



# Australian Grain Industry – Code of Practice Technical Guideline Document

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No. 21

## GRAIN SAMPLING – ALL SAMPLING SCENARIOS USED DURING THE STORAGE AND TRANSPORT OF GRAIN

**Compiled on behalf of the Australian Grain Industry by:  
Grain Trade Australia**

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**Technical Guideline Document**

**No. 21 Grain Sampling**  
**– All Sampling Scenarios**  
**used during**  
**the storage and transport of grain**

**Version Control**

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## **Disclaimer**

Information provided in this Technical Guideline Document (TGD) is provided as guidance information to assist industry participants to understand the minimum standard required to obtain a representative sample of grain for the purpose of facilitating trade within Australia.

This TGD should not be the sole basis for any decision on the method utilised to obtain a representative sample of grain. Grain Trade Australia does not represent or warrant the TGD is free from errors or deletions that may have a material impact on readers commercial activity. As a result, GTA will accept no liability for any losses, consequential or otherwise, which may be incurred by any party as a result of reliance on this TGD.

## 1 Summary

This Technical Guideline Document (TGD) provides summary level information that will assist industry participants, both existing and new, in the establishment of effective business procedures to obtain a sample of grain. A key objective of the TGD is to list and describe the relevant minimum steps and processes required to obtain a representative sample of grain in a wide range of sampling scenarios.

This TGD in conjunction with the Australian Grain Industry Code of Practice, and the Grain Trade Australia (GTA) Trading Standards will support and enhance overall industry effectiveness as well as providing confidence to customers the Australian grain industry is committed to the provision of grain samples subject to industry recommended practices. Participants remain free to develop their own procedures and methodology for taking a representative sample of grain. It is hoped that the GTA TGD No 21 may assist in this process as it reflects an industry developed consensus methodology of a minimum standard that industry may choose to consider or reference.

The following tables outline two of the main sampling methods used by industry for obtaining a representative sample of grain. For full details, and for reviewing the approved sampling method to be used in a range of other scenarios, refer to the detail in this TGD:

### A. Static Sampling from a Road Truck – Minimum Number of Probes based on tonnage in Load.

10 tonnes or less .....	3 L / 3 probes
Over 10 tonnes and up to 20 tonnes .....	4 L / 4 probes
Over 20 tonnes and up to 30 tonnes .....	5 L / 5 probes
Over 30 tonnes and up to 40 tonnes .....	6 L / 6 probes
Over 40 tonnes and up to 50 tonnes .....	7 L / 7 probes
Over 50 tonnes and up to 60 tonnes .....	8 L / 8 probes
Over 60 tonnes and up to 70 tonnes .....	9 L / 9 probes
Over 70 tonnes and up to 80 tonnes .....	10 L / 10 probes

### B. Manual or Mechanical Sampling from a moving grain stream

Criteria	Details	Example
Tonnage to be sampled	Variable	25 tonnes (e.g. 20ft container)
Sampling Rate	Take samples evenly spaced, i.e., 1 - Just after grain movement occurs (1-2t) 3 - Evenly spaced during the movement of the next 22-23t) 1 - Just prior to completion of grain movement (1-2t)	Grain flow rate 150t/hr Sub-sample taken every two minutes.
Sub-sample size	Min. 350g	350g per sub-sample
No. of sub-samples	Min. of 1 sub-sample per 5T	5 sub-samples
Composite sample	Min. 1.75kg	Total 1.75kg

Note: sub-sample size may need to be increased to meet other requirements (e.g., DAWE export rates) however the minimum number of sub-samples should be met (i.e., 1 sub-sample/5t)

## 2 Application

This Technical Guideline Document (TGD) outlines the minimum standard required to obtain a representative sample of grain (sampling). It includes elements of:

- Sampling of static grain such as from a road truck and various storage types;

- Sampling of moving grain from different locations where grain samples are taken;
- Sampler skills required at a minimum, including training qualifications/skills; and
- Positives and negatives of different sampling methods, equipment etc.

This TGD replaces in entirety the previously published TGD No. 5 Static Grain Sampling – Road Truck.

Note that where relevant, alternative sampling procedures used to obtain a sample that is not representative are outlined. The specific nature of these samples, being not representative of the parcel of grain, are outlined.

### 3 Regulations and Industry References to Sampling

#### 3.1 Government Regulatory Controls

##### 3.1.1 Department of Agriculture, Water and Environment

The Department of Agriculture, Water and the Environment (DAWE) is the Australian Government body through Plant Export Operations that provides export inspection and certification services for plants and plant products, including grains. Under the *Export Control Act 2020*, all prescribed goods for which export certification is required should be inspected in an Export Registered Establishment (ERE) and in accordance with the *Export Control (Plants and Plant Products) Order 2020* prior to export. This includes a range of measures outlined in the Plant Export Operations Manual (PEOM) related to sampling such as:

- Inspection of grain by Authorised Officers;
- Sampling for inspection and export certification as per legislated rates, being 2.25l per 33.33t;
- Samples taken for analysis are representative of the consignment and have been taken at the above legislated sampling rate; and
- The samples are clearly traceable to the consignment to be exported.

This TGD has been produced to support industry endeavours to meet those requirements.

##### 3.1.2 National Measurement Institute

The National Measurement Institute (NMI) references the grain industry sampling method for static sampling of a truckload of grain for the purpose of assessment according to grain standards. There are no other regulatory controls on sampling referenced by the NMI. Nevertheless, as sampling has an impact on other aspects of grain quality assessment that falls within NMI regulations, the NMI will continue to keep a watching brief on sampling protocols implemented by industry and may provide input where required.

#### 3.2 Industry Standards

The Australian grain industry Code of Practice for the management of grain along the supply chain (Code) requires a range of measures to be implemented in relation to sampling. For example:

- Procedures are documented for all major processes associated with sampling and testing grain. These documented procedures for equipment maintenance and use, sampling and

testing procedures are outlined in the company Sampling Manual or the Operating Procedures.

