

BEST PRACTICE GUIDELINES AND STANDARDS

January 2002

To Members and Interested Parties:

Please find attached the revised **Best Practice Guidelines** relating to the Safe Manufacture, Storage and Transportation of Vermiculture Products and **Standard Parameters** relating to the Quality and Safety of Vermiculture products offered to the public. This document is issued to all full members of the New Zealand Earthworm Association currently listed on the Commercial Register and will be available to other interested parties on request. The document has been prepared taking into account the advice and criticisms received following distribution of the initial draft dated May 2000 and is issued in the interests of advancing the professionalism of those involved in the vermiculture industry. These guidelines and standards are at this stage voluntary. However it is strongly recommended that all members identified on the Commercial Register as offering their product and their services to the public, whether operating on a large or a small scale, make themselves aware of the contents of the document and to the best of their ability follow the recommendations therein, which are considered to be logical, sensible and not onerous and in the best interests of all concerned. Comments, suggestions, criticisms, requests for assistance and explanations, and advice, are welcomed and should be addressed to the Secretary, NZEA. These revised guidelines and standards replace the initial draft and should be inserted in the folder which all members received in May/June 2000.

Derek Barratt-Boyes, President

New Zealand Earthworm Association. January 2002



THE NEW ZEALAND EARTHWORM ASSOCIATION Inc.
An Association of Breeders and Worm Farmers, Educators, Enthusiasts and
Resourcers.

**BEST PRACTICE GUIDELINES AND STANDARDS RELATING TO THE
MANUFACTURE, STORAGE, TRANSPORTATION AND QUALITY TESTING OF
VERMICULTURE PRODUCTS. ----Issued January 2002**

NB: The original document having been through a process of scrutiny and due diligence is now published under the authority of the New Zealand Earthworm Association Incorporated for the benefit of members of the NZEA and all users of vermiculture products.

**1.0 SCOPE OF BEST PRACTICE GUIDELINES RELATING TO THE SAFE
MANUFACTURE, STORAGE AND TRANSPORTATION OF VERMICULTURE PRODUCTS
AND STANDARD PARAMETERS RELATING TO THE QUALITY AND SAFETY OF
VERMICULTURE PRODUCTS OFFERED TO THE PUBLIC.**

This a document which attempts to provide systems that adequately support achievable and sustainable methodology for the husbandry of earthworms, manufacture of solid and liquid phase earthworm based products, and the processing of waste organic streams. The document is necessary in light of continuing concerns by the public as to what constitutes acceptable earthworm growing practices and what vermiculture product properties are desirable in vermi products offered for sale. The **Best Practice Guidelines** - relating to the manufacturing process - and **Standards** - relating to the quality and safety of the product - are designed to provide guidance in minimising risks associated with the potential to pollute the environment, or to cause health and safety concerns, by advising of provisions that must be met for statutory compliance. The document will look primarily at the compost worm species present in New Zealand, and the manufacture of solid and liquid vermiculture products.

1.1 OBJECTIVES :

- (A) To promote the advancement of earthworm husbandry throughout New Zealand with the aim of minimising organic waste, increasing the quality of our soils and promoting community involvement and acceptance of vermiculture processes, including promoting the benefits of compost earthworms and their associated products. To avoid or mitigate any adverse environmental effects of activities associated with the vermiculture industry.
- (B) To encourage and set high standards within the earthworm growing community, to establish and recommend adherence to a code of ethics for such community, and to require all NZEA members to adopt and maintain those standards and code of ethics.
- (C) To facilitate cooperation between earthworm growers through the exchange of ideas, skills and information, to provide for training and professional development of all people engaged in earthworm growing, and to encourage links and interaction between earthworm growers.
- (D) To select, determine and foster standards for selling compost worms and compost worm products throughout New Zealand.
- (E) To educate the community, Government agencies, the media and educational establishments through agricultural, horticultural and environmental displays.

- (F) To stimulate educational opportunities for earthworm growers and allied industries by creating appropriate educational programmes and/or NZQA approved training courses, and developing, delivering and evaluating such training.
- (G) To support the members of the Association in matters of mutual concern and interest and to represent their collective views on any matter concerning the Association or its members.

1.2 SUPPORTIVE CONCEPTS :

- Determine prospective markets for quality endorsed Vermiculture and recycled organic products.
- Ensure product development meets or exceeds community expectations for environmentally friendly and safe sustainable products.
- The executive of the NZEA will promote all such Vermiculture products and practices, comment on and endorse the Best Practice Guidelines and Standards, in consultation with all Vermiculture, research and allied industries.
- Introduce a quality manual meeting ISO9001 requirements to further reduce the variability of products and increase professionalism within the industry.
- Encourage and invite industry acclaimed national and international professionals to deliver seminars, conferences and workshops to promote wider interest in all aspects of Vermiculture and related fields.

