



**DEPARTMENT OF RURAL DEVELOPMENT
AND AGRARIAN REFORM – EASTERN CAPE
PROVINCE**

RIPPLEMEAD CITRUS PACK HOUSE

WASTE MANAGEMENT REPORT

JUNE 2015

PREPARED FOR:

**DEPARTMENT OF RURAL DEVELOPMENT
AND AGRARIAN REFORM**

PRIVATE BAG X 9032
EAST LONDON
5200

PREPARED BY:

**LUKHOZI CONSULTING ENGINEERS
(PTY) LTD**

KWA-LUKHOZI
THE QUARRY
QUARTZITE DRIVE
SELBOURNE
EAST LONDON
5201

TEL.: 043 - 721 1321

FAX: 043 - 721 1330

E-MAIL : d.kennedy@lukhozi.co.za

www.lukhozi.co.za

LUKHOZI



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 CAPE PROVINCE**

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1. INTRODUCTION

1.1 GENERAL

Lukhozi Consulting Engineers (Pty) Ltd was invited to tender on the proposed development of Ripplemead Citrus Pack House by the Department of Rural Development and Agrarian Reform's East London Branch with a closing date of 3 August 2012. Lukhozi Consulting Engineers (Pty) Ltd was appointed as the service provider for the implementation of this project.

Reference No: SCMU8-12/13-0008

Title: Bid document for the rendering of professional services required for Ripplemead Pack.

1.2 DESCRIPTION OF THE PROJECT

Ripplemead pack house is situated on the Farm called Groet Hoek 226 in the Peddie area located in the Ngushwa Municipality and the Amathole District Municipality approximately ± 23.0 km to the north west of Peddie.

The three citrus farms in the Keiskamma River Valley, which formed part of the Ulimocor group, are producing citrus fruit for export markets. All citrus produce used to be packed in the Ripplemead pack house in the past, however over time, the producers, due to stringent customer specifications, were forced to look at alternative pack houses due to the pack house not being suitable for packing soft citrus and a lack of capital to improve

the pack house.

The fourth farm in the Ripplemead area has yet to be developed with funding approved at provincial level. These orchards will take a number of years to start producing again, but are included in the study for fruit handling requirements for the 2017 season. All three of the producing citrus farms have indicated that they see the need to co-operate and this report focuses on the Ripplemead Pack House and fruit handling needs in the Keiskamma River Valley.

1.3 **PURPOSE OF REPORT**

This report sets out the proposed waste management processes for the Ripplemead pack house.

2. **BACKGROUND INFORMATION**

2.1 **LOCATION AND SITE DESCRIPTION**

2.1.1 **Location**

Ripplemead pack house is situated approximately 23 km north west of Peddie. The site is accessible via the N2 from Peddie to King Williams Town.

Co-ordinates for the site centre are as follows: 33°01'50"S, & 26°58'54" E

A Locality Map is provided in **Appendix 1** of this report.

2.1.2 **Site Description**

The site is approximately 2 ha in extent and has a slope which varies from 1: 43,42 to 1:17,23, which is classed as fairly flat. The proposed site is currently vacant old lands and is surrounded by the existing pack house, community and existing citrus orchards. The entire area is situated along the Keiskamma River, which also forms the boundary of this area under discussion.

3. **CITRUS PACK HOUSE ELEMENTS**

The following items will form part of the Ripplemead Pack House development:

3.1 **BUILDINGS:**

- Citrus Pack House will consist of a steel structure with cladding on roof and side walls,
- The floor will be a 150mm thick concrete floor.
- Offices.
- Ablution and Canteen Block.
- Various 10 000 l tanks for rain water harvesting.

3.2 **EXTERNAL SITE WORKS:**

- Boundary Security Fence.
- Paved access and parking internally with kerbing and channeling for storm water control.
- Underground Storage tanks for all pack house waste water and a septic tank and French drains for the sewer
- Pumps with control gear and irrigation equipment for garden sprinkler system around the pack house facility for use of waste water.

3.3 **BULK WATER SUPPLY SYSTEM:**

There is an existing bulk water supply system to the Ripplemead Pack House which is described below:

- Water is extracted from a weir in the Keiskamma River, with a movable KSB pump connected to an electrical motor.
- The water then passes through a filter.
- The water is then pumped to 10 000 l water tanks at the Pack House.

If the bulk supply is upgraded it will not exceed a diameter of 300 mm and the flow rate will be below 120 l/s.

3.4 WASTE WATER SYSTEM:

The water will be divided into components namely:

- Domestic waste water
- Pack House Waste water.

3.4.1 Domestic Waste Water

This water will be produced from the ablution facilities. The water from the toilets will flow to a septic tank and then the grey water into a French drain / soak away. The water from the wash hand basins will flow directly into the French drain / soak away.

The septic tank will be fitted with a manhole cover and a draw-off valve, so that it can be cleaned when required.

The anticipated volume of waste water produced from the pack house, for domestic waste is as follows:

| | | |
|----------------------------|---|--|
| Estimated seasoned workers | = | 100 |
| Permanent workers | = | 10 |
| Operational period | = | 6 – 8 months |
| Total water consumption | = | 90 l/p/d |
| <u>Volume</u> | = | 110 x 90 = 9 900 l/d.(9.9 m ³ /day) |
| | = | 22 x 9 900l/d = 217 800l/mth (217.8 m ³ /mth) |
| | = | 8 x 217.8m ³ /mth = 1 742m ³ over an 8 month period. |

Sewer waste water is approximately 90% of the water demand.

$$\begin{aligned}
 &= 1\,742\text{m}^3 @ 90\% &= 1\,567,8\text{m}^3 / 8 \text{ month period} \\
 & &= 196\text{m}^3 / \text{month} \\
 & &= 8.9 \text{ m}^3/\text{day}
 \end{aligned}$$

3.4.2 Pack House Waste Water

This waste water will be produced from the drenching of the fruit and the fungicide bath.

This water will contain the following chemicals:

3.4.2.1 Imazalil

- **Trade and other names**

Trade names for products containing imazalil include Bromazil, Deccoziil, Fungaflor, Freshgard, and Fungazil. The fungicide is compatible with many other types of pesticides.

- **Regulatory Status**

Imazalil is a moderately toxic compound in EPA toxicity class II. Labels for products containing it must bear the Signal Word WARNING [1]. Imazalil is a General Use Pesticide (GUP).

- **Ecological Effects**

Effects on birds: Both the mallard duck and the Japanese quail are relatively insensitive to the fungicide. The 8-day LC50 values in these birds range from about 5500 to 6300mg/kg/day [1]. These values indicate that the compound is practically nontoxic to birds.

Effect on aquatic organisms: Imazalil is moderately toxic to fish. The LC50 for imazalil in trout is 2.5 mg/L and in the bluegill sunfish is 3.5mg/L [1].