- Only sampling equipment suited to its intended purpose is to be used.
- All sampling equipment is to be routinely monitored, calibrated, and checked as relevant, to ensure correct operation as outlined in the company Sampling Manual or the Operating Procedures.
- The frequency of calibration and these checks will vary based on the type of equipment, frequency of use and operating procedures of the company. At a minimum, equipment should be checked annually. During periods of continual use, equipment should be checked more frequently.
- Sampling equipment used may be deemed “for trade”, thus it must meet certain conditions regulated by NMI. Industry is committed to the use of all equipment of a standard for “use in trade” where the outcome of the grain classification process is a payment to the supplier of the grain. All other testing equipment that does not fall under this legislation, such as sampling equipment, is also to be checked under similar processes, as it is the desire of industry to ensure all equipment ultimately used for grain testing is suited to that purpose.
- During the storage period, regular sampling and grain inspection occur, and these processes are documented:
  - Grain should be sampled regularly to determine the presence of live stored grain insects.
  - Industry practices include a range of sampling and testing procedures to determine the chemical residue status of grain.
  - Quality control checks involve assessment of a range of representative samples taken along the supply chain to ensure customer and regulatory requirements will be met on outturn of that grain.
- On outturn of grain:
  - Representative samples are taken, and grain is physically inspected to ensure its quality has been maintained whilst in storage.
  - As required, representative samples are taken according to requirements of the National Residue Survey.
  - Representative samples obtained are retained for a suitable period.

The key to having dependable and representative samples, is sampling often and then thoroughly mixing and/or dividing down the composite sample, so that a suitable size sample is available for assessment.

The equipment and sampling procedures outlined in this TGD are the minimum standard required. Industry is encouraged to continually improve and upgrade equipment and processes as part of a best practice management strategy.

## 4 Sampling Procedures by Equipment and Location

### 4.1 General

There is a range of sampling equipment available for use to obtain a sample from the different locations throughout the supply chain. Each type of sampling equipment has a specific or intended use and is not suited to sampling in every situation. The appropriate sampling device should be used where it is best suited, which depends on a range of factors and whether a representative sample of the grain is required.



A range of sampling equipment used in Australia and their potential pitfalls is described below. This includes a description of the frequency and size of samples for both industry purposes and to meet regulatory purposes.

The following two tables indicate sample size requirements commonly required to be used by industry that are the minimum to be collected for certain scenarios. There may be other requirements (i.e., contractual, DAWE) that over-ride or may be required in addition to these sampling rates.

Table 1. Static Grain in Storage - Lot size and related representative sample sizes required

Lot size (tonnes)	Required minimum representative sample size (in kg)
0 - 1,000	2
1,001 – 2,500	3
2,501 – 4,000	4
4,001 – 5,000	5
5,001 – 10,000*	2 times 5 kg samples to be provided

\*For lots 10,000 tonnes and above, a 5kg sample per 5,000 tonnes is required.

GAFTA Procedure 124 – commonly referred to in contracts where certification of a consignment may be required.

Table 1: Increment sampling - size of lots, number and size of consignments.

Consignment size	Tonnes	0-5000	5001-10,000	10,001 - 25,000	>25,000
Lot size	Tonnes	500	1000	2500	5000
No. of increments per lot	number	min 20	min 30	min 40	min 50
Min bulk aggregate sample per lot	Kilos	20	30	40	50
Max weight of increments	Kilos	1	1	1	1

## 4.2 Sampling from Road Trucks

### 4.2.1 Static Probe Sampling

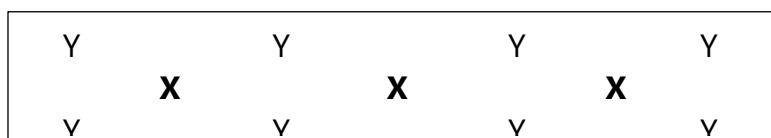
#### 4.2.1.1 General

The method of sampling as outlined below is the same for all cereal commodities. It is listed in each cereal commodity GTA Trading Standard. Therefore, the sampling method forms part of the Standard for that applicable commodity. For other commodity types (e.g., pulses, oilseeds) those standards also refer to and require the same sampling guidelines to be applied, although the level of detail may differ.

### 4.2.1.2 Sampling Locations and Number of Probes

The sample is taken by use of a probe that takes the same amount of grain at each point and throughout the entire depth of the grain in the truck. The locations of these probes are depicted in diagram 1 below:

Diagram 1: Probe Location in Single Delivery Unit



X = primary location of probe for any sized truck, with a minimum of 3 probes per load  
 Y = placement of probe for truck sizes requiring above the minimum of 3 probes per load. Probes are placed systematically throughout the load.

Following the full probing pattern as depicted in diagram 1 will not always be physically possible. In these instances, it is recommended that probes are to be taken evenly spread out along the length of the unit as close to the centre as possible. The probe should be inserted into the load in as close to a vertical position as safely as possible. For practical purposes, it is recognised the probe may be inserted into the grain (on one side of the truck) at an angle to obtain a grain sample at depth on the other side of the truck.

The following minimum sampling guidelines apply:

- Ensure that at least 3 litres (L) of grain is collected from each truck unit tendered for delivery.
- The number of probes depends on the quantity of grain tendered for delivery, with larger loads requiring a greater number of probes as outlined in diagram 2 below:

Diagram 2: Number of Probes based on tonnage in Load.

10 tonnes or less .....	3 L / 3 probes
Over 10 tonnes and up to 20 tonnes .....	4 L / 4 probes
Over 20 tonnes and up to 30 tonnes .....	5 L / 5 probes
Over 30 tonnes and up to 40 tonnes .....	6 L / 6 probes
Over 40 tonnes and up to 50 tonnes .....	7 L / 7 probes
Over 50 tonnes and up to 60 tonnes .....	8 L / 8 probes
Over 60 tonnes and up to 70 tonnes .....	9 L / 9 probes
Over 70 tonnes and up to 80 tonnes .....	10 L / 10 probes

Note that legal weight restrictions will apply to the tonnage permitted in individual truck units.

The amount of grain obtained each time the probe is inserted into the grain will depend on the method used and type of probe. This may alter the quantity obtained from that outlined above.

As outlined in diagram 1, the probes are to be placed systematically into the load into the general areas as indicated. In undertaking this approach:

- The probing should avoid unrepresentative areas of the load that do not appear to be uniform throughout the load such as an area containing high chaff levels. For example, if the probe was placed into this area, the sample obtained would contain levels of chaff that are not reflective of the overall average of the load.

Each truck unit tendered for delivery is to be probed separately:

- If the grain in each truck unit is of the same quality, then the samples may be combined and only one assessment should be made for the entire load. This is the most common method of sampling a truck with more than one unit. Variations to this policy may exist for some grain types.
- If on inspection the vehicle has more than one unit with grain that appears to be of a different quality, then an individual assessment should be made for each unit. This also applies where it is requested by the deliverer of the grain that each unit be separately assessed. Therefore, a separate sampling and assessment process is to apply for each truck unit.

