



CIVIL AVIATION AUTHORITY
OF NEW ZEALAND



SAFETY GUIDELINE
FARM AIRSTRIPS AND
ASSOCIATED FERTILISER
CARTAGE, STORAGE AND
APPLICATION

ACKNOWLEDGEMENTS



The following organisations and personnel contributed to the preparation and development of this guideline.

Their assistance is gratefully acknowledged.

- Federated Farmers of New Zealand Inc.
- The Agricultural Health and Safety Council
- New Zealand Agricultural Aviation Association (NZAAA) and members
- Rural Women
- Civil Aviation Authority of New Zealand (CAA) staff
- Department of Labour health and safety staff
- Northern Lime Millers Association
- Ministry of Agriculture and Forestry



Department of Labour
TE TARI MAHI



SAFETY GUIDELINE
FARM AIRSTRIPS AND
ASSOCIATED FERTILISER
CARTAGE, STORAGE AND
APPLICATION

Jointly published by

Civil Aviation Authority
PO Box 31441
Lower Hutt

and

Department of Labour
PO Box 3705
Wellington

December 2006

ISBN 0-478-28088-2

→ FOREWORDS

FOREWORD BY THE MINISTER FOR TRANSPORT SAFETY

I am very pleased to introduce this guideline. It provides safety information for those in the agricultural and aviation industries who are involved with top-dressing. It covers farm airstrips; the business of producing, carting and storing fertiliser; and how that affects the final application of that fertiliser by a top-dressing aircraft.

This guideline was triggered by a recommendation from an Inquest into a top-dressing accident that occurred as a result of a hung load. While that was a tragic accident, the lessons learned from it have been instrumental in the development of a guideline that I am sure will prevent accidents and save lives in the future.

Accidents seldom have a single cause; there are usually many contributing factors. When seeking to prevent accidents, a broad look across all of those industry sectors involved with top-dressing is necessary to prevent top-dressing accidents. This is the approach taken in this guideline.

It has been developed by the Civil Aviation Authority of New Zealand and the Department of Labour, working with the Agricultural Health and Safety Council of New Zealand. Other members include the New Zealand Agricultural Aviation Association, Federated Farmers of New Zealand, the Accident Compensation Corporation, Northern Lime Millers' Association, the Road Transport Federation, and the Ministry of Agriculture and Forestry.

All parties are to be congratulated for their collaborative efforts in developing this guideline, which is widely perceived as having significant safety benefits for all involved in top-dressing. Adoption of the guideline will ensure that the farming and aviation communities are able to work together, minimising costs while maximising the safety of those people most exposed to the dangers of top-dressing – the pilots.



Hon. Harry Duynhoven
Minister for Transport Safety

FOREWORD BY FEDERATED FARMERS OF NEW ZEALAND INC.

Federated Farmers welcomes this guideline as the result of the collaboration between pilots, farmers and the wider industry. The Federation recognises the vital role of agricultural aviation in the success of much of New Zealand's pastoral industry. Aerial top-dressing opened up the farming of our expansive hill country, with the third generation of farmers now benefiting from increased pasture growth on what was once marginal land.

These economic gains have not come without cost. Accidents in the industry reflect the risks of an inherently dangerous occupation. Pilots, loader drivers, farmers and fertiliser suppliers all have a role in reducing the risk factors to ensure that the aerial application of fertiliser happens as safely as is possible.

This guideline aims to highlight the responsibilities and potential dangers existing in each role, and to minimise those factors that could lead to an accident. Aerial top-dressing is important to the future of farming in New Zealand, and this guideline will help ensure the safety of those involved in this essential industry in the years to come.

We recommend the adoption of this guideline by all involved.



Charlie Pedersen
President
Federated Farmers of New Zealand Inc.

FOREWORD BY NEW ZEALAND AGRICULTURAL AVIATION ASSOCIATION

The New Zealand Agricultural Aviation Association is pleased to see the introduction of this *Safety Guideline for Farm Airstrips and Associated Fertiliser Cartage, Storage and Application*. The agricultural aviation industry is keen to work with farmers, transport operators and fertiliser manufacturers to ensure continued safe and efficient operations in the application of fertiliser by air. We are very grateful for the support offered by the contributing organisations to bring this document to reality.



Ken MacKenzie
Chairman
New Zealand Agricultural Aviation Association

TABLE OF CONTENTS

Forewords	3
Foreword by the Minister for Transport Safety	3
Foreword by Federated Farmers of New Zealand Inc.	4
Foreword by New Zealand Agricultural Aviation Association	4
Table of contents	5
Scope	7
Review of this guideline	7
Key definitions	8
Introduction	9
Objective	9
Industry hazards	11
Hazard 1: The top-dressing material is not free-flowing	11
Hazard 2: Farm tracks and roads are unsuitable or in an unsafe condition	12
Hazard 3: Airstrip unsafe for use	12
Hazard 4: Lack of training, information, supervision or communication	13
Manufacturers of fertilisers	14
Manufacturing guidance and information	14
Transport operators and drivers	17
Control of moisture and storage	17
Farm tracks and roads: access	18
Transport operator – employer: training and supervision	19
Truck drivers: employed and self-employed	19
Process for evaluation of access and fertiliser storage	20
Airstrip owner	21
Control of fertiliser storage, access and airstrip condition	23
Farm tracks and roads: access	23
Farmer: (Fertiliser purchaser)	25
Process for evaluation of farm airstrip condition and fertiliser condition	26
Process for evaluation of access and fertiliser storage	27
Aerial operator	28
Employer: Loader driver and pilot (and self-employed people)	28
Loader driver	31
Pilots	32
Pilot checks prior to commencing a top-dressing contract	33
Definitions	34

Appendices	38
Appendix 1: Requirements for fertiliser storage	38
Appendix 2: Top-dressing airstrip standards and specifications	41
Appendix 2a: Airstrip risk assessment checksheet	47
Appendix 3: Free-flowing fertiliser field test	48
Appendix 4: Access, storage and airstrip checklist	50
Appendix 5: Health and safety in employment farmer (principal) and contractor agreement	51
Summary	52
Delivery control	52
Airstrip control	52
Application control	52

→ SCOPE

This guideline is aimed at those persons who own, maintain, access or use top-dressing airstrips and fertiliser storage facilities.

The guideline is largely good practice rather than mandatory in nature, and expresses guidelines that should aid in

maximising safety for all those involved in the top-dressing industry. It also includes recommendations for safer farm access.

The reader should note, that if an event does occur, the application of this guideline may be considered by appropriate agencies examining that event.



REVIEW OF THIS GUIDELINE

This guideline will be reviewed by the Department of Labour, Civil Aviation Authority, Federated Farmers and New Zealand Agricultural Aviation Association by December 2008.

→ KEY DEFINITIONS

For the purpose of this guideline the following definitions apply.

Airstrip owner: means the person who has ownership of the airstrip and/or who has the authority to allow or disallow use of that airstrip and/or the land upon which the airstrip is situated. When the land is leased to another party who then effectively has the right of tenure, the term airstrip owner may include the lessee.

Farmer: means the person who has purchased fertiliser and intends to have the fertiliser spread by aerial application onto his/her farm. See also the definition of 'Principal'.

Principal: a person who or that engages any person (other than as an employee) to do any work for gain or reward.

Shall: and **Shall not:** refers to a recommendation that is mandatory for compliance with a statute.

Should: means a preferred practice or recommendation.

A full list of definitions is located on page 34.

→ INTRODUCTION

The top-dressing industry in New Zealand has its roots in the late 1940s when aircraft were first used for applying fertiliser to land that was, in the context of fertiliser application, inaccessible by other means. Numerous airstrips were built or simply marked out on available land and many have remained in use relatively unchanged. Despite significant and ongoing advances in technology and aircraft performance, the fatal accident rate in the New Zealand agricultural aviation industry has remained high and relatively steady.

In the period 1993 to 2003 there were 18 aircraft accidents that resulted in 19 fatalities in the industry. The size of the fixed-wing agricultural pilot group has consistently remained at about 100 persons equating to a fatality rate of 18% over the ten-year period.

Some of these accidents occurred because of the site or condition of airstrips and their immediate surrounds, or the inability of a pilot to release the fertiliser load because the material was not 'free-flowing'. That is, it contained foreign material or objects, was too wet or became too compacted in the aircraft hopper because it was milled too finely. All these conditions are correctable.

So that there is better recognition and understanding of the need for higher safety standards, this guideline offers advice and identifies and explains the responsibilities of persons involved in this part of the agricultural scene in New Zealand. Success in reducing the accident/injury rate in this area will be as a result of all parties working together.

OBJECTIVE

The primary objective of this guideline is to reduce the death and injury rate of those people involved with the transport and aerial application of fertiliser, particularly pilots.

This guideline aims to:

- assist fertiliser manufacturers, transporters, airstrip owners, farmers, pilots and others by providing guidance to achieve this primary objective
- give information to assist parties in meeting their obligations under the Health and Safety in Employment Act 1992 (the Act). In particular, it aims to provide guidance and methods which may be suitable within the context of 'all practicable steps' in the terms of the Act.

The Health and Safety in Employment Act 1992 promotes the management of health and safety issues in industry, and requires employers to take 'all practicable steps' to eliminate, isolate or minimise workplace hazards. Obligations are also placed on self-employed persons, principals, and on persons who control places of work – towards other people in their workplace and towards themselves.