Effects on other organisms: The compound is non-toxic to bees [1].

- **Environmental Fate:**

Breakdown in soil and groundwater: Imazalil is highly persistent in the soil environment, with a reported field half-life of between 120 and 190 days [11]. A

representative value is estimated to be 150 days for most soils [11]. It is soluble in water, but strongly bound to soils [11], and thus unlikely to pose a risk to groundwater. In a plot where seven applications were made at 14-day intervals, leaching was practically nonexistent and accumulation did not appear to be a problem [42].

Breakdown in water: In acid to neutral aqueous solutions, imazalil is stable for at least 8 weeks at 40 F. Decomposition occurs at elevated temperatures and under the influence of light [41].

Breakdown of vegetation: One week after treated barley seed was sown in soil, about 76% of the imazalil was in the adjacent soil and about 29% was in the seedcoat.

After 3 weeks, only 6% was in the green plant parts. Under normal storage conditions, oranges dipped in 2000mg active ingredient/L and stored have residues (89%) present as the parent compound. Only a small amount of imazalil was present in the pulp, and part of this may have resulted from handling during peeling [41]. Studies with apples gave similar results.

(See Appendix 3)

3.4.2.2 Thiabendazole

- **Trade and other names**

Trade names for products containing this compound include Api-Luster, Arbotect, Mertect, Mycozol, TBZ, Tecto, and Thibenzole. The product is often used in combination with other fungicides and insecticides.

- **Regulatory Status**

Thiabendazole is a General Use Pesticide (GUP). It is in EPA toxicity class III – Slightly toxic, and products containing it carry the Signal Word CAUTION on the label.

- **Ecological Effects**

Effects on birds: No data are currently available.

Effects on aquatic organisms: Thiabendazole is of low toxicity to fish [8]. The compound is not expected to appreciably accumulate in aquatic organisms. The bioconcentration factor for thiabendazole in whole fish is 87 times the ambient water concentrations. Fish eliminated the compound within 3 days after being placed in thiabendazole-free water [49].

Effects on other organisms: Earthworms are sensitive to the compound (LD_{50} = approx. 20 ug/worm), while bees are not [8]. It is nontoxic to bees.

- **Environmental Fate:**

Breakdown in soil and groundwater: Thiabendazole's affinity for binding to soil particles increases with increasing soil acidity. It is highly persistent. The field half-life for thiabendazole has been reported as 403 days [11]. In one study, 9 months following application, most of the residues (85% to 95%) were recovered from soil. Due to its binding and slightly solubility in water, it is not expected to leach readily from soil.

Breakdown in water: Thiabendazole is stable in aqueous suspension and acidic media [1]. Its low water solubility will make it unlikely to be in solution, and it will most likely be bound to sediment.

Breakdown in vegetation: No metabolism was seen with seed potatoes, but photoproducts were detected on sugar beet leaves [8]. Total residues in sugar beets were 78% parent compound with the remaining 22% being benzimidazole, benzimidazole-2-carboxamide, and unidentified products. Thiabendazole is readily absorbed by roots and translocated to all parts of a plant, but predominantly to the leaf margins [8].

(See Appendix 4)

3.4.2.3 Pyrimethanil

- **Trade and other names**

Trade names for products containing this compound include Protector 400 SC & Pyrus 400 SC.

- **Hazard Identification**

Hazard: **N = Dangerous for the environment**
NON HAZARDOUS SUBSTANCE – NON DANGEROUS GOOD

Classification: Classified as *Not Hazardous* according to the criteria of NOHSC

Risk Phrases: R51 / 53 = Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety Phrases: S60 =This material and its container must be disposed of as hazardous waste.

- **Handling and storage**

Precautions for safe: Always store pesticides in their original containers, which include the label listing ingredients, directions for use, and first aid steps in case of accidental poisoning. *Never transfer* pesticides to soft drink bottles or other containers. Children or others may mistake them for something to eat or drink.

Keep out of reach of children.

Wear suitable protective clothing (Dust mask; Eye shields, Gloves)

Wash hands, arms and face after use. Wash gloves and contaminated protective clothing daily.

- **Conditions for safe storage:**

DO NOT re-use the container for any other purpose.

Store in the closed original container in a cool, dry and well ventilated, secure area.

- **Ecological Information**

Ecotoxicity: Fish LC₅₀ (96h) = Mirror carp – 35.4 mg/l;= Rainbow trout – 10.6 mg/l

Bees: LD₅₀ (oral and contact) = 100 µg / bee

Birds: LD₅₀ (oral) = Mallard ducks > 2000mg/kg
= Bobwhite quail > 2000mg/kg

Earthworms: LC₅₀ (14d) = 625 mg/kg dry soil.

Daphnia: LC₅₀ (48h) = Daphnia magna (water flea) = 2.9mg/l

Persistence, degradability and mobility:

DT₅₀ in laboratory studies 27 – 82 days; fields studies indicate rapid degradation. DT₅₀ = 7 – 54 DAYS. Low potential for leaching to groundwater, minimal movement into deeper soil layers.

Pyrimethanil disappears rapidly from surface water.

(See Appendix 5)

The waste chain designers opinion that the waste water produced containing the chemicals as listed above can be used for irrigation of gardens and lawns, which will assist in dust control around the pack house facility.

The estimated volume of waste water to be produced by the pack house is as follows:

| | |
|---------------------------------|---|
| Estimated waste water | = 5000 l/week (5 m ³ /week or 1 m ³ /day) |
| Monthly total | = 20 000 l/month (20m ³ / month) |
| Total for 8 months of operation | = 160.0m ³ |

Two options are being considered for the storage and use of the waste water:

Option 1:

The waste water will be collected and stored in a series of three (3) underground tanks of ± 6 000l each, the water will enter the first tank and through the second and third tanks. In the third tank a product like "Funds" produced by Janssen PMP, will be added to break down the chemicals. A pump with a float control switch will be installed at the third tank, this water will then be pumped into the garden irrigation system around the pack house to irrigate the gardens and lawns and assist with dust control. The tanks will be marked hazardous materials.

Option 2:

The waste water will be collected and stored in a series of two (2) upright tanks of ± 10 000l each, the water will enter the first tank and then flow through to the second tank. In the second tank a product like "Funds" produced by Janssen PMP, will be added to break down the chemicals. A pump with a float control switch will be installed at the second tank, this water will then be pumped into the garden irrigation system around the pack house to irrigate the gardens and lawns and assist with dust control. The tanks will be marked hazardous materials.

3.5 **ELECTRICITY SUPPLY AND DISTRIBUTION:**

- To Electrical Engineers specifications.
- Specially manufactured control switch board with indicator lights for all pumps to be situated in the Managers Office.

