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OBJECTIVES

Main objectives of biosecurity –

- a) To prevent the introduction of infectious diseases to farm livestock.
- b) To prevent the spread of disease from an infected area to an uninfected area.

Biosecurity is about managing risk to meet the objectives stated above. It is essential that a risk assessment be conducted for each farming enterprise to establish what level of risk exists in each phase of its operations and introduce measures appropriate to these levels.

MAJOR ROUTES FOR DISEASE TRANSMISSION

- Livestock:** Transfer of dead crocodiles
Dead crocodile carcass disposal
- Animals:** Wild crocodile access
Feral or domestic animals and pets
Vermin
Wild caught crocodile introduction.
- People:** Contractors, maintenance personnel, neighbours, service/delivery men & friends.
Disease can be transmitted by, for example, hands, boots, clothing and hair
Equipment and vehicles used by people.
- Air:** Transmission as an aerosol or dust
- Water Supply:** Surface water attracts waterfowl and other birds which ingest contaminated water.

LEVELS OF BIOSECURITY

- Level one (1): Routine procedures**
Routine biosecurity procedures advisable should be implemented on a daily basis. This will assure that diseases will not be carried into crocodile sheds on farms and will reduce the risk of transmission. This should be seen as a minimum requirement.
- Level two (2): High Risk Biosecurity Procedures**
In the event of an outbreak of an emergency disease or serious endemic disease, high risk bio security procedures will be implemented.

GENERAL BIOSECURITY MEASURES FOR CROCODILE FARMS (LEVEL1)

1. Farm personnel and visitors:

- Access to the farm should be minimal for visitors, truck drivers, delivery personnel and employees from other crocodile farms. A visitor book should also be completed.
- No entry into pens, housing, sheds or incubators prior to use of footbaths.
- Specific personnel dedicated to the hatchlings, where no contact is made with older or other animals.
- Visitors and personnel should be supplied with boots, gloves and clothing that does not leave the farm premises.
- Personnel and visitors should not remove or transfer anything or any object between hatchling pens and grower pens including personal equipment, testing and cleaning equipment like gloves, boots, testing devices or hoses.

2. Cleaning:

- Pens are best left cleaned to spell and dry out before the introduction of next years hatchlings into the farm system.
- Pens need to be cleaned after every feed night by removing old food, rinsing, disinfecting, scrubbing, a final rinse and then filled.
- Pens need clean fresh water on a daily basis. On non feed nights, water should be dropped, pens cleaned/scrubbed and water re-filled.
- Walls, hide boards and the floor need to be scrubbed with disinfectant at every clean.
- All cleaning equipment should be stored off the floor by either hanging, on shelves or stored in a receptacle of some sort.
- One set of cleaning equipment should be designated to each pen/shed – NO swapping equipment between pens/sheds.

3. Pens:

- The opening of sheds will differ between seasons to adjust for the ambient air temperatures, to avoid over-heating or cooling.
- Entry to pens should be restricted and the use of footbaths compulsory.
- Water needs to be clean fresh and at a temperature of 32 degrees.
- Needs to be a temperature gradient within the pens ranging from 30-32 degrees including the ambient air, water and dry surface temperatures.
- Needs to be a dry landing, enough water to submerge and pen space to avoid overcrowding.
- Pens need to be protected from dust, direct winds, vermin and wildlife entry.
- Pens which have access to sun and shade are desirable.
- Monitoring bacterial counts of pens on a regular basis is essential.

4. Water:

- Needs to be clean and fresh water from bore or town supply. It is not advisable to use surface water supplies unless chlorinated or UV treated.
- Water needs to be chlorinated at 2-3 parts per million.
- Water in pens should be at a temperature of 32 degrees.
- Fresh water flow through pens will be reduced in the wet season as water temperatures remain warm. Constant water flow is needed to avoid water stagnation and contamination.
- Water should not be recirculated through other pens.
- Pens with individual drains are desired over multi-draining systems.