#### 4.2.1.3 Sampling Equipment

There is a range of sampling equipment used by industry to obtain a representative sample. Industry is free to use any sampling equipment provided it generates a representative sample of the truckload of grain.

The most common probes in Australia are manual, vacuum, or pneumatic sampling devices.

##### 4.2.1.3.1 Manual Probe

The manual probe spear is made of aluminium or steel and has two tubes:

- The inner tube is divided into compartments.
- The outer tube has slots that match the compartment openings of the inner tube.

Probes come in various lengths, generally 1.5m, 1.8m or 2m. Depending on the probe length and sampling platform height, these shorter probes may not reach the bottom of large trucks.

When the tubes are aligned, grain enters the compartments of the probe.

The probe compartments should open sequentially from the bottom to the top so that grain enters the tube from the bottom first (if it opened from the top first, grain from the top of the load would enter the probe and fill it. No grain from the bottom of the load would be collected). Some older manual probes open all slots at the one time. For those probes that open sequentially from the top, it is recommended that these probes are not used.

The basic operation is as follows:

- Ensure the probe is clean and empty.
- Close the slots on the probe.
- Insert the probe vertically into the grain to its full depth.
- Hold the outer probe compartment and open the inner tube.
- After the probe fills (hear grain flow ceases) fully close the probe.
- Remove the probe from the load and upend the probe over a clean plastic bucket. The grain will flow from the open end of the probe into the bucket.

##### 4.2.1.3.2 Vacuum Probe

A vacuum probe is an air assisted sampling instrument. The probe is hollow. The probe is connected to the sample collection device by a flexible hose through which the grain flows. Grain flows into the probe and into a collection device located on the sample stand or in/near the sampling and testing location. The flexible hose allows the probe to be moved to enable the probing to occur over the entire area of the truck, generally without moving the truck.

Vacuum sampling devices are varied in their design. The two main criteria required for proper use are:

- The suction is of sufficient strength to draw the sample of grain from the bottom of the probe into the sample collection device without altering the grain composition.
- The probe is sufficiently robust and long to be inserted to the bottom of the load.

The basic operation is as follows, noting that depending on the type of unit, the following procedure may vary slightly:

- Ensure the probe and flexible hose is empty of grain before turning on the vacuum unit and inserting the probe in the load.
- The probe should be inserted into the load and removed from the load in one smooth action.
- Insert the probe into the top 30cm of the load.
- Place hand over the hole in the top of the probe to create suction.
- Insert probe into grain keeping your hand over the exposed hole.
- Push the probe into the load at a constant rate until it reaches the bottom.
- Upon reaching the bottom of the load, immediately remove your hand from the hole to prevent suction removing an excessive amount of grain from the bottom of the load compared to other locations throughout the grain bulk.
- Only operate the probe when pushing the probe into the load i.e., grain should not be taken from the load when withdrawing the probe from the load.
- Remove the probe from the load and wait until all grain has exited from the probe and flexible hose and has entered the sample collection device. Placing your hand over the hole, or straightening the flexible hose, may assist in removing any remaining material in the probe or hose.
- Depending on the probe type and the technique of the sampler, the probe should be in the grain no more than 4-5 seconds when inserting the probe into the load and the same when removing the probe from the load. Do not keep the probe on the bottom of the load.
- Ensure no material remains in the probe or flexible hose before turning off the unit.

#### 4.2.1.3.3 Pneumatic Probe

These types of grain probe are generally recognised as the easiest method to take a sample from any sized truck unit. They may be pneumatically or hydraulically operated. There are various types available, with many operating with some form of telescopic arm that can extend or retract the core sampling tube. They are often able to be turned horizontally and raised or lowered vertically, enabling access to the truck without requiring the truck to be repositioned.

The basic operation is as follows, recognising various models may differ:

- Some form of remote control operates the sample probe.
- The core tube is forced vertically downward into the load. As this occurs, due to the downwards pressure grain enters the probe.
- Grain is pushed upwards into the inner chamber of the core tube as the probe is pushed downwards into the grain.
- Grain is moved to the receiving chamber for collection.
- The size of sample taken depends on the model. Once set, this is consistent each time the probe is inserted into the load.
- These units operate on the principle that only the grain that is forced into the core sample tube is taken as the sample.
- Given most units operate mechanically, the probe inserted into the truck takes a sample through the entire depth of the load i.e., to the bottom of the truck.

#### 4.2.2 Running Sample from a Road Truck

Where a road truck cannot be safely or adequately probed by the above method, a running sample may need to be obtained from the truck during discharge of the grain into the receival hopper or other discharge area. This may present additional WH&S issues which should be taken into consideration.

The procedure to be used is outlined in 4.9 “Falling Grain Stream Manually”.

## 4.3 Vertical Silo

### 4.3.1 Description

A vertical storage is referred to by a number of terms including vertical cell, vertical bin or vertical silo. For the purposes of this TGD it will be referred to as a vertical silo. It may:

- Be constructed of any material (i.e., steel, concrete).
- Be in any location pre-farm gate or post-farm gate.
- Be of any size, ranging from a few tonnes capacity to 10,000 tonnes or more.
- Be of differing designs that impact on the ability to take a sample
  - Flat bottom
  - Cone bottom
  - Sloping bottom
- Not have any designated sampling points, requiring sampling to be conducted as grain is loaded into or discharged from the vertical silo.
- As with all sampling, each vertical silo should be uniquely numbered to ensure traceability of samples collected to that storage unit.

### 4.3.2 Sample Collection Method

There are two options for sampling a vertical silo as described below.

#### 4.3.2.1 During In-loading or Out-loading

This method is generally preferred over attempting to take a sample from grain held within the vertical silo for a number of reasons outlined below.

As the grain is loaded into or discharged from the vertical silo:

- During in-loading, generally this occurs via unloading grain from a transfer unit such as a field bin (i.e., chaser bin), truck or train.
- Out-loading generally occurs to a transport vehicle such as a road truck, train or ship.
- Samples should be taken at consistent and regular intervals to ensure the sample is representative of the entire bulk.
- The sampling rate should be determined prior to commencing in-loading or discharge of the grain from the vertical silo. This is determined based on a range of factors including:
  - Amount of grain that is being moved
  - Type of equipment you are using
  - How much sample you need
- If grain is being loaded into a vertical silo from more than one transfer unit, the sampling rate listed in this TGD should be undertaken taking into account the above factors and the number of transport units.
- Each transfer unit should be sampled separately based on the sampling plan designed prior to commencement of loading the vertical silo.

