Government of **Western Australia**
Department of **Mines and Petroleum**
Environment

Management of Dieback Disease in Mineral Exploration

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Dieback is a fungal disease which kills a wide variety of plants in moist parts of Western Australia. The disease is particularly well known for its serious effect on Jarrah forests. However, it seriously affects many plants in a wide range of environments. Mineral exploration, which is mostly a short-term, low-impact, land- assessment activity, should not cause long-term detrimental effects. However, without taking the necessary care, exploration activities can spread infection into areas of native vegetation which would not otherwise be contaminated.

This guide is directed to mineral explorationists - to help individuals, company staff, and contractors to define and accept standards of field operation that will help to prevent the spread of the disease. A condition will be placed on mineral exploration tenements by the Minister for State Development at the time of grant. The intent of the condition is to reduce the risk of spreading dieback during exploration activities authorized on the tenement. The condition will require explorers, when they apply to the State Mining Engineer for approval to conduct ground-disturbing activities, to present a plan of action. This plan will firstly identify those parts of the tenement where unmanaged exploration activities could spread dieback, and then specify the management procedures that will be adopted to prevent the spread. The area to which this condition will be applied is that part of the southwest of Western Australia that receives more than 450 mm of rain per year (Figure 1).

What Is Dieback?

Dieback is a plant disease caused by the growth of fungus around and through the roots of plants. There are over 1000 species of plants known to be affected by dieback. In Western Australia large numbers of plants, ranging from Jarrah trees to small herbaceous plants, are susceptible to the disease. The fungus lives in susceptible plant tissue and soil, and migrates and reproduces in warm, moist conditions. Infected roots cannot provide the water and nutrients needed to maintain life, and the plants die from dehydration. Jarrah trees may take several years to die after the first symptoms appear, whereas the Bull Banksia can be dead within days of the onset of symptoms. Some plants may not die from the disease when infected, although their vigour is impaired and death may follow through their weakened condition.

Where the disease occurs, the native vegetation can become devastated, and the delicate fabric of ecosystems seriously impaired; certain species can disappear from the area. The vulnerability of plants varies widely. There may be minimal impact on some sedges and grasses, while, in contrast, all species in some genera may be susceptible. An example of the worst impact of dieback is on the Banksias, which has led to Hart (1990) making the statement that there may be none left growing in the wild in Western Australia in another 100 years. Consequently the spread of the disease must be slowed in the hope that a cure may be developed.

The dieback fungus belongs to the genus Phytophthora. The varieties recognized in Western Australia are:

- *Phytophthora cinnamomi*
- *Phytophthora citricola*
- *Phytophthora cryptogea*
- *Phytophthora drechsleri*
- *Phytophthora megasperma van mega*
- *Phytophthora megasperma var. sojae*
- *Phytophthora nicotinnae var. nicotinnae*
- *Phytophthora nicotinnae var. parasitica*

Other, as yet unidentified, species may also occur.

The body of the fungus, which consists of microscopic thread-like mycelium, passes through three reproductive forms:

- a zoospore which is mobile in water and moist soil,

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- a chlamydospore which is a form resistant to desiccation, with a thick protective wall, and
- an oospore which is highly resistant to desiccation.
-

The latter two are able to survive under dry conditions, and are ready to develop into active zoospores once exposed to wet conditions. The need for wet conditions means the fungus is restricted to the moister parts of Western Australia (Figure 1).

The accurate recognition of the presence of dieback can be difficult. The presence of dead plants known to be susceptible to dieback may be indicative of an infection, but confirmation is possible only after detailed examination by a specialist. Mapping of the present extent of infection in Western Australia is proceeding, but is a time-consuming process.

The mapping has a limited lifetime because it shows only the infections that were present at the time the mapping was conducted. Subsequent outbreaks, or a rapid spread of the disease, could render the mapping highly inaccurate. This mapping is being conducted between Gingin and Dongara by the Department of Environment and Conservation (DEC) and by the Northern Sandplains Working Party - a group sponsored by the heavy-mineral sand-mining industry and Government.

The natural spread of the fungus by movement through the soil or infected root systems is very slow (one to ten metres per year). Movement in free-flowing water can be rapid (many kilometres per year). However, people can spread the fungus at very high rates by carrying soil particles from infected areas to uninfected areas on vehicles and machinery or on footwear. This can start new spot infections many kilometres from the original infection source.