This document includes guidance for:

- manufacturers of fertiliser
- transport operators and drivers

- airstrip owners
- farmers (as purchasers of fertiliser)
- aircraft operators, loader drivers and pilots.

Each of these parties is addressed through a section of this guideline that gives information about the hazards that they can control, general discussion about the hazard(s), detail concerning their responsibilities in the workplace, and how to comply. While each of the parties has their own particular responsibility, many overlap meaning that a breakdown in safety performance in one area can impact further on and significantly affect others.

NOTE: One person or business may have more than one set of responsibilities.

For example:

- the fertiliser purchaser (the farmer), and airstrip owner may be one and the same. Where combined activities are performed by one entity, all sections relevant to those activities apply to that entity. See also the definition of 'Principal'
- a manufacturer, supplier and transport operator may be one and the same, or may be different entities in any combination. Where combined activities are performed by one entity, all sections relevant to those activities apply to that entity.

→ INDUSTRY HAZARDS

HAZARD 1: THE TOP-DRESSING MATERIAL IS NOT FREE-FLOWING

Controlled by: manufacturer; transport operator; driver, airstrip owner, and farmer.

1. Moisture can alter the flow characteristics of the material from the hoppers in top-dressing aircraft and in extreme cases, the particles of material can adhere to each other changing the nature of the material from one of free-flowing powder to large chunks of material. In some situations the throat of the hopper can be entirely blocked.
2. When excessive fineness of material is involved, the material may become compacted and immovable.
3. Aircraft hopper throat blockage can also occur due to the fertiliser containing large lumps, or debris from the storage site, for example: stones and rocks, earth clumps, sticks, vegetation and cowpats.

These situations can present a potential life-threatening hazard for the pilot of the aircraft, particularly when the pilot needs to discharge the payload during an emergency and cannot. This requires the fertiliser to be manufactured to, and maintained at a suitable standard until it is applied and it should be free-flowing and free from contaminants when placed in the hopper of the aircraft.

Chain of responsibility

Each party: manufacturer, supplier, transport operator, airstrip owner, farmer, loader driver, aerial operator and pilot, has responsibilities to ensure the fertiliser is in a suitable condition before delivery, while taking delivery, and while handling the product including loading and sowing, to ensure that the product is maintained in a free-flowing condition while in their possession.

Control of contaminants and moisture is vital to ensure flow characteristics are maintained. Appendix 1: *Requirements for fertiliser storage* covers these issues and provides an important source of information on the storage of fertiliser.

HAZARD 2: FARM TRACKS AND ROADS ARE UNSUITABLE OR IN AN UNSAFE CONDITION

Controlled by: airstrip owner/farmer.

1. Culverts, crossings and bridges shall be able to withstand the gross weight of both the truck and trailer units in use.
2. Farm tracks and roads should be constructed and maintained to a standard fit for purpose.
3. Restrictions may need to be applied as to when farm tracks and roads can be safely used (for example due to weather conditions), and agreed between the transport operator and airstrip owner/farmer.

HAZARD 3: AIRSTRIP UNSAFE FOR USE

Controlled by: airstrip owner.

1. Design limitations

The function of an airstrip is affected by numerous things, each of which can impact on the performance of the pilot and aircraft. The design and location of the airstrip may restrict the type of aircraft that can be used, reduce the maximum load that can be carried, or be so affected by weather that operations are restricted to set periods. The decision to use the strip within the airstrip design and location limitations lies with the aerial operator.

2. Inadequate airstrip maintenance

Accidents have occurred through remarkably small but nevertheless important and manageable oversights. Examples are:

- failing to stop on the airstrip because the grass was too long and wet – the aircraft slid off at the run way end point
- aircraft destroyed after its wheel struck a pothole caused by a rabbit
- aircraft hit a tree which had grown into the take-off path.

All of these instances cause severe damage to the aircraft involved and often fatal or serious injury to pilots. Airstrip position, length, slope, direction, surface condition, the proximity of fences and trees and stock and pest control, are all important in the management of airstrips.

Appendix 2: *Top-dressing airstrip standards and specifications* covers these issues and provides an important source of information needed to manage airstrip safety.

HAZARD 4: LACK OF TRAINING, INFORMATION, SUPERVISION OR COMMUNICATION

Controlled by: employers and employees.

- Staff performing work are not sufficiently trained and/or supervised.
- Staff are not communicating health and safety issues.

Ensuring that the staff performing work are trained and/or properly supervised is an employer's direct responsibility. The systematic review of work conditions is a responsibility shared by all parties to a work situation. When substandard conditions are identified, key information shall be shared with **all** relevant parties to determine an appropriate control prior to work continuing.

→ MANUFACTURERS OF FERTILISERS

HAZARD 1: THE TOP-DRESSING MATERIAL IS NOT FREE-FLOWING

Fertiliser that is not free-flowing can, in some situations, completely block the throat of the aircraft's hopper. This presents a potentially life-threatening hazard for the pilot of the aircraft, particularly when the pilot needs to discharge his payload during an emergency and cannot.

Control of contaminants and moisture is vital to ensure flow characteristics are maintained. See Appendix 1: *Storage*.

MANUFACTURING GUIDANCE AND INFORMATION

The flow properties of fertiliser, including lime, depend on particle size and size range, particle shape, compression (the amount of pressure applied to the bulk material) and whether the material is cohesive i.e. sticky. These properties of the bulk fertiliser can be measured.



Lime delivery

No mixtures of fertilisers, either as supplied or mixed

on site, should be used for aerial application unless it has been established that the flow properties of the resulting mixture will remain free-flowing at the time of use.

The farmer purchasing fertiliser should inform the supplier what method will be used to spread the fertiliser, for example, whether it will be spread by air or from a truck.

When the customer places the order the manufacturer and/or supplier should request information about the intended application method (aerial or ground spread) of the product. The manufacturer should ensure that a process is adopted in their order system which requires this information. It is the responsibility of the supplier of the fertiliser to ensure that the product is supplied in a free-flowing condition, according to the intended application method of the product.

An important factor when considering lime suitability for aerial sowing is the fineness of grinding or surface area of the lime particle. The surface area increases in almost direct proportion to the fineness of grinding. At any given constant weight, if the particle size is halved the surface area is doubled. This is a critical issue in establishing the amount of moisture that the material will hold and also the degree of compaction that the material will inherently have. Finer materials have a very high surface area to which water molecules will attach. Agricultural limestone usually has a wide range of particle sizes; this is a desirable feature unless too large a proportion of the particles

is so coarse that, under most environmental conditions, little of the material will dissolve for many years.

The fineness of lime is measured by passing it through a series of standard sieves. Previous regulations (then administered by the Ministry of Agriculture and Forestry) controlling the fineness of grinding of agricultural lime to be used in aerial applications specified the following:

- at least 95 percent of the ground limestone to pass through a 2.0 mm sieve
- at least 50 percent of the ground limestone to pass through a 0.5 mm sieve.

While the farming community may desire limestone to be ground as fine as possible for better absorption, it should be recognised that very fine limestone carries with it an increased risk of compaction. In an aerial application situation, the material will be generally less free-flowing than a coarser grind which still complies with the specification above. In order to ensure that the material can remain free-flowing, controlling excessive fineness is very important. This was recognised by the fertiliser industry when powder superphosphate bulk fertiliser was implicated in many of the aircraft accidents which occurred while sowing super. As a result, pelletised superphosphate is now the normal form for that material for aerial application.

Manufacturers shall be aware of the requirement under Civil Aviation Rule Part 137 Subpart C – Special Flight Rules. This rule is printed below, and attention should be focused on 137.103 (a)(2).

“137.103 Maximum take-off weight

- (a) Notwithstanding Part 91 and subject to paragraph (b), a pilot performing, or being trained to perform, an agricultural aircraft operation in an aeroplane must not take-off at a weight greater than the MCTOW prescribed in the aeroplane’s flight manual unless—
- (1) the pilot complies with the procedures listed in Appendix B; and
 - (2) the aeroplane is equipped with a jettison system that, in accordance with D.5, is capable of discharging not less than 80 percent of the aeroplane’s maximum hopper load within five seconds of the pilot initiating the jettison action.
- (b) Where there is a third party risk as defined in Appendix A, the pilot must determine the maximum take-off weight in accordance with 137.107 and 137.109.”

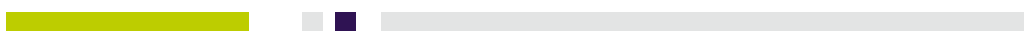
While these rules relate to the aircraft itself, it obviously becomes important that fertiliser material, including lime, is manufactured so that the criterion for jettison is achievable. A material which is so fine that it compacts and does not flow freely may inevitably be implicated in discharge problems.

Control of particle size, moisture and storage

Any fertiliser placed into an aircraft must be completely free from any large lumps, foreign objects or debris, and be sufficiently dry and in a condition where it will flow freely from the aircraft hopper when discharged during flight.

It is the responsibility of the supplier to supply fertiliser (including for example, lime, sulphur or any other bulk solid to be applied by air) as above.

It is the responsibility of the farmer to store the material in a manner that ensures that the condition of the fertiliser remains free-flowing while in storage and that it continues to satisfy these requirements when being extracted from storage for use.



→ TRANSPORT OPERATORS AND DRIVERS



HAZARD 1: THE TOP-DRESSING MATERIAL IS NOT FREE-FLOWING

Fertiliser that is not free-flowing can, in some situations, completely block the throat of the spreader hopper.