1.3 EXPLANATION AND DEFINITIONS OF COMMONLY USED TERMS:

- **Aerobic Conditions:** Composting and vermiculture systems require free oxygen to be available.
- **Anaerobic conditions:** Processing without oxygen
- **Biosolids (sewage sludge):** Solid cake, semi-solid or slurry material produced by the treatment of urban sewage.
- **Bund:** A containment wall or levee to prevent the loss of liquids from a specific area.
- **Capsule:** The oval shaped case containing worm eggs.
- **Castings:** The excretia of worms
- **Castings Extract:** The liquid form of Vermicast produced by steeping solid vermicast in aerated and circulated pure water, allowed to settle, and sieved to remove suspended solids. This product could also describe the term "Liquefied Vermicast" which should however be differentiated from the term "worm bed Leachate" which is a liquid by-product naturally resulting from the processing of organic waste by compost earthworms either in a ground or raised worm bed or from domestic sized worm bins.
- **Certification to an Organic Standard:** Bio-gro/Demeter certification or other approved body.
- **Compost:** Material resulting from the controlled microbial transformation of organic materials under aerobic and thermophilic conditions.
- **Compost worms:** Earthworms that live and breed in biodegradable organic wastes. (see worm identification Table page 3)
- **Earthworms:** Segmented worms which are predominately terrestrial, but exclude groups of tiny worms. Earthworms are sometimes called Megadriles.
- **Fresh Compost:** Organic materials that have undergone controlled microbiological transformation under aerobic and thermophilic conditions, but which do not meet the criteria for mature compost as defined by Table 1.2 of AS 4454-97.
- **Leachate:** Liquid run-off from any (stored) organic waste feed source. To be distinguished from "worm bed leachate" as described under the heading *Castings Extract*.
- **Manure:** Any organic product composed mainly of animal excretia.
- **Mature Compost:** Organic materials that have undergone controlled microbiological transformation under aerobic and thermophilic conditions that meet the criteria for mature compost as defined in Table 1.2 of AS 4454-97
- **Mesophilic Temperature Range:** A range of temperature between 10deg c and 30deg c which most compost worms find suitable for the processing of organic materials.

- **Mulch:** Any composted or non-composted organic material, excluding plastic, that is suitable for placing on soil surfaces.
- **Primary Package:** Any form of packaging material, ie any packet, envelope, box, bag, bottle or the like which is in intimate contact with the product and which is not intended to serve solely as a transport package.
- **Soil Conditioner:** Any composted or non-composted material of organic origin that is produced or distributed for adding to soils. This term also includes "soil amendment", "soil additive", "soil improver", "soil nutrient" and similar terms, but excludes polymers which do not biodegrade, such as plastics, rubber and coatings.
- **Vermicast:** The excreta of worms in its pure form, produced by the action of microbiological life within the digestive tract of the worm.
- **Vermicompost:** Mixture of vermicast and unprocessed organic matter, it may also contain worm capsules and small worms. The term may also apply to a mix of vermicast and composted material.

2. WORM CLASSIFICATION, IDENTIFICATION, BEHAVIOUR AND HABITAT

2.1 Classification

Earthworms have been classified by a variety of schemes, the most useful being those based on their behaviour and habitat. The classification of M Bouche describes a worm species as occupying a certain level in the soil and indicates its feeding behaviour. (Also refer to various publications of the former Ministry of Agriculture and Fisheries via Aglink, in particular FPP 569: 3/10/000/2/85 revised 1985)

EPIGEIC: - (surface dwelling) lives at or close to the soil surface. Feeds on soil, freshly decayed plant material and animal residues. e.g. *E. fetida* and *L. rubellus*

ENDOGEIC: (soil dwelling) - lives within the soil and ingests soil and decayed organic material. E.g. *A caliginosa*

ANECIC:- (surface feeding, soil dwelling) lives in semi-permanent burrows and feeds on decaying plants at the soil surface. eg *A. longa*, *L. terrestris*.

2.2 Identification of New Zealand Earthworms (source Dr Nicholas Martin, Crop & Food, Auckland)

Earthworm Species current valid names (some old names)	Earthworm habitat	Earthworm feeding preferences	Species associated with Compost
<i>Amyntas corticis</i> (<i>A. diffringens</i> , <i>Pheretima peregrina</i>)	Top soil	litter, possible old animal dung, and soil	possible
<i>Amyntas hupiensis</i>	top soil	litter, possible old animal dung, and soil	no
<i>Allolobophora chlorotica</i>	top soil	litter, old animal dung, and soil	no
<i>Aporrectodea caliginosa</i> (<i>A. turgida</i>)	top soil	litter, old animal dung, and soil	no
<i>Aporrectodea longa</i>	deep burrowing	litter, old animal dung, and soil	no
<i>Aporrectodea rosea</i>	top soil	litter, old animal dung, and soil	no
<i>Aporrectodea trapezoides</i>	top soil	litter, old animal dung, and soil	no

<i>Aporrectodea tuberculata</i>	top soil	litter, old animal dung, and soil	no
<i>Dendrodriilus rubidus</i> (<i>Dendrobaena rubida</i>)	shallow	litter feeder, may feed on old animal dung	yes
<i>Eisenia andrei</i> - red tiger worm	shallow	compost, litter and animal dung	yes
<i>Eisenia fetida</i> - tiger worm	shallow	compost, litter and animal dung	yes
<i>Eiseniella tetraedra</i>	wet places	high organic matter	possible
<i>Lumbricus castaneus</i>	shallow	plant litter and animal dung	yes
<i>Lumbricus eiseni</i>	shallow	in places with high organic matter	possible
<i>Lumbricus rubellus</i> - true red worm	shallow	plant litter and animal dung	yes
<i>Lumbricus terrestris</i>	deep burrows	surface plant litter and animal dung	yes
<i>Microscolex dubius</i>		probably plant litter and old animal dung	possible
<i>Octolasion cyaneum</i>	deep burrowing	mineral soil	no
<i>Perionix excavatus</i>	shallow	plant litter	yes
<i>Octolasion lacteum</i>	topsoil	high organic litter feeder	possible
Native earthworms (up to 200 species)	varied	Varied	some species

