
Anthrax

Technical Report

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AUSVET

Anthrax Assessment and Management Strategy for New England REZ Project

Project report summary

Prepared for EnergyCo

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**Ausvet Pty Ltd and Public Health
Matters Pty Ltd**

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Abbreviations and acronyms

Abbreviation	Definition
AEMO	Australian Energy Market Operator
ALOP	Appropriate Level of Protection
AUSVETPLAN	Australia Veterinary Emergency Plan
CVO	Chief veterinary officer
DPIRD	Department of Primary Industries and Regional Development of New South Wales
EnergyCo	Energy Corporation of NSW
EIS	Environmental Impact Statement
ICT	Immunochromatographic test
IPC	Infection Prevention and Control
LD ₅₀	50% Lethal Dose
LGA	Local Government Area
NEM	National Electricity Market
NSW	New South Wales
PEP	Post-exposure prophylaxis
PPE	Personal Protective Equipment
QLD	Queensland
REZ	Renewable Energy Zone
WHO	World Health Organisation
WHS	Work health and safety
WOAH	World Organisation for Animal Health



1. Executive summary

Background

New South Wales (NSW) is transitioning much of its power supply to renewable energy. Much of this renewable energy is being installed in five Renewable Energy Zones (REZs), including the New England REZ.

EnergyCo is seeking approval for a project which includes the construction and operation of new high voltage electricity network infrastructure that is required to connect energy generation and storage projects within the New England REZ to the National Electricity Market (NEM) at Bayswater Power Station.

As part of this project, EnergyCo became aware of a history of anthrax in livestock in the Rouchel area, in the Upper Hunter. The Rouchel area is located along the proposed transmission line route to Bayswater Power Station.

This summary report has been prepared by Ausvet as part of the Environmental Impact Statement for the New England Renewable Energy Zone Network Infrastructure Project. It is based on a more detailed scientific and risk assessment study that was prepared to inform project design and construction planning. Further details on the methodology and results are included in this report. The purpose of this risk assessment is to identify and assess the potential impacts of anthrax on livestock and human health near Rouchel during the construction and operation of the project, and to outline proposed management measures to mitigate impacts.

Methodology

The methods involved four core components:

1. Scientific literature review – to understand the epidemiology of anthrax and transmission dynamics of *Bacillus anthracis* to inform the risk assessment.
2. Spatial analysis – to understand the distribution and occurrence of anthrax in the project area and landscape features that might influence transmission and risk.
3. Stakeholder consultations – to collate expert opinion on anthrax risk as it relates to livestock and human health and discussion of effective mitigation strategies.
4. Qualitative risk assessment to understand exposure risk to livestock and humans during transmission line construction activities in the Rouchel area with and without mitigations. The risk assessments considered the three primary transmission routes for anthrax infection, including gastrointestinal, inhalation and cutaneous across each construction activity. Consequences were assumed to be high to extreme and risk estimation were performed in line with the Terrestrial Code of the World Organisation for Animal health.

Results and discussion

Risks of anthrax transmission to construction workers

Without mitigation strategies in place, the overall risk of anthrax to construction workers is considered generally low, but still above an acceptable level. Construction workers are more likely to contract anthrax from touching an infected animal carcass than from contact with contaminated soil, as carcasses contain much higher spore concentrations. However, repeated exposure to lower spore levels in soil over long periods of time still presents a risk. Higher-risk construction activities are those where there may be contact with deceased animals (e.g. vegetation clearing), activities that may cause abrasions (e.g. scratches



from vegetation) or activities where workers are in closer contact with soil or dust, frequently and over long durations.

These risks to construction workers can be reduced to an acceptable level (i.e. very low to negligible risks) if practical mitigation measures are properly implemented. However, significant risks remain if public health mitigations are poorly applied, and concurrent environmental and construction conditions are conducive to transmission. Key mitigation measure to reduce outbreak risk include avoiding direct contact with animals and soil, managing livestock risks, reducing dust and spore dispersal, following infection prevention and control measures, disease surveillance and governance structures to advise on and oversee implementation of mitigations.

As landholders are not present on active construction sites, their risk of direct transmission (but not zoonotic risk i.e. transmission from a sick animal or carcass) is assumed as lower than construction workers. This does assume livestock mitigations are applied. However, we recommend that EnergyCo and construction contractors re-assess the risk to local residents and farm workers once construction work begins as the exact project area in relation to dwellings and high activity farming locations are confirmed.

Risks of anthrax to livestock

While mitigation measures can markedly reduce the risk of anthrax to livestock in most circumstances, they cannot reduce the risk to a very low or negligible level in every scenario, even if implemented well. This is because specific environmental conditions, such as extreme weather events like drought or flooding, can create ideal conditions for spore distribution, as previously seen in the Rouchel area.

As a result, a modest risk of anthrax in livestock remains in the Rouchel area during and after construction, despite the implementation of mitigations measures. Transmission risks are particularly associated with extensive surface groundworks (e.g. access roads) and deep soil excavations (e.g. pile excavations). To mitigate these risks, key control measures include avoidance of known historical anthrax sites (via GPS locations), prophylactic vaccination of livestock, exclusion fencing, water and soil management, grazing management and ongoing extension to local landholders.

The context of anthrax in NSW and Australia

Understanding the broader Australian context is essential when assessing anthrax risk. In this assessment, the consequences of an anthrax outbreak have been considered as high to extreme, which directly influences the risk assessment findings. The reason we have presumed this is multi-factorial: livestock health and welfare impacts, potential health impacts on livestock owners and construction workers, outbreak response costs at the state level, potential livestock trade disruption, and public perception.

However, it is important to place the consequences and risks in context. Livestock anthrax outbreaks occur nearly every year in Australia (2.6 outbreaks per year for last decade). While such events are routinely managed and eradicated by the veterinary authorities in Australia, they still result in significant social and financial impacts to local communities. Importantly, there have only been three reported cases of anthrax in humans since the 1980's, all of which were directly linked to contact with infected livestock.

Advantages and limitations of risk assessment

The risk assessment has evaluated risks in an objective and repeatable way, in accordance with international standards and guidelines.

Several limitations should be noted. Anthrax is a neglected disease with limited published research which leaves a number of unknown variables regarding outbreak dynamics and construction-related transmission risks. Consequently, expert opinion was relied on for several components of the assessment



in the absence of epidemiological and anthrax specific data. To accommodate these data gaps, conservative and simplified assessment scenarios were used.

Additionally, this was a desktop-based risk assessment conducted within a limited timeframe. Site access was not possible prior to completion of the assessment. Despite these constraints, this review provides a robust, high-quality assessment of anthrax risks to construction workers and livestock in the Rouchel area associated with transmission from construction activities.

Conclusions

This risk assessment indicates that the risk to human health from anthrax during construction activities can likely be effectively managed, provided that appropriate mitigation strategies are implemented. Relevant control measures have been outlined to ensure worker safety. Additionally, further on-ground assessment is required once final project areas are confirmed to validate the assumption that local landholders face lower exposure risks than construction workers. Nevertheless, risks to human health remain elevated in scenarios where control measures are improperly implemented.

For livestock, risks can be reduced to appropriate levels across most scenarios through the proper application of mitigation measures. However, elevated risk of outbreaks remains possible under specific, realistic worst-case scenarios, such as extreme weather events (e.g. drought and heavy rain) that promote spore dispersal in the environment. Should this occur, a rapid outbreak response must be deployed to ensure effective control.



2. Background

New South Wales (NSW) is transitioning much of its power supply to renewable energy. Much of this renewable energy is being installed in five Renewable Energy Zones (REZs), including the New England REZ.

The Energy Corporation of NSW (EnergyCo), a NSW Government statutory authority, has been appointed as the Infrastructure Planner under the *Electricity Infrastructure Investment Act 2020*. EnergyCo is responsible for planning and coordinating the necessary network infrastructure (including transmission towers, transmission lines and energy hubs) required to connect renewable energy generator and storage projects to the grid.

EnergyCo is seeking approval for a project which includes the construction and operation of new high voltage electricity network infrastructure that is required to connect energy generation and storage projects within the New England REZ to the National Electricity Market (NEM) at Bayswater Power Station.

The project extends from the central area of the New England REZ north of Armidale to the existing Bayswater Power Station near Muswellbrook. The project is located across the Local Government Areas (LGAs) of Armidale Regional, Uralla Shire, Tamworth Regional, Walcha Shire, Liverpool Plains Shire, Upper Hunter Shire, Muswellbrook Shire and Singleton.

The project would comprise the following key features:

- new transmission infrastructure including new dual 500 kilovolt (kV) transmission lines and associated infrastructure to connect the New England REZ to the NEM south of Muswellbrook NSW and new 500 kV and 330 kV lines to connect to the proposed energy hubs within the New England REZ
- five energy hubs to connect future energy generation and storage projects within the New England REZ to the new 500 kV network infrastructure
- a maintenance facility to support the operational requirements of the project
- ancillary development to support the project, including:
 - establishment and/or upgrade of access tracks and public roads
 - upgrade and/or augmentation to existing electricity and utility infrastructure
 - installation and operation of communications infrastructure and facilities
- other construction related works and facilities, such as laydown and staging areas, earthworks material sites with crushing and screening plants, concrete batching plants, stringing sites, helicopter landing pads, site offices and workforce accommodation camps.

See the next section for a more detailed discussion of the project elements.

As part of this project, EnergyCo became aware of a history of Anthrax in livestock in the Rouchel area, in the Upper Hunter. The Rouchel area is located along the proposed transmission line route to Bayswater Power Station.