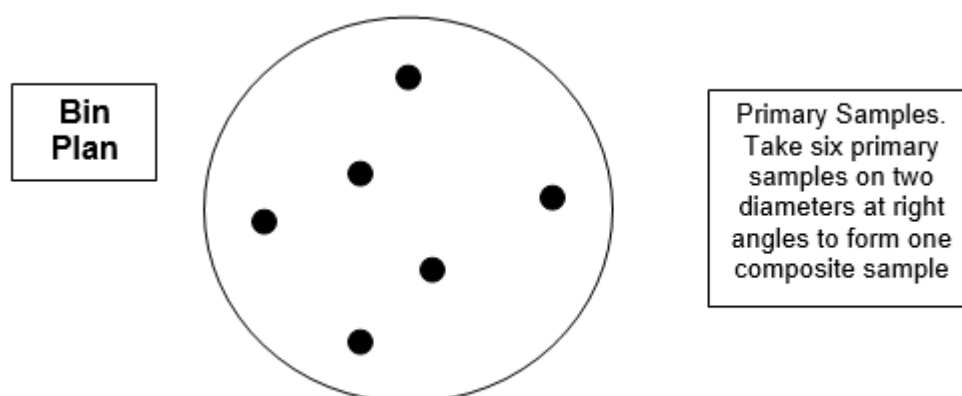
The process of sampling involves sampling as per the process outlined in 4.9 “Falling Grain Stream Manually” in this Technical Guideline Document. Note however that sampling as per 4.2 “Static Truck Probe Sampling” may be available and thus be the preferred option and more likely to provide a representative sample.

**Note:** the time to empty the transfer unit should be estimated in order to determine the required collection of samples evenly spaced over the period grain is being discharged.

#### 4.3.2.2 While in Storage – Static Sampling

Unless the tonnage held in storage is very small (i.e., a small field bin of limited capacity), this procedure generally does not provide a sample that is representative of the bulk. This sample obtained is generally considered only suitable for checking for live stored grain insects. All Workplace Health and Safety regulations should be complied with (e.g., access to the grain surface, clearance of any fumigant from the storage):

- A sample may be taken by opening a valve at the bottom of the bin (or from an auger in the bin) and allowing some grain to be released.
- A sample may be taken from the surface of the grain at the top of the bin:
  - A minimum of 6 sub-samples is required.
  - The sub-samples should be taken by manual probing where possible, alternatively scooping grain from the surface may occur however this does not provide the same degree of accuracy as probing. The primary samples should be taken according to the sampling pattern below:



#### 4.3.2.3 While in Storage – Turning Grain on Itself

This method if done correctly will provide a more representative sample than static sampling described above. This method:

- Requires discharge of the grain from the bottom of the silo and in-loading at the top.
- Requires the ability to move the grain in this manner. Many vertical silo configurations do not enable this to be done without a series of augers and / or conveyors.
- May involve moving the entire grain parcel from one vertical silo to another storage.
- Is time consuming and generally costly to conduct.
- The representative nature of the samples collected depends on the size of the structure and rate of sampling.
- The method and location of sample collection depends on the discharge method.
- Method of collecting individual sub-sample from the grain stream is to be as per that outlined in 4.9 “Falling Grain Stream Manually”.
- The sampling rate should be calculated based on the following minimum rate, but will vary based on the flow rate of grain:

Sampling Type	Criteria	Requirement	Example
Manual	Silo Tonnage	Variable	2,000t grain in storage
	Sampling Rate	Bin turned for min. 20 minutes. No maximum. Take samples evenly spaced, approximately every 30 seconds, from the commencement of turning to completion.	Bin turned for 20 minutes Grain flow rate 200t/hr Sub-sample taken every minute
	Sub-sample size	Min. 100g each	100g per sub-sample
	No. of sub-samples	Min. 10 per 1,000t of grain. Total number depends on grain flow rate	20 sub-samples
	Composite sample	Min. 1kg to be available	Total of 2kg
	Method of obtaining sub-sample	Sample cup placed into entire grain stream as per 4.9	Sample cup placed into entire grain stream as per 4.9

Note: for silos smaller than 1,000t, minimum number of sub-samples is to be 10, with the number to be varied to obtain the minimum composite sample.

### 4.3.3 Key Issues to Consider

A representative sample requires the sampling of the entire length/core of a vertical silo.

Taking a static sample from a silo, no matter how much grain is in the silo, will never be representative.

Samples should only be collected when safe to do so:

- Without appropriate ladder cages and other safety devices, never climb onto a vertical silo.
- When entering a silo from the top, always follow safety requirements including ensuring the silo is gas free.
- Always use appropriate WHS equipment (e.g. harness, ropes, in-case of engulfment, falls etc.)

## 4.4 Horizontal Shed

### 4.4.1 Description

This sampling procedure involves sampling a static grain bulk located in a horizontal shed. Grain may be at varying depths, thereby preventing obtaining a sample from grain near the floor region with a hand-held probe. In those situations, where a sample is required from the full profile depth of the grain, a portable vacuum probe may be required.

As with other storage types where grain is held in a static situation, it is preferable to obtain a representative sample of the grain during the in-loading or out-loading process.

Frequently, as per industry requirements, grain held in storage is inspected regularly to ensure the condition has not deteriorated (i.e., moisture ingress, mould development, vermin entry/contamination or insect infestation). For these inspections, full profile sampling is not required, and quality changes can usually be detected in the surface layers using a hand-held probing technique.

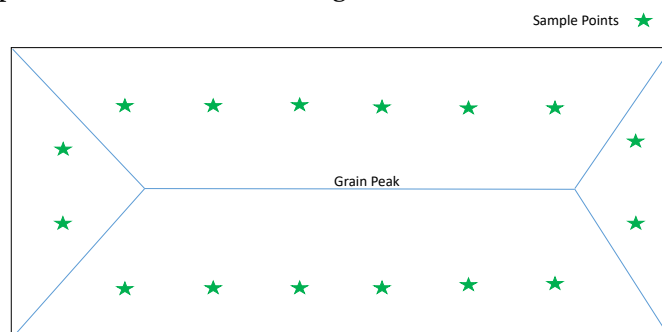
**NOTE:** Workplace Health and Safety requirements may prevent walking on grain in a horizontal shed storage or obtaining a sample from the horizontal shed. This may require obtaining a sample only while the sampler is on the ground level.