* Species now in the genus *Aporrectodea* were previously in the genus *Allolobophora*

Composting:

Yes = likely to assist composting. **No** = unlikely to be much help with composting

Possible = may be of benefit to composting.

PART A**GUIDELINES FOR THE SAFE MANUFACTURE, STORAGE AND DISTRIBUTION OF VERMICULTURE PRODUCTS****3. SITE CLASSIFICATION AND FEED SOURCE.**

Guidelines for vermicomposting and related activities should have regard to the following :

3.1 Environmental impact:

- The reviewing of planning and consultation processes applying to the site in discussions with relevant Government agencies, and Regional, District and City Councils.
- Ascertaining the suitability of the intended location having regard to the key issues of potentially damaging environmental effects. These issues include air quality (especially odour), surface water and groundwater protection e.g. from leachate, transport and traffic issues, storage of raw materials, storage of finished products, potential noise and vermin nuisance, buffer zones from residential dwellings and community buildings such as schools.

3.2 Environmental Scrutiny:

The higher the class of material used, the more likely it is that there will be environmental impacts from outdoor operations, and the more scrutiny by central and local Government agencies, including the impact of statutes, such as :

- Regional, District and City Councils
- Ministry of the Environment
- Ministry of Health - Health Act, Health and Safety in Employment Act
- Ministry of Agriculture and Forestry
- Resource Management Act
- Bio Security Act
- HASNO Act

3.3 Feed Source

Class	Category	Examples of Organic Material
1	<ul style="list-style-type: none"> • Garden and Landscaping Material • Untreated Timber • Natural Fibrous Material, Processed Fibrous Material 	<ul style="list-style-type: none"> • Grass*, Leaves, Plants ,Loppings, Branches, Trees and Stumps • Sawdust, Shavings, Timber offcuts, Crates, Pallets, Wood packaging • Peat, Seed hulls/husks, Straw, Natural Fibrous Material, • Paper, Cardboard, Paper processing sludge, Non synthetic Textiles.
2	<ul style="list-style-type: none"> • Natural or processed vegetables and fruits 	<ul style="list-style-type: none"> • Vegetables, Fruit, Seeds & associated processing sludges & wastes
3	<ul style="list-style-type: none"> • Meat, fish & fatty foods • Fatty & oily sludges and wastes 	<ul style="list-style-type: none"> • Animal, Fish & parts of carcasses, blood, bone, fatty or food wastes • De-watered grease traps, fatty & oil sludges
4	<ul style="list-style-type: none"> • Bio-solids and manures 	<ul style="list-style-type: none"> • Sewage bio-solids**, Animal manure, mixtures of manure & biodegradable bedding materials • Animal paunch

Resource consents will in all cases be subject to the Resource Management Act and the relevant planning requirements of each particular Local Body

Notes * The processing of grass clippings at a rate greater than or equal to 15% per annum changes the classification to class 2. ** Conditions applying to the use of bio-solids may be found in the Environment Management Guidelines for the "Use and disposal of Bio-solids EPA 1997".

4. COLLECTION AND STORAGE OF THE RAW MATERIAL:

4.1 COLLECTION

4.1.1 An integral part of the recycling of organic materials is collection from the community or by way of delivery from waste management operators. Many years of local and overseas experience have proved that source separated collection of pre-consumer waste is imperative for the production of high quality recycled products.

4.1.2 The main methods of collection by local government are kerbside collection, delivery by the source generator and source collection by organic recyclers. Generally the delivery by source generators and source collectors will be free of contamination, as both are readily identifiable, and the organic recycler will have direct control over the quality of the raw materials.

4.1.3 Education and awareness in conjunction with Regional, District and City Councils is important in reducing the costs associated with secondary separation, especially in terms of plastics, glass, metal and noxious plants.

4.2 TRANSPORT AND STORAGE OF THE RAW MATERIAL:

4.2.1 Collection vehicles should be enclosed and sealed to prevent the possibility of odour nuisance or the escape of particulate, dust or leachate. Containers that can be closed to achieve the same degree of prevention of pollution can be used provided suitable restraints are used to prevent spillage.

4.2.2 Collection frequency should be determined to suit the type of waste being collected, with the collection cycle being such that the collection containers do not become anaerobic and generate odours.

4.2.3 Consideration must be given to the movement of transport, processing equipment and other vehicles and its potential impact on neighbors or the local community.

4.2.4 Short term storage at an approved transfer facility may be acceptable, in the event that because of transport efficiencies an operator needs to unload from a low volume specialty collection vehicle for pre processing and/or transport by conventional trucks.