This report has been prepared by Ausvet as part of the Environmental Impact Statement for the New England Renewable Energy Zone Network Infrastructure Project (the project). The purpose of this assessment and management strategy is to identify and assess the potential impacts of anthrax on the construction and operation of the project near Rouchel on livestock and human health and to outline proposed management measures to mitigate impacts.



Project elements

Transmission lines and towers

The project includes the construction of new high voltage double circuit transmission lines and related infrastructure, including:

- about 240 kilometres of dual 500 kV transmission lines from the central energy hubs (Central Hub A and Central Hub B) to the Bayswater Power Station
- about 50 kilometres of single 500 kV transmission lines (operated as 330 kV) from Central Hub A to the northern energy hub (North Hub)
- about 15 kilometres of dual 330 kV transmission lines from Central Hub B to the eastern energy hub (East Hub)

Typical easement widths would be 70 metres for single 500 kV lines, 120 metres for dual 330 kV lines and 140 metres for dual 500 kV lines.

The transmission towers would typically be between 45 metres and 75 metres high. On average towers are currently expected to be spaced about 450 metres apart, however, this can vary greatly depending on terrain.

Energy hubs, substations and switching stations

The project includes five energy hubs within the New England REZ, which would act as connection points between renewable energy projects and the wider New England REZ transmission network. The energy hubs include:

- North Hub (330 kV switching station) located about 16 kilometres north west of Armidale
- Central Hub A (500/330 kV substation) located about 8 kilometres west of Kentucky
- Central Hub B (500/330 kV substation) located about 7 kilometres north of Kentucky
- East Hub (330kV switching station) located about 13 kilometres south east of Uralla
- Central South Hub (500/330 kV substation) located about 13 kilometres west of Walcha.

The project also includes an extension to the existing Bayswater Power Station Substation to connect the project to the NEM.

Road upgrades and access tracks

The project requires establishment and/ or upgrade of access tracks and upgrade of public roads.

Communication infrastructure

The project includes a communications system to provide interconnection between energy hubs and to link to external interfaces such as Transgrid and the Australian Energy Market Operator (AEMO). Communications infrastructure would include fibre optic cabling, repeater stations and microwave links.

Utilities

As part of ancillary infrastructure, utility relocations may be required where the new infrastructure would intersect existing utilities. Work may also be required to connect construction ancillary sites with existing utility services.



Maintenance facility

The project includes the construction and operation of a maintenance facility to support the operation and maintenance of the transmission lines and energy hubs. The facility would be located at the intersection of the New England Highway and Nundle Road in Nemingha and likely comprise a two-storey storage and workshop building with attached office and on-site car parking.

Construction ancillary sites

Temporary facilities used to support construction are required and may include: offices, amenities, parking, storage of plant and equipment, concrete batching plant, crushing grinding and screening plant, material stockpile areas, laydown and staging areas, helicopter landing pads and stringing sites.

Workforce accommodation camps

Project workforce would be accommodated across five workforce accommodation camps in locations in proximity to the transmission corridor and energy hubs. The workforce accommodation camps would be used for temporary housing and associated living facilities to house the construction workforce for the duration of construction. Four specific workforce accommodation camps sites have been identified along with a geographic locality for the fifth camp. The locations for workforce accommodation camps are:

- Camp 1 – Inglewood Road, Muswellbrook
- Camp 2 – Waverly Road, Glenrock
- Camp 3 – in the vicinity of Barry
- Camp 4 – Central South Hub, Walcha
- Camp 5 – Central Hub A, Kentucky.

Workforce

At peak construction the project is expected to generate about 1,400 jobs. The construction workforce required would vary depending on the stage of construction and associated activities.

The operational workforce is estimated to be up to 100 personnel consisting of both site and office based jobs.

Project Timing

Construction of the main project elements is planned to commence in 2028 and is expected to take around six years in total to complete. Construction activities would occur across multiple work fronts, i.e. at any one-time construction activities would be occurring concurrently at several locations across the project area. Key construction activities for the project include:

- enabling works, such as access tracks and road upgrades and establishment of construction ancillary sites and workforce accommodation camps
- vegetation clearing and removal in preparation for construction works
- construction works associated with energy hubs and switching stations
- construction works associated with the transmission lines
- pre-commissioning and commissioning of the project
- demobilisation and rehabilitation of areas disturbed by construction activities.

The project would be energised in two stages. Stage 1 would provide 2.4 gigawatts (GW) of transfer capacity with an additional 3.6 GW of capacity delivered in Stage 2, for a total capacity of 6 GW. Stage 1



is expected to be energised in 2032 and Stage 2 in 2034. The project was declared a Critical State Significant Infrastructure (CSSI) project in July 2024 under Section 5.13 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Purpose of this summary report

This summary report has been prepared by Ausvet and Public Health Matters as part of the EIS for the project. It outlines the identification and assessment of potential construction and operational anthrax risks associated with the project, alongside management strategies to deal with anthrax risks.



3. Methodology

The methods involved four core components:

1. Scientific literature review – A review of available scientific literature was conducted to investigate the epidemiology of anthrax, and the causative agent *Bacillus anthracis* to inform the risk assessment for construction activities in the Upper Hunter Shire.
2. Spatial analysis – This was conducted to understand the distribution and occurrence of anthrax in the project area and landscape features that might influence transmission and risk. To understand the distribution and occurrence of anthrax within the project area, historical epidemiological data for anthrax (*Bacillus anthracis*) in livestock were collated and mapped (data provided by NSW DPIRD). Spatial data representing the proposed infrastructure layout and transmission line construction easements were then overlayed with historical anthrax cases, farming properties and landscape features to assist in identifying relevant mitigation strategies to reduce the likelihood of exposure.
3. Stakeholder consultations – Interviews were conducted to collate expert opinion on anthrax risk as it relates to livestock and human health and discussion of effective mitigation strategies.
4. Qualitative risk assessment to determine risk to livestock and humans during transmission line construction activities in the Rouchel area with and without mitigations. The risk assessments considered the three primary transmission routes for anthrax infection, including gastrointestinal, inhalation and cutaneous across each construction activity. Consequences were assumed to be high to extreme and risk estimation were performed in line with the Terrestrial Code of the World Organisation for Animal health (WOAH).

Further details of the methodology and results can be found in the detailed scientific and risk assessment report.



4. Results – Summary of literature review

What is anthrax?

Anthrax is a zoonotic infectious disease caused by *Bacillus anthracis*, a large, sporulating, gram-positive, aerobic bacterium (Barro et al., 2016; Carlson et al., 2019). It is highly virulent but not considered contagious (i.e. doesn't spread directly from live infected animals or humans to others) (Subedi et al., 2024). The pathogen relies on a bi-phasic lifecycle consisting of a vegetative form and a spore form (Barandongo et al., 2023). The vegetative bacillus replicates inside a host but is highly fragile and quickly destroyed by environmental exposure. For example, upon contact with air following host death, vegetative cells either die or transform into robust spores that persist in soil for decades (Bengis and Frean, 2014; Galante and Fasanella, 2024; Pilo and Frey, 2011).

Natural infection in both humans and livestock is indirect, environmentally mediated, and requires host exposure to large doses of spores (Barandongo et al., 2023; Blackburn et al., 2019). It occurs via three main transmission routes:

1. Cutaneous: direct contact with skin. Most common in humans.
2. Pulmonary: via inhalation of spores.
3. Gastrointestinal: oral ingestion of spores. Most common in livestock.

Once a host is infected, the bacterium produces a toxic complex that damages capillary walls, interferes with blood clotting, and induces rapidly fatal systemic sepsis (Alam *et al.*, 2022; Galante and Fasanella, 2024; Pilo and Frey, 2011).

Global distribution and outbreaks in Australia

Anthrax occurs globally across agricultural and pastoral zones (Carlson *et al.*, 2019). In Australia, it was first detected in 1847 near Sydney, believed to have been introduced following the importation of contaminated bone manure used as fertiliser (Moloney and Salmon, 2015). It subsequently spread along stock routes across New South Wales (NSW) and southern Queensland (QLD) (Barro et al., 2016). Today, the disease continues to persist within a recognised area known as the anthrax belt (Barro *et al.*, 2016). Outbreaks are uncommon and sporadic. This belt includes areas of the Upper Hunter where favourable soil conditions enable the persistence of *B. anthracis* (Barro *et al.*, 2016). Several important anthrax outbreaks have occurred in livestock in Australia across the last two decades including; Goulburn Valley (1997), Rouchel (2007-2008), Forbes (2017), Swan Hill (2017-2022), St George (2017), Shepparton (2024) and central west NSW (2025) (Agriculture Victoria, 2024a; Animal Health Australia, 2017; Durrheim et al., 2009; Turner et al., 1999b).