This presents a potentially life-threatening hazard for the pilot of the aircraft, particularly when the pilot needs to discharge his payload during an emergency and can not.

Control of contaminants and moisture is vital to ensure flow characteristics are maintained. See Appendix 1: *Requirements for fertiliser storage*.

HAZARD 2: FARM TRACKS AND ROADS ARE UNSUITABLE OR IN AN UNSAFE CONDITION

Controlled by: airstrip owner/farmer

1. Culverts, crossings and bridges shall be able to withstand the gross weight of both the truck and trailer units in use.
2. Farm tracks/roads should be constructed and maintained to a suitable standard.
3. Restrictions may need to be applied as to when farm tracks/roads can be safely used (for example due to weather conditions), and agreed between the transport operator and airstrip owner/farmer.

HAZARD 4: LACK OF TRAINING, INFORMATION, SUPERVISION, COMMUNICATION

Controlled by: employers, employees.

- Staff performing work are not sufficiently trained and/or supervised.
- Staff are not communicating health and safety issues.

CONTROL OF MOISTURE AND STORAGE

Any fertiliser placed into an aircraft must be completely free from any contaminants, foreign object or debris and be sufficiently dry and in a condition where it will flow freely from the aircraft hopper when discharged during flight.

It is the responsibility of the transport operator not to alter the condition of the fertiliser as it was when uplifted from the manufacturer. Water shall not be added as a dust control measure during transport as this may result in sticky and/or lumpy material.



Truck access bin

It is the responsibility of the farmer to store the material in a manner that ensures that the condition of the fertiliser remains free-flowing while in storage and that it continues to satisfy these requirements when being extracted from storage for use.

FARM TRACKS AND ROADS: ACCESS

The responsibility for the design, construction and maintenance of access ways, such as roads and/or tracks to top-dressing airstrips, rests with the owner of the land on which the top-dressing airstrip, including the loading areas and fertiliser storage areas, is sited. This is regardless of whether the fertiliser being transported and stored is for use on that farm or another farm in the local vicinity.

All farm tracks and roads and access points leading to the airstrip and storage site should be clearly identified by signage at the road gate and at any intersections leading to the airstrip. Gates on access roads should be properly hung and swing freely. Branches overhanging access roads should be cut back to provide a clearway for large vehicles.



Above and below: Vehicle accidents can and do happen. Always take all practicable steps.

Transport of fertiliser, machinery and fuel for top-dressing operations normally requires the use of heavy transport. Access to storage areas on or near the top-dressing airstrip should be via a graded and, if practicable, gravelled road that is well drained and maintained. Although some tracks and roads are not gravelled and are used only in good weather conditions, they shall nevertheless be



maintained to a standard that ensures safety for the transport operation. For example, besides being graded, all roads and tracks should be sprayed to prevent vegetation growth in wheel tracks, particularly on slopes.

If gravel is used, it should be compacted and the aggregate size should not exceed GAP 65. Information on Gap 65 can be found on the Aggregate and Quarry Association of New Zealand (Inc) website at www.aqa.org.nz/publications.html by clicking on the typical product table link or referring to your local crushed rock quarry.

All culverts, crossings and bridges shall be able to withstand the gross weight of the truck and any trailer.

If there is a reasonable expectation of public access to the fertiliser storage area(s) and the airstrip or where operations are near to a public road, then the whole site should be protected by fencing and signs warning of aircraft operations.

TRANSPORT OPERATOR – EMPLOYER: TRAINING AND SUPERVISION

In the context of this guideline, an employer has a duty of care to ensure that the fertiliser load delivered to a storage facility remains in a fit for purpose condition. This is covered by section 15 of the Health and Safety in Employment Act 1992 – ensuring that no action or inaction of any employee does not harm other people.

Practicable steps that may be taken by the employer of the truck driver include ensuring that:

- the truck driver has the proper licence, training and experience to undertake the work
- the truck/trailer is appropriate for the task with respect to load and access conditions
- the truck driver is aware of the requirement not to add water to any fertiliser load, during transport or after delivery
- the access to the storage facility is safe and of a standard fit for purpose
- the driver is aware of the need for adequate storage of the load, and undertakes steps appropriate for good storage on delivery
- a system is followed for reporting of storage facilities that allow degradation of the load
- a system is followed for communicating to the airstrip owner/farmer, any inadequacies of the storage facility found, and of any inadequacies in respect of access.

TRUCK DRIVERS: EMPLOYED AND SELF-EMPLOYED

The Act requires self-employed persons and employees to take all practicable steps to ensure their own safety while at work and to ensure that no person in their workplace is harmed.

Poor storage factors can affect the condition of the fertiliser loads and the viability of sowing the load in a safe manner. Fertiliser truck drivers can therefore contribute significantly to the safety of the operation.

Practicable steps that may be taken by the truck driver include the following:

- during delivery en route, cover the fertiliser load as appropriate to deny water ingress
- ensuring that the fertiliser does not become wet if transhipped after pick-up from the manufacturer/supplier and before final delivery to the storage facility
- taking appropriate steps to store the load so that it remains in good condition after unloading at the storage facility e.g. ensuring bin doors are closed and/or covers are replaced and secured
- communicating to the airstrip owner/farmer, any inadequacies found of the storage facility
- communicating to the airstrip owner/farmer, any inadequacies found in respect of access.

The truck driver is responsible for the appropriate use of the truck/trailer with respect to the task, load and access conditions.

PROCESS FOR EVALUATION OF ACCESS AND FERTILISER STORAGE

1. The farmer will assess the condition of the fertiliser storage system, before ordering fertiliser delivery, using the *Access and Storage Checklist* (Appendix 4), and make good any deficiencies found.
2. The transport operator will assess the access ways and storage against the requirements in the checklist prior to delivering fertiliser:
 Access ways and storage meet the requirements → **Fertiliser is delivered.**
 Access ways OR storage do not meet requirements → **No fertiliser is delivered.**
3. The manufacturer or transport operator will advise the farmer in writing of the reasons for the access way or storage failing to meet the required standards and requesting the deficiencies be made good.
4. The farmer will either:
 Make good the deficiencies → **Fertiliser will be delivered.**
 Not make good the deficiencies → **No fertiliser delivery is made.**
5. A health and safety inspector may be advised by any party if fertiliser is delivered by another transport operator.

→ AIRSTRIP OWNER

NOTE 1: A farmer, airstrip owner may be one and the same, or be different entities. Where combined activities are performed by one entity, the sections relevant to both activities apply to that entity.

NOTE 2: See also the definition of 'Principal'.



HAZARD 1: THE TOP-DRESSING MATERIAL IS NOT FREE-FLOWING

Fertiliser that is not free-flowing can, in some situations, completely block the throat of the spreader hopper. This presents a potentially life-threatening hazard for the pilot of the aircraft, particularly when the pilot needs to discharge the payload during an emergency and can not.

Control of contaminants and moisture is vital to ensuring flow characteristics are maintained. See Appendix 1: *Requirements for fertiliser storage*.

HAZARD 2: FARM TRACKS AND ROADS ARE UNSUITABLE OR IN AN UNSAFE CONDITION

Controlled by: airstrip owner/farmer.

1. Culverts, crossings and bridges shall be able to withstand the gross weight of both the truck and trailer units in use.
2. Farm tracks/roads should be constructed and maintained to a suitable standard.
3. Restrictions may need to be applied as to when farm tracks and roads can be safely used (for example due to weather conditions), and agreed between the transport operator and airstrip owner/farmer.

HAZARD 3: AIRSTRIP UNSAFE FOR USE

Controlled by: airstrip owner.

1. Design limitations

The function of an airstrip is affected by numerous things, each of which can impact on the performance of the pilot and aircraft. The design and location of the airstrip may restrict the type of aircraft that can be used, reduce the maximum load that can be carried, or be so affected by weather that operations are restricted to set periods.

2. Inadequate airstrip maintenance

Accidents have occurred through remarkably small but nevertheless important and manageable oversights. Examples are:

- failing to stop on the airstrip because the grass was too long and wet – the aircraft slid off at the runway end point
- aircraft destroyed after its wheel struck a pothole caused by a rabbit
- aircraft hit a tree which had grown into the take-off path.

These accidents cause severe damage to the aircraft and often result in fatal injury to the pilots. Airstrip position, length, slope, direction, surface condition, proximity to fences and trees; and stock management and pest control, are all important in the management of airstrips.

Appendix 2: *Top-dressing airstrip standards and specifications* covers these issues and provides information needed to manage an airstrip safely.

CONTROL OF FERTILISER STORAGE, ACCESS AND AIRSTRIP CONDITION

Any fertiliser placed into an aircraft must be completely free from any contaminants, large lumps, foreign objects or debris, and be sufficiently dry and in a condition where it will flow freely from the aircraft hopper when discharged during flight.

It is the responsibility of the airstrip owner to ensure that suitable storage facilities are available at the airstrip which will ensure, subject to correct use, that the condition of the fertiliser remains free-flowing while in storage.

The storage facility must, therefore, be capable of maintaining the fertiliser in a clean and dry state. The facility should also allow for the storage of different types of fertiliser to be stored separately.

The airstrip owner is required to manage the hazards on the access ways, airstrip and storage and loading areas in accordance with the guidelines set out above.