3.6 **INTERNAL PACK HOUSE EQUIPMENT:**

- De-greening rooms and or Cool Rooms.
- Fruit processing equipment.

4. **PROPOSED CITRUS PROCESSING PROCESS**

4.1 **DELIVERY OF FRUIT FROM THE ORCHARDS**

The fruit will be delivered from the orchards by tractor and trailer or in bins and the pack house should cater for both methods.

4.2 **DRENCHING OF FRUIT**

Once the fruit arrives at the pack house it is placed in the shade to allow it to cool down before being sent through the drencher. This process is where the fruit is moved through a water curtain which contains a fungicide to protect the fruit if there are any scratches and at the area where the fruit was connected to the stem.

The fruit is then allowed to dry before the next process is started.

4.3 **DE-GREENING OF FRUIT**

Once the fruit in the orchards has reached the correct sugar and acid content it can be picked even if the colour is not yet correct. The fruit is then placed in a de-greening room to achieve the correct colour before being packed. Water usage in the de-greening rooms will be ± 100 litres per day for about 90 days.

4.4 PROCESSING OF FRUIT

Once the fruit has dried it is sent through a washing unit to remove all dust, etc that is on the surface of the fruit and at this point any waste fruit is removed from the line.

The fruit then moves through a drying unit to remove any moisture from the fruit and is then moved through the waxing unit, where the fruit is covered with a thin layer of wax. The fruit then moves through a dryer to dry the wax before moving to the sorting lanes.

The sorting process is where the fruit is sorted according to grading, colour, size, local and export markets.

Waste or spoil fruit is collected by local livestock farmers for use as livestock fodder which is an acceptable practice.

Once sorted the fruit is moved to the packaging area where it is packed into cartons and then onto pallets. The pallets are then placed in cold storage before being sent to the export agents.

5. OPERATION AND MAINTENANCE

The successful operation of the facility is highly dependent on functional infrastructure. The infrastructure will uphold the pack house processes as long as maintenance is carried out on a regular basis.

Refer to the table below where the different maintenance intervals on infrastructure items are identified:

| ITEM | DESCRIPTION | MAINTENANCE INTERVAL SCHEDULE | | | | |
|-----------|--------------------------------------|-------------------------------|------------|-------------|-----------|--------|
| | | Daily | Weekl y | Month ly | Bi-Annual | Annual |
| 1. | <u>PACKHOUSE</u> | | | x | | |
| 1.1 | Wash pack house floors | | | x | | |
| 1.2 | Check operation of gates | | | x | | |
| 1.3 | Check and replace broken light bulbs | | | x | | |
| 1.4 | Clean A/C filters & sieves | | | x | | |
| 2. | <u>DOMESTIC WASTE WATER</u> | | | x | | |
| | Check septic tank inlet and | | | | | |

| | | | | | | |
|-----|--|---|---|---|---|---|
| 2.1 | outlet structures for blockages | | | | | |
| 2.2 | Have septic tank cleaned | | | | | x |
| 3. | PACK HOUSE WASTE WATER | | | | | |
| 3.1 | Ensure water is replaced | | x | | | |
| 3.2 | Change tanks over | | x | | | |
| 3.3 | Add "Funds" | | x | | | |
| 3.4 | Irrigate the waste water through irrigation system | | x | | | |
| 3.5 | Repair and damaged or broken pipes (as they occur) | x | | | | |
| 3.6 | Service pumps | | | | | x |
| 4. | OTHER | | | | | |
| 4.1 | Sweep and remove vegetation from paved surfaces | | x | | | |
| 4.2 | Check and replace leaking pipes | | x | | | |
| 4.3 | Check for and repair leaks in water storage tanks | | x | | | |
| 4.4 | Clean vents of AC units | | | x | | |
| 4.5 | Servicing of AC units | | | | x | |
| 4.6 | Servicing of Fire Extinguishers | | | | x | |
| 4.7 | Check for and replace defective pumps | | x | | | |

6. **CONCLUSION**

In conclusion the salient points of this report are listed below as follows:

- 6.1 The waste water to be produced at Ripplemead Citrus Pack House will consist of Domestic and Pack House Waste Water.
- 6.2 The domestic waste will be treated by using septic tanks and French drains.
- 6.3 The pack house waste water will be collected, treated with a product like "Funds" and then irrigated through a garden irrigation system around the pack house to assist with dust control.
- 6.4 From the information collected there would not seem to be any negative effects to using the waste water as stipulated in 5.2 and 5.3 above.



**D.C. KENNEDY
LUKHOZI CONSULTING ENGINEERS (PTY) LTD**

**LUKHOZI CONSULTING ENGINEERS (PTY) LTD
3A GRIFFITH STREET
QUEENSTOWN**

TEL.: 045 – 839 2532
FAX: 045 – 8393067
E-MAIL : d.kennedy@lukhozi.co.za
www.lukhozi.co.za