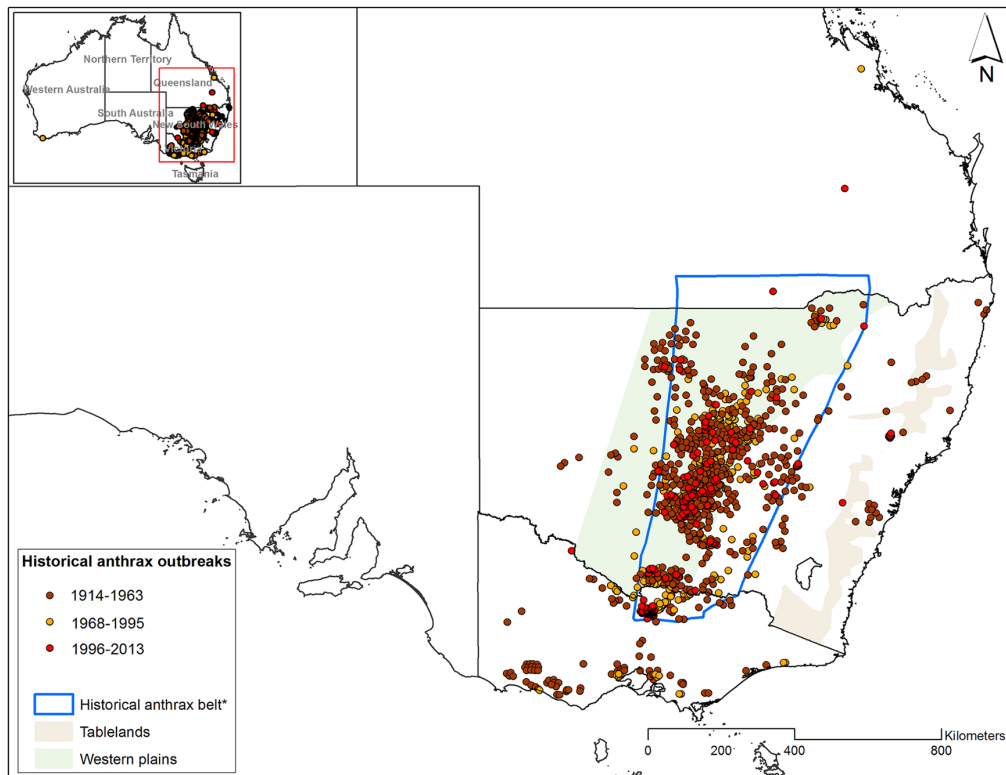


Figure 1: Spatial distribution of anthrax outbreak locations in Victoria, New South Wales and Queensland between 1914 to 2013, obtained from Barro et al. (2016).

Epidemiology

The long-term persistence and infectivity of spores requires specific edaphic and climatic conditions. Soil becomes contaminated when an infected animal dies and bodily fluids and other exudates saturate surrounding soil. Spore survival in the environment is then influenced by soil type, climate and topography (Barandongo et al., 2023; Deka et al., 2022; Galante and Fasanella, 2024). Spores favour neutral or alkaline calcareous soils with high moisture, organic material, and ambient temperatures above 15.5°C (Barandongo et al., 2023; Deka et al., 2022; Hugh-Jones and Blackburn, 2009; Williams et al., 2012). Spores often accumulate along drainage tracks, such as dried up watercourses or hillside seep areas (Van Ness, 1971). Soils in the Rouchel area are neutral to alkaline, and match the parameters necessary for persistence, as confirmed by a major historical outbreak in the region between December 2007 and January 2008 (Barro et al., 2016; DCCEEW, 2012).

Climate and extreme variations in rainfall patterns influence spore redistribution in the environment (Driciru et al., 2020; Williams et al., 2012). During flooding, rising soil water transports buried spores to the surface and then, as it retreats, bound spores can be drawn deeper into the soil, or dispersed with water movements elsewhere (Turner et al., 1999a; Williams et al., 2012). During periods of drought, pasture cover decreases and top soil erodes leading to greater levels of soil ingestion by grazing livestock (Dolfi et al., 2024; Pittiglio et al., 2022).

Human health

Anthrax in humans is rare. Apart from bioterrorism, which is not relevant to this risk assessment, almost all human cases of anthrax are zoonotic, contracted from infected animals or animal products. There are almost no documented examples internationally of transmission from contaminated soil in humans, for



any transmission route. Anthrax in humans is typically associated with occupational exposure to infected livestock, carcasses, or raw animal products (Carlson et al., 2019; Healthdirect Australia, 2025; Subedi et al., 2024). It manifests as cutaneous, respiratory, and gastrointestinal forms, with 95% of the patients showing cutaneous symptoms (Carlson et al., 2019; Subedi et al., 2024). Since the 1980s, only three human cases of anthrax have been reported in Australia; in 2006, 2007 and 2010. All were cases of cutaneous anthrax due to domestic farm or animal exposure. Australia has never recorded a human case of inhalational or gastrointestinal anthrax (Department of Health, 2021; Healthdirect Australia, 2025). It is not contagious in terms of human to human transmission, and there are studies that suggest that healthy humans can tolerate low level spore exposure without ill effects (Sahin et al., 2024).

Cutaneous infection is the most common type seen in humans (Kolbe et al., 2006; Subedi et al., 2024). Early antibiotic treatment is important for survival as untreated cases often result in fatal systemic infection (Subedi et al., 2024). Infection is typically observed in those with high-risk occupations such as butchers, farmers, wool processors and other animal handlers (Sangwan et al., 2025; Subedi et al., 2024). Earthworks or construction workers, or those involved with landscaping or vegetation, do not appear to be a common occupation among reported anthrax cases. Reported events of soil-based transmissions are scarce in the literature (Finke et al., 2020). Because of its rarity, peer-reviewed evidence on inhalational risk is limited. Human infections via this route are rare and sporadic, however result in a high case fatality rate (Agriculture Victoria, 2024b).

Livestock health

Factors that increase anthrax exposure risk in livestock include grazing on historical anthrax sites or recently disturbed soil, contact with carcasses or bodily exudates, improper carcass disposal and poor pasture management (e.g. over grazing or low pasture cover during drought). Environmental drivers such as flooding, erosion and mechanical transmission by biting flies (following feeding on an infected carcass) further contributes to spore redistribution and contamination in the environment (Alam et al., 2022; Beyer and Turnbull, 2009; Blackburn et al., 2014; Brownlie et al., 2020; WHO, 2008). Conversely, the likelihood of airborne transmission causing natural inhalational infection in livestock is exceptionally low (Barandongo et al., 2023; Bengis and Frean, 2014). Similarly, cutaneous infection in livestock is not common, and most likely occurs via mechanical transmission from biting flies that have recently fed on anthrax infected carcasses (Blackburn et al., 2014; Wang et al., 2026). The dose where 50% of exposed animals die (LD_{50}) for anthrax varies significantly between species and has been shown to be much higher via the gastrointestinal or inhalation route in comparison to cutaneous (Bengis and Frean, 2014). Studies have reported that a single dose of approximately 10-100 million spores is required via the gastrointestinal route for successful infection (Subedi et al., 2024).

Anthrax is a nationally notifiable disease in Australia subject to passive surveillance for reporting and outbreak investigation rather than routine environmental monitoring for both human and veterinary medicine (Animal Health Australia, 2021; Department of Primary Industries, 2023). Rapid outbreak response and mitigations should be employed when anthrax is suspected as the cause of sudden death in livestock (Animal Health Australia, 2021; NSW Government, 2024). Authorities must be notified and anthrax exclusion performed within 48 hrs of death (Department of Primary Industries, 2023). Notification can be achieved by contacting the Emergency Animal Disease Hotline, Local Land Services, the chief veterinary officer (CVO), or private veterinarians. Outbreak response is performed in accordance with the Australia Veterinary Emergency Plan (AUSVETPLAN) (Animal Health Australia, 2021).



5. Results - Spatial analysis

Project distribution and historical anthrax

The project area extends from the central area of the New England REZ north of Armidale to the existing Bayswater Power Station near Muswellbrook. It is located across the Local Government Areas (LGAs) of Armidale Shire, Uralla Shire, Tamworth Regional, Walcha Shire, Liverpool Plains Shire, Upper Hunter Shire, Muswellbrook Shire and Singleton.

Figure 2 illustrates the project area and the location of anthrax cases from the Rouchel outbreak in 2007/2008. Rouchel in the Upper Hunter is the only section of the project area that intersects with an LGA that has recorded a confirmed case of anthrax in the past 20 years.



Figure 2: Project area and historical anthrax cases in Rouchel, NSW (data provided by DPIRD).

Rouchel and property level information

Data provided by DPIRD allowed identification of 58 anthrax sites across 15 different properties in Rouchel. These cases cover four different LGA's including Rouchel, Upper Rouchel, Rouchel Brook and McCullys Gap. The transmission line alignment passes through four properties with known anthrax sites identified. The remaining 11 properties are impacted by ancillary development such as local road treatments which are generally aligned with the existing road corridor. There are three properties where construction activities directly overlap with historical anthrax sites. Twelve of the properties are associated with Rouchel Brook, which either runs directly through their property or along the boundary. This is relevant to consider in terms of flood risk.



6. Results - Livestock health qualitative risk assessment

A qualitative risk assessment was conducted to determine the risk of anthrax exposure during construction activities in Rouchel across the project area. The risk was estimated by combining the likelihood of an anthrax event and the consequences of that event. The likelihood was assessed by developing scenario trees for key construction activities and examining conditional likelihood down the scenario tree. The risk assessment applied to anthrax affected farms in the Rouchel area that overlap with or are adjacent to the project area. We conducted the risk assessment twice, in a form where no risk mitigations were applied, and then again applying risk mitigations to determine the residual risk. An example scenario tree for the gastrointestinal pathway in livestock can be seen in Figure 3.

Table 1 provides a summary of the estimated combined likelihood values and their estimated risk for livestock with and without mitigation measures in place for each construction activity and transmission pathway. The gastrointestinal pathway presents the highest risk for anthrax exposure during construction activities with high levels of soil disturbance. These include access tracks, site preparation and tower pad, construction laydown, tower foundations and post-construction revegetation and maintenance. Despite mitigations, in the worst-case scenarios, there is still a moderate risk with four activities.

Risks can be markedly reduced with the implementation of mitigations (Table 2) in most scenarios, but they cannot be reduced to a very low or negligible level in all circumstances. These circumstances include unusually good conditions for transmission as has occurred in the Rouchel area in the past (e.g. droughts/floods and other circumstances), even if mitigations are applied well.