4.2.5 Storage on the processing site shall be such that there is no impact due to dust and odour and aerobic conditions are maintained as there is a low risk of spontaneous combustion.

4.2.6 An organic stockpile must be covered and have a containment bund or suitable drainage arrangement to prevent leachate or rain ingress from causing soluble and particulate nutrients loss off site, or into ground water or water courses. The leachate and any contaminated rain water that is thus contained is to be treated and reused on the site.

5. OCCUPATIONAL HEALTH AND SAFETY:

5.1 Background Data:

There is considerable scientific data available on programmes that demonstrate the efficiency of processing and stabilising bio-solids and other organic wastes by way of composting earthworms, including evidence of pathogen elimination such as *E. coli*, *Salmonella*, *Enteric* viruses and to an extent *Helminth Ova*, and the significant reduction of heavy metals. Biosolids which have passed through the digestive system of composting earthworms meet the criteria for faecal coliform, *Salmonella*, *Enteric* viruses and viable *Helminth Ova* levels as specified by Part 503 of the US EPA Guidelines and the NSW EPA Guidelines (1997). See also (NZ) Public Health Guidelines for the safe use of Sewage Effluent on land (1992-HP 3077), the Living Earth (Wellington) Joint Venture resource consents, the Dana Peterson Wellington Vermicomposting Trials (1997). Research, and practical trials by various Local Authorities, is continuing.

5.2 Precautions

- 5.2.1 Wear gloves when handling both fresh, putrescible or manure style materials
- 5.2.2 Use implements rather than your hands to feed material
- 5.2.3 Bury vegetable matter under bedding materials to prevent access of fly larvae or the attraction of vermin
- 5.2.4 Ensure strict hygiene provisions are maintained when considering eating or even smoking in areas where raw feeds are present
- 5.2.5 Wear a dust mask if dealing with pollen, chaff or dusty feed material and products
- 5.2.6 Limit your time in conditions that are not well ventilated
- 5.2.7 Take extra precautions if you are asthmatic; utilise mechanical handling techniques whenever possible.
- 5.2.8 Wear a dust mask when opening bagged worm products as per the industry standard warning label especially relating to Legionella bacteria

5.3 Legal Requirements:

- 5.3.1 Material safety data sheets need to be kept on site
- 5.3.2 Warning labels on bagged products or on invoices for bulk
- 5.3.3 Warning signs in manufacturing or material handling areas e.g. eye protection, dust masks, gloves, appropriate clothing, safety showers
- 5.3.4 Legal implications governing employee working conditions
- 5.3.5 Transportation of product with respect to public risk.
- 5.3.6 Compliance with Resource Management Act requirements, also the Health Act and the Health and Safety in Employment Act



PART B

OUTLINE OF STANDARD PARAMETERS RELATING TO THE QUALITY AND SAFETY OF VERMICULTURE PRODUCTS OFFERED TO THE PUBLIC

6. PRODUCT AND PUBLIC LIABILITY :

6.1 Sales of the product should comply with the Fair Trading Act, the Consumer Protection Act, and legislation dealing with the protection of the environment e.g. Resource Management Act. With reference in particular to castings generated from bio-solids or a mix of feed sources containing bio-solids legislation dealing with the protection of the environment must be taken into account in terms of organic material application rates and purposes. The allowed rate and purpose depends on the contamination grade of the product, and the customer advised of the origin of the product and the existence and applicability of those guidelines.

7. PRODUCT STANDARDS, PACKAGING AND QUALITY LIMITS :

7.1 Products resulting from a vermiculture or composting process should be assessed to ensure that they pose no hazard in relation to human, animal, plant and environmental health. There are at present no standards in New Zealand relating to the production and sale of vermiculture products although there is a voluntary draft relative to the production of compost developed by the New Zealand Potting Mix and Manufacturers Federation which came into force in 2000. In Australia the document **AS 4454-99** is currently under review with the purpose of including vermicast within the testing regime for composts. The various Australian and New Zealand standards and specifications which have been developed include test methods and limits for properties that will indicate a product fitness for purpose. These include but are not limited to the following :

7.2 Compost, Soil, Potting Mix and Vermiculture Products:

AS 4419-98 Soils for Landscaping and garden use

AS 4454-99 Composts, soil conditioners and Mulches - under review to include vermicast

AS 3743-96 Potting Mixes

Environmental guidelines – Use and disposal of biosolids products (NSW EPA, 1997)

New Zealand Potting Mix Federation Voluntary guidelines, also relative to compost

Department of Health (NZ) Public health Guidelines for the safe use of sewage effluent and sludge on land. (1992)

7.3 The manufacturer must be able to demonstrate that the manufacturing facility is capable of producing product to specification. In order to ensure consistent product which always meets specification, the manufacturer should have a quality management plan in place which addresses the following elements as appropriate :

7.3.1 Source of raw materials : The source of raw materials used in vermicomposting and composting must be known in order to separate materials and treat these appropriately for the risks of contamination in each source. The system should minimise physical contamination by foreign bodies such as glass, plastics and metal, chemical contamination by heavy metals, and organic residues such as herbicides and insecticides [(including organochlorines) and PCB's]..