5. Feed:

- All old food should be removed from pens and weighed to prevent wastage and monitor food intake.
- Food should be prepared in a cool like environment with no access from vermin and wildlife and without exposure to sun, wind or dirt.
- Food should not be left to defrost for lengthy periods of time. Food should be fed just after defrost with minimal fat levels and with the correct supplements added last.
- Meat buckets and mincing equipment should be cleaned correctly after use and left to air dry. Buckets and equipment should not have direct contact with the floor.
- Food and food buckets should be covered to prevent vermin and wildlife from feeding from it. Spilled food should be removed as soon as possible to prevent vermin attraction.

6. Animals:

- Hatchlings should be introduced into clean spelled pens with no animals from previous years.
- Gains of wild crocodiles should have a quarantine period on the farm before entering into the farming system.
- Not desirable to move or transfer young animals in the colder months as this leads to stress and may lead to the induction of disease.
- Preferably no access by wild crocodiles onto the farm.
- Dead animals should be removed ASAP to prevent potential contamination.
- All animals gained, sold, processed or dead need to be recorded on the farm records.
- Daily records of deaths and illness should be used to observe and react to usual trends.
- Unknown illness or usual deaths should be submitted to the veterinary laboratories for analysis.
- Domestic stock and pets should not access the farm site nor enter into pens/sheds.

7. Equipment, infrastructure and consumables:

- All equipment, chemicals and consumables used in a specific area for example hatchlings should not be removed or transferred elsewhere.
- All chemicals and drugs used should be registered for use on crocodile farms or in the process of being approved.
- Non veterinarian treatment or treatment directed by a vet but not applied by a vet, must be entered in the farm records and kept for two years. This includes product name, usage dates, dosage administered, withholding period and treated animals identified.
- All chemicals should be used before they expire. Ensuring correct dilution rates and regular replacement of old chemical solutions such as in the food baths.
- Safety equipment like gloves and boots should not be transferred between workers or different farm areas.
- All equipment and infrastructure should be checked regularly by maintenance and/or by a supervisor.
- Clear correct identification and labelling of cleaning chemicals and other solutions used on the farm is desirable to prevent accidental consumption by employees.

STANDARD OPERATING PROCEDURES: CLEANING OF CROCODILE PENS (LEVEL1)

1. Daily procedure before cleaning:

- Ensure foot baths are used upon shed entry.
- Open shed or pens for the days requirement.
- Check temperatures are between 30-32 degrees.
- Check all water inlets are functioning.
- Check all drains for blockages or leaks.
- Ensure adequate supply of cleaning chemicals.
- Ensure correct cleaning equipment is available.

2. Cleaning procedure:

- Remove any excess food and record leftover amount.
- Remove and record animal deaths.
- Ensure drain grate is secure and no animals trapped.
- Drop drains to pens about to be immediately cleaned.
- Hose pens thoroughly including walls and hide boards.
- Scrub pens with a broom and correctly diluted disinfectant agent.
- Allow enough contact time for the disinfectant to work.
- Hose away all traces of disinfectant from the pen.
- Clean the drain and grate of meat and other debris.
- Replace drain and fill.
- Check pen later to ensure correct drain placement.
- Ensure water is turned off after pen is full and correct temperature.

3. After Cleaning:

- Ensure sheds cannot be access by non employees.
- Ensure all mortalities are recorded.
- Dead animals removed and disposed of correctly.
- Ensure left over food is weighed and disposed off correctly.
- Ensure used chemicals are replaced for next clean.
- Report all faults, problems or concerns to supervisor.

4. Supervisor/maintenance role:

- Ensure water temperatures are adequate.
- Ensure water chlorination is functioning.
- Check all infrastructure and equipment for faults.
- Ensure adequate supply and use of cleaning chemicals.
- Ensure cleaning equipment is adequate.
- Ensure chemicals and equipment is stored correctly.
- Ensure old chemical solutions are replaced regularly.
- Ensure cleaning procedure is being adhered too.
- Ensure all data is recorded daily.
- Ensure employees report all possible faults or problems.

BIOSECURITY CONCERNS FOR CROCODILE FARMS (LEVEL 1)

1. Farm entry and exit

- Farm entry and exit should be through one point only for use by all individuals employee or otherwise.
- Vehicle drive through or wash down bays would be desirable for off farm vehicles particularly delivery trucks.
- Lockable gates to restrict access to the farm with "NO ENTRY UNLESS AUTHORISED" sign should be displayed.