This means there is a modest chance of anthrax cases in livestock in the Rouchel area during and after construction, even where mitigations are adequately implemented. In particular, these risks occur where large amounts of soil are disturbed across wide areas (e.g. access tracks) or deep soils are exposed (e.g. pile excavation).

Key mitigation measures to reduce risks of outbreaks in livestock include avoidance of previous anthrax sites (via GPS locations), prophylactic vaccination of livestock, exclusion fencing, water and soil management, grazing management and producer extension and awareness raising work in the local area. In the event of an outbreak, very good passive surveillance to promote rapid detection and an excellent outbreak response will reduce the consequences of an outbreak by limiting the size which will limit the consequences.

The mitigations contained in Table 2 and Table 4 will be incorporated into an Anthrax Management Plan, that will form part of the Individual Property Management Plans described in the EIS.



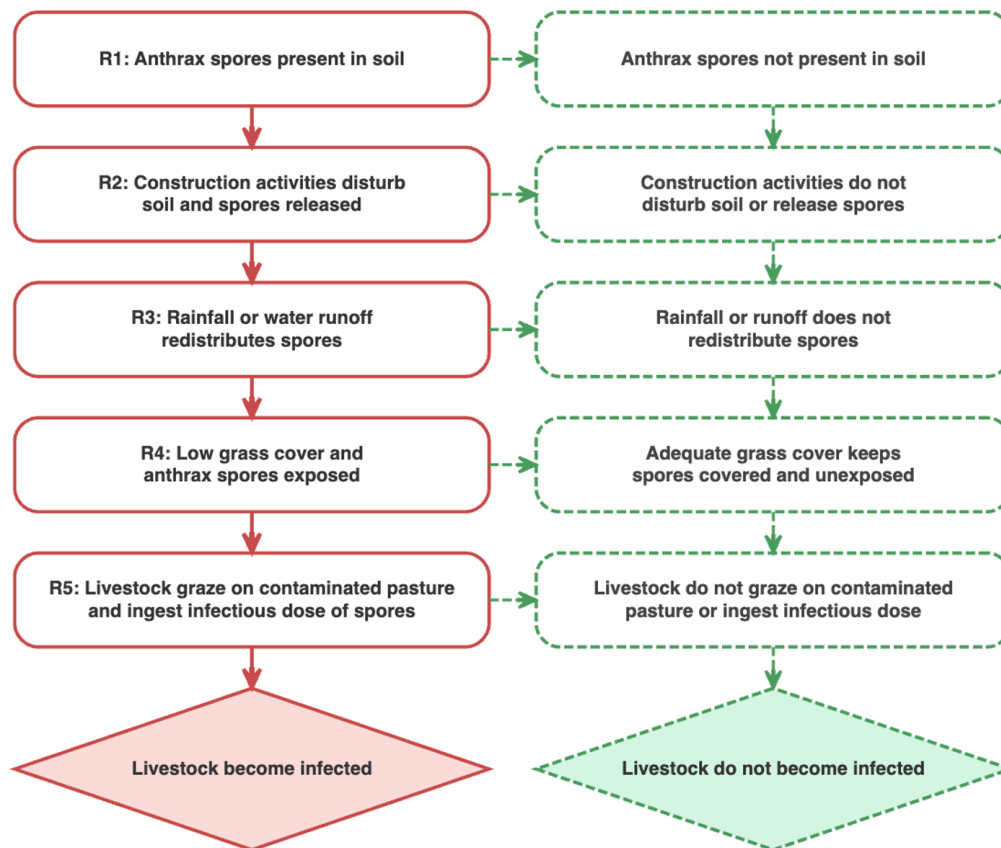


Figure 3: Scenario tree for exposure of anthrax via the gastrointestinal route in livestock.

Table 1: Summary of risk assessment findings for livestock for each construction activity with mitigation strategies in place.

Pathway	Construction activity	Scenario	Unmitigated risk assessment (extreme consequence)	Mitigated risk assessment (extreme consequence)
Ingestion	Access tracks	Best-case	Low	Very low
		Most likely	Moderate	Very low
		Worst-case	High	High
	Vegetation/corridor clearing	Best-case	Low	Very low
		Most likely	Low	Very low
		Worst-case	Moderate	Low
	Site preparation and tower pad	Best-case	Moderate	Low
		Most likely	Moderate	Low
		Worst-case	High	High
	Construction laydown	Best-case	Moderate	Low
		Most likely	Moderate	Low
		Worst-case	High	High
	Tower foundations	Best-case	Moderate	Very low
		Most likely	Moderate	Low
		Worst-case	High	Moderate
	Transmission assembly and erection	Best-case	Low	Very low
		Most likely	Low	Very low
		Worst-case	Moderate	Low
	Transmission line stringing works	Best-case	Low	Very low
		Most likely	Low	Very low
		Worst-case	Moderate	Low



Pathway	Construction activity	Scenario	Unmitigated risk assessment (extreme consequence)	Mitigated risk assessment (extreme consequence)
Inhalation	Post-construction revegetation and maintenance	Best-case	Low	Very low
		Most likely	Low	Very low
		Worst-case	High	Moderate
	Access tracks	Best-case	Very low	Very low
		Most likely	Low	Very low
		Worst-case	Low	Very low
	Vegetation/corridor clearing	Best-case	Very low	Very low
		Most likely	Very low	Very low
		Worst-case	Low	Very low
	Site preparation and tower pad	Best-case	Very low	Very low
		Most likely	Low	Very low
		Worst-case	Low	Low
	Construction laydown	Best-case	Very low	Very low
		Most likely	Low	Very low
		Worst-case	Low	Low
	Tower foundations	Best-case	Very low	Very low
		Most likely	Low	Very low
		Worst-case	Low	Low
	Transmission assembly and erection	Best-case	Very low	Very low
		Most likely	Very low	Very low
		Worst-case	Low	Low
	Transmission line stringing works	Best-case	Very low	Very low
		Most likely	Very low	Very low
		Worst-case	Low	Low
	Post-construction revegetation and maintenance	Best-case	Very low	Very low
		Most likely	Very low	Very low
		Worst-case	Low	Low
Cutaneous	Access tracks	Best-case	Very low	Very low
		Most likely	Very low	Very low
		Worst-case	Very low	Very low
	Vegetation/corridor clearing	Best-case	Very low	Very low
		Most likely	Very low	Very low
		Worst-case	Very low	Very low
	Site preparation and tower pad	Best-case	Very low	Very low
		Most likely	Very low	Very low
		Worst-case	Very low	Very low
	Construction laydown	Best-case	Very low	Very low
		Most likely	Very low	Very low
		Worst-case	Very low	Very low
	Tower foundations	Best-case	Very low	Very low
		Most likely	Very low	Very low
		Worst-case	Very low	Very low
	Transmission assembly and erection	Best-case	Very low	Very low
		Most likely	Very low	Very low
		Worst-case	Very low	Very low
	Transmission line stringing works	Best-case	Very low	Very low
		Most likely	Very low	Very low
		Worst-case	Very low	Very low
	Post-construction revegetation and maintenance	Best-case	Very low	Very low
		Most likely	Very low	Very low
		Worst-case	Very low	Very low



Table 2: Summarised mitigations for livestock to reduce the risk of anthrax transmission. Mitigations should be implemented using the detailed descriptions in the full report.

Reference	Impact	Mitigation measure	Timing	Relevant location
AT1	Reduces likelihood of an anthrax outbreak	Livestock exclusion fencing along the project area in Rouchel To reduce the likelihood of livestock accessing anthrax contaminated soil, the project should implement the following: • Livestock exclusion fencing along the project area in Rouchel. Fencing should include all project areas that contain areas with disturbed soil and any water retention or erosion areas that could contain contaminated collected runoff water or sediments. This will prevent access for both livestock and wildlife. • At the post-construction revegetation stage, exclusion fencing will need to remain until ground cover has fully established and the soil matrix has stabilised. For access tracks, fencing will need to remain until earthworks are completed on permanent roads or revegetation and ground cover have established on temporary roads. • Where grazing land is reduced or agistment is required, please refer to the supporting documentation from EnergyCo regarding compensation arrangements: EnergyCo Fact Sheet.	Applied directly prior to construction and during construction.	Rouchel
AT2	Reduces likelihood of an anthrax outbreak	Livestock vaccination To reduce the likelihood of an anthrax outbreak, all livestock on properties directly affected by construction in Rouchel should be vaccinated annually with the Sterne 34F2 vaccine following the manufacturer's directions (Virbac Australia, 2026). This is the only vaccine registered in Australia for use in cattle, sheep and pigs. Vaccination will be guided by state veterinary authorities (NSW DPIRD /LLS) and conducted in accordance with emergency planning arrangements. There is currently no vaccine registered for use in horses in Australia. In Australia, an off-label claim use can be sought from veterinarians and has been used in previous outbreaks.	Applied prior to and during construction. Livestock require annual vaccination.	Rouchel