23 June 2015

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APPENDICES

APPENDIX 1
LOCALITY MAP

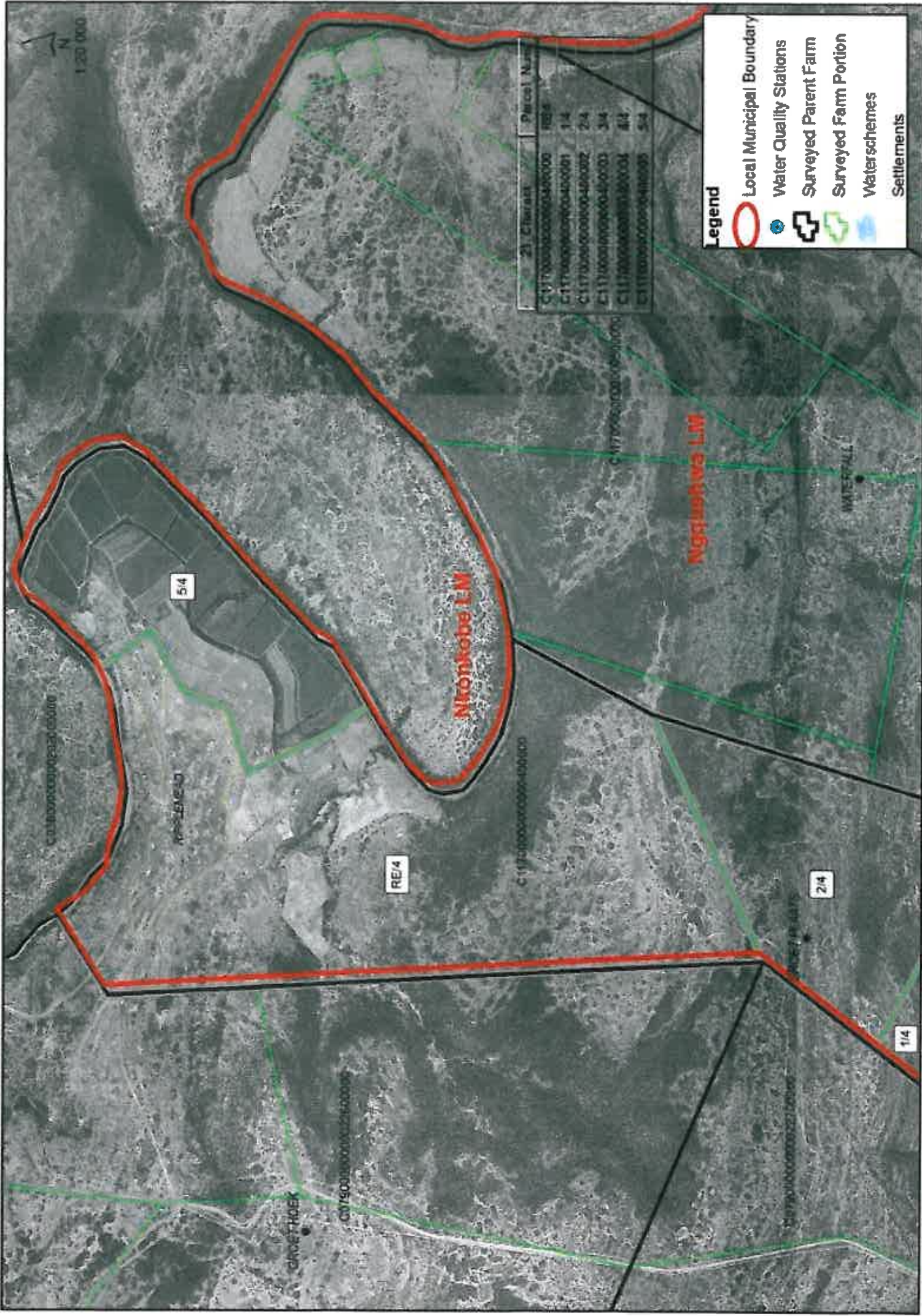


1:250 000

| 2) Character | Parcel Number |
|------------------------|---------------|
| C117000000000000000000 | RE/4 |
| C117000000000000000001 | 1/4 |
| C117000000000000000002 | 2/4 |
| C117000000000000000003 | 3/4 |
| C117000000000000000004 | 4/4 |
| C117000000000000000005 | 5/4 |

Legend

-  Local Municipal Boundary
-  Water Quality Stations
-  Surveyed Parent Farm
-  Surveyed Farm Portion
-  Water schemes
-  Settlements



Ntronkobe L.M

Nqushwa L.M

5/4

RE/4

2/4

1/4

WATERFALL

GRACE THORPE

APPENDIX 2

INFORMATION FROM CITRUS RESEARCH INTERNATIONAL

Fungicide bath

Recommended products (actives)

- **Imazalil sulphate (IMZ)**
 - 500 ppm = 67 g in 100 L water (750 g/kg formulation)
- **2.4-D** [if not in drench or wax]
 - 250 ppm = 1 L in 100 L water (25 g/L formulation)
- **Guazatine (GZT)** [optional, not allowed in all markets]
 - 1000 ppm = 480 mL in 100 L water (210 g/L formulation)
 - = 500 mL in 100 L water (200 g/L formulation)

Mixing protocol

1. Fill bath to 80% capacity
2. Start pump(s)
3. If pH of water is > 7 amend pH to 7
4. Order of mixing:
 1. IMZ
 2. 2.4-D
 3. GZT
5. Fill bath to full capacity
6. Measure pH and amend, the pH of mixture should never exceed 6
7. Let the system run for 15 min before commencing treatment

Operation

- pH and exposure time
 - pH 3: 1.5 to 3 min
 - pH 6: ≤ 45 s
- Temperature: 35°C
- Measure the concentration at least twice daily and amend accordingly
- Renew the mixture at least once a week, preferably daily
- Mixtures used for more than one day can be pasteurised by heating it to 60°C and letting it cool down over night

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Owen othorobol vir trokstell

More info:

Top-up procedure: CRI Cutting Edge no 22

Titration method: Contact your supplier

MRL list and restrictions: Visit www.cga.co.za or email

ph@cga.co.za for "RECOMMENDED USAGE RESTRICTIONS FOR PLANT PROTECTION PRODUCTS ON SOUTHERN AFRICAN EXPORT CITRUS"

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Wax application - 2015

Recommended products (actives)

- **Imazalil (IMZ)**
 - 3000 ppm (if applied in wax only – single application)
 - = 600 mL in 100 L wax (500 g/L formulation)
 - IMACulate 300 is an option for single application of IMZ with wax, this is an IMZ product that contains a GRAS (Generally Regarded As Safe) chemical that has an action against sour rot and can be applied as an GZT alternative
 - 2000 ppm (if also applied in fungicide bath – double application)
 - = 400 mL in 100 L wax (500 g/L formulation)
- **2,4-D – 250 ppm** (if not in fungicide bath)
 - = 1 L in 100 L (25g/L formulation)
- **Thiabendazole (TBZ) – 4000 ppm**
 - = 800 mL in 100 L wax (500 g/L formulation)
- **Guazatine (GZT) – 3000 ppm** (optional, not allowed in all markets)
 - [GZT formulated waxes are available , it should not be mixed manually]

Mixing protocol

1. Fill wax applicator tank with wax to 80% capacity
2. Start mixer/agitator
3. Premix each product separately in \pm 500 mL of warm water (\pm 40°C) before adding it to wax
4. Order of mixing:
 1. IMZ
 2. TBZ
 3. 2,4-D
5. Fill wax applicator tank to full capacity
6. Agitate for at least 15 min before commencing with treatment
7. To prevent precipitation of certain actives, mix continuously; agitator should be active 24 hours per day

Operation

- Apply wax as specified by supplier (1 – 1.5 L/ton)
- Prevent wind from drying tunnels blowing on wax applicator
- Ensure an even spread of wax on brushes (follow wax supplier recommendations)
- Brushes should always be moist with wax, but no foam should be formed
- At the end of a packing day, brushes should be rinsed with hot water to remove wax

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More info:

MRL list and restrictions: Visit www.cga.co.za or email ph@cga.co.za for "RECOMMENDED USAGE RESTRICTIONS FOR PLANT PROTECTION PRODUCTS ON SOUTHERN AFRICAN EXPORT CITRUS"

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Chlorine application

Specification

- **Total chlorine (Cl):** 150 – 200 ppm
- **Free / Available chlorine:** 75 – 100 ppm
- **Solution pH:** 6.5 – 7.5
- **ORP:** \geq 800 mV
- **Application options**
 1. Dry tip on sorting table followed by total loss chlorine system on brushes
 2. Wet tip in chlorine dip tank/bath followed by sorting table and a total loss chlorine application system on brushes

Concentration management:

- Use a automatic dosing system
- Fill tank to capacity with water
- Add calcium hypochlorite manually
 - 30 g per 100 L (680 g/kg formulation)
= 200 ppm (total chlorine)
 - Dissolve in bucket lukewarm water before adding to tank
- Start dosing system
- Continued dosing is required to maintain the concentration level
- The level of dosing can only be determined by regular measurement of Cl concentration, solution pH and ORP

Operation:

- Regularly measure (at least every 2 hours)
 - Concentration
 - pH
 - ORP
- It is paramount to maintain the pH level at 6.5 – 7.5, at higher levels chlorine is less effective
- Minimum exposure time of 1 min
- Renew the mixture at least once a day

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Green alternatives for food safety

Alternatives for chlorine

- Chlorine dioxide
 - Hydrogen peroxide combined with peracetic acid
- For specifications contact the specific suppliers of these products.