2. Foot bath signs

- Posted outside all animals pens particularly hatchlings to notify footbath use before entry.

3. Change of footbath solution

- Regular routine of changing footbath solution.
- Who and When – remember solution changes will be different from wet to dry season.

4. Cleaning list posted

- Cleaning steps should be listed so they can be refereed to while actually in the process of cleaning – ensures all steps have been completed.

5. Pen Cleaning

- Thorough cleaning between hatchling intakes is advisable.
- Pen spelling annually is also useful.
- Beware of using high pressure cleaners – can fragment and form cracks in the pen surface.
- Desirable to re-seal pen surface every few years.

6. Pen outside clean

- Keep grass/weeds down around pens.
- No rubbish / used equipment around pens.
- Discourage the attraction of pests and vermin.

7. Barriers

- Barriers are used to control the spread of dust and to reduce the effect of direct winds.
- Barriers can be vegetation or man made material.
- Barriers also screen pens from noise and visual distractions.

8. Awareness

- Importance of the ability to be aware of the changes in animal behaviour, feeding patterns and growth rates.
- Behavioural and feeding pattern changes that go undetected are often precursors for disease problems.

HIGH RISK BIOSECURITY MEASURES FOR CROCODILE FARMS (LEVEL 2)

1. Notification:

- In the event of a suspect disease or disease out break on crocodiles farms, the Northern Territory Government and the NT crocodile industry must be immediately notified.
- The NTG will inform the crocodile industry upon disease notification and again upon disease / organism identification.
- Upon disease notification, the industry should immediately enforce level 2 biosecurity measures.
- Upon disease / organism identification, the industry should apply necessary controls measures for that particular disease / organism.

NT Govt Berrimah Farm contacts for Disease Notification on Crocodile Farms:

Senior Field Veterinary Officer (SFVO) – Ph: 08 8999 2035 or 0427 003 600 after hours.

Duty Pathologists – Berrimah Veterinary Laboratory – Ph: 08 8999 2249.

Crocodile Technical Officer – Ph: 08 8999 2036 or 0401 115 853 after hours.

Chief Veterinary Officer (CVO) – Ph: 08 8999 2130

2. Facilities:

- Gates locked and shed doors locked. Farm access restricted to nil.

3. Personnel:

- No visitors. Company personnel discontinue visits except on suspicion of problems.
- Repairs and maintenance – no routine work, only emergency work to be carried out.

4. Operational:

- Essential visits only- head to toe shower before and after visit. Complete change of clothes and footwear, which should stay on farm premises. Headwear to be worn.
- Any vehicle which must enter farm must be washed and disinfected at a wash station before and after entry. Vehicles should be disinfected inside as well.
- Vehicles not entering the farm but parked outside should be washed and disinfected before visiting another farm.
- No animals, wastage or products should be moved off farm until disease status is clarified.

CHECK LIST FOR CROCODILE FARMS - CLEANING/BIOSECURITY

MORNINGS DAILY	CHECK ✓	AFTERNOON DAILY	CHECK ✓	COMMENTS
Prepare facility for the day eg open doors/windows.		Close facility for the day eg shut doors/windows.		
Ensure adequate cleaning resources available to use.		Ensure cleaning resources available for next day.		
Check water temperatures		Check water temperatures		
Check/remove/record deaths		Check/remove/record deaths		
Remove/weigh old feed		Remove/weigh old feed	Not Required	
Remove bungs/drain		Check bungs/drain		
Hose/rinse pens, under hides		Hose/rinse pens, under hides	Not Required	
Scrub with disinfectant – whole pen plus under hide		Scrub with disinfectant – whole pen plus under hide	Not Required	
Hose/rinse away disinfectant		Hose/rinse away disinfectant	Not Required	
Replace drains/grates/bungs		Replace drains/grates/bungs	Not Required	
Fill pen and check water inlets		Fill pen and check water inlets	Not Required	
Water off, ensure pen is full and temperatures correct		Water off, ensure pen is full and temperatures correct		
Ensure deaths removed/recorded/disposed		Ensure deaths removed/recorded/disposed		
Ensure old food is removed/recorded/disposed.		Ensure old food is removed/recorded/disposed.	Not Required	
Ensure shed is secure		Ensure shed is secure		
Ensure and check temperature measuring devices	Supervisor Weekly_____	Ensure foot baths are in use and solution correct.	Supervisor Weekly_____	
Ensure and check water chlorination systems	Supervisor Weekly_____	Ensure correct use and supply of cleaning chemical/equipment	Supervisor Weekly_____	
Check and ensure water inlets/drains	Supervisor Weekly_____	Ensure bio security is being adhered too.	Supervisor Weekly_____	