Reference	Impact	Mitigation measure	Timing	Relevant location
AT3	Reduces likelihood of an anthrax outbreak	Dust suppression Dust suppression should be implemented in alignment with the necessary WHS legislation. Primarily whenever construction activities have the potential to generate visible dust or when weather condition and environmental risk assessments indicate a risk of dust movement and exposure risk. There are no exposure standards for dust containing potential anthrax spores, so dust mitigation strategies need to be highly stringent and minimise the presence of any dust particles, where possible. For further details, please refer to the Air Quality Impact Assessment.	Applied during construction.	Rouchel
AT4	Reduces likelihood of an anthrax outbreak	Water runoff and erosion management To reduce to likelihood of an anthrax outbreak, water runoff and erosion needs to be minimised. Mitigations will need to be tailored to the specific construction activity and any exposed soil needs to be stabilised. The following will need to be addressed: • Selection of appropriate measures such as instalment of sediment barriers along the easement boundary, grading of pad boundaries to direct water runoff away from adjacent grazing pastures, physical temporary coverings to any soil piles. • Any areas where water/runoff is retained (i.e. retention ponds or swales), these areas should be fenced to prevent livestock or wildlife access. • For more information on climate monitoring and flood management outlined within the Soil and Water Management Plan and an Erosion and Sediment Control Plan, please consult the Surface Water Assessment.	Applied during construction.	Rouchel
AT5	Reduces likelihood of an anthrax outbreak	Grazing management Work with landholders to discuss grazing management on affected properties in Rouchel will be an important mitigation to reduce the likelihood of exposure to anthrax spores in the soil. Managing stocking density to ensure pastures do not get over grazed and utilising rotational grazing or supplementary feed to provide rest periods for grass recovery will be needed. This will be dependent on season, weather, livestock numbers and available grazing land. Where relevant, please refer to the Individual Property Management Plans as outlined in the Agricultural Impact Assessment for compensation arrangements.	Applied during construction.	Rouchel



Reference	Impact	Mitigation measure	Timing	Relevant location
AT6	Reduces likelihood of an anthrax outbreak	Soil management Excavated or disturbed soil should not be removed from the immediate construction site and distributed to other locations of the project area. If there are discard soil piles, these need to be managed with temporary coverings to prevent aerosolisation of spores. Please refer to the Air Quality Assessment for further details.	Applied during construction.	Rouchel
AT7	Reduces likelihood of an anthrax outbreak	Avoid construction work on known historical anthrax sites Using the spatial analysis and data from NSW DPIRD, construction activities should avoid disturbing the soil at known historical anthrax sites. Two properties were confirmed to have anthrax sites overlapping with the project area. Other additional sites bordering earthworks should also be noted.	Applied during construction.	Rouchel
AT8	Reduces the likelihood and consequence of an anthrax outbreak	Standard farm biosecurity as per site specific biosecurity plans To reduce the likelihood of an anthrax outbreak, the project will need to comply with the following biosecurity standards: • Compliance with the general biosecurity duty under the <i>Biosecurity Act 2015</i>. • Requirements will vary between farms and will need to be outlined in Individual Property Management Plans. • Cleaning protocols should include the removal of any soil material from contaminated items in property specific biosecurity washdown bays. • Where appropriate, guidance should be taken from state veterinary authorities (NSW DPIRD/LLS).	Applied during and after construction.	Rouchel
AT9	Reduces the likelihood and consequence of an anthrax outbreak	Strengthening disease surveillance To reduce the likelihood and consequence of an anthrax outbreak, passive disease surveillance will need to be strengthened through the following: • A robust reporting protocol for construction workers to immediately contact someone in the event of a dead or sick animal (livestock or wildlife) being detected. The Emergency Animal Disease Hotline is 1800 675 888.	Applied during and after construction.	Rouchel



Reference	Impact	Mitigation measure	Timing	Relevant location
		Communication and engagement initiatives should be delivered to local farmers and farm workers to improve awareness and to encourage reporting via the standard pathways e.g. calling the Emergency Animal Disease Hotline or reporting to state veterinary authorities (NSW DPIRD/LLS).		
AT10	Reduces the likelihood and consequence of an anthrax outbreak	Engagement with impacted workers, industry and the community Communication and engagement activities should be conducted with construction workers, farmers (+farm workers) and residents in the Rouchel area to improve awareness of anthrax and associated risks. This reduces the consequence of an outbreak by allowing early detection and reducing the size of an outbreak if it occurs.	Applied during and after construction.	Rouchel
AT11	Reduces the consequence of an outbreak	Emergency response plan for anthrax outbreak In the event of a suspect or confirmed anthrax case, all work should stop immediately, and direction should be taken from state veterinary authorities (NSW DPIRD/LLS). They will be guided by the Australian Veterinary Emergency Plan (AUSVETPLAN) for anthrax to implement appropriate mitigation strategies to control and limit the size of an outbreak.	Applied during and after construction.	Rouchel



7. Results - Human health qualitative risk assessment

Table 3 provides a summary of the estimated combined likelihood values and their estimated risk for humans with and without mitigation measures in place for each construction activity and transmission pathway. The unmitigated risk to construction workers is generally low, but above an acceptable level. The cutaneous transmission route presents the highest risk to human health. An example scenario tree for this route can be observed in Figure 4.

Construction workers are considered more likely to contract anthrax from contact with infected animal carcasses than from contact with contaminated soil. Soil generally contains lower concentrations of anthrax spores than animals, but the risk to construction workers would come from repeated exposure to lower levels of spores over extended periods. Construction activities that are considered higher risk are those where there may be contact with deceased animals (e.g. vegetation clearing), activities that may cause abrasions (e.g. scratches from vegetation) or activities where workers are in closer contact with soil or dust, frequently and over long durations.

Key mitigation measures to reduce human risks include:

- Successful application of anthrax mitigations in livestock
- Workers to avoid contact with animals
- Avoid soil contact (e.g. gloves)
- Reduce spore dispersal (e.g. reduce movement of soil long distance),
- Identification of personnel (e.g. to enable reduction of workers on site),
- Infection prevention and control measures (e.g. medical and veterinary staff to wear personal protective equipment)
- Identify exposures (e.g. animal carcasses) and rapid post exposure prophylaxis (e.g. antibiotics)
- Good surveillance for cases (e.g. education of workers)
- Formal establishment of processes and governance structures to advise on and oversee implementation of mitigations.

The mitigations contained in Table 2 and Table 4 will be incorporated into an Anthrax Management Plan, that will form part of the Individual Management Plans described in the EIS.

Risks to landholders are likely lower than to construction workers assuming that livestock risk mitigations are applied. However, we were unable to conduct a site visit to confirm this. It is recommended that EnergyCo confirm this at a late date as the exact project area in relation to dwellings and high activity arming locations is confirmed.



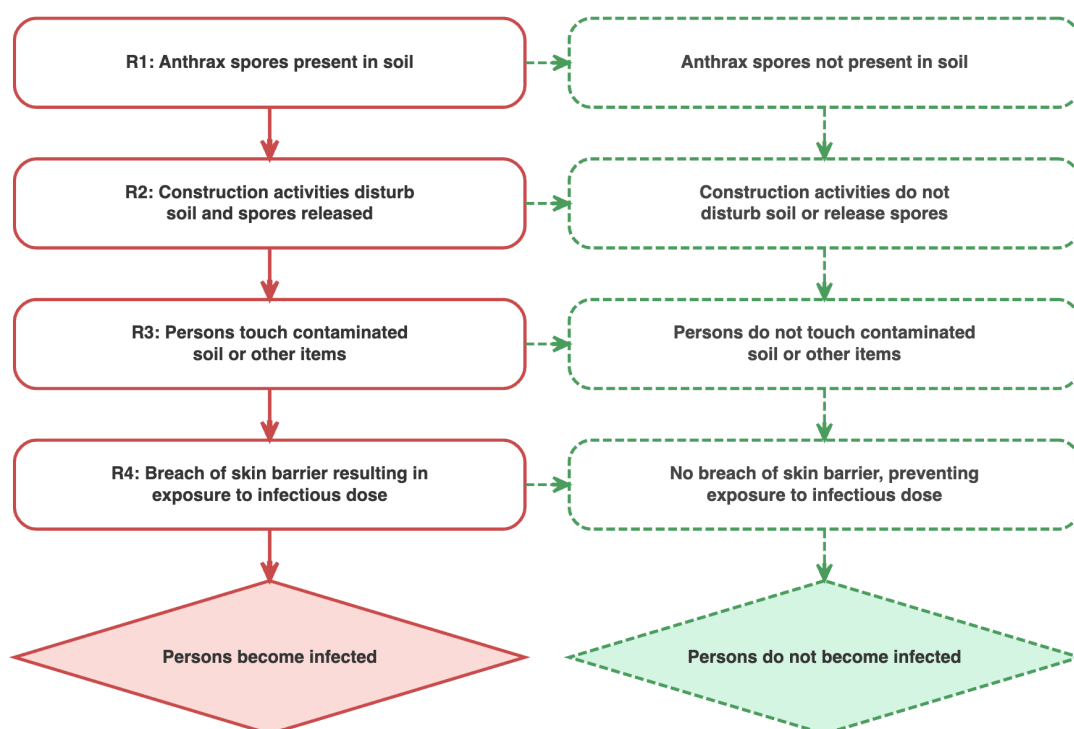


Figure 4: Scenario tree for exposure via direct cutaneous transmission route in humans.

Table 3: Estimated combined likelihoods and risk assessments for each pathway and unmitigated risk for humans.