This includes:

- Maintaining the fertiliser storage facilities such that the load to be sown is kept in a condition suitable for safe sowing, that is, fit for purpose. The storage area should be checked and, if necessary, repaired prior to use. See Appendix 1: *Requirements for fertiliser storage*.
- Maintaining the access ways, airstrip, and loading area so that they are in a condition suitable for safe operation. See Appendix 2: *Top-dressing airstrip standards and specifications*.



FARM TRACKS AND ROADS: ACCESS

The responsibility for the design, construction and maintenance of access ways, such as roads and/or tracks to top-dressing airstrips, rests with the owner of the land on which the top-dressing airstrip, including the loading areas and fertiliser storage areas, are sited. This is regardless of whether the fertiliser being transported and stored is for use on that farm or another farm in the local vicinity.

All farm tracks, roads and access points leading to the airstrip and storage site should be clearly identified by signage at the road gate and at any intersections leading to the airstrip. Gates on access roads should be properly hung and swing freely. Branches overhanging access roads should be cut back to provide a clearway for large vehicles.

Transport of fertiliser, machinery and fuel for top-dressing operations normally requires the use of heavy transport. Access to storage areas on or near the airstrip should be via a graded and, if practicable, gravelled road or track that is well drained and maintained. Although some tracks and roads are not gravelled and are used only in good weather conditions, they shall nevertheless be maintained to a standard which ensures safety for the transport operation. For example, besides being graded,

all roads and tracks used should be sprayed to prevent vegetation growth in wheel tracks, particularly on slopes.

If gravel is used, it should be compacted and the aggregate size should not exceed GAP 65. Information on Gap 65 can be found on the Aggregate and Quarry Association of New Zealand (Inc) website www.aqa.org.nz/publications.html by clicking on the typical product table link or referring to your local crushed rock quarry.

All culverts, crossings and bridges shall be able to withstand the gross weight of both the truck and the trailer.

If there is a reasonable expectation of public access to fertiliser storage areas and the airstrip or where operations are near to a public road, then the whole site should be protected by fencing and signs warning of aircraft operations.

→ FARMER: (FERTILISER PURCHASER)

NOTE 1: A farmer or airstrip owner may be one and the same, or be different entities. Where combined activities are performed by one entity, the sections relevant to both activities apply to that entity.

NOTE 2: See also the definition of 'Principal'.

Farmers routinely arrange or contract for a top-dressing operator spreading fertiliser on their property to be able to use an airstrip and storage facility situated on another property. Such arrangements between farmers and owners can appear to blur the duties and responsibilities of persons under the Health and Safety in Employment Act 1992 and they are therefore often simply overlooked or avoided. However, the Act still applies in such situations. The airstrip owner and the farmer must take steps to ensure that the general integrity and safety of the airstrip and facilities is acceptable to allow use from the commencement of the agreement.

For clarity, the position in this guideline is that:

- the airstrip owner has a duty to ensure that the access ways, airstrip and storage facilities are suitable and fit for their purpose
- the farmer should ensure that the airstrip owner, in allowing use of the airstrip, has checked that the airstrip and facilities are fit for purpose as noted above
- once an agreement has been reached between the airstrip owner and the farmer regarding the safety of the access ways, airstrip and facilities, the farmer then has the responsibility of ensuring that the safe conditions are maintained
- it is the farmer's responsibility to inform the manufacturer/supplier of the fertiliser as to its method of application, i.e. whether it will be applied by aircraft or ground system
- the farmer should not request an operator to work off the airstrip if it appears unsafe or has been previously deemed unsafe by another agricultural aviation operator without first requiring any unsafe conditions to be corrected
- should the farmer become aware that any condition relating to the access ways, airstrip or storage facilities has become unsafe, the farmer shall cause work to cease, if necessary, until the condition has been evaluated and corrected
- the farmer must manage hazards such as overhead wires and other hazards and communicate relevant information about them directly to the pilot whether the pilot is an employee or self-employed. The farmer must also communicate with the pilot with respect to the length and slope of the airstrip.

A useful form for the exchange of information and setting out the agreement for the airstrip owner and farmer is included as Appendix 4: *Access, storage and airstrip checklist*.



A useful form for the exchange of information and setting out the agreement for the farmer and aerial operator is included as Appendix 5: *Health and safety in employment farmer (principal) and contractor agreement*.

The farmer must also record, notify and report occurrences of serious harm to any person, employees and contractors involved in the operation to the nearest office of the Department of Labour or the Civil Aviation Authority.

PROCESS FOR EVALUATION OF FARM AIRSTRIP CONDITION AND FERTILISER CONDITION

1. The farmer will assess the airstrip using Appendix 4: *Airstrip condition checklist*, before engaging an aerial operator, and make good any deficiencies found.
2. The farmer will assess the fertiliser condition for suitability, before engaging an aerial operator. See Appendix 3: *Free-flowing fertiliser field test*.
3. The aerial operator will ensure that a confirmation check of the fertiliser flow is conducted immediately prior to the job. See Appendix 3: *Free-flowing fertiliser field test*.
4. The pilot will assess the airstrip against the requirements in Appendix 2a: *Airstrip risk assessment checksheet* prior to applying fertiliser:
 Airstrip and fertiliser flow meet the requirements → **Fertiliser applied.**
 Airstrip OR fertiliser flow **do not** meet requirements → **No fertiliser applied.**
5. The aerial operator will advise the farmer, in writing if necessary, of the reasons for the airstrip OR fertiliser failing to meet a standard that makes it fit for purpose, and request that the deficiencies be made good.
6. The farmer will either:
 Make good the deficiencies → **Fertiliser will be applied.**
 OR
 Not make good the deficiencies → **No fertiliser application is made.**
7. A health and safety inspector may be advised by an aerial operator if fertiliser is applied by another aircraft operator.

PROCESS FOR EVALUATION OF ACCESS AND FERTILISER STORAGE

1. The farmer will assess the condition of the fertiliser storage system, before ordering fertiliser delivery, using Appendix 4: *Access, storage and airstrip checklist*, and make good any deficiencies found.
2. The transport operator will assess the access ways and storage against the requirements in the checklist prior to delivering fertiliser:
Access ways **and** storage meet the requirements → **Fertiliser is delivered.**
Access ways **or** storage do not meet requirements → **No fertiliser is delivered.**
3. The transport operator will advise the farmer, in writing if necessary, of the reasons for the access way or storage failing to meet a standard that makes them fit for purpose and request that the deficiencies be made good.
4. The farmer will either:
Make good the deficiencies → **Fertiliser will be delivered.**
Not make good the deficiencies → **No fertiliser delivery is made.**
5. A health and safety inspector may be advised by any party if fertiliser is delivered by another transport operator.

→ AERIAL OPERATOR

HAZARD 4: LACK OF TRAINING, INFORMATION, SUPERVISION OR COMMUNICATION

Controlled by: employers and employees.

- Staff performing work are not sufficiently trained and/or supervised.
- Staff are not communicating health and safety issues.



EMPLOYER: LOADER DRIVER AND PILOT (AND SELF-EMPLOYED PEOPLE)

Employers of pilots and loader drivers have a duty to ensure that the work assigned is able to be performed safely and that employees are not harmed. To this end, employers have a duty to provide supervision, training and information relevant to the tasks involved in the work being performed.

Management of fundamental issues such as ensuring that the pilot is current on type, correctly trained, is medically fit and has knowledge of hazards and how to avoid them needs to be demonstrable. The same applies to loader drivers. Training and information with regard to specific hazards of the tasks involved is crucial.

Supervision, training and information is covered by s.12 and s.13 of the Health and Safety in Employment Act 1992, and in the context of this guideline, includes the following:

- ensuring that the pilot and the loader driver are conversant with the flow property of the load, and the test regime set out in Appendix 3: *Free-flowing fertiliser field test*
- ensuring that the pilot and the loader driver are conversant with the procedure to communicate the result of a flow test to both the farmer, and their own employer, if required
- Ensuring the pilot is properly licensed and current on type, has the requisite certificates and is appropriately trained for the task



Loading plane using new bin

- ensuring that the pilot has the experience and knowledge necessary for the task or is properly supervised commensurate with training and experience
- ensuring that the pilot has been provided with information on the condition, length and slope of the strip before operations begin
- communicating information relevant to hazards such as overhead wires and other hazards, obtained from the farmer
- ensuring that the loader/driver is properly licensed and trained to safely carry out the necessary functions.

Employers must be aware that they have a duty to take all practicable steps to provide a safe place of work. Self-employed people have a duty to take all practicable steps to keep themselves from harm. Therefore, both employers and self-employed people must be aware of the requirement under Civil Aviation Rule Part 137 Subpart C – Special Flight Rules. This rule is printed below, and attention should be focused on 137.103 (a)(2).

“137.103 Maximum take-off weight

- (a) Notwithstanding Part 91 and subject to paragraph (b), a pilot performing, or being trained to perform, an agricultural aircraft operation in an aeroplane must not take-off at a weight greater than the MCTOW prescribed in the aeroplane’s flight manual unless—
- (1) the pilot complies with the procedures listed in Appendix B and
 - (2) the aeroplane is equipped with a jettison system that, in accordance with D.5, is capable of discharging not less than 80 percent of the aeroplane’s maximum hopper load within five seconds of the pilot initiating the jettison action.
- (b) Where there is a third party risk as defined in Appendix A, the pilot must determine the maximum take-off weight in accordance with 137.107 and 137.109.”