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APPENDIX 3
DATA SHEET FOR IMAZALIL

The information in this profile may be out-of-date. It was last revised in 1996. EXTOXNET no longer updates this information, but it may be useful as a reference or resource.

Please visit the National Pesticide Information Center (NPIC) to find updated pesticide fact sheets. If you don't find a fact sheet related to your question, feel free to call 1-800-858-7378. NPIC is open five days a week from 8:00am to 12:00pm Pacific Time.

EXTOXNET

Extension Toxicology Network

Pesticide Information Profiles

A Pesticide Information Project of Cooperative Extension Offices of Cornell University, Oregon State University, the University of Idaho, and the University of California at Davis and the Institute for Environmental Toxicology, Michigan State University. Major support and funding was provided by the USDA/Extension Service/National Agricultural Pesticide Impact Assessment Program.

EXTOXNET primary files maintained and archived at Oregon State University

Revised June 1996

Imazalil

Trade and Other Names: Trade names for products containing imazalil include Bromazil, Deccoziel, Fungaflor, Freshgard, and Fungazil. The fungicide is compatible with many other types of pesticides.

Regulatory Status: Imazalil is a moderately toxic compound in EPA toxicity class II. Labels for products containing it must bear the Signal Word WARNING [1]. Imazalil is a General Use Pesticide (GUP).

Chemical Class: imidazole

Introduction: Imazalil is a systemic imidazole fungicide used to control a wide range of fungi on fruit, vegetables, and ornamentals, including powdery mildew on cucumber and black spot on roses. Imazalil is also used as a seed dressing and for postharvest treatment of citrus, banana, and other fruit to control storage decay. Under natural conditions, it is less likely that imazalil treatment will lead to resistant strains of fungi than as a result of treatment with other fungicides.

Formulation: Not Available

Toxicological Effects:

- **Acute toxicity:** Imazalil is moderately toxic by ingestion, with a reported oral LD50 of 227 to 343 mg/kg in rats [1,8]. The LD50 in dogs is greater than 640 mg/kg [41]. The reported dermal LD50 is 4200 to 4880 mg/kg in rats, indicating slight toxicity [1]. Test animals have experienced symptoms such as excitation of hair follicles (goose pimples), muscle incoordination, reduced arterial tension, tremors, and vomiting [41]. Contact dermatitis has been noted in some cases in sensitive individuals [41].
- **Chronic toxicity:** Rats fed imazalil nitrate at dietary levels of up to 0.4 mg/kg/day for 14 weeks were not affected in appearance, behavior, survival, food consumption, urinalysis, or tissue composition. There were slight liver, body weight, and bilirubin changes at higher doses [41]. Groups of rats fed up to 0.4 mg/kg/day for 6, 12, and 24 months did not show compound or dose related effects on body weight gain, food consumption, appearance, behavior, or survival [41]. Similar results were found in a dog study where animals received up to 0.5 mg/kg/day for 2 years. The liver showed some slight effects at the higher doses, but all other measured and observed parameters were within normal limits [41].
- **Reproductive effects:** In three separate three-generation rat studies at low to moderate doses of 0.4 mg/kg/day, there was a trend to a lower number of live births at the highest dose level. No differences were noted in percent of pregnancies or duration of pregnancy [3,41]. These data suggest that imazalil is unlikely to cause reproductive effects under normal conditions.
- **Teratogenic effects:** None of the rat studies mentioned above resulted in fetal abnormalities. A mouse study at doses up to 4.8 mg/kg/day was also negative. It is unlikely that imazalil is teratogenic [3,41].
- **Mutagenic effects:** Dominant lethal mutagenic effects were not evident in male and female mice [3]. Based on these data, it appears that imazalil is not mutagenic.
- **Carcinogenic effects:** In a group of rats given imazalil for 30 months at a dose of 5.0 mg/kg/day, there were no increases in tumors compared to the controls [41]. This suggests that imazalil is noncarcinogenic.
- **Organ toxicity:** Based on animal tests, imazalil affects the nervous system and liver.
- **Fate in humans and animals:** Imazalil is rapidly absorbed, distributed, metabolized, and excreted by rats. Following a single dose of imazalil sulfate, 90% was excreted in metabolized form within 96 hours [1]. Only 3% was eliminated via the feces in nonmetabolized form, indicating almost complete absorption from the gastrointestinal tract [41]. At least four metabolites are formed 48 hours after administration. Accumulation in fatty tissue did not occur [41].

Ecological Effects:

- **Effects on birds:** Both the mallard duck and the Japanese quail are relatively insensitive to the fungicide. The 8-day LC50 values in these birds range from about 5500 to 6300 mg/kg/day [1]. These values indicate that the compound is practically nontoxic to birds.
- **Effects on aquatic organisms:** Imazalil is moderately toxic to fish. The LC50 for imazalil in trout is 2.5 mg/L and in the bluegill sunfish is 3.2 mg/L [1].
- **Effects on other organisms:** The compound is non-toxic to bees [1].

Environmental Fate:

- **Breakdown in soil and groundwater:** Imazalil is highly persistent in the soil environment, with a reported field half-life of between 120 and 190 days [11]. A representative value is estimated to be 150 days for most soils [11]. It is soluble in water, but strongly bound to soils [11], and thus unlikely to pose a risk to groundwater. In a plot where seven applications were

made at 14-day intervals, leaching was practically nonexistent and accumulation did not appear to be a problem [42].

- **Breakdown in water:** In acid to neutral aqueous solutions, imazalil is stable for at least 8 weeks at 40 F. Decomposition occurs at elevated temperatures and under the influence of light [41].
- **Breakdown in vegetation:** One week after treated barley seed was sown in soil, about 76% of the imazalil was in the adjacent soil and about 29% was in the seedcoat. After 3 weeks, only 6% was in the green plant parts. Under normal storage conditions, oranges dipped in 2000 mg active ingredient/L and stored have residues (89%) present as the parent compound. Only a small amount of imazalil was present in the pulp, and part of this may have resulted from handling during peeling [41]. Studies with apples gave similar results.