Pathway	Construction activity or zoonotic	Scenario	Unmitigated risk assessment (extreme consequence)	Mitigated risk assessment (extreme consequence)
Cutaneous	Vegetation/corridor clearing	Best-case	Very low	Very low
		Most likely	Low	Very low
		Worst-case	Moderate	Low
	Access tracks	Best-case	Very low	Very low
		Most likely	Low	Very low
		Worst-case	Low	Low
	Site preparation and tower pad	Best-case	Very low	Very low
		Most likely	Low	Very low
		Worst-case	Low	Low
	Construction laydown	Best-case	Very low	Very low
		Most likely	Low	Very low
		Worst-case	Low	Low
	Tower foundations	Best-case	Very low	Very low
		Most likely	Low	Very low
		Worst-case	Low	Low
	Transmission assembly and erection	Best-case	Very low	Very low
		Most likely	Very low	Very low
		Worst-case	Low	Low
	Transmission line stringing works	Best-case	Very low	Very low
		Most likely	Low	Very low
		Worst-case	Low	Low
	Post-construction revegetation and maintenance	Best-case	Very low	Very low
		Most likely	Low	Very low
		Worst-case	Moderate	Low
	Zoonotic (animal/carcass contact)	Best-case	Low	Very low
		Most likely	Extreme	Moderate
		Worst-case	Extreme	High



Pathway	Construction activity or zoonotic	Scenario	Unmitigated risk assessment (extreme consequence)	Mitigated risk assessment (extreme consequence)
Gastrointestinal	Vegetation/corridor clearing	Best-case	Very low	Very low
		Most likely	Low	Very low
		Worst-case	Low	Low
	Access tracks	Best-case	Very low	Very low
		Most likely	Low	Very low
		Worst-case	Low	Low
	Site preparation and tower pad	Best-case	Very low	Very low
		Most likely	Low	Very low
		Worst-case	Low	Low
	Construction laydown	Best-case	Very low	Very low
		Most likely	Low	Very low
		Worst-case	Low	Low
	Tower foundations	Best-case	Very low	Very low
		Most likely	Low	Very low
		Worst-case	Low	Low
	Transmission assembly and erection	Best-case	Very low	Very low
		Most likely	Very low	Very low
		Worst-case	Low	Low
	Transmission line stringing works	Best-case	Very low	Very low
		Most likely	Low	Very low
		Worst-case	Low	Low
	Post-construction revegetation and maintenance	Best-case	Very low	Very low
		Most likely	Low	Very low
		Worst-case	Low	Low
	Zoonotic (animal/carcass contact)	Best-case	Very low	Very low
		Most likely	High	Low
		Worst-case	Extreme	Moderate
Inhalational	Vegetation/corridor clearing	Best-case	Very low	Very low
		Most likely	Low	Low
		Worst-case	Low	Low
	Access tracks	Best-case	Very low	Very low
		Most likely	Low	Low
		Worst-case	Low	Low
	Site preparation and tower pad	Best-case	Very low	Very low
		Most likely	Low	Low
		Worst-case	Low	Low
	Construction laydown	Best-case	Very low	Very low
		Most likely	Low	Low
		Worst-case	Low	Low
	Tower foundations	Best-case	Very low	Very low
		Most likely	Low	Low
		Worst-case	Low	Low
	Transmission assembly and erection	Best-case	Very low	Very low
		Most likely	Very low	Very low
		Worst-case	Low	Low
	Transmission line stringing works	Best-case	Very low	Very low
		Most likely	Very low	Very low
		Worst-case	Low	Low
	Post-construction revegetation and maintenance	Best-case	Very low	Very low
		Most likely	Low	Low
		Worst-case	Low	Low
	Zoonotic (animal/carcass contact)	Best-case	Moderate	Very low
		Most likely	High	Low
		Worst-case	Extreme	Moderate



Table 4: Summarised mitigations table for human health to reduce the risk of anthrax transmission. Mitigations should be implemented using the detailed descriptions in the full report.

Reference	Impact	Mitigation measure	Timing	Relevant location
AT12	Reduces likelihood of an outbreak	<u>Mitigation strategies for livestock</u> Livestock mitigation strategies (AT1-AT11) are required to reduce the likelihood of zoonotic transmission to acceptable levels.	Applied directly prior and during construction.	Rouchel
AT13	Reduces likelihood of an outbreak	<u>Contact avoidance with animals</u> Construction workers should avoid contact with all animals or carcasses, including livestock or wildlife. Any cases need to be reported and investigated via an established reporting protocol (refer to AT9).	Applied directly as construction occurs.	Rouchel
AT14	Reduces likelihood of an outbreak	<u>Contact avoidance with contaminated soil and other items</u> Construction workers should avoid direct (e.g., ungloved) contact with soil and dust where practical. This includes, but is not limited to: - infection prevention and control (IPC) principles applied to rest breaks, including rest breaks away from construction activities (see AT17); and - education and instruction to construction workers: where practical, to stand away from, or downwind of, any dust, and avoid touching soil if it's not necessary, and avoid hand to face contact.	Applied directly as construction occurs.	Rouchel
AT15	Reduces likelihood of an outbreak	<u>Identification of work processes to reduce spore dispersal</u> Identify opportunities to reduce soil disturbance/aerosolisation/dispersal, or human contact, where possible and appropriate. Examples include, but are not limited to: - opportunities to reduce manual tasks – for instance, removing vegetation by hand can cause minor scratches, and using a tool to remove vegetation instead could help eliminate that point of contact; - selecting equipment that minimises soil disturbance/dispersal – for instance, using a drone instead of a helicopter where appropriate; and	Applied directly as construction occurs.	Rouchel



Reference	Impact	Mitigation measure	Timing	Relevant location
		choosing work processes that minimise spore dispersal – for instance, not moving large amounts of soil long distances if it can be avoided, or delaying excavating when it is dry and the wind is strong, unless dust suppression is available.		
AT16	Reduces likelihood of an outbreak and reduces size of an outbreak if it occurs	<u>Identification and restriction of personnel and equipment</u> - Identify and document construction personnel in the project area. This is needed to enable a rapid health response to potential or confirmed cases and should be provided to the public health authorities, if needed. - Restrict the overall numbers of construction workers in the Rouchel area or otherwise minimise the number of unnecessary entries into the area. This reduces the number of opportunities to breach protocols. Dedicate machinery or equipment to the Rouchel area, where practical, and select machinery or equipment that is easy to clean where possible. - Consider rotating construction crews into the Rouchel area to minimise cumulative frequency and duration of exposure, but balance this against training, education, and supervision load.	Applied directly as construction occurs.	Rouchel
AT17	Reduces likelihood of an outbreak (defined as one case or more) and reduces size of an outbreak if it occurs	<u>Infection prevention and control (IPC) measures, including personal protective equipment (PPE)</u> All persons who may be called to investigate animal carcasses or sick animals should wear personal protective equipment (PPE). Health practitioners attached to the construction project should be trained to use full PPE. Construction workers should protect against contact with soil or dust. For example: - cover all wounds, including minor abrasions, with waterproof dressings; - use work gloves when handling soil, or other soil-contaminated items; - wear work boots and (long-sleeved) overalls; - wear appropriate PPE when cleaning vehicles, machinery or other contaminated equipment; - particulate respirator masks (e.g., P2/N95) are generally not required but, for situations where there is expected close or prolonged contact with contaminated dust that is otherwise unavoidable, respirator masks should be made available for additional protection, alongside training and fit testing; and	Applied directly as construction occurs.	Rouchel



Reference	Impact	Mitigation measure	Timing	Relevant location
		- similarly, consider dust-graded eye goggles when working directly in dust or when splashes are expected. All persons using PPE should do so according to established protocols, including but not limited to training, fit testing, appropriate and accessible PPE stations, and appropriate waste disposal. All construction workers should routinely undertake personal sanitation measures, which include: - contact avoidance as above, including taking rest breaks away from contaminated areas and avoiding hand to face contact, - regular hand washing, with soap being preferred over alcohol-based hand rubs, - on leaving the Rouchel area, washing hands and then showering thoroughly with soap and water, - on leaving the Rouchel area, workers should change out of clothing without unnecessarily agitating the clothes, such as by shaking, brushing, or beating, and use dedicated change facilities that enable work clothes to be stored separately from ‘street clothes’, - clothes should be transported in clearly labelled, leak-proof bags, if needing to be transported, - clothing that is heavily contaminated with soil, such as in a direct spill, could be disposed of instead. If there is an on-site, dedicated laundry zone, the best practice is that the laundry ventilation should be directed away from any ‘uncontaminated’ zones such as shared spaces. If any staff is assigned to assist with laundry, full PPE should be considered to protect against re-suspension of spores during handling.		
AT18	Reduces likelihood of an outbreak and reduces size of an outbreak if it occurs	<u>Identifying potential exposures, contact management, and post-exposure prophylaxis</u> Construction workers should be instructed to immediately report to on-site health practitioners if they touch an animal carcass, or a sick animal. Staff should also report higher-risk contact with soil, such as if soil enters an open wound, even minor cuts, or any other types of contact that they may be concerned about.	Applied directly as construction occurs.	Rouchel



Reference	Impact	Mitigation measure	Timing	Relevant location
		All on-site health practitioners should be appropriately trained and educated on anthrax. Where post-exposure prophylaxis (PEP) is considered after medical risk assessment, consult an infectious disease physicians (e.g., at John Hunter Hospital; phone number: (02) 4921 3000). If PEP is deemed appropriate, contact the Newcastle Public Health Unit (Phone number: 1300 066 055).		
AT19	Reduces likelihood of an outbreak and reduces size of an outbreak if it occurs	<u>Early case identification and treatment</u> Construction workers in the Rouchel area must be encouraged to report all illness early, because many early symptoms of anthrax are non-specific, yet early treatment is critical for survival. Staff should be referred to on-site health practitioners for risk assessment and testing. Medical practitioners should consult local infectious disease physicians on treatment options e.g. John Hunter Hospital (Phone number: (02) 4921 3000).	Applied directly as construction occurs and up to 60 days (maximum incubation period) after construction.	Rouchel
AT20	Reduces likelihood of an outbreak and reduces size of an outbreak if it occurs	<u>Enhanced active disease surveillance</u> • Management should continuously prompt construction workers to adhere with mitigation strategies, including reporting touching carcasses or signs of illness. • Management should also continuously monitor for reportable events, such as signs of illness in workers. • If there are regular touchpoints with local communities, project management should also routinely seek intelligence about whether there have been instances of sudden deaths in livestock.	Applied directly as construction occurs and up to 60 days (maximum incubation period) after construction.	Rouchel



7. Discussion

7.1 Risk of anthrax to human health

The human health risk assessment demonstrated that risks for construction workers can be reduced to an acceptable level (i.e. very low to negligible risks) if practical mitigation measures are successfully implemented. However, significant risks remain if mitigations are applied poorly, and concurrent environmental and construction conditions are conducive to transmission.