7.3.2 Inspection and testing of raw materials. Should be at a level to verify that the product meets specified requirements. It is suggested that where feed sources remain the same, are prepared in the same way and used in the same proportions, validation tests frequency may be reduced to 6 monthly intervals or more once sufficient records verify the level of variance within agreed tolerances for a known customer. Inspection and testing should be carried out on incoming raw materials to determine potential contaminants, process materials to determine aerobic / moisture conditions, and finished products to determine customer's requirements and the level of residual contaminants.

7.3.3 Process Control : Procedures should be in place to ensure that processing operations are carried out under controlled conditions. Controlled conditions should include the following :

- A defined manner of production
- The use of suitable equipment and working conditions
- Compliance with reference standards / codes, quality plans and / or documented procedures
- The monitoring and control of suitable process parameters
- A criteria for workmanship (usually defined by process parameters and product characteristics)
- The suitable maintenance of equipment to ensure continuing process capability.

7.3.4 Inspection and Testing of Finished Product: Inspection and / or testing should be at an adequate level to verify that the products meet specified requirements. Inspection and testing may be carried out on incoming materials, in process materials and in finished products. Test methods and specifications for product characteristics are outlined in the various standards identified above and also as outlined in the parameters for quality standards in the following pages of this document.

7.3.5 Inspection, Measurement and Test Equipment : Where the inspection, measurement and testing is carried out on-site then the equipment should be selected so that it is capable of the appropriate accuracy and precision for the characteristic being measured. All such equipment should be calibrated and adjusted at prescribed intervals, or prior to use, against known standards ie Standards New Zealand.

7.3.6 Control of non conforming product : The manufacturer should have procedures for ensuring that product which does not meet specifications is prevented from intended use. The procedure should enable the manufacturer to re-work, re-grade, scrap or dispose of non conforming product as appropriate, and ensure that non conforming product is not offered for sale purporting to be compliant.

7.3.7 Handling, Storage, Packaging and Delivery : The manufacturer should ensure that the finished product is handled, stored and delivered to ensure that the product does not deteriorate to such an extent that it is unfit for use when delivered into the hands of the customer.

7.3.8 Corrective and Preventative Action : The manufacturer should have procedures in place for implementing corrective and preventative actions appropriate to the magnitude of the problems and commensurate with the risks encountered. Testing of incoming materials and record keeping can determine how best to handle/store certain feed sources. Potential exothermic reactions causing temperatures to rise as feed sources reduce in volume can be better managed to meet prevailing conditions. Management and prevention of pests and vermin is preferable to reaction after the event.

7.3.9 Training : All personnel performing activities affecting product quality should be competent to perform their assigned tasks. Competency may have been gained by qualification, prior knowledge, or on the job training.

8. EVIDENCE OF EFFECTIVENESS OF SYSTEM :

The effectiveness of the system for achieving compliance to product specification should be supported by :

8.1 Document and Data Control : Appropriately authorised, issued and revised documents are available at point of use.

8.2 Records : Legible and permanent records provide evidence that procedures have been followed. The following records can be used as evidence that the product complies with specified requirements :

- Batch Release
- Laboratory Analysis Reports
- Inspection and Test Reports
- Approved / Acceptable Suppliers Lists
- Design Changes
- Traceability Records
- Calibration of Test Equipment (within the required frequency)
- Training of all Operations Staff
- Customer Complaints and Corrective Action Taken

8.3 Policies and Plans : The manufacturer's senior managers should enunciate the organisation's plans and policies for achieving Best Management Practices, and deploy these policies and plans throughout the organisation. This is usually done by issuing manuals, organisational charts, job descriptions, procedures and work instructions, and providing appropriate training for employees. Such policies and plans must be consistent with the organisation's overall business aims and objectives.

9. VERMICULTURE PRODUCTS :

9.1 Compost Worms :

- When describing the compost worm varieties for sale, the member shall ensure that the correct scientific or *Linnean Genus* and *Species* is used. If in doubt have the identity of their earthworms checked by an independent person with the known expertise or refer to publications earlier identified. Descriptions such as reds, and tigers, are not in themselves acceptable.
- Worms shall be sold solely by the kilogram and part thereof, **AND NOT** by 1000's.
- Weighing instruments used for product sold by weight should be reliable and conform to Standards New Zealand requirements.
- Packaging for worms should be in a container suitable for the quantity involved, with provisions of air-holes and sufficient food and moisture in the packing mix to sustain the worms over the expected period of transportation.
- All packaging should clearly state that the package is "fragile", storage is to be in a "cool place", contains "live worms", specifies the name of the supplier and their contact details, quantity and species of worms, and the use by date for the food provided.

9.2 Bait Worms :

- As per Compost Worms above but replacing the word “Bait” for “Compost”.

9.3 Pasture Worms

- When describing pasture worm varieties for sale, the member should accurately specify the species. All other information as per Compost Worms above.

9.4 Castings Extract: When describing “castings extract” for sale, the member shall provide :

- A label specifying the organisation’s name and if applicable the batch number
- Volume of the contents in litres
- Date of production
- Feed source used
- The addition of any other enhancing materials including chemical nitrogen supplements
- Dilution rate
- Storage conditions

The container should be UV resistant, and when packaged the product should allow either an air space to allow the bacteria to breathe, or be fitted with a suitable breather cap to achieve the same result.