#### 4.4.2 Sample Collection Method

To collect samples from any sized horizontal shed for the purposes of obtaining a sample the following procedure applies using a standard hand-held probe (i.e., 1.5m, 1.8m or 2m):

- Ensure it is safe to enter the storage and take samples.
- Determine the tonnage held in the shed.
- Samples are to be taken from the storage all around the sides of the peak area as per the diagram below.
- Samples should not be taken from the peak area unless specifically required such as checking for insect infestation.
- Sampling should occur via walking over the surface of the grain, hence appropriate personal protective clothing should be worn, including a dust mask where required.
- Each probe should be placed in the grain approximately halfway down the side of the storage unit from the grain peak.
- This sampling should also include probing the end faces of the storage unit.
- A 1kg sample should be obtained for every 1,000t of grain held in the shed. This may require several probes every few metres to be collected, noting each probe quantity varies depending on its length but should average approximately a minimum of 500 grams. Note this also varies by commodity and its quality.
- Where required, the location of each composite sample (1,000t) should be noted.

The general sampling pattern is outlined in the diagram below:



Sampling Type	Criteria	Requirement	Example
Probe	Storage Tonnage	Variable	10,000t grain in storage
	Sampling Location & Rate	Min. 2 per 1,000t of grain. Take samples evenly spaced, around peak approx. half way down grain slope	Sub-sample taken every 3m, totalling 20
	Sub-sample size	Min. 500g each	1kg per sub-sample
	No. of sub-samples	Total number depends on tonnage in storage	20 sub-samples
	Composite sample	Min. 2kg to be available	Total of 20kg
	Method of obtaining sub-sample	Various probe types	Probe grain to depth of 1.8m manually



### 4.4.3 Key Issues to Consider

It is difficult if not impossible to obtain a truly representative sample of the grain stack unless appropriate sampling procedures are implemented.

Difficulties with sampling grain in a horizontal shed include:

- Not all areas of the shed may be accessible.
- Access to the grain may not be available due to workplace health and safety issues.
- In general, to determine the quality of the grain probing the full depth of the grain bulk is not required.
- Where probes are required to be used that can reach the entire depth of the grain bulk, these are generally:
  - Difficult to use due to the length of probe required.
  - Resource intensive due to the effort and time required to reach the entire depth of the grain and take the required number of samples in the grain bulk.
- Depending on the method of filling, troughs in the grain stack may arise due to infrequent movement of the tripper. This may result in lighter material accumulating in those areas. In those situations, a sample should not be taken as it does not represent the grain in the bulk of the storage.

## 4.5 Horizontal Bunker

### 4.5.1 Description

This sampling procedure involves sampling a static grain bulk located in a horizontal bunker. Grain is generally at varying depths, thereby preventing obtaining a sample from grain near the floor region with a hand-held probe. In those situations, where a sample is required from the full profile depth of the grain, a portable vacuum probe may be required.

As with other storages where grain is held in a static situation, it is preferable to obtain a representative sample of the grain during the in-loading or out-loading process.

Frequently, as per industry requirements, grain held in storage should be inspected regularly to ensure the condition has not deteriorated (i.e., moisture ingress, insect infestation). For these inspections, sampling is generally not required and quality changes can usually be detected in the surface layers via walking on the stack.

**NOTE:** Workplace Health and Safety requirements may prevent walking on a bunker storage or obtaining a sample from the bunker. This may require obtaining a sample only while the sampler is on the ground level.

### 4.5.2 Sample Collection Method

To collect samples from any sized horizontal bunker for the purposes of obtaining a representative sample or to determine the quality of the grain, the procedure as outlined for sampling “Horizontal Sheds” should be used, with the following variations potentially available:

- To obtain a sample, a small slit should be cut in the bunker covering tarpaulin. Following obtaining the sample, the slit should be sealed using an appropriate bunker tarpaulin patch.

- Alternatively, the bunker configuration may allow sampling from the ground via the external bunker walls. In this scenario walking on the surface of the bunker is not required, nor is cutting of the tarpaulin thereby preserving the integrity of the tarpaulin.

#### 4.5.3 Key Issues to Consider

It is considered very difficult (and potentially dangerous) to take representative samples from a horizontal bunker:

- As noted, WH&S rules of the company operating the bunker may prevent this from occurring.
- The bunker storage may be under fumigation.
- The covering tarpaulin may be wet or slippery, preventing a person from walking onto the bunker surface in a safe manner.
- The covering tarpaulin may be loose and thus move/flap in the wind, preventing a person from walking onto the bunker surface.
- The bunker sides may be raised all around the bunker, preventing a person from gaining access to the surface of the bunker without some form of lifting device.

## 4.6 Rail Wagon

### 4.6.1 Description

This sampling procedure involves sampling a rail wagon either:

- While grain is held in the rail wagon. Grain is generally at varying depths, thereby preventing obtaining a sample from grain near the floor region with a hand-held probe. In those situations, a sample representing the full profile of the grain cannot be obtained; or
- As with storages where grain is held in a static position, it is preferable to obtain a representative sample of the grain during the loading or of discharge of a rail wagon.

### 4.6.2 Sample Collection Method

To obtain a sample from a static rail wagon:

- A hand-held probe is to be inserted into the top of the rail wagon.
- The procedure as outlined in 4.2 “Static Sampling of Road Trucks” is to be used.
- **Note:** workplace health and safety rules may prevent this sampling from occurring.

To obtain a sample from grain being loaded into a rail wagon:

- Determine if workplace health and safety rules prevent this sampling from occurring.
- Determine if there is a suitable safe location where sampling can occur.
- Follow the procedure for sampling as per 4.9 “Falling grain stream manually”.
- There may be mechanical sampling devices available for this purpose or manual sampling may need to occur.

To obtain a sample from grain discharged from a rail wagon:

- Following the procedure for sampling as per 4.9 “Falling grain stream manually”.
- There may be mechanical sampling devices available for this purpose or manual sampling may need to occur.

### 4.6.3 Key Issues to Consider

It is considered very difficult (and potentially dangerous) or prohibited to take representative samples from a static rail wagon.

During loading or discharge of a rail wagon, sampling may not be able to be done adequately given:

- The generally high rate meaning:
  - A sample across the grain cannot physically be taken manually.
  - There is insufficient time to collect the required number of samples.
- Adequate areas for access may not be available.

## 4.7 Belt, Auger, Grain Stream Manual Sampling

### 4.7.1 Description

Manual sampling can be conducted by the following, involving a number of different scenarios:

- Horizontal (or near) grain stream involving a sampler taking a sample manually from a location where:
  - The grain stream changes direction; or
  - The grain moves from one type of grain handling equipment to another i.e., grain is in free fall for a short period of time only.
- Off the conveyor belt involving manually taking a sample from the moving grain stream as it is transferred from one location to another.