These risk mitigations include:

- Successful anthrax mitigation in livestock (e.g. fencing by construction companies, dust suppression) and by landholders (e.g. vaccination and good surveillance and reporting)
- Workers to avoid contact with livestock and wildlife by construction workers and farmers to avoid contact with sick and dead livestock
- Avoid contact with potentially contaminated soil (e.g. reducing manual tasks)
- Reduce spore dispersal through application of suitable work practices (e.g. minimise soil movement from place to place)
- Identification of personnel and equipment (e.g. to restrict numbers of workers on site)
- Infection prevention and control measures (e.g. medical and veterinary staff to wear personal protective equipment, construction workers to wear work gloves, wash hands before eating or smoking, cover skin exposed to soil or dust, and wear goggles and masks if in very dusty conditions)
- Identify potential staff anthrax exposures (e.g. animal carcasses) and rapid post exposure prophylaxis (e.g. antibiotics)
- Good surveillance for cases (e.g. education of workers and medical staff, actively looking for early symptoms)
- Establishment of processes and governance structures to review, advise on and oversee implementation of mitigations.

As landholders are not on the construction sites, direct transmission risk (but not zoonotic risk) can be tentatively assumed to be lower than construction workers, but this does assume good mitigation in livestock (e.g. vaccination, surveillance etc.). However, we advise that EnergyCo and construction contractors re-assess the risk to residents and farm workers when construction starts. This would need to be done on a case by case basis, considering factors such as household distribution, location of farm activities and the magnitude, frequency and duration of proximity to anthrax spores.

In the worst-case scenarios, the risk of anthrax infection to construction workers was much higher than appropriate, highlighting the importance of applying mitigation strategies. Whilst these worst-case scenarios could be possible, we believe the risk can be managed with good risk mitigation implementation. We do, however, highlight these scenarios to bring focus to the importance of careful implementation of risk mitigations.

7.2 Risk of anthrax to livestock

The risk assessment for livestock revealed that the use of risk mitigation strategies could significantly reduce the risk of cases of anthrax developing in livestock. For example, the risks of transmission by ingestion was above the acceptable level of protection (ALOP) across every construction activity before



risk mitigations were applied. After appropriate risk mitigations were assumed applied, in almost every scenario and activity, the risk was reduced to an appropriate level (i.e. equal to or lower than very low risk).

Despite this, some realistic worst-case scenarios had risks that remained relatively high (above very low) for five construction activities. This indicates there is a real risk of an occasional outbreak of anthrax in livestock during the several years of construction in the Rouchel area. These construction activities include:

- Access track construction
- Site preparation and tower pad
- Construction laydown
- Tower foundations
- Post-construction revegetation and maintenance.

The key mitigation measures that were identified to manage risks to livestock included:

- Physical separation of previous anthrax sites and construction activities- avoid construction activities on previous sites where livestock have died of anthrax - these sites are recorded as GPS locations by NSW DPIRD/LLS. However, some older cases may not be included in that record of locations (e.g. outbreaks from mid 20th century)
- Livestock fencing of the project area – to exclude livestock from construction areas
- Livestock prophylactic vaccination – to create immunity in livestock and reduce transmission risks even if exposed
- Dust suppression – to reduce chance of aerosolisation and inhalation by livestock
- Water runoff and erosion management – to prevent physical dispersal and accumulation of anthrax spores where livestock could graze them
- Grazing management – to prevent exposed areas of soil that could be easily ingested (with anthrax spores) by livestock whilst grazing
- Excavated soil management – where soil is excavated care taken to reduce dispersal of soil and its potential anthrax contamination
- Engagement and extension with livestock producers – to recognise, report and avoid touching livestock that suddenly die as these could be infected with anthrax.

7.3 Context of risk assessment findings

Over the last 10 years there have been an average of 2.6 outbreaks of anthrax each year in Australia. Some of these have been very significant outbreaks with large impacts on local industries and communities. For example, the previous Rouchel outbreak occurred in 2007/8 and involved 15 properties and had more than 58 sites associated with livestock deaths (Durrheim et al., 2009). In general, each outbreak detected in Australia has been detected, controlled and eradicated. However, the social and financial impacts on communities and their livestock have been very high in some circumstances.

We have therefore assumed in our risk assessment that the consequence of an anthrax outbreak associated with the construction of the transmission infrastructure in the Rouchel area would be high or extreme. The reason we have presumed a high or extreme consequence of an outbreak are multi-factorial; livestock health and welfare impacts, potential health impacts on livestock owners and construction workers, outbreak response costs at the state level, potential livestock trade disruption, public perception and reputational risk. This consequence selection influences the level of risk identified in our assessment



as the likelihood and consequence are combined to estimate overall risk. For example, if we assessed a lower consequence, the overall risk assessed may have been lower.

7.4 Advantages and limitations of risk assessment

This risk assessment was conducted according to the risk assessment chapter of the Terrestrial Code of the World Organisation for Animal Health and follows international best practice (WOAH, 2018). Specifically, we have identified scenario trees that document transmission pathways, conducted risk assessments by combining likelihood and consequence and assessed this risk against the ALOP. Our assessment was a qualitative approach, as we did not have sufficient data on construction risks and anthrax to enable a quantitative risk assessment. These methods are also compatible and similar to human exposure risk assessments. This enabled us to apply a standardised method across both the human and animal health risk assessments.

Several limitations should be noted. Anthrax remains a neglected disease with limited published research which leaves a number of unknown variables regarding outbreak dynamics and construction-related transmission risks (Barro et al., 2016; Bengis and Frean, 2014; Subedi et al., 2024). Furthermore, many environmental and operational variables influencing outbreak likelihood cannot be identified in advance, particularly regarding construction within anthrax contaminated areas where evidence is especially sparse. Consequently, expert opinion was relied on for a number of components throughout the assessment in the absence of epidemiological and anthrax specific data. To accommodate these data gaps, conservative and simplified assessment scenarios were used.

Additionally, this was a desktop-based risk assessment conducted within a limited timeframe. Site access was not possible prior to completion of the assessment. Despite these constraints, we believe this review provides a robust, high-quality assessment of anthrax risks to construction workers and livestock in the Rouchel area associated with transmission from construction activities.

Lack of research is an important limitation on the mitigation strategies recommended for human health. Our recommended mitigation strategies are generally derived from expert opinion in other settings (e.g., expert panels or guidelines from other countries concerned with different types of construction projects). We have drawn on best available evidence to formulate our recommendations, but these recommendations are general, in that there are many variables that impact the ways in which mitigation strategies might be applied. For a large construction project, risk scenarios and risk factors would be dynamic over years. For these reasons, we recommend that clear processes and governance structures be established to advise on and oversee the implementation of mitigations.

7.5 Conclusions

This risk assessment indicates that the risk to human health from anthrax during construction activities can likely be effectively managed, provided that appropriate mitigation strategies are implemented. Relevant control measures have been outlined to ensure worker safety. Additionally, further on-ground assessment is required once final project areas are confirmed to validate the assumption that local landholders face lower exposure risks than construction workers. Nevertheless, risks to human health remain elevated in scenarios where control measures are improperly implemented.

For livestock, risks can be reduced to appropriate levels across most scenarios through the proper application of mitigation measures. However, elevated risk of outbreaks remains possible under specific, realistic worst-case scenarios, such as extreme weather events (e.g. drought and heavy rain) that promote



spore dispersal in the environment. Should this occur, a rapid outbreak response must be deployed to ensure effective control.