9.5 Vermicast : When describing “vermicast” for sale, the member shall provide :

- A label specifying the organisation’s name and if applicable the batch number
- The material should be screened through a 10 mm screen to remove potential contaminants
- The volume of the contents in litres, or, if in bulk, cubic metres
- The grade of the product - where the manufacturer provides more than one grade
- Feed sources used
- Date of production
- Whether pasteurised or precomposted
- Packaging for vermicast shall be suitable for the quantity involved and the time/distance over which it is to travel, labelled specifying it contains live worms and should contain an air space
- OH&S warnings are clearly visible on outer packaging and any documentation including invoices
- Where nutritional levels and other allied data as to quality standards resulting from laboratory testing are known these should be included in the promotional data

9.6 Vermicompost : When describing “vermicompost” for sale, the member shall provide :

- A label specifying the organisation’s name and if applicable the batch number
- The volume of the contents in litres, or if in bulk, cubic metres
- The grade of the product - where the manufacturer provides more than one grade
- Feed source used
- Date of production
- Whether pasteurised or precomposted
- Packaging for vermicompost shall be suitable for the quantity involved and the time/distance over it is to travel, labelled specifying it contains “live” bacteria and should contain an air space
- OH&S warnings should be clearly visible on outer packaging and any documentation including invoices.
- Where nutritional levels and other allied data as to quality standards resulting from laboratory testing are known these should be included in the promotional data.

10. STANDARD FOR CASTINGS EXTRACT:

A single grade is proposed, namely; wormcastings produced from organic waste that has been steeped in pure / filtered water of known volume for at least 24 hours from a known volume of totally worked vermicast, that is contamination free of plant pathogens; containing soluble nutrients and active aerobic bacteria, suitable for use in BioGro and Demeter or other approved certifying system.

The product should be able to be shown to relate to the Laboratory Analysis of the vermicast from which it is derived, be screened through a filter medium of <10 micron and have a recommended dilution rate.

11. STANDARD FOR SOLID PHASE VERMICAST.

A single grade is proposed, namely : Wormcastings that have been produced by the processing of organic waste by compost worms. If the castings have been through a pasteurisation process this should be stated. Where the product is described as **Vermicompost** a single grade is proposed, namely, castings produced from organic waste that has been through a pre-composting, bioremediation or pasteurisation process under aerobic and thermophilic conditions. Where the producer has determined that he is producing more than one grade then that fact should be stated.

11.1 All grades of materials should contain non organic matter at a rate of no more than 0.5% by weight/volume.

11.2 Testing for heavy metals may be required if the product is to be applied to food growing areas, but independent documented analysis shows that the addition of particulate clay at pH neutral conditions should immobilise these metals.

12. PRODUCT QUALITY IN RELATION TO MARKETING :

12.1 Product Quality should be in accordance with industry and international standards, with consideration given to the receiving environment and to soil and plant health. Where New Zealand or international standards are available products should be manufactured to comply to those standards. Inferior product quality or contamination may have a serious impact on the sustainability of the industry through negative publicity or public perception. Products must be produced and sold with consideration to the principles of fitness for purpose.

12.2 Products must not contain unacceptable levels of visual or chemical contamination and the producers should make every effort to monitor and maintain product quality. Products to be used in landscaping or for horticulture purposes should not contain any viable seed or plant pathogens.

12.3 Marketing strategies should be directed to the intended purpose of the end product and should not include claims or statements in regard to the product performance that are not able to be substantiated. Efforts should not be taken to hide or obscure the source of raw materials. In fact marketing should take advantage of the increased public acceptance of recycled organics.

12.4 Product sales and use should be effected with consideration of impacts on the receiving environment and if a client intends to use a product for purposes which are not in accordance with best practise, the seller should give such advice.

12.5 Records should include but not be limited to :

- Source, volume and date of receipt of feedstock
- Traceability of feedstock during processing
- Temperature and moisture content of material during processing
- pH and Electrical Conductivity of dissolved salts in processing beds
- Screening to 10 mm, bagging or bagging date code on finished product
- Traceability and delivery of finished product

Additional records may be required for some feed stocks and where special circumstances may apply. However as a matter of reality and practicality the extent of record keeping should have regard to the scale of the operation.

PART C

13. TESTS FOR QUALITY :

General : As stated in Section 7 of this document there are at present in New Zealand no agreed standards relative to a testing regime for vermiculture products. Similarly in Australia the incorporation of vermiculture products into the testing regime for compost (AS 4454-99) is still in progress. The Australian Standards for composts (AS4454-99), for soils for landscaping and gardening (AS4419-98), and for potting mixes (AS3743-96) are extremely useful and relevant under New Zealand conditions and should be referred to for guidance. The New Zealand Potting Mix and Manufacturers Federation is in the process of developing a testing regime for compost. The testing regime outlined below for vermiculture products has been scrutinised by highly competent and professional New Zealand soil scientists and is considered to be reasonable and realistic.