Either of these scenarios are the preferred method of sample collection where manual sampling is required to be conducted. In all cases, as noted previously, automatic sampling is preferred over manual sampling.

The equipment moving the grain or involved in this system may include:

- Conveyor belts;
- Screw augers;
- Drag chains;
- Or a range of combinations of the above in various locations.

**NOTE:** Never attempt to obtain a sample from a screw auger, drag chain conveyor or similar equipment. Only sample where grain is discharged or prior to entry of grain into this equipment and appropriate Workplace Health and Safety regulations and equipment allows this to occur.

There may be one or more pieces of grain handling equipment used in the process of moving grain under this scenario. This equipment is commonly used to load grain into a road truck, silo or container for export. Samples may be taken from any of the transfer points or off any equipment used to transfer the grain, provided it is safe to do so.

### 4.7.2 Sample Collection Method

The rate of sampling and thus representativeness of the sample depends on the rate of taking a sample by the sampler and the amount of sample taken each time.

The process of sampling involves:

- Suitable access to the grain stream.
- Manual collection of samples of grain from across the entire grain stream at regular and even intervals:
  - A minimum number of five sub-samples to be collected per 25t.
  - Samples are to be collected during the entire grain movement process, being at evenly spaced intervals.
- A measuring jug, or other suitable device to draw a representative sample is required to be placed in the grain stream where manual sampling occurs.
- A suitable sized and robust sample cup for collection of each sample as it passes through the grain stream. Depending on the configuration of the conveyors etc., this may need to be on an extendable pole or have a long handle of suitable sturdiness.
- A collection bucket for all sub-samples obtained during the sampling.

The following table summarises sampling rates to be used:

Sampling Type	Criteria	Details	Example
Manual	Tonnage to be sampled	Variable	25 tonnes (e.g. 20ft container)
	Sampling Rate	Take samples evenly spaced, i.e., 1 - Just after grain movement occurs (1-2t) 3 - Evenly spaced during the movement of the next 22-23t 1 - Just prior to completion of grain movement (1-2t)	Grain flow rate 150t/hr Sub-sample taken every two minutes
	Sub-sample size	Min. 350g	350g per sub-sample
	No. of sub-samples	Min. of 1 sub-sample per 5T	5 sub-samples
	Composite sample	Min. 1.75kg	Total 1.75kg

Note: sub-sample size may need to be increased to meet other requirements (e.g., DAWE export rates) however the minimum number of sub-samples should be met (i.e., 1/5t)

The following describes the procedure for obtaining the sub-sample from a conveyor belt (for other devices a similar procedure may apply) moving grain to load a truck or container:

- The sampler faces in the direction opposite to which the conveyor belt is moving (i.e., facing away from the truck/container being loaded).
- The sample cup is held over the moving conveyor belt at a point slightly away from the sampler with the open end facing the direction where the grain is coming from.
- The sample cup is rapidly inserted into the moving grain stream to cover more than half of its diameter by pushing down rapidly.
- As the grain will move the sample cup in the direction of the grain is travelling in, the sampler is to allow the sample cup to move in the direction of the conveyor belt to a point where it reaches just past the sampler standing position (as this occurs, turning to follow the direction of the grain stream may assist this process).
- When the sample cup has passed the samplers standing position, the sample cup is to be removed from the grain stream by raising it vertically. It should be raised vertically with the opening facing upwards to prevent spillage.
- Where the sample is obtained as the grain moves from one conveyor belt or auger onto another, the sample procedure may need to be modified slightly but the same principles outlined above apply.

### 4.7.3 Key Issues to Consider

- This system is considered to be time-consuming and often not very economic where high flow rates are used, or a large tonnage of grain needs to be sampled.
- Staff training and adherence to procedures is critical to ensure sampling is representative and consistently applied during loading. The measuring jug should be placed into the grain stream correctly to obtain a representative sample:
  - If on the surface from the centre of the grain stream, being towards the top surface of the grain, this potentially leads to higher Foreign Material as this area is where lighter material in the grain tends to accumulate.
  - If on the edge of the grain stream, it generally provides a higher result for lighter and smaller material, being Foreign Material and “Screenings”. This is a consequence of this material being lighter than the full grain kernels, hence it tends to move to the outside and on top of the heavier full grain.
  - A sample should be taken across the entire grain stream to ensure the closest edge, centre and outer edge of the grain stream are sampled.
- Full access to the entire grain stream may not be achievable due to obstructions, hatches or the sampling point is low to the ground:
  - If the belt cover is closed to some degree, as many are, the sampler will not be able to obtain a sample across the entire grain stream i.e., will have difficulty in accessing grain moving along the belt.
  - This may also lead to grain spillage at the sampling point.
  - In this case a fully representative sample cannot be obtained.
- There may be insufficient space between the hopper and grain flowpath for the sampler to obtain a sample across the entire grain stream.
- For some equipment (i.e., augers, drag chain conveyors), adequate access to sample the grain may not be achievable and attempting to obtain a sample may be a considerable (or prohibited) Workplace Health & Safety issue.
- The flow rate of grain needs to be considered before sampling commences. This determines the frequency of obtaining a sample.
- Any minor change in the flow rate of grain may significantly impact on the rate at which samples are required to be obtained. Communication with the conveyor operator is vital to ensure the rate of sampling varies as required.
- With high rates of grain movement, it may be difficult to move the sample cup across the entire grain stream and take the required sample (i.e., the sample cup may fill immediately after insertion into the edge of the grain stream).
- Is labour intensive and the sampler needs to be present at regular intervals throughout the grain movement process to obtain the required number of sub-samples.
- The configuration of the conveyor belt will impact on the ease of obtaining the sample across the entire grain stream:
  - For conveyors that are narrower in design and more tubular, grain is more concentrated than for the flatter and wider conveyor type.

A low flat conveyor belt will require the collection cup to be in the grain stream for a longer time than a narrower but deeper conveyor belt (tubulator type construction) to collect the sample across the entire grain stream.

## 4.8 Belt, Auger, Grain Stream Semi-Mechanical Sampling

### 4.8.1 Description

This system is not referring to a fully automated system as described in section 4.10.