8. References

- Agriculture Victoria, 2024a. Anthrax vaccination program continues in Shepparton. Department of Energy, Environment and Climate Action, Victoria State Government, accessed on 28 May 2026, available online at: <https://agriculture.vic.gov.au/about/media-centre/media-releases/2024-releases/anthrax-vaccination-program-continues-in-shepparton>.
- Agriculture Victoria, 2024b. Anthrax factsheet. Victoria State Government, access on 10 June 2026, available online at: <https://agriculture.vic.gov.au/biosecurity/animal-diseases/important-animal-diseases/anthrax-in-animals/anthrax-factsheet>.
- Alam, M.E., Kamal, M.M., Rahman, M., Kabir, A., Islam, M.S., Hassan, J., 2022. Review of anthrax: A disease of farm animals. *J Adv Vet Anim Res* 9, 323–334. <https://doi.org/10.5455/javar.2022.i599>
- Animal Health Australia, 2021. AUSVETPLAN Response Strategy Anthrax. Animal Health Australia, Canberra, Australia.
- Animal Health Australia, 2017. Animal Health Surveillance Quarterly Q1 2017. Animal Health Australia, Canberra, Australia.
- Barandongo, Z.R., Dolfi, A.C., Bruce, S.A., Rysava, K., Huang, Y.-H., Joel, H., Hassim, A., Kamath, P.L., van Heerden, H., Turner, W.C., 2023. The persistence of time: the lifespan of *Bacillus anthracis* spores in environmental reservoirs. *Research in Microbiology, Insights into the Bacillus anthracis cereus thuringiensis* 2022 conference 174, 104029. <https://doi.org/10.1016/j.resmic.2023.104029>
- Barro, A.S., Fegan, M., Moloney, B., Porter, K., Muller, J., Warner, S., Blackburn, J.K., 2016. Redefining the Australian Anthrax Belt: Modeling the Ecological Niche and Predicting the Geographic Distribution of *Bacillus anthracis*. *PLoS Negl Trop Dis* 10, e0004689. <https://doi.org/10.1371/journal.pntd.0004689>
- Bengis, R.G., Frean, J., 2014. Anthrax as an example of the One Health concept. *Rev. Sci. Tech. OIE* 33, 593–604. <https://doi.org/10.20506/rst.33.2.2309>
- Beyer, W., Turnbull, P.C.B., 2009. Anthrax in animals. *Mol Aspects Med* 30, 481–489. <https://doi.org/10.1016/j.mam.2009.08.004>
- Blackburn, J.K., Ganz, H.H., Ponciano, J.M., Turner, W.C., Ryan, S.J., Kamath, P., Cizauskas, C., Kausrud, K., Holt, R.D., Stenseth, N.C., Getz, W.M., 2019. Modeling R0 for Pathogens with Environmental Transmission: Animal Movements, Pathogen Populations, and Local Infectious Zones. *International Journal of Environmental Research and Public Health* 16, 954. <https://doi.org/10.3390/ijerph16060954>
- Blackburn, J.K., Van Ert, M., Mullins, J.C., Hadfield, T.L., Hugh-Jones, M.E., 2014. The necrophagous fly anthrax transmission pathway: empirical and genetic evidence from wildlife epizootics. *Vector Borne Zoonotic Dis* 14, 576–583. <https://doi.org/10.1089/vbz.2013.1538>
- Brownlie, T., Bishop, T., Parry, M., Salmon, S., Hunnam, J., 2020. Predicting the periodic risk of anthrax in livestock in Victoria, Australia, using meteorological data. *International Journal of Biometeorology*.
- Carlson, C.J., Kracalik, I.T., Ross, N., Alexander, K.A., Et., A., 2019. The global distribution of *Bacillus anthracis* and associated anthrax risk to humans, livestock and wildlife. *Nature Microbiology*. <https://doi.org/10.1038/s41564-019-0435-4>
- DCCEEW, 2012. eSPADE v2.2. State Government of NSW, Australia, access 10 June 2026, available online at: <https://espade.environment.nsw.gov.au/>.
- Deka, M.A., Vieira, A.R., Bower, W.A., 2022. Modelling the ecological niche of naturally occurring anthrax at global and circumpolar extents using an ensemble modelling framework. *Transbound Emerg Dis* 69, e2563–e2577. <https://doi.org/10.1111/tbed.14602>
- Department of Health, 2021. Communicable Diseases Intelligence: Australia's notifiable disease status, 2016: Annual report of the National Notifiable Diseases Surveillance System NNDSS Annual Report Working Group. <https://doi.org/https://doi.org/10.33321/cdi.2021.45.28>
- Department of Primary Industries, 2023. Anthrax: Emergency Animal Disease Information [WWW Document]. URL <https://www.dpi.nsw.gov.au/dpi/biosecurity/animal-biosecurity/animal-diseases-of-concern-for-nsw2/anthrax> (accessed 4.15.26).



- Dolfi, A.C., Kausrud, K., Rysava, K., Champagne, C., Huang, Y.-H., Barandongo, Z.R., Turner, W.C., 2024. Season of death, pathogen persistence and wildlife behaviour alter number of anthrax secondary infections from environmental reservoirs. *Proc Biol Sci* 291, 20232568. <https://doi.org/10.1098/rspb.2023.2568>
- Driciru, M., Rwego, I.B., Ndimuligo, S.A., Travis, D.A., Mwakapeje, E.R., Craft, M., Asimwe, B., Alvarez, J., Ayebare, S., Pelican, K., 2020. Environmental determinants influencing anthrax distribution in Queen Elizabeth Protected Area, Western Uganda. *PLOS ONE* 15, e0237223. <https://doi.org/10.1371/journal.pone.0237223>
- Durrheim, D.N., Freeman, P., Roth, I., Hornitzky, M., 2009. Epidemiologic questions from anthrax outbreak, Hunter Valley, Australia. *Emerg Infect Dis* 15, 840–842. <https://doi.org/10.3201/eid1505.081744>
- Finke, Beyer, Loderstat, Frickmann, 2020. Review: The risk of contracting anthrax from spore-contaminated soil – A military medical perspective. *European Journal of Microbiology and Immunology* 10. <https://doi.org/https://doi.org/10.1556/1886.2020.00008>
- Galante, D., Fasanella, A., 2024. Anthrax in Animals [WWW Document]. MSD Veterinary Manual. URL <https://www.msdsvetmanual.com/infectious-diseases/anthrax/anthrax-in-animals> (accessed 4.9.26).
- Healthdirect Australia, 2025. Anthrax (text/html). Healthdirect Australia, accessed 10 June 2026, available online at: <https://www.healthdirect.gov.au/anthrax>.
- Hugh-Jones, M., Blackburn, J., 2009. The ecology of *Bacillus anthracis*. *Molecular Aspects of Medicine* 30, 356–367. <https://doi.org/10.1016/j.mam.2009.08.003>
- Kolbe, A., Yuen, M.G., Doyle, B.K., 2006. A case of human cutaneous anthrax. *Medical Journal of Australia* 185, 281–282. <https://doi.org/10.5694/j.1326-5377.2006.tb00562.x>
- Moloney, B., Salmon, D., 2015. Relevance of historical anthrax data in current property risk assessments. Case Notes, Flock & Herd, Australia (Accessed 7th May 2026), available online at: <https://www.flockandherd.net.au/cattle/reader/anthrax-historical-data-relevance.html>.
- NSW Government, 2024. Anthrax diagnosis – Information for Veterinarians. NSW Government.
- Pilo, P., Frey, J., 2011. *Bacillus anthracis*: Molecular taxonomy, population genetics, phylogeny and patho-evolution. *Infection, Genetics and Evolution* 11, 1218–1224. <https://doi.org/10.1016/j.meegid.2011.05.013>
- Pittiglio, C., Shadomy, S., El Idrissi, A., Soumare, B., Lubroth, J., Makonnen, Y., 2022. Seasonality and Ecological Suitability Modelling for Anthrax (*Bacillus anthracis*) in Western Africa. *Animals* 12, 1146. <https://doi.org/10.3390/ani12091146>
- Sahin, M., Laws, T.R., Dyson, H., Celebi, O., Doganay, M., Buyuk, F., Baillie, L., 2024. Soil Sample Analysis of *Bacillus anthracis* Contaminated Animal Burial Sites. *Microorganisms* 12, 1944. <https://doi.org/10.3390/microorganisms12101944>
- Sangwan, N., Gangwal, A., Jain, P., Langtso, C., Srivastava, S., Dhawan, U., Baweja, R., Singh, Y., 2025. Anthrax: Transmission, Pathogenesis, Prevention and Treatment. *Toxins* 17, 56. <https://doi.org/10.3390/toxins17020056>
- Subedi, D., Pantha, S., Jyoti, S., Gautam, B., Kaphle, K., Yadav, R.K., Ghimire, S., Dhakal, S., 2024. Anthrax in Humans, Animals, and the Environment and the One Health Strategies for Anthrax Control. *Pathogens* 13, 773. <https://doi.org/10.3390/pathogens13090773>
- Turner, A.J., Galvin, J.W., Rubira, R.J., Condrón, R.J., Bradley, T., 1999a. Experiences with vaccination and epidemiological investigations on an anthrax outbreak in Australia in 1997. *J Appl Microbiol* 87, 294–297. <https://doi.org/10.1046/j.1365-2672.1999.00894.x>
- Turner, A.J., Galvin, J.W., Rubira, R.J., Miller, G.T., 1999b. Anthrax explodes in an Australian summer. *J Appl Microbiol* 87, 196–199. <https://doi.org/10.1046/j.1365-2672.1999.00869.x>
- Van Ness, G.B., 1971. Ecology of anthrax. *Science* 172, 1303–1307. <https://doi.org/10.1126/science.172.3990.1303>
- Virbac Australia, 2026. Anthrax vaccine. accessed online 3rd July 2026, available online at: <https://au.virbac.com/products/sheep-cattle-vaccination/anthrax-vaccine>.
- Wang, J.-S., Farkas, J.Z., Zhao, H., 2026. The effect of flies on the transmission of anthrax among wild herbivores. *J. Appl. Math. Comput.* 72, 170. <https://doi.org/10.1007/s12190-026-02821-z>



- WHO, 2008. Anthrax in Humans and Animals. (4th edition), World Health Organization, Geneva, accessed on 10 June 2026, available online at:
<https://www.who.int/publications/i/item/9789241547536>.
- Williams, G., Linley, E., Nicholas, R., Baillie, L., 2012. The role of the exosporium in the environmental distribution of anthrax. *Journal of Applied Microbiology*. <https://doi.org/10.1111/jam.12034>
- WOAH, 2018. Chapter 2.1 - Import Risk Analysis. Terrestrial Animal Health Code, World Organisation for Animal Health, Paris, France, accessed 10 June 2026, available online at:
https://www.woah.org/fileadmin/Home/eng/Health_standards/tahc/2018/en_chapitre_import_risk_analysis.htm.