It is critical that the fertiliser material being applied has flow characteristics such that the criterion for jettison is achievable. Material which is not free-flowing may inevitably be implicated in discharge problems, therefore, employers and self-employed people must take all practicable steps to ensure that:

- the jettison system is capable of discharging the agricultural material used within the criteria specified and
- the fertiliser material will remain free-flowing after placement into the aircraft hopper.



Ground-based refuelling operations.

Employers and self-employed people must also abide by the aviation safety reporting requirements of the Civil Aviation Authority Rules Part 12 and the serious harm reporting requirements of s.25 of the Health and Safety in Employment Act 1992.

Where strips do not meet the length and slope information specified in Appendix 2: *Top-dressing airstrip standards and specifications*, employers and self-employed people shall make the farmer/principal aware of the length limitation.

Information should be given to the farmer/principal with respect to the maximum safe load and any payload weight reduction, see Appendix 2a: *Airstrip risk assessment checklist*.

→ LOADER DRIVER

The Health and Safety in Employment Act 1992 requires employees to take all practicable steps to ensure their own safety while at work and to ensure no person in their workplace is harmed as a result of their action or inaction.

Poor storage of fertiliser can affect the condition of the aircraft loads and the ability to spread the load in a safe manner. Loader drivers can therefore contribute significantly to the safety of the operation by ensuring that fertiliser is free-flowing prior to loading it into an aircraft.

Loader drivers are in a good position to make an early assessment of the fertiliser for free-flowing characteristics and its suitability for spreading. Practicable steps include:

- checking the flow characteristics of the load and communicating test results to the pilot. See Appendix 3: *Free-flowing fertiliser field test* for the method
- checking and agreeing with the pilot as to the suitability of the fertiliser load to be spread
- communicating to their employer and to the farmer, any inadequacies of the storage facility that were noted.

The loader driver is responsible for the appropriate use of the loader and load weight/mass measurement mechanisms.

→ PILOTS

The Health and Safety in Employment Act 1992 requires self-employed persons (under section 17) and employees (under section 19) to take all practicable steps to ensure their own safety while at work and to ensure that no person is harmed as a result of their action or inaction while at work. For employees there is a specific duty to use any protective clothing or equipment that is provided for their use.



For pilots these duties mean, for example, abiding by the conditions of the Civil Aviation Authority Operating Certificate and Rules governing the role and operation of the aircraft and wearing appropriate personal safety gear. Other practicable steps may include the following:

- operating in accordance with the employing company's documented policies and procedures or Standard Operating Procedures (SOPs)
- assessing the safety/condition of the runway strip, operating areas and approaches with respect to the aircraft type to be used, see Appendix 2A: *Airstrip risk assessment checklist*
- assessing the suitability of environmental conditions for the operation
- checking and agreeing with the loader driver as to the suitability of the condition of the fertiliser to be spread. See Appendix 3: *Free-flowing fertiliser field test* for the method
- giving an informed positive or negative statement to his/her employer (if appropriate) and the farmer with regard to carrying out the work, based on the above
- being aware of the condition, length and slope of the strip before operations begin.

The pilots must report incidents and accidents in accordance with Civil Aviation Authority Rules Part 12 and serious harm under the Health and Safety in Employment Act 1992.



Agricultural airstrip with soft patch

PILOT CHECKS PRIOR TO COMMENCING A TOP-DRESSING CONTRACT

The *airstrip risk assessment checklist* should be used by an agricultural pilot to demonstrate that the risks of using a particular runway with the aircraft type have been considered in relation to the contract requirements. It should also be used to note that the pilot has received a briefing from the owner or contractor on the known hazards, particularly with respect to wires, of both the runway and the top-dressing task itself, and that the pilot has checked on the condition of the fertiliser and that it is suitable for the task.

The checklist should be incorporated with the job documentation and retained for future reference. Should an area be noted as unsatisfactory, the checklist can be used to bring the problem to the attention of the farmer for rectification.

Where strips do not meet the length and slope information specified in Appendix 2: *Top-dressing airstrip standards and specifications*, the pilot shall, along with any other performance limiting factors, make the farmer/principal aware of the length limitation. Performance factors that the pilot will take into account are: the wind direction and speed, airstrip surface and condition, slope, and the pressure altitude and temperature (density altitude).

Information should be given to the farmer/principal with respect to the maximum safe load and any payload weight reduction, see Appendix 2a: *Airstrip risk assessment checklist*.

→ DEFINITIONS

For the purposes of this guideline, the following definitions apply.

Aerial operator: a business or person engaged in top-dressing for an agricultural operation.

Agricultural operation: an operation carried out during the course of agricultural work, pastoral work, or horticultural work of any kind.

Airstrip: refer to page 41.

Airstrip owner: the person who has ownership of the airstrip and/or who has the authority to allow or disallow use of that airstrip and/or the land upon which the airstrip is situated. When the land is leased to another party who then effectively has the right of tenure, the term 'airstrip owner' may include the lessee.

NOTE 1: a farmer or airstrip owner may be one and the same, or be different entities. Where combined activities are performed by one entity, the sections relevant to both activities apply to that entity.

NOTE 2: see also the definition of 'principal'.

All practicable steps: all steps taken to achieve the safest result that it is reasonably practicable to take in the circumstances. The full definition from the Health and Safety in Employment Act 1992 is:

"s2A All practicable steps

(1) In this Act, all practicable steps, in relation to achieving any result in any circumstances, means all steps to achieve the result that it is reasonably practicable to take in the circumstances, having regard to—

(a) the nature and severity of the harm that may be suffered if the result is not achieved; and

(b) the current state of knowledge about the likelihood that harm of that nature and severity will be suffered if the result is not achieved; and

(c) the current state of knowledge about harm of that nature; and

(d) the current state of knowledge about the means available to achieve the result, and about the likely efficacy of each of those means; and

(e) the availability and cost of each of those means.

(2) To avoid doubt, a person required by this Act to take all practicable steps is required to take those steps only in respect of circumstances that the person knows or ought reasonably to know about."

Contamination: in respect of a fertiliser, means the inclusion of any foreign material into the fertiliser, after manufacture.

Employee: means any person of any age employed by an employer to do any work (other than residential work) for hire or reward under a contract of service and, in relation to any employer, means an employee of the employer].

Farmer: means the person who has purchased fertiliser and intends to have the fertiliser spread by aerial application onto their farm.

NOTE 1: A farmer or airstrip owner may be one and the same, or be different entities. Where combined activities are performed by one entity, the sections relevant to both activities apply to that entity.

NOTE 2: See also the definition of 'Principal'.

Fertiliser: any dry, powdered, granular, or other dry fertiliser material that flows, is delivered in bulk, and is used to top-dress agricultural land. Fertiliser includes agricultural lime.

Fit for purpose: in respect of a place of work, means designed, made and maintained so that it is safe for its intended use.

Flow property: the flow rate achievable from a nominal aircraft hopper given the condition of the fertiliser with respect to substance type, granular size, compaction, contamination and moisture content.

Free-flowing: a fertiliser may be said to be free-flowing when:

1. It can be discharged as a dry powder from an aircraft hopper, in the form intended, without compacting and blocking in the throat of the hopper.
2. It can be discharged as a dry powder from an aircraft hopper, in the form intended, without sticking and blocking in the throat of the hopper.
3. It has passed the field test in Appendix 3: *Free-flowing fertiliser field test*. Note that the field test is under development by Lincoln and Massey Universities. See Appendix 3 for more detail.

Harm: illness, injury or both; and includes physical or mental harm caused by work related stress.

Hazard: any event that is an actual or potential cause of harm. The full definition from the Health and Safety in Employment Act 1992 is:

“‘Hazard’ —

(a) means an activity, arrangement, circumstance, event, occurrence, phenomenon, process, situation, or substance (whether arising or caused within or outside a place of work) that is an actual or potential cause or source of harm; and

(b) includes —

(i) a situation where a person’s behaviour may be an actual or potential cause or source of harm to the person or another person; and

(ii) without limitation, a situation described in subparagraph (i) resulting from physical or mental fatigue, drugs, alcohol, traumatic shock, or another temporary condition that affects a person’s behaviour”

Manufacturer: includes a person who creates fertiliser (including ground lime) for use in the agricultural industry, and which is applied to the land by ground spreading or aerial spreading.

NOTE: A manufacturer, supplier, transport operator, may be one and the same, or be different entities in any combination. Where combined activities are performed by one entity, all sections relevant to the activities apply to that entity.

Must: see ‘Shall’.

Performance standard: an internationally-recognised standard recognising the performance of a structure or material in a defined series of tests. Examples are ISO, OECD, SAE, AS and NZS.

Person who controls a place of work: a person who is:

1. The owner, lessee, sub-lessee, or person in possession of the land on which the top-dressing airfield, including the access ways, loading areas and bulk storage areas are sited; and/or
2. The owner, lessee, sub-lessee, or person in possession of the land on which the top-dressing operation is taking place.

Place of work: a place where a person works for gain or reward, or places associated with the workplace. The full definition from the Health and Safety in Employment Act 1992 is:

““Place of work” means a place (whether or not within or forming part of a building, structure, or vehicle) where any person is to work, is working, for the time being works, or customarily works, for gain or reward; and, in relation to an employee, includes a place, or part of a place, under the control of the employer (not being domestic accommodation provided for the employee),—

(a) Where the employee comes or may come to eat, rest, or get first-aid or pay; or

(b) Where the employee comes or may come as part of the employee’s duties to report in or out, get instructions, or deliver goods or vehicles; or

(c) Through which the employee may or must pass to reach a place of work:

Plant: includes—

(a) Appliance, equipment, fitting, furniture, implement, machine, machinery, tool, and vehicle; and

(b) Part of any plant, the controls of any plant, and any thing connected to any plant:”

Principal: a person who or that engages any person (other than as an employee) to do any work for gain or reward.