13.1 The following tests should be carried out :

- pH as a Calcium Chloride test of the product
- Moisture Content
- Electrical Conductivity as a measure of total dissolved solids
- Nitrogen Supplied
- Nitrogen Content as Ammonium & Nitrate
- Vermicompost / Vermicast Stability as an ignition test
- Cation exchange for available levels of potassium (K) , calcium (Ca) , Magnesium (Mg) , and Sodium (Na)
- Faecal coliform tests according to Australian EPA's Biosolids Guidelines GRADE A stabilised products
- Heavy metals, organochlorines, or PCB's contamination if to be used in the growth of foodstuffs.

13.2 The level of testing and testing frequency will be a result of the raw material quality and source separation control. In order to determine final methodology and frequency of testing, initial testing should be at a high frequency and only be reduced as statistics are gathered validating the final chosen frequency. The degree and frequency of testing would in reality be a reflection of the scale of the operation and the desire of the operator to achieve a high level of known competency, professionalism, efficiency and market competitiveness but always bearing in mind the safety of the product and the safety to the consumer. The testing will aim to determine the amount of compostable material that has been converted to a biologically stable product that is odour free, has no adverse biological effects on plants, and has little capacity to support the growth of pathogenic microorganisms. The testing will aim to allow producers of worm products to decide the correct mix of waste stream components for successful processing and to determine which waste stream components have desirable levels of both macro and micro-nutrients that will end up in the finished product.

13.3 Each product should be analysed and tested to ensure the final Product Quality meets categorical limits. The test certificate or Certificate of Analysis is asked to state the following criteria as a minimum.

Basic Certificate

A standard analysis of Vermicast should reveal :-

<i>C : N Ratio</i>	<i>:minimum 15 : 1, maximum 25 : 1</i>
<i>SG (specific gravity) or Bulk Density</i>	<i>:0.6 < V < 1.0</i>
<i>Particle size</i>	<i>: 8 mm minus</i>
<i>Moisture Content (for fresh material)</i>	<i>:45% - 55%</i>
<i>LOI (Loss of weight on ignition)</i>	<i>:50% - 60%</i>
<i>Heavy Metals</i>	<i>:below permitted maxima</i>

FM (Foreign Matter - sand and rock minerals)	:<0.5%
Animal Pathogens	:(below permitted specified maxima)
Plant Pathogens	:(below permitted specified maxima)
Plant Propagules	: < 2%
PH	: 5.0 - 8.5
EC	: 1 - 12 dS / m

13.4 Explanatory Notes

C : N This is the ratio of Carbon to Nitrogen and gives an indication of the stability of the product. Above 20 : 1 the product will have a noticeable nitrogen demand and may consequently restrict plant growth. Below 20 : 1 the demand for nitrogen is sufficiently low that there should be no restriction to plant growth, but in fact, growth promotion.

Reason : Above 20 : 1 the activity of the microbial population in the vermicast is concerned mostly with reducing the carbon by converting it to carbon dioxide. So intent on this mission is the microbial population that all available nitrogen will be taken up forming populations, leaving nothing - or very little - for the plant roots. Most plants cannot photosynthesize nitrogen and can only access nitrogen through the root system, except for legumes.

Below 20 : 1 , nitrogen becomes available to the plant roots. The plants are able to photosynthesize by accessing the carbon dioxide from the atmosphere. The underside of leaves is roughened by the presence of the stomata, through which the CO₂ is absorbed.

The C : N ratio will also expose any producer who has added fine sawdust as a cheap extender or filler because the C : N ratio will be found to be high - perhaps as high as 500 : 1. Similarly, sand as a filler would produce a very low C : N ratio. Either C : N ratio will disqualify the product.

Specific Gravity ; This is the weight per volume. It is the result of the combined factors of moisture, mineral and vegetative matter content per volume - say grams / litre. Vermicast should have a high vegetative (and organic matter) content, so that the SG *must be* <1. Water is SG 1, mineral sand (sand) is > than 1, dry vegetative (and organic matter) < 1. The combination of these should fall between 0.6 - 0.8. Organic matter includes not only vegetative but the spectrum of microbiological life - bacteria, actinomycetes, Fungi. SG is therefore a means of quickly checking if the product has been adulterated or not by the addition of (heavy) sand, clay, and/or (light) sawdust.

Particle Size: Needs no explanation.

Moisture Content: It is strongly advised that moisture content not be allowed to fall below 45%. A great benefit of worm castings is the bacterial population and this requires moisture to survive. Whilst many members of this population floriate, or lay spores before death, not all do so and allowing worm castings to dry may destroy some of its microbiological benefits. A moisture content of > 55% could also promote the development of anaerobic conditions during storage, particularly if bagging material is polythene. Vermicast produced which meet these guidelines is living matter and requires air for the microbiol population to breathe, but the more moisture, the less air. It is a matter of striking a proper balance. Worm castings of this level of moisture will flow and be spread easily without clogging a fertiliser spreader.

LOI Loss of Weight on Ignition: Since only organic matter (vegetative matter, micro fauna) will be destroyed and gasified - therefore lost - on ignition, this is a clear indication of the organic content of the product. LOI will assist in detecting any product adulteration and will identify the style if this has occurred. It is desirable that worm castings should be able to provide some mineral plant nutrition. This mineral portion will be present in the residue after ignition. If the product has been adulterated by the addition of sand for example, LOI will be not great because all the heavy sand will remain. Alternatively, if sawdust has been used, LOI will be substantial.