Monthly duties – INFRASTRUCTURE CHECK, BACTERIAL MONITORING, RECORDS CHECK AND SYSTEMS CHECK (water, chlorination, temperatures and drains)

ACTION PLAN IN THE EVENT OF SUSPECT CHLAMYDIOSIS IN HATCHLING FARMED CROCODILES DURING 2007

Background

Following the outbreak of a new clinical and pathological manifestation of chlamydiosis in farmed saltwater crocodiles during 2006, a voluntary biosecurity plan for crocodile farms was developed in consultation with NT crocodile farmers.

There was sporadic disease in yearling crocodiles at all four major farms in the Darwin area during 2006. Prevalence in older crocodiles is unknown. Serious disease occurred in hatchling crocodiles on 2 of the 4 farms in the Darwin area.

Action:

1. Farmers report suspect clinical chlamydiosis (eye infection and/or throat infection, with loss of condition and death) in hatchlings to either the RVO (Dick Morton) on 08 89992035 or the duty pathologist at Berrimah Veterinary Laboratory on 08 89992249.
2. The suspected disease will be investigated to confirm chlamydiosis by:
 - PCR for chlamydiaceae on conjunctival and pharyngeal swabs (in RLT buffer) or tissue specimens.
 - Necropsy of affected animals with follow up histopathology and PCR for Chlamydiaceae.
3. If chlamydiosis is confirmed:
 - Full disease investigation including biosecurity measures on the farm
 - Dick Morton discusses control options with the farmer
 - Advise all crocodile farmers for information and awareness
 - Consider further investigations

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PROPOSED DISEASE CONTROL MEASURES TO MANAGE CHLAMYDIA DISEASE IN FARMED CROCODILES

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BASIC PRINCIPLES

- Control farm environment to suit crocodiles
- Optimum biosecurity measures (especially protect the hatchlings)
- Minimal use of antibiotics

PROTECT THE WHOLE CROCODILE FARM

- Maintain optimum biosecurity for all visitors with prior contact with crocodiles
- Minimal (preferably no access) by other animals to the farmed crocodiles
- Segregate wild caught crocodiles from farmed crocodiles
- Minimise visitors to the farm
- All necessary visitors must be provided with clean boots and clothes
- Only use bore water or chlorinated surface water (2-4 ppm)
- Daily record and monitor deaths and illness by shed and pen and react to unusual trends.
- Remove dead animals from the pens quickly to reduce potential contamination.
- Remove food wastage from the pens as soon as possible
- Foot baths for all staff and visitors prior to entry to all sheds
- Segregate equipment used in specific sheds to the shed
- Manage risk of disease transmission by feed trucks and drivers
- Consider dipping eggs with an antiseptic prior to incubation
- Consider bacterial count monitoring of pens
- Consider Chlamydia monitoring of hatchling crocodiles

PROTECT THE CROCODILE HATCHLINGS

- Clean and sterilise hatchling pens prior to introducing hatchlings
- No introduction of sick or healthy older crocodiles to the hatchlings
- No recirculated water to hatchlings from other parts of the farm
- Monitor water temperature (30-32° C) and provide heating if temperature drops to less than 28°C.
- Preferably have dedicated staff to work with the hatchlings to minimise spread of infection from older crocodiles. (if staff must work in other areas of the farm, work with hatchlings first).

Refer to the more detailed document – Biosecurity of Crocodile Farms – NT – Cleaning procedures and biosecurity concerns – for procedures and check lists.

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