Serious harm: includes permanent or severe loss of any bodily function, or loss of consciousness, or any harm that causes a person to be hospitalised for 48 hours or more. A full definition is in the Health and Safety in Employment Act 1992, First Schedule.

Shall: refers to a recommendation that is mandatory for compliance with a statute. In the context of this guideline ‘Shall’ includes ‘must’.

Should: means a preferred practice or recommendation.

Supplier: includes any person who sells or offers for sale agricultural fertilisers.

NOTE: A manufacturer, supplier, transport operator, may be one and the same, or be different entities in any combination. Where combined activities are performed by one entity, all sections relevant to the activities apply to that entity.

Transport operator: includes a person who transports fertiliser from the supply point to the airstrip facility.

NOTE: A manufacturer, supplier, transport operator, may be one and the same, or be different entities and any combination. Where combined activities are performed by one entity, all sections relevant to the activities apply to that entity).

REFERENCES

- Health and Safety in Employment Act 1992
- Civil Aviation Rules: Part 137, Subpart C – Special Flight Rules 137.103
- Civil Aviation Rules: Part 12

→ APPENDICES

APPENDIX 1: REQUIREMENTS FOR FERTILISER STORAGE

Weatherproof storage of fertiliser

Often fertiliser is delivered to a top-dressing operation and used virtually immediately and exposure to weather, and in particular moisture, is not a significant issue. However, moisture can be a problem if the fertiliser has to be stored on site for some time. Most top-dressing fertilisers such as lime and superphosphates are hygroscopic; they absorb moisture from the air, especially if the material is exposed to weather and rain. This characteristic is made worse when they are in powdered or granulated forms such as when they are used in agricultural aerial top-dressing operations. The absorption of moisture causes two problems:

- it increases the weight of the material and therefore makes it more expensive to sow; and
- it alters the flow characteristics of the material from the hoppers in top-dressing aircraft and in extreme cases, can cause the flow to cease altogether. This presents a potentially life-threatening hazard for the pilot of the aircraft.

Providing a weatherproof storage area for top-dressing fertilisers can therefore reduce the cost of the operation and remove a very real hazard to safe top-dressing operations.



Example of good fertiliser storage facility



Storage bins and frames for tarpaulin roof



Site guidance for fertiliser storage facilities

- The fertiliser storage facility should be sited such that water flows away from the area.
- The area should provide unobstructed backing space for delivery and loader purposes. This will avoid truck and trailer units jack-knifing.
- The area around the entrance to the storage area should be compacted metal with good drainage, and graded to shed surface water away from the loading area and the airstrip.
- Careful consideration should be given to the site of the storage area in order to gain the most efficient operation in the terms of delivery of material to the site, and for aircraft loading.
- Careful siting of the loader movement area out of the turning circle of the aircraft will also avoid disrupted operating area surfaces which can damage the aircraft.
- Top-dressing aircraft can load up to 2 tonnes of fertiliser at a time depending on the type of aircraft, and the storage capacity should be commensurate with the scope of the likely operations. For example, if a farm normally requires 100 to 150 tonnes of fertiliser, a bin that holds only 25 tonnes will cause delays in the operation and/or result in fertiliser being stockpiled on the ground outside the bin with a high likelihood of contamination.

Design guidance for fertiliser storage facilities

The main requirement for any fertiliser storage facility is to keep the fertiliser in a free-flowing condition. Ensuring that the fertiliser does not become wet or otherwise contaminated is paramount. The facility should also be designed such that the fertiliser can be extracted using the conventional loading buckets currently in use.

The **minimum design features** of such a facility include:

- water- and weather-proof (i.e. with a tarpaulin, roof and doors/shutters)
- concrete floor which includes a damp course to prevent moisture entry
- a barrier at the facility entrance to prevent stock from entering.

Further recommended features include:

- concrete walls or equivalent structures that prevent moisture entry and are structurally suitable to contain the fertiliser while being loaded with current bucket loaders
- a recommended bin width of 5.5 metres (to suit the dimensions of commonly-used loading equipment).

A simple framework structure such as water pipe can provide a suitable structure for the perimeter of a storage facility. This can be used with a waterproof cover which overhangs the structure, down to ground level when the maximum amount of fertiliser to be used is present. The cover must be capable of being made taut to prevent water pooling on and around it to prevent moisture contamination of the fertiliser.

Storage facility suitability, maintenance and inspection

The suitability of a storage facility design should be agreed between the aerial operator and the airstrip owner/farmer.

The storage facilities should be kept and maintained in a condition such that fertiliser intended for aerial sowing remains in a condition that is fit for purpose.

A record should be kept of any maintenance carried out on the facility.

The fertiliser storage site may be inspected for suitability on request from owners, farmers, transport operators, top-dressing operators, pilots or loader/drivers. The inspection may be carried out by an appointed health and safety inspector who may refer to this guideline.

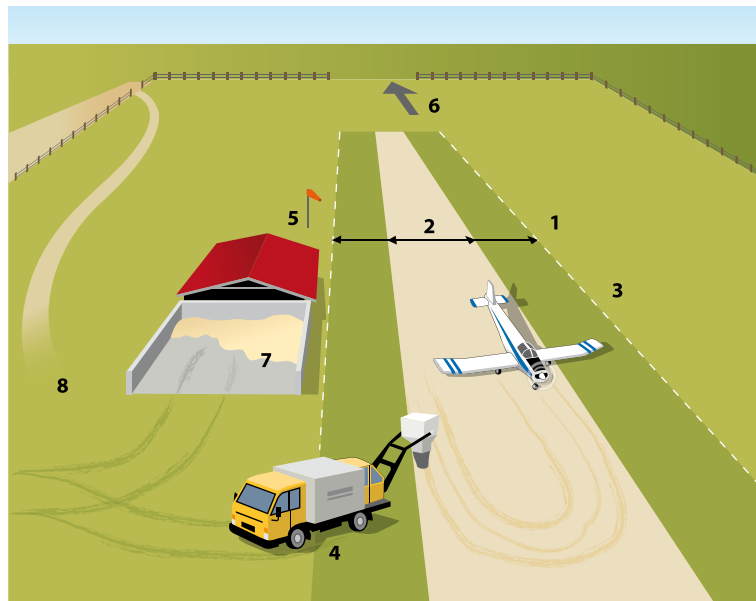


Fertiliser bin with sliding roof in back position for access

APPENDIX 2: TOP-DRESSING AIRSTRIP STANDARDS AND SPECIFICATIONS

Introduction

The function of an airstrip, its layout and associated elements is to provide for safe and efficient aircraft landing and take-off. The design of these areas must take into account the operational and physical characteristics of the aircraft expected to use the strip.



- | | |
|--|--|
| 1. Airstrip width – Minimum 30m | 5. Wind indicator |
| 2. Runway width – Minimum 15m | 6. Drop down fence at end of strip |
| 3. All stock removed – (cattle 2 weeks prior to operation) | 7. Dry free flowing fertiliser (Covered bin) |
| 4. Loading area | 8. Strictly no admittance to work area. |

Strip Length

Please check strip length requirements with your aerial operator. Fertiliser application costs will increase on airstrips of marginal length due to the need to carry smaller loads

Definitions: agricultural aviation and airstrips

Airstrip: a defined area symmetrically including the runway that is intended:

- to reduce the risk of damage to aircraft running off a runway
- to protect aircraft flying over it during take-off or landing operations.

Manoeuvring area: that part of an aerodrome to be used for the take-off and landing of aircraft and for the surface movement of aircraft associated with take-off and landing; but does not include areas set aside for loading, off-loading, or maintenance of aircraft.

Obstacle: all fixed and mobile objects, or parts thereof, that may obstruct either the movement of an aircraft on the ground or protrude into an aircraft's take-off or landing path.

Runway: a defined rectangular area on a land aerodrome prepared for the landing and take-off of aircraft.

Threshold: means the beginning of that portion of the runway usable for landing.

Airstrip specifications

The essential requirement is that the place where aerial agricultural operations are being conducted is safe. To achieve that, it is important to consider all of the following factors in a holistic way.

Airstrip site

The site for a top-dressing airstrip should be selected carefully having regard to the farm location and prevailing wind.

The runway direction should be aligned as closely as possible with the prevailing wind in the area. In this respect, the Meteorological Service of New Zealand Ltd can provide information on prevailing area wind flows. Even a small amount of tailwind (e.g. 18 kph) can significantly increase the required take-off distance for a loaded aircraft, or alternatively, cause the pilot to have to significantly reduce the load to be carried.

Advice on siting an airstrip can be obtained from the New Zealand Agricultural Aviation Association or your local aerial operator.

Airstrip width

The desired strip width is 40 metres with a minimum of 30 metres if terrain or other obstacles make 40 metres unobtainable. The whole of the defined area of the strip should be suitably prepared for the needs of the aircraft that are expected to use it. Aircraft can depart the side of a runway unexpectedly for a number of reasons such as an unexpected crosswind or tyre or steering problems. The runway strip provides some safety margin for the pilot to either stop the aircraft or get it safely airborne.

Runway width

The minimum width of the runway itself should not be less than 15 metres.