Physical Properties:

- **Appearance:** Imazalil is a slightly yellow to brown solidified oil [1].
- **Chemical Name:** (+/-)-allyl 1-(2,4-dichlorophenyl)-2-imidazol-1-ylether ester [1]
- **CAS Number:** 35554-44-0
- **Molecular Weight:** 297.18
- **Water Solubility:** 1400 mg/L @ 20 C [1]
- **Solubility in Other Solvents:** s.s. in hexane, methanol, toluene, benzene [1]
- **Melting Point:** 50 C [1]
- **Vapor Pressure:** 0.0093 mPa 25 C [1]
- **Partition Coefficient:** 3.8195 [1]
- **Adsorption Coefficient:** 4000 [1]

Exposure Guidelines:

- **ADI:** 0.03 mg/kg/day [12]
- **MCL:** Not Available
- **RfD:** 0.013 mg/kg/day [13]
- **PEL:** Not Available
- **HA:** Not Available
- **TLV:** Not Available

Basic Manufacturer:

Janssen Pharmaceutica
Plant Protection Division
1125 Trenton-Harbourton Road
Titusville, NJ 08560-1200

- **Phone:** 609-730-2607
- **Emergency:** Not Available

References:

References for the information in this PIP can be found in Reference List Number 10

DISCLAIMER: The information in this profile does not in any way replace or supersede the information on the pesticide product labeling or other regulatory requirements. Please refer to the

pesticide product labeling.

APPENDIX 4
DATA SHEET FOR THIABENDAZOLE

The information in this profile may be out-of-date. It was last revised in 1996. EXTOXNET no longer updates this information, but it may be useful as a reference or resource.

Please visit the National Pesticide Information Center (NPIC) to find updated pesticide fact sheets. If you don't find a fact sheet related to your question, feel free to call 1-800-858-7378. NPIC is open five days a week from 8:00am to 12:00pm Pacific Time.

EXTOXNET

Extension Toxicology Network

Pesticide Information Profiles

A Pesticide Information Project of Cooperative Extension Offices of Cornell University, Oregon State University, the University of Idaho, and the University of California at Davis and the Institute for Environmental Toxicology, Michigan State University. Major support and funding was provided by the USDA/Extension Service/National Agricultural Pesticide Impact Assessment Program.

EXTOXNET primary files maintained and archived at Oregon State University

Revised June 1996

Thiabendazole

Trade and Other Names: Trade names for products containing this compound include Apl-Luster, Arbotect, Mertect, Mycozol, TBZ, Tecto, and Thibenzole. The product is often used in combination with other fungicides and insecticides.

Regulatory Status: Thiabendazole is a General Use Pesticide (GUP). It is in EPA toxicity class III - slightly toxic, and products containing it carry the Signal Word CAUTION on the label.

Chemical Class: benzimidazole

Introduction: Thiabendazole is a systemic benzimidazole fungicide used to control fruit and vegetable diseases such as mold, rot, blight, and stain. It is also active against storage diseases and Dutch Elm disease. In livestock and humans, thiabendazole is applied to treat several helminth species such as roundworms. Thiabendazole is also used medicinally as a chelating agent to bind metals. It is available as a wettable powder, suspension concentrate, flowable concentrate, and liquid.

Formulation: It is available as a wettable powder, suspension concentrate, flowable concentrate, and liquid.

Toxicological Effects:

- **Acute toxicity:** Effects of acute overexposure to the fungicide include dizziness, anorexia, nausea, and vomiting. Other symptoms such as itching, rash, chills, and headache occur less frequently. The symptoms are brief and are related to the dose level [3]. The oral LD50 is 3100 to 3600 mg/kg in the rat, 1395 to 3810 mg/kg in mice, and greater than 3850 mg/kg in the rabbit [1,3]. The lethal dose in sheep is 1200 mg/kg. The dermal LC50 in rabbits is greater than 5000 mg/kg. Thiabendazole is not a skin irritant or a sensitizer [3].
- **Chronic toxicity:** Rats fed 200 mg/kg/day or less showed few or no growth effects. At higher doses (400 mg/kg/day), there was growth suppression. Death occurred in a few days at 1200 mg/kg/day and 30% mortality occurred within 30 days at 800 mg/kg/day. A decrease of active bone marrow at high doses was also noted [8]. At doses somewhat below the LD50, mice experienced significant liver, spleen, and intestinal effects. In dogs, high daily doses (200 mg/kg/day) for 2 years produced few effects other than occasional attacks of vomiting and persistent anemia. Sheep experienced toxic depression and anorexia at very high doses (800 to 1000 mg/kg/day). Studies on cattle, sheep, goats, swine, horses, and zoo animals have shown few chronic symptoms at low doses [3].
- **Reproductive effects:** A three-generation study in rats showed no adverse effects on reproduction at 20 to 80 mg/kg/day. However, four times this low therapeutic dose produced serious pregnancy related disorders (eclampsia) in sheep [3]. Mice studied for five generations showed no effects at 10 mg/kg/day, decreased weanling weights at 50 mg/kg/day, and decreased weanling weight and size at 250 mg/kg/day [3,8]. Reproductive effects in humans are not likely at anticipated levels of exposure.
- **Teratogenic effects:** Pregnant rabbits fed doses of 75, 150, and 600 mg/kg/day produced pups with lower fetal weights at the highest dose tested. No birth defects were observed with thiabendazole at any dose tested [3,8]. Teratogenic effects are not likely from thiabendazole exposure.
- **Mutagenic effects:** Several studies with bacteria have failed to produce any chromosome changes or mutations due to thiabendazole [8]. It appears that the compound is not mutagenic.
- **Carcinogenic effects:** A 2-year feeding study with rats at levels of 10 to 160 mg/kg/day produced no cancer-related effects attributable to thiabendazole [3,8]. Another study conducted over 18 months at the maximum tolerated dose in mice produced no evidence of cancer related effects [3,8]. It does not appear that thiabendazole is carcinogenic.
- **Organ toxicity:** Dogs autopsied after a 2-year feeding study had incomplete development of bone marrow, a wasting away of lymph tissue, and other abnormalities [30]. Most dogs tested at about 100 mg/kg/day for 2 years developed anemia. The dogs recovered at the end of the study [3].
- **Fate in humans and animals:** In four men given 1000 mg (approximately 14 mg/kg) thiabendazole orally, plasma concentrations peaked at 13 to 18 ppm within an hour [3]. Within 4 hours, 40% of the dose was excreted, and within 24 hours, 80% was excreted, mostly in the urine as metabolites of the compound [3]. Elimination is rapid in other species as well. Rats almost completely eliminate the compound after 48 hours and sheep after 96 hours [3]. Metabolites are distributed throughout most body tissues in sheep, but detectable in only a few tissues at low levels (less than 0.2 ppm) at 16 days and at very low levels (0.06 ppm or less) after 30 days [8].