Risk Reduction

The dieback fungus spreads naturally both by moving within open water, and through the movement of water within soils. People spread the disease primarily by the transport of infected soil and roots; the most likely movers of soil and root material are machinery and vehicles. It is therefore important to:

- prevent soil and root material being picked up, and
- if it is picked up, remove and sterilize the soil and root material immediately

Vehicles driven through wet areas, or on wet tracks, can collect soil on wheels, as well as on or within the underparts of vehicles. If this occurs the soil should be washed, brushed, or airblown off the vehicle before it is moved on. However, it is safer to work only in what are termed "dry soil" conditions. These conditions prevail when the ground is too dry for soil to adhere to vehicle parts. Consequently, exploration activities, in some circumstances, may only be permitted under dry soil conditions. Operations shall net be permitted:

- during wet months (late Autumn to Spring),
- immediately after sufficient rain has fallen to leave the surface wet or damp, and
- in swampy or other permanently moist areas.

DEC has adopted a policy of erecting markers along certain tracks within forest areas to identify the mapped limits of dieback infections. Other tracks are signposted as being closed and these should be used only after consultation with the District or Regional Manager of the Department. However, the absence of such markers may indicate lack of surveying, not lack of dieback.

Dieback Hygiene Strategies

Hygiene precautions should be taken to guard against any activities that will permit the dieback fungus to spread.

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Ideally, explorers should undertake a survey of dieback infections prior to starting any exploration. However, it is accepted by the Department of Mines & Petroleum (DMP) that such a survey would be an unreasonable impost on the explorer in the initial phases of exploration. An alternative approach is to assume that all the native vegetation in the exploration area is at risk, and take action to avoid spreading infection by the adoption of preventative measures. Taken together, these measures are termed dieback hygiene strategies.

Risk will be reduced by operating under hygienic conditions in all areas of native vegetation on Crown Land, both reserved and vacant, and wherever appropriate on private land. It is important that measures are taken to ensure that exploration activities do not introduce dieback to private land on which native vegetation is preserved and not otherwise under threat of infection. For instance, uncleared private land that is not used for agricultural or other purposes is not at great risk, except from external influences such as exploration. However, on uncleared land that is being used for grazing,
the risk of introduction of dieback by grazing stock is high and the implementation of dieback hygiene strategies is not warranted within these areas. Any equipment used in such areas will, however, require thorough cleaning down on leaving the area.

When light adhesion of dirt occurs, blowdown of the material using compressed air, brushing down using hard brushes, or washing down using high-pressure, low-volume water jets is recommended during an exploration program. Washing down must be with water sterilized daily with sodium hypochlorite solution (guidelines are included on page 6). The cleaning should be conducted close to where the material was picked up, otherwise all material removed will require sterilization. In areas of confirmed infection, stringent washing down must be completed before leaving the area.

Dieback Management Program

Explorationists operating within the zone defined in Figure 1 will be required to submit a Dieback Management Program and show their commitment to avoid spreading dieback.

This will apply in specified areas of native vegetation on vacant Crown Land (VCL), in all reserves, and in areas of native vegetation on private land.

The aim of the program is to reduce the possibility of mineral exploration activity causing the spread of dieback infection into uninfected native vegetation, through the company becoming aware of:

- the presence or absence of dieback within its exploration tenements, based on existing surveys,
- the problems caused by dieback infection, and
- actions needed to prevent new infections being initiated by company activity.

The explorationist shall commit to:

- conducting exploration under dry soil conditions,
- educating its operational and field staff in the need for, and the procedures of, dieback hygiene,
- preventing vehicles and equipment from carrying any soil or vegetable matter which may be infected with dieback into or out of the area.

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- washing, brushing, or blowing down of equipment and vehicles when they are used in uncleared native vegetation if there is a possibility of infected material being accidentally transported within or exported from the tenement, and
- ensuring any soil or root matter removed from vehicles or machinery does not pose a threat to uninfected areas.