These systems can generally be described as sampling of the grain stream using some form of a mechanical device. The sampling apparatus is either commercially available or self-designed and/or self-built. A number of systems of differing design and location are used. These may include design principles such as but not limited to:

- A simple tap located on the equipment used to move the grain. Once opened, grain flows from the grain stream into a collection box (e.g., a tap may be on the side or bottom of an auger).
- A sample cup that enters the grain stream and collects a sample.
- An open pipe that enters the grain stream and collects a sample. The pipe may be fixed in position or rotates to collect a sample from the grain stream.
- Opening of a valve on the side of the auger/conveyor equipment to allow grain from the grain stream to be collected. Once opened the grain may flow by gravity or be removed by vacuum.

For all these systems:

- The location of the sampling device varies. In many situations the location is set based on the practicalities of allowing easy access.
- Due to their design, the sample obtained is generally from a particular area of the flow-path only, with the location of the sampling device determining which part of the grain stream is sampled.
- These devices are generally an attempt to automate the process and not rely on manual collection of a sample by a sampler. Over time the system may be updated to improve the accuracy of the sample (representativeness by ensuring the sample taken is more across the grain stream than at a specific location).
- The main benefit of these systems is that to some degree, there is mechanisation involved.

#### 4.8.2 Sample Collection Method

The process of sample collection involves:

- Taking a sample continuously or at intervals determined by the operator.
- The device being operated either manually or via an automatic timer.
- The frequency of operation and the time the collection process occurs depends on the unit design.
- The settings may or may not be able to be varied based on the loading rate.
- Once the sample is removed from the grain stream, the sample is collected in a collection box either manually or automatically.
- A suitable sized and robust sample cup, pipe opening etc. for collection of each sample as it passes through the grain stream.

The following table summarises sampling rates to be used, for example for a 25t container:

Sampling Type	Criteria	Details	Example
Semi-Mechanical	Tonnage to be sampled	Variable	25 tonnes (e.g. 20ft container)
	Sampling Rate	Take samples evenly spaced, i.e., 1 - Just after grain movement occurs (1-2t) 3 - Evenly spaced during the movement of the next 22-23t)	Grain flow rate 150t/hr Sub-sample taken every two minutes.

		1 - Just prior to completion of grain movement (1-2t)	
	Sub-sample size	Min. 350g	350g per sub-sample
	No. of sub-samples	Min. of 1 sub-sample per 5T	5 sub-samples
	Composite sample	Min. 1.75kg	Total 1.75kg

Note: sub-sample size may increase however the minimum number of sub-samples should be met (i.e., 1/5t)

### 4.8.3 Key Issue to Consider

While systems vary, these systems are generally regarded as providing a less representative sample of grain given, they generally obtain a sample from a portion of the grain stream only i.e., not across the entire grain stream. As with most systems, a more frequent but smaller sample generally provides a more representative sample. The type that relies on the operator to time the sample collection may not provide a timely sample depending on the operator vigilance.

These devices are often used given restrictions on access to conveyancing devices and ability to take a sample. Thus, they may be located in an area for practical reasons rather than a location that provides the most representative sample. Therefore, the use of these devices at the required frequency may not occur as it is “too difficult” (or worse still a Workplace Health and Safety issue) to continually operate them.

They may or may not be operated mechanically. If manually operated (e.g., operator should press a button), they can only function as well as the operator and can be considered to be labour intensive. Thus, if the sampler is distracted, conducts other tasks during loading, or does not comply with the required frequency of sample collection, the sampling process may not be as rigorous as required and the risk of not obtaining a representative sample increase.

#### Tap System

General observations for the tap type of sampling indicate:

- Samples obtained by opening a tap on the bottom or side of an auger used to move the grain will only collect the initial portion of that grain that falls into the collection area at that specific point in time. This needs to be done frequently in order to collect a representative sample for the entire portion of grain moved.
- The length of time the tap is turned on has an influence over the representativeness of the sample collected.
- There is a minimal amount of grain held in the tap device before release of the sample, hence the grain in the auger at the time of sample collection is the quality determinant.
- If the tap is located at the bottom or side of the auger, a higher amount of smaller material is collected using this system than with a manual collection process.

#### Cup System

Some conveyor belts are fitted with a rotating arm with a cup attached:

- When the arm rotates, it enters the conveyor belt and takes a sample. However, this is generally a particular spot on the belt and not across the grain stream.
- With these systems, a sample is generally only taken at the point where the sample cup comes into contact with grain and moves into the grain. Thus, in most instances the sample is not taken across the entire grain stream but from that portion of the sample that is located in the vicinity of the sampling cup device.
- Depending on the system, the sample cup may fill immediately after insertion into the edge of the grain stream. This occurs for various systems where a sample cup enters the stream at one

point but does not move across the entire grain stream. Hence a fully representative sample may not be taken.

#### Open Pipe

- A pipe may be permanently inserted in the grain stream or may be inserted at a frequency set by the operator (either manually or automatically).
- In most cases the sample collected is from a particular spot in the grain stream and hence is not representative.
- A pipe with holes that open, or if the pipe rotates to collect sample is more representative as these pipes can be placed in such a way to obtain a sample across the entire grain stream.

#### Valve System

As with the cup system, unless the valve removes grain from across the entire grain stream, the sample obtained is only from a portion of the grain stream and not considered representative.

### 4.9 Falling Grain Stream Manually

#### 4.9.1 Description

This process may involve sampling under a number of different scenarios, including:

- Grain leaves the grain discharge area (i.e., spout, end of belt, end of auger, back of truck etc.).
- Grain moves from one conveyance to another.
- Grain moves from one direction to another.

In all scenarios, grain is seen to be “falling” to some extent.

#### 4.9.2 Sample Collection Methods

The process of sample collection involves:

- Suitable access to the grain stream.
- Manual collection of samples of grain from across the entire falling grain stream at regular and even intervals.
- A suitable sized and robust sample cup for collection of each sample as it passes through the grain stream. Depending on the configuration of the spout or its location, this may need to be on a pole or have a long handle of suitable sturdiness.
- A collection bucket for all sub-samples obtained.

The following table summarises sampling rates to be used:

Sampling Type	Criteria	Details	Example
Manual	Tonnage to be sampled	Variable	25 tonnes (e.g. 20ft container)
	Sampling Rate	Take samples evenly spaced, i.e., 1 - Just after grain movement occurs (1-2t) 3 - Evenly spaced during the movement of the next 22-23t 1 - Just prior to completion of grain movement (1-2t)	Grain flow rate 150t/hr Sub-sample taken every two minutes
	Sub-sample size	Min. 350g	350g per sub-sample
	No. of sub-samples	Min. of 1 sub-sample per 5T	5 sub-samples



	Composite sample	Min. 1.75kg	Total 1.75kg
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Note: sub-sample size may increase however the minimum number of sub-samples should be met (i.e. 1/5t)

The process of obtaining each sub-sample is as follows:

- The sampler faces the load spout (or other device as applicable where grain flows from).
- The sample cup is inserted into the falling stream of the commodity.
- As it is generally not possible to sample across the entire grain stream and collect a representative sample of this grain, the falling stream is to be sampled using the following pattern throughout the entire sampling process:
  - Centre of grain flow
  - Left-hand side of the grain flow (a third inward from the edge of the grain stream)
  - Right-hand side of the grain flow (a third inward from the edge of the grain stream).