Runway length

In determining runway length, a key objective is that the runway should be of such a length that a fully loaded agricultural aircraft of the type that will use the runway must be in controlled flight by the end of the runway when carrying its full legal load in nil wind and International Standard Atmospheric (ISA) conditions. A short runway length will impact upon the weight of the load that can be carried. Advice on the length/weight reduction for specific sites can be obtained from the New Zealand Agricultural Aviation Association or your local aerial operator.

Air density decreases as altitude increases and as temperature rises. Lower air density penalises pilots in three ways: The lifting ability of an aeroplane's wings decreases, the power produced by the engine decreases, and the thrust of a propeller, rotor or jet engine decreases.

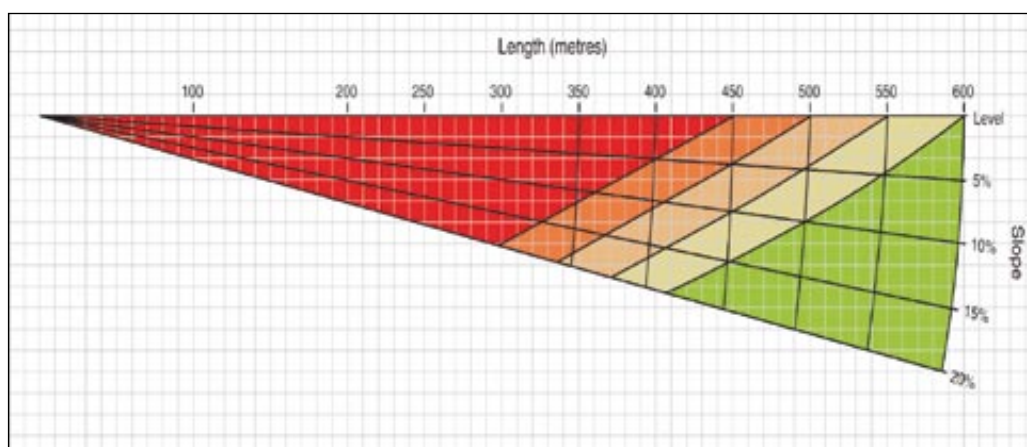
Pilots use charts or calculators to find out how temperature and air pressure at a particular time and place affect the air's density and therefore aircraft performance. When the air's density is low, aircraft need longer runways to take off and land and they don't climb as quickly.

Based on the requirements for common agricultural aircraft and airstrip altitude, the following table provides the typical **equivalent flat** runway length that top-dressing airstrips should meet. It is expected that these guidelines will be followed where a new airstrip is being constructed or an existing airstrip is being improved; achievement of the maximum length practicable should be a key aim. Where an airstrip is shorter than suggested here, there may be restrictions on the type of aircraft that can use the airstrip and/or the weight of loads that can be carried by the aircraft. This does not mean that existing airstrips with lengths shorter than those suggested below are unsafe, but simply that they have reduced safety margins and therefore the pilot may need to reduce the load being carried and/or even cease operations to ensure that an appropriate level of safety is maintained; e.g. if environmental, airstrip, aircraft or task conditions change.

SUGGESTED FLAT LENGTHS — NEW AIRSTRIPS

Feet above sea level	Suggested flat length of new airstrips
Up to 1000 feet above sea level	600 metres
Up to 2000 feet above sea level	650 metres
Up to 3000 feet above sea level	750 metres

These suggested lengths may be reduced if the airstrip has a slope. Advice on the length reduction for specific sites can be obtained from the New Zealand Agricultural Aviation Association or your local aerial operator. The following diagram depicts length compensation adjustments for various slopes.



Examples:

1. A 450-metre-long airstrip with a 10 percent down-slope has an equivalent length of 550 metres. (Find 450 on the 'level' line. Follow the 450 line down until it intersects the 10 percent line. Follow the curve line back up to the level line: read off = 550 metres.)
2. A 350-metre-long airstrip with a 20 percent down-slope has an equivalent length of 510 metres. (Find 350 on the 'level' line. Follow the 350 line down until it intersects the 20 percent line. Follow an approximated curve line back up to the level line: read off = 510 metres.)

An alternative table is shown below:

Height above sea level	Flat strip	Slope:			
		5%	10%	15%	20%
Up to 1000 feet	600 metres	550 metres	500 metres	450 metres	420 metres
1000 to 2000 feet	650 metres	600 metres	550 metres	500 metres	470 metres
Over 2000 feet	750 metres	700 metres	650 metres	600 metres	570 metres

Where strips do not meet the length and slope information specified the pilot shall, along with any other performance limiting factors, make the farmer/principal aware of the length limitation. Performance factors that the pilot will take into account are: the wind direction and speed; airstrip surface and condition; slope; and the pressure altitude and temperature (density altitude).

Information should be given to the farmer/principal with respect to the maximum safe load and any payload weight reduction, see the pilot checklist, Appendix 2a: *Airstrip risk assessment checksheet*.

The maximum slope along the length of the strip should not exceed 1 in 5 (20%). This means that for every 5 metres one moves horizontally, the land must not rise/fall more than 1 metre.

Runway surface and strength

The runway should have a smooth, consolidated surface free of bumps and hollows, and with a surface of dense, hard-wearing and deep-rooted turf, or other all-weather surfacing such as limestone or tar seal. Clover use should be minimised as it provides poor braking action and can degrade aircraft directional control.

The runway surface should be of sufficient strength for the take-off and landing of the aircraft types the runway is intended to serve.

The runway surface should be capable of taking a motor vehicle comfortably at 80 kilometres per hour.

The runway itself should have an evenly graded surface not higher than 200 mm above the level of the strip to allow water runoff and prevent washout from heavy rain.

The airstrip should be kept free of pests. Rabbit holes and diggings aid washouts and can severely damage the landing gear on an aircraft. Similarly, for other than airstrip inspections, vehicles should not routinely be used on the airstrip as ruts can also assist the formation of washouts.

Note: Where cattle are grazed on the airstrip, the surface shall be free of fresh cattle manure and any other damage to the surface as a result of grazing. Fresh manure is corrosive and can significantly degrade directional control of the aircraft and aircraft braking action. Sheep grazing should have minimal impact on a properly surfaced runway.

Loading area

A loading area of sufficient size to allow for the manoeuvring and loading of the aircraft should be provided. Some aircraft are unable to make very tight turns due to nose wheel steering geometry. There should be sufficient room to allow the aircraft to commence the take-off run once loaded without having to turn to line up.

The area should have a well compacted surface with good drainage and be sloped to shed water away from the runway. The surface strength must be such as to withstand the wheel loads of both the aircraft and the loader turning and manoeuvring, fully laden, in all weather conditions in which aerial top-dressing may take place, without causing significant wheel ruts.

Wind indicators (socks)

Variations in wind direction and strength have been significant factors in agricultural aircraft take-off and landing accidents. A wind direction indicator should be provided to aid the aircraft pilot to judge both the wind direction and velocity. These are commonly called windsocks. Wind indicators need not be highly technical; a simple length of red or orange ribbon attached to a pole can be quite sufficient.

Depending on the airstrip site and runway environment, the wind indicator should be positioned not closer than 40 metres to the side of the runway threshold, or if the strip can be used in either direction, then not closer than 40 metres to the side of the centre of the strip.

NOTE: The aircraft operator may provide their own indicator.

Fencing and obstacles

A fifth of agricultural aircraft accidents involve fence strikes¹.

The airstrip, storage and loading area should be completely fenced so that stock can be reliably excluded. A pilot may inspect the airstrip and immediate area for stock prior to the first landing; therefore there should be no bush stands or gullies in which stock can be obscured and later obstruct the runway without warning.

There should be no obstruction within 200 metres measured from each end of the runway, or from the landing threshold on a one-way runway.

Fencing within 200 metres of the runway threshold should be removed for the duration of the top-dressing operations. Any immovable obstruction within the 200 metres may require the pilot to use a displaced threshold thereby reducing the available runway length. In turn, this may limit the aircraft load and therefore require more runs to complete the task, so increasing the cost of the operation.

Once airborne, an aircraft has to accelerate and climb before turning and proceeding to the area to be fertilised. This airborne path should be clear of obstructions such as trees, poles and strung wires. When operating in hilly terrain, wind direction, speed and wind gusts can significantly affect the flight path of a loaded aircraft and may even cause it to descend. An obstructed take-off flight path presents a potentially life-threatening hazard for the pilot of the aircraft.

There are occasions when for any reason, such as an obstruction on the runway, a pilot may overshoot from the landing approach. Even though the aircraft is generally not carrying a load at this stage of flight, an obstructed overshoot flight path presents a potentially life-threatening hazard for the pilot of the aircraft.

¹ Civil Aviation Authority Accident/Incident database

Public access

If there is a reasonable expectation of public access to either the fertiliser storage areas or the airstrip, or where operations are near to a public road, then the whole site should be protected by fencing and signs warning of aircraft operations.

Airstrip and facility suitability, maintenance and inspection

The suitability of an airstrip should be agreed between the aerial operator and the airstrip owner/farmer.

The airstrip and facilities should be kept and maintained in a condition that is fit for purpose. A record should be kept of any maintenance carried out on the airstrip and facilities.

A top-dressing airstrip may be inspected for suitability on request from owners, farmers, top-dressing operators, pilots or loader/drivers. The inspection may be carried out by an appointed health and safety inspector who may refer to this guideline.