The program should contain the following:

(i) An identification of all parts of the tenement that contain remnant native vegetation in which exploration activity may occur. The status of this land with respect to:
   a. Ownership (e.g. Reserve, vacant Crown Land, private land), and
   b. Use (e.g. none apparent, grazed, beekeeping).

(ii) A list of cleaning equipment and methods to be used (e.g. pressure washing with treated water on rigs, air blowing on rigs, brushing down of vehicles).

(iii) Locations of all proposed cleaning sites. These should ensure that cleaning down of vehicles and equipment is undertaken:
   a. when leaving tracks to access areas of native vegetation,
   b. when leaving areas of dieback infection (on any tracks which have dieback markers),
   c. after completing work at any site where any soil material adheres to, for example, drilling rods or backhoe buckets,
   d. upon leaving an exploration area if there is a suggestion of soil matter adhering, and
   e. after passing through muddy sites.

(iv) A statement of hygiene actions proposed for all areas in which the vegetation may be infected by exploration activities, and of the timing of the proposed activities. Reference should be made to both the seasonal effect and immediate effect of rainfall.

Finally, the plan should be submitted to the State Mining Engineer of DMP well before the proposed commencement date of field activities. No work should commence before receiving approval. Further information may be obtained from DMP's Environment Division, or DEC.

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References

Department of Conservation and Land Management, 1980, Chemical Users' Manual.

Department of Conservation and Land Management, 1986, Dieback hygiene manual.

HART, R. 1990, Identification of dieback disease and sampling techniques: Workshop on Dieback Prevention and Management, Bunbury, 13-14 November 1990, Chamber of Minerals and Energy of Western Australia.

Instruction for use of Chemicals (to be used in conjunction with the Chemical Users Manual, 1980)

Adopted from Chemical Users Manual, 1980 Department of Conservation and Land Management Ref CLM 729, Sheet B7

TRADE NAME: Sodium Hypochlorite.

ACTIVE INGREDIENT: 125 gm/litre of available chlorine.

CLASSIFICATION: Fungicide (pesticide).

FORMULATION: Liquid solution.

USE: Control dieback - used in (fire) tankers. Mixing:

a. Heavy duty tankers: add 21itres (L) to every 2700-3000 L
b. Standard unit: add 500ml to every 800-900L
c. Light gang unit: add 250ml to every 400-500L

Life of mix: Sodium hypochlorite erodes quite rapidly when mixed with water and has only a useful life of 24hours. It is therefore essential that the solution be added just prior to use when possible. Where a tanker mix is carried over for use on the next day or later, a new dosage must be added.

PROTECTIVE CLOTHING: Mixing: PVC gloves, long-sleeved combination overalls and eye goggles. Application: Not needed.

PERSONAL PRECAUTIONS: Avoid contact with eyes and skin. Wash skin with soap and water immediately after use and also before eating, drinking and smoking. Wash clothing regularly or when known to be contaminated.

HAZARD TO HEALTH: Stored in body:- No.
Degree of toxicity:

- Swallowing:- High.
- Skin absorption:- Strong irritant.
- Inhalation:- High.

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FIRST AID:

- Swallowing: Drink water or milk- do not induce vomiting.
- Splashing in Eyes: Flush with water for 15minutes, cover eye with eye pad.
- Spillage on person: Carefully remove protective clothing, wash skin with soap and water, then put on clean clothes.
- Inhalation: Remove from contamination and resuscitate.

IN ACCIDENTS INVOLVING SWALLOWING, SPLASHING IN EYES, OR SKIN CONTACT, SEE LOCAL MEDICAL OFFICER

ENVIRONMENTAL: Toxic to fish. Avoid indiscriminate use. Do not contaminate.

LIMITATIONS: Waterways, streams, ponds, dams, domestic or irrigation supplies.

STORAGE: Cool, dry locked store. Keep in airtight container and separate from reactive substances.

SPILLAGE: Treat with soda ash and cover with soil.

CONTAINER DISPOSAL: Flush container with water. Return container to manufacturer or dispose of at local authority rubbish tip.

MANUFACTURER: Rampire Laboratories - Welshpool.

The information contained in this pamphlet is designed to assist in gaining a general awareness of the requirements of the Mining Act 1978 and is not intended to be a substitute for understanding the statutory requirements of the Act and Regulations there under.

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