Ecological Effects:

- **Effects on birds:** No data are currently available.
- **Effects on aquatic organisms:** Thiabendazole is of low toxicity to fish [8]. The compound is

not expected to appreciably accumulate in aquatic organisms. The bioconcentration factor for thiabendazole in whole fish is 87 times the ambient water concentrations. Fish eliminated the compound within 3 days after being placed in thiabendazole-free water [49]

- **Effects on other organisms:** Earthworms are sensitive to the compound (LD50 = approx. 20 ug/worm), while bees are not [8]. It is nontoxic to bees.

Environmental Fate:

- **Breakdown in soil and groundwater:** Thiabendazole's affinity for binding to soil particles increases with increasing soil acidity. It is highly persistent. The field half-life for thiabendazole has been reported as 403 days [11]. In one study, 9 months following application, most of the residues (85 to 95%) were recovered from soil. Due to its binding and slight solubility in water, it is not expected to leach readily from soil.
- **Breakdown in water:** Thiabendazole is stable in aqueous suspension and acidic media [1]. Its low water solubility will make it unlikely to be in solution, and it will most likely be bound to sediment.
- **Breakdown in vegetation:** No metabolism was seen with seed potatoes, but photoproducts were detected on sugar beet leaves [8]. Total residues in sugar beets were 78% parent compound with the remaining 22% being benzimidazole, benzimidazole-2-carboxamide, and unidentified products. Thiabendazole is readily absorbed by roots and translocated to all parts of a plant, but predominantly to the leaf margins [8].

Physical Properties:

- **Appearance:** Thiabendazole is an odorless, colorless powder [1].
- **Chemical Name:** 2-(thiazol-4-yl)benzimidazole [1]
- **CAS Number:** 148-79-8
- **Molecular Weight:** 201.20
- **Water Solubility:** <50 mg/L @ pH 5 to 12 [1]
- **Solubility in Other Solvents:** s. in acetone and ethanol; s.s. in benzene and chloroform [1]
- **Melting Point:** 304-305 C [1]
- **Vapor Pressure:** Negligible at room temperature [1]
- **Partition Coefficient:** Not Available
- **Adsorption Coefficient:** 2500 [1]

Exposure Guidelines:

- **ADI:** 0.1 mg/kg/day [12]
- **MCL:** Not Available
- **RfD:** 0.1 mg/kg/day [13]
- **PEL:** Not Available
- **HA:** Not Available
- **TLV:** Not Available

Basic Manufacturer:

Merck Agvet
Division of Merck & Co., Inc.
P.O. Box 2000
Rahway, NJ 07065-0912

- **Phone:** 908-855-4277
- **Emergency:** Not Available

References:

References for the information in this PIP can be found in Reference List Number 10

DISCLAIMER: The information in this profile does not in any way replace or supersede the information on the pesticide product labeling or other regulatory requirements. Please refer to the pesticide product labeling.

APPENDIX 5
DATA SHEET FOR PYRIMETHANIL

Material Safety Data Sheet

| | | |
|----------------|---|----------------|
| Issue No.: 1.0 | 1 st Edition: 31 August 2009 | Revision date: |
|----------------|---|----------------|

1. IDENTIFICATION OF THE SUBSTANCE AND SUPPLIER

Product Name: **Protector 400 SC**
 Recommended Use: Agricultural fungicide
 Supplier: ICA International Chemicals (Pty) Ltd
 Address: 28 Planken Street
 Plankenbrug Industrial
 STELLENBOSCH · 7600 · SOUTH AFRICA
 Telephone No.: +27 (0) 21 886 9812
 Fax No.: +27 (0) 21 886 8209

2. HAZARD IDENTIFICATION

Hazard: **N = Dangerous for the environment**
NON HAZARDOUS SUBSTANCE - NON DANGEROUS GOOD
 Classification: Classified as *Not Hazardous* according to the criteria of NOHSC
 Risk Phrases: R51/53 = Toxic to aquatic organisms, may cause long-term adverse affects in the aquatic environment.
 Safety Phrases: S60 = This material and its container must be disposed of as hazardous waste.

3. COMPOSITION/INFORMATION ON INGREDIENTS

| INGREDIENT(s) | CAS NO.: | UN Code | Classification | Concentration (g/l) |
|---------------|------------|---------|----------------|---------------------|
| Pyrimethanil | 53112-28-0 | 3082 | N; R51/53; S60 | 400 |
| Inerts | | | Non hazardous | |

4. FIRST AID MEASURES

Show this MATERIAL SAFETY DATA SHEET to a doctor.

- INHALATION:**
- Remove the patient from immediate source of exposure.
 - Move victim to fresh air.
 - Give artificial respiration if victim is not breathing.
 - Administer oxygen if breathing is difficult.
- EYES:**
- Check and remove any contact lenses.
 - Rinse eyes immediately with plenty of clean water for at least 15 minutes. Hold eyelids apart while flushing.
 - Seek medical help if irritation continues.
- SKIN:**
- Remove contaminated clothing immediately.
 - Rinse affected areas (skin) immediately with plenty water.
- INGESTION:**
- If swallowed, DO NOT induce vomiting. Have person sip a glass of water if able to swallow.
 - If vomiting does occur, keep on giving fluids. Get medical advice.

- MEDICAL ATTENTION:** · Treat symptomatically.
- POTENTIAL HEALTH AFFECTS:** · No significant adverse effects were reported. Practically non-toxic.
 · Slight irritation is possible for eyes.
 · Not a skin sensitizer may.
 · There is no antidote for poisoning with pyrimethanil.

5. FIRE FIGHTING MEASURES

- SUITABLE EXTINGUISHING MEDIA:** · As this product is not combustible, use extinguishing agent for the surrounding fire.
- HAZARDS FROM COMBUSTION PRODUCTS:** · In a fire, formation of oxides of carbon and nitrogen can be expected.
- PRECAUTIONS FOR FIRE FIGHTERS:** · Fire fighters should wear full protective gear including self-contained breathing apparatus. If possible, safely remove intact containers from the fire.
- HAZCHEM CODE:** · No code has been assigned

6. ACCIDENTAL RELEASE MEASURES

SPILL OR LEAK:

- Avoid contact with spilled material or contaminated surfaces.
- DO NOT eat, drink or smoke.
- Wear personal protective clothing and equipment (see section 8). Keep people and animals away.
- PREVENT spilled material from entering drains or sewer systems. Dike and bund area with sand or earth to prevent contamination of drains or sewers.