FM. Foreign Matter Content : This is material which will not reduce to its components within a reasonable time. Plastics, while originally organic are included as foreign matter. Other examples of foreign matter which could be found in worm castings are glass particles, mortar, brick chips, gravel, clay.

Heavy Metals Content: The six of concern are Lead (Pb), Mercury (Hg), Cadmium (Cd), Chromium (Cr), Molybdenum (Md), Zinc (Zn). Their presence in itself does not present a problem, providing the concentrations are low. It is possible they can be taken up by plants and thus enter the food chain. If present above prescribed and specified minimums, their presence in the food chain could present a health hazard.

Animal and Plant Pathogens : Some of these such as Legionella and Salmonella can all cause severe sickness and even death in humans. Others have a similar effect on animals. Some, not yet tested (for example Anthrax) may travel in manures and survive the vermi-treatment in worm beds. Plant pathogens may similarly survive and be transferred from one part of the country to another in which they have previously been unknown or rare. The potential for lasting and severe environmental damage would be present and for potential legal consequences. A high proportion of pathogens are destroyed by the aerobic conditions in vermicast. Residual (known) pathogens - plant and animal - will be destroyed during pasteurisation. It is of extreme importance that worm castings be free of plant and animal pathogens. Either pre-vermi-treatment, bio-remediation or post treatment pasteurisation is satisfactory, but bear in mind that the treatment carried out closest to point of sale is most safe. Of the two systems, pasteurisation is preferable because of its greater reliability. It is also probably less costly to apply.

Plant Propagules : A propagule is a fertile seed or plant shoot. Generally it is held that a propagule is a fertile weed seed. But a weed seed is a plant growing in the wrong place. Therefore in worm castings, any shoot or rootling is a weed. Frequently worm castings will be used as a basis for a potting or seed raising mix. Customers do not want seed germinating other than those desired or intended. The only level of Propagules permitted is nil. Another consideration is that weed seeds in vermicast can be carried across the country from areas in which they are profligate into areas where they are unknown, in a medium which promotes plant growth. Again the environmentally damaging potential is present.

If a sample of vermicast produces propagules, this is a clear indicator that the product has been neither bio-remediated nor pasteurised because propagules will be destroyed in either process. There are cases where pasteurisation or bio-remediation will not be necessary. If your *feedstock is demonstrably free* of pathogens and seed, and can be guaranteed to be so, then it would be foolish to insist on a costly process which is unnecessary. Examples of these could be cotton waste paper processing sludge, wheat silo dust, fruit or vegetable pulp after juice extraction, some bio-solids.

If it is even remotely possible that your feedstock could contain pathogens or propagules, it is absolutely essential that you heat treat.

The decision whether to heat treat or not is yours. If there is a risk, then it may cause your product to fail to pass analysis.- to your cost.

pH: means potential hydrogen and is the measure used to determine acidity or alkalinity with pH 7 being neutral. Worm castings should be as close to this as possible so that their addition or application to soil is one of minimal impact. Ideally pH should be 6.5.

EC : Electrical Conductivity is the means of determining salt content. *Caution.* "Salt" does not mean only NaCl, or table salt, so that a high EC does not necessarily mean that the vermicast is unusable. A high EC means further analysis must be carried out to determine exactly what the salts are - certainly the chloride content. Many salts are plant benevolent in low concentration - for example Ammonium sulphate. *However worm castings showing a high EC must be disqualified as being suitable to be sold as pure vermicast.* Such castings could be suitable for applications other than seed germination and seed raising, such as some potting mixes. Such castings may have been Adulterated or Nitrogen boosted by the deliberate addition of a synthesized fertiliser.

At EC 1 - 12 ds/m (deciSiemens per metre) salt level is sufficiently low as to be of no concern. Because vermicast is often used - indeed recommended - as a basis for germinating and seed raising mix, the standard of low salt content must necessarily be strictly applied as many seedlings and potted plants will be salt intolerant.

General Appearance : At 50% moisture, the product should be dark grey to black in colour and in aggregate form. Compressed in the bag, it should exhibit a clear elastic property. A handful squeezed firmly in a fist, on release should not remain as a reproduction of the fist clasp but should break up as it falls away. If the fist clasp remains, it means the product is free of aggregates and *will not be genuine worm castings.* Aggregates at around 50% moisture content will flow freely and cannot be moulded into a shape.

Commercial quantities of castings are produced by compost worms, and the castings are produced as aggregates. Aggregates are the building blocks of erosion resistant soils. Aggregates remain soft and spongy whether damp or dry. The aggregate form provides air pockets in packaged vermicast for the high level of oxygenation necessary to sustain life during packaged storage and makes for easy soil application at the customer level.

Marketing strategies should be directed to the purpose of the product and should not include claims or statements in regard to the product performance that are not able to be substantiated. Efforts should not be taken to hide or obscure the source of raw materials, in fact marketing should take advantage of the increased public acceptance of recycled organics. Product sales and use should be effected with consideration of impacts on the receiving environment and if a client intends to use a product for purposes which are not in accordance with best practice, the seller should give notice to that effect.

November 2001

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