affected areas. DHW have a standby Fight the Bite communications action plan which is initiated when the risk of arbovirus transmission is deemed to be high risk.

Community engagement

Local councils routinely engage with local communities to raise awareness of mosquito borne disease risk and support their community to take responsibility for and implement practices to reduce mosquito nuisance and risks around their homes. DHW provide data, information and resources for local councils and communities to assist with the communication and engagement campaigns as required.

Reporting

DHW routinely prepare reports to ensure that risk is clearly communicated to key stakeholders. HPP prepare monthly and annual reports and routinely update the SA Health website.

Key actions

SP10.1	Develop and maintain the annual Fight the Bite campaign. [LINK SP8]
SP10.2	Develop and maintain the annual standby Fight the Bite communications action plan.
SP10.3	Continue to prepare and publish the annual report. [LINK SP2]
SP10.4	Continue to prepare and publish the monthly report. [LINK SP2]
SP10.5	Continue to prepare and publish material on the SA Health website to inform local communities and key stakeholders. [LINK SP2]

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Appendix 1

ARCAG membership

Table 3: ARCAG membership by agency/department

Member agencies/ groups
CDCB, DHW
DEW
Environment Protection Authority (SA)
HPP, DHW
Landscape SA
LGA SA
Local councils
Media and communications, DHW
PIRSA
SA Water

For more information
Health Protection Programs
Public Health Division
www.sahealth.sa.gov.au