7. HANDLING AND STORAGE

- PRECAUTIONS FOR SAFE HANDLING** · Always store pesticides in their original containers, which include the label listing ingredients, directions for use, and first aid steps in case of accidental poisoning. *Never transfer pesticides to soft drink bottles or other containers. Children or others may mistake them for something to eat or drink.*
 · Keep out of reach of children
 · Wear suitable protective clothing (Dust mask; Eye shields, Gloves)
 · Wash hands, arms and face after use. Wash gloves and contaminated protective clothing daily.
- CONDITIONS FOR SAFE STORAGE** · DO NOT re-use the container for any other purpose.
 · Store in the closed original container in a cool, dry and well ventilated, secure area.

8. EXPOSURE CONTROL / PERSONAL PROTECTION

- NATIONAL EXPOSURE STANDARDS:** No exposure standards have been assigned for this product.
- BIOLOGICAL LIMIT VALUES:** No biological limit allocated.
- ENGINEERING CONTROLS:** Facilities should be equipped with an eyewash facility and a safety shower.
- PERSONAL PROTECTIVE EQUIPMENT:** Wear suitable protective clothing (Dust mask; Eye shields, Gloves).

9. PHYSICAL AND CHEMICAL PROPERTIES

| | |
|--|---|
| APPEARANCE (colour; physical form:) | White grey suspension liquid |
| ODOUR: | Organic solvent |
| pH: | 6 - 9 |
| DENSITY: | 1.06 g/ml |
| VISCOSITY: | 1560 mPa/s |
| SPONANEITY of DISPERSION: | 99% (CIPAC MT 160) |
| SUSPENSIBILITY / RESUSPENSIBILITY: | 98 - 99% (CIPAC MT 184) |
| PERSISTENT FOAM: | None |
| n-Octanol/Water Partition Coefficient | $K_{ow} \log P = 2.84$ (pH 6.1 at 25 °C) (a.i.) |
| FLASH POINT: | Not a combustible product |

10. STABILITY AND REACTIVITY

| | |
|----------------------|--|
| CHEMICAL STABILITY: | Stable under normal conditions of use. |
| CONDITIONS TO AVOID: | Excessive heat, freezing. |

11. TOXICOLOGICAL INFORMATION

ANIMAL ACUTE TOXICITY DATA (A.I.)

| | | |
|--------------------|---------------------------|--|
| ORAL: | LD ₅₀ (rat) | 4150 - 5971mg/kg. Harmful if swallowed. Low toxicity. |
| DERMAL: | LD ₅₀ (rats) | > 5000 mg/kg bw. Low dermal toxicity. |
| INHALATION: | LC ₅₀ (4h) rat | > 1.98 mg/l. Harmful if inhaled. Low toxicity. |
| DERMAL IRRITATION: | (OECD 404) | Not irritating to the skin (rabbits) |
| EYE IRRITATION: | (OECD 405) | Minimally irritating to the eyes (rabbit). |
| SENSITISATION: | Guinea pig | Not a skin sensitizer |
| | | Not mutagenic, unlikely to be genotoxic. Pyrimethanil is unlikely to pose a carcinogenic risk to humans. |

12. ECOLOGICAL INFORMATION

| | | |
|--|------------|--|
| ECOTOXICITY: | Fish | LC ₅₀ (96h) = Mirror carp - 35.4 mg/l; = Rainbow trout - 10.6 mg/l |
| | Bees | LD ₅₀ (oral and contact) = 100 µg/bee |
| | Birds | LD ₅₀ (oral) = Mallard ducks > 2000 mg/kg; = Bobwhite quail > 2000 mg/kg. |
| | Earthworms | LC ₅₀ (14d) = 625 mg/kg dry soil. |
| | Daphnia | LC ₅₀ (48h) = <i>Daphnia magna</i> (water flea) = 2.9 mg/l |
| PERSISTENCE, DEGRADABILITY and MOBILITY: | | DT ₅₀ in laboratory studies 27 - 82 days; fields studies indicate rapid degradation. DT ₅₀ = 7 - 54 days. Low potential for leaching to groundwater, minimal movement into deeper soil layers. Pyrimethanil disappears rapidly from surface water. |

13. DISPOSAL CONSIDERATIONS

Do not use fungicide containers or packaging material for storing water or food. Triple or preferable pressure rinse empty containers with clean water before disposal. Add rinsing to spray/mixing tank. Do not dispose of undiluted chemical on-site. If recycling, replace cap and return clean containers to recycler or designated collection point. IF NOT recycling, break crush or puncture and bury empty containers in a local authority landfill. If no landfill is available bury the containers below 500mm in a disposal pit specifically marked and set up for this purpose clear of any water source (river, dam, spring, or borehole). Empty containers and product should not be burnt.

14. TRANSPORT INFORMATION

UN NUMBER: UN 3082

PROPER SHIPPING NAME: ENVIRONMENTALLY HAZARDOUS SUBSTANCES, Liquid ,N.O.S
Contains Pyrimethanil as a suspension concentrate.

PACKING GROUP: III (minor danger); Class 9

HAZCHEM CODE: Non allocated

15. REGULATORY INFORMATION

Not applicable

16. OTHER INFORMATION

This Material Safety Data Sheet (MSDS) summarises our best knowledge of the health and safety hazard information of the product and how to safely handle and use the product in the workplace. Each user should read this MSDS and consider the information in the context of how to prevent accidents in the normal workplace including in conjunction with other products.

The information was obtained from sources which we believe are reliable. However, the information is provided in good faith. The conditions or methods of handling, storage, use or disposal of the product are beyond our control and for this reasons we do not assume responsibility and expressly disclaim liability for loss, damage or expense arising out of or in any way connected with the handling, storage, use or disposal of the product. This MSDS was prepared and is to be used for this product only.

END of MSDS



DOCUMENT CONTROL SHEET

CLIENT : Department of Rural Development and Agrarian Reform

JOB NO : 1471

PROJECT : Ripplemead Citrus Pack house – Waste Management Report

CONTRACT NO : SCMU8-12/13-0008

Prepared By

Reviewed By

Approved By

| | | | |
|--------------------------|----------------------------------|------------------------------------|----------------------------------|
| ORIGINAL | NAME D.C. KENNEDY | NAME <i>J.P. Neethling</i> | NAME D.C. KENNEDY |
| DATE 26 June 2015 | SIGNATURE <i>D.C. Kennedy</i> | SIGNATURE <i>J.P. Neethling</i> | SIGNATURE <i>D.C. Kennedy</i> |

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| REVISION | NAME | NAME | NAME |
| DATE | SIGNATURE | SIGNATURE | SIGNATURE |

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| REVISION | NAME | NAME | NAME |
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| REVISION | NAME | NAME | NAME |
| DATE | SIGNATURE | SIGNATURE | SIGNATURE |

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