Accreditation of aerial operators by the New Zealand Agricultural Aviation Association includes a requirement that the sites from which they operate provide for safe and efficient operations to be carried out.

APPENDIX 2a: AIRSTRIP RISK ASSESSMENT CHECKSHEET

Date:		Airfield owner/occupier name:	
Pilot name:		Loader name:	
Aircraft type:			Aircraft reg: ZK-
Airstrip position:			Job number:
Strip length:	Strip slope:	Altitude:	Equivalent strip length:

Checks (*The farmer should be notified of any "no" response as below)

Item checked	Yes	No*	Comments
<i>General airstrip checks</i>			
Weather satisfactory for the contract job	<input type="checkbox"/>	<input type="checkbox"/>	
Wind indicator satisfactory	<input type="checkbox"/>	<input type="checkbox"/>	
Runway surface satisfactory	<input type="checkbox"/>	<input type="checkbox"/>	
Runway approach/take-off paths safe	<input type="checkbox"/>	<input type="checkbox"/>	
Runway width satisfactory	<input type="checkbox"/>	<input type="checkbox"/>	
Fences/obstacles/wire clearance satisfactory	<input type="checkbox"/>	<input type="checkbox"/>	
Braking action satisfactory	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Job hazard briefs</i>			
Runway hazard brief received from owner	<input type="checkbox"/>	<input type="checkbox"/>	
Job hazard brief received from principal	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Load checks</i>			
Material flow checks satisfactory	<input type="checkbox"/>	<input type="checkbox"/>	
Aircraft load adjusted for conditions: wind direction and speed, airstrip surface and condition, slope, pressure altitude and temperature (density altitude). N.B. This value may vary during the day as temperature rises or falls and as wind direction and speed alters.			
Initial maximum safe load =			
Reassessed at (time) =			
Reassessed at (time) =			
Farmer/principal advised	<input type="checkbox"/>	<input type="checkbox"/>	

Pilot signature Name

Date / / Time

Hand to loader/driver for retention. Loader/driver to file on return to home base.

APPENDIX 3: FREE-FLOWING FERTILISER FIELD TEST

A fertiliser may be said to be 'free-flowing' when:

1. It can be discharged as a dry powder from an aircraft hopper, in the form intended, without compacting or sticking in the throat of the hopper, thereby reducing the risk of blockage.
2. It can be discharged as a dry powder from an aircraft hopper, in the form intended, without blocking in the throat of the hopper.
3. It has passed the field test explained below.



Hopper with free-flowing fertiliser

The procedure for the field test involves two steps:

1. Information gathering and visual observation, and
2. Physical testing.

Step 1: Information gathering and visual observation

- Confirm with the farmer the age of the product.
- Confirm delivery date.
- Confirm the presence of any pre-existing product underneath.
- Visually check for contamination, including:
 - dirt and debris, sticks or vegetation
 - stock movement and/or the presence of cowpats
 - obvious lumpiness, stickiness or wetness.

The information gathered is useful in determining how old the material is, how long it has been on-site and whether or not it has been mixed with other material. Direct observation is a very important part of the process. Evidence of material contamination through dirt and debris, stock movement, cow pats and so forth is readily apparent, as is the material's lumpiness, stickiness or wetness.

The loading of the aircraft presents an opportunity to assess flow-rate of the fertiliser prior to take-off and application. Any lack of free-flow of the product from the loader hopper into the aircraft hopper should be noted and acted upon immediately. If the product will not flow freely and readily from the loader hopper, free-flow from the aircraft may be compromised. Action must be taken to address this situation. Failure to meet the flow requirement of the field test means the pilot should take steps such as restricting the load, for example, to 75 percent or less of the aircraft's standard load.

Step 2: Physical test

Lincoln University and Massey University have established a joint research programme to identify reasons as to why poor flow can exist and then to develop and establish a means to test for that. Due to the time-line projected for developing the procedure, agreement has been reached to release this guideline in its current form so that the agricultural, aviation and manufacturing and supply industries can make use of its broader content. The guideline will then be updated and reprinted with that information as it becomes available. Until then, parties who are assessing product flow should undertake at least step 1 above and those further steps listed below.

Steps to take if the prior tests show poor flow.

The farmer shall be advised that action must be taken to either:

1. Limit the load to a weight, decided by the aerial operator, below maximum certified take-off weight (MCTOW). Overload **shall not** be allowable. This allows a pilot to have a safe recovery if the load does not discharge.
 - 1.1 If a complete discharge does not occur, the farmer must be advised to return the fertiliser to the works for remanufacture as a dry flowable product. It is illegal for any pilot to load material for aerial application that will not meet the minimum jettison standard of 80 percent of the load in five seconds.
 - 1.2 If discharge does occur, the load limit, as per 1.1, shall be maintained until the parties are satisfied that the poor flow no longer exists.
 - 1.3 Locking the hopper control lever at full dump on the completion of the sowing run is a precaution taken by pilots against the accidental accumulation of fertiliser and the possibility of an overloading problem occurring. However landing with the hopper door open may not in itself be sufficient to discharge compacted, wet or sticky fertiliser. The pilot will need to visually check that the hopper contents have been discharged totally during the previous sowing run as any additional load introduced to the hopper may cause an overload situation. To visually inspect the hopper after each load may be impractical with some aircraft currently in use, leaving the pilot with no other option but to refuse to apply the product.

Or

2. Bring more product in and use that only – a new test is to be done.

Control actions from the above are therefore:

All of step 1

Or, step 2 alone.

APPENDIX 4: ACCESS, STORAGE AND AIRSTRIP CHECKLIST

Access and storage

	Yes	No
All access ways to the storage bin are clear and level, graded as necessary, and are free from long grass and weeds.	<input type="checkbox"/>	<input type="checkbox"/>
There is sufficient room for the truck to turn without damaging the aircraft operating area.	<input type="checkbox"/>	<input type="checkbox"/>
The storage area or bin is dry and has a waterproof cover or roof.	<input type="checkbox"/>	<input type="checkbox"/>
The farmer or an agent will be on hand to ensure the fertiliser is covered after delivery.	<input type="checkbox"/>	<input type="checkbox"/>

Airstrip

The airstrip surface has been checked for branches, wire, potholes, damage from stock, cowpats and other surface irregularity.	<input type="checkbox"/>	<input type="checkbox"/>
The grass is short, either cut or grazed by sheep.	<input type="checkbox"/>	<input type="checkbox"/>
Stock has been removed.	<input type="checkbox"/>	<input type="checkbox"/>
The strip has been checked by driving over it at 80 km/h.	<input type="checkbox"/>	<input type="checkbox"/>
The flight path is clear of fences, wires and trees etc.	<input type="checkbox"/>	<input type="checkbox"/>

A 'No' answer requires attention before the airstrip is used.

Farmer sign-off

Airstrip owner sign-off

Date / /

APPENDIX 5: HEALTH AND SAFETY IN EMPLOYMENT FARMER (PRINCIPAL) AND CONTRACTOR AGREEMENT

The purpose of this agreement is to ensure that contractors and farmers clarify, and give regard to, their respective responsibilities under the Health and Safety in Employment Act 1992. While it is impossible to indemnify both parties from all liability, a commitment to the warranties given in this agreement is an essential step in health and safety risk management.

NB: For the purpose of this agreement, "farmer" means "farmer or his/her agent".

1. The contractor warrants:
 - 1.1 That the contractor has been advised by the farmer of any significant hazards in the work place that the farmer controls, that might cause serious harm to the contractor or the contractor's employees/assistants.
 - 1.2 That the contractor and the contractor's employees/assistants are trained and competent to carry out the work assigned in a safe manner.
 - 1.3 That any plant, machinery or tools that may be used by the contractor and/or the contractor's employees/assistants are in good repair and in a safe working condition.
 - 1.4 That where necessary to avoid serious harm appropriate and adequate safety equipment is available and used at all times.
 - 1.5 That the contractor has developed adequate emergency procedures, as required under the Health and Safety in Employment Act 1992.

If the contractor or the contractor's employees/assistants identify any hazards on the farmer's property which are likely to cause them serious harm, access to the farmer's land and/or work on it shall not proceed until appropriate control actions are taken. Besides taking their own control actions, the contractor or the contractor's employees/assistants shall, where necessary, request the farmer who controls any such hazards to take appropriate actions before access or work begins.

2. The farmer warrants:
 - 2.1 That the farmer has advised the contractor of any significant hazards in the workplace that he/she controls, that might cause serious harm to the contractor or the contractor's employees/assistants.
 - 2.2 That should the farmer become aware of any significant workplace hazard or unsafe practices that might cause serious harm the farmer shall take appropriate actions before work begins or continues. This assurance applies to the area in which the contractor or the contractor's employees/assistants are working, whether relating to the workplace that the farmer controls or to that under the control of the contractor,

Contractor Signed

Farmer Signed

Date / /

SUMMARY

DELIVERY CONTROL

- The manufacturer will supply the product clean and dry.
- The transport operator will deliver the product clean and dry.
- Once delivered, the product will be protected from moisture and contamination.

AIRSTRIPE CONTROL

- Airstrip owners and farmers will ensure the airstrip meets the guidance criteria.
- Pilots will inspect the airstrip prior to the job.

APPLICATION CONTROL

- The farmer should perform a product check for free-flow prior to engaging an aerial operator.
- The aerial operator will ensure a product check for free-flow is performed immediately prior to job.
- The pilot will inform the farmer of an affirmative or negative decision.
- The pilot has the right of refusal to fly.