#### 4.9.3 Key Issues to Consider

- A sample should be taken across the entire grain stream to ensure a representative sample is taken. This is often difficult given:
  - The location of the spout may be at height and difficult to gain access to.
  - The spout may be relatively wide and thus not suitable for a sample to be obtained across the entire grain stream.
  - Given that the spout may be at height and of a reasonable distance from the elevator/bin where grain is discharged, often load rates are relatively high. In this scenario the force of the grain makes taking a representative sample difficult and often only part of the grain stream is sampled (the part closest to the sampler where the sample cup enters the grain stream).
- Full access to the entire grain stream may not be achievable for Workplace Health and Safety reasons.
- The rate of obtaining a sample needs to be considered before loading commences. This determines the frequency of obtaining a sample.
- As with other manual sampling systems, this system is labour intensive, and the sampler needs to be present at regular intervals throughout the loading process to obtain the required number of sub-samples. This is an added burden given sampling often could occur at heights involving scaling ladders/towers etc.

### 4.10 Grain from a Sprout Mechanically

#### 4.10.1 Description

Generally, these devices include:

- A crosscut sampler that moves across the entire grain stream; or
- A diverter that is permanently in the grain stream and diverts a portion of the grain stream to the sample collection point.

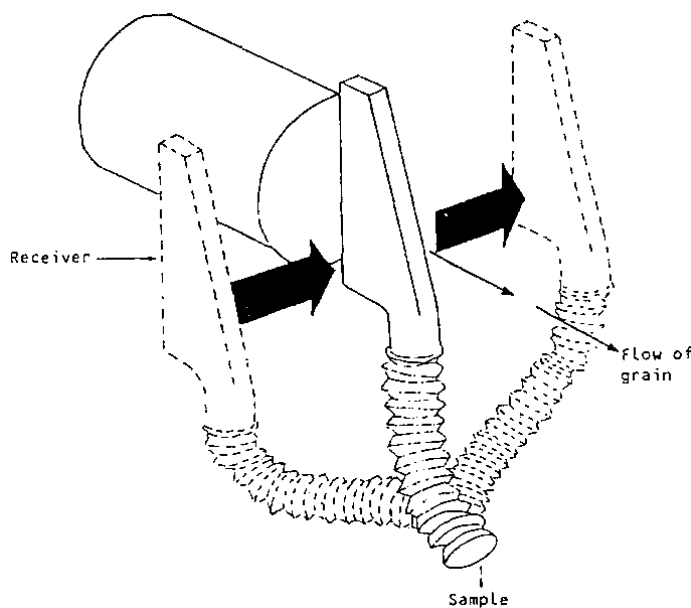
These systems are generally used for bulk loading at export terminals. The units may be located at any point prior to loading but are generally just below a weigher or discharge bin, or an elevator. By being in an elevated location, gravity generally enables the collected sample to flow down a sampling tube, through a series of dividers if required, into a collection bin located near ground level. Generally, the sampling system is fully enclosed.

### Cross-cut Sampler

A cross-cut sampler is a mechanical device that moves across the entire grain stream at regular intervals and takes a sample across the entire grain stream during the loading process.

The sampling collection tube (Pelican) moves across the entire grain stream at rates able to be modified by the operator based on grain loading rates. The entire system should be constructed of materials and designed in such a manner in order to operate under all conditions (varying load rates etc.).

A typical Diverter-Type unit is pictured below (courtesy FAO)



### 4.10.2 Sample Collection Method

The process of sample collection involves:

- The pelican speed moving through the grain stream and the frequency of this sampling should be set prior to loading commencing. These settings vary based on the loading rate.
- The pelican moves through the grain stream at a constant rate. This may either be set automatically or require an operator to control the interval between sampling the grain stream.
- The size of the pelican opening should be sufficient to receive sample of the commodity being sampled.
- The sampling system should be self-cleaning to prevent contamination from one commodity to another.
- Where sample collection is undertaken to meet the *Export Control Act* regulations as controlled by DAWE, the rate of sampling is 2.25L / 33.33t.

### 4.10.3 Key Issues to Consider

- There are various types of these units available on the commercial market. The main benefits of these type of devices such as the following can only be achieved if the units are adequately installed, maintained and calibrated:

- A standard rate of sampling;
- Sampling occurs across the entire grain stream path;
- Equipment can be adjusted based on the rate of grain loaded; and
- Equipment can be calibrated and verified.
- These units may require extensive site modifications in order to install them in the appropriate location. There may not be sufficient infrastructure to enable their installation.
- These units are relatively costly compared to other manual systems.
- Human error is generally removed from the sampling process.
- As the process is automated, the sampler may be able to conduct other tasks provided the key sampling tasks are undertaken as required.
- A secondary sampler may be required depending on the flow rate of grain being loaded, given excessive grain may be received in the collection box.

## 5 Seed for Sowing

Where seed is sold on the basis of the ISTA International Rules for Seed Testing (ISTA Rules):

- ISTA rules apply and seed should be sampled by an ISTA accredited sampler. Sampling does not have to occur at an Export Registered Establishment (ERE) but should be undertaken by an ISTA accredited sampler. Please refer to the relevant rules published by ISTA.

Where seed is not sold on the basis of the ISTA International Rules for Seed Testing (ISTA Rules):

- Seed can be sampled by an ISTA or ASA (Australian Seeds Authority) accredited sampler. Sampling does not have to occur at an ERE but should be undertaken by an ISTA or ASA accredited sampler. Please refer to the relevant rules published by ISTA and ASA.

or

- Otherwise, seed should be sampled by an AO at an ERE (AO does not need ISTA or ASA accreditation) and the following sampling procedures apply:

Suitable sampling equipment for the goods being inspected should be used, with correct size sampler for the product size / volume being sampled. Draw the sample from across the entire consignment to ensure that the sample is representative:

For packets of seed less than 1kg - the number of packets to be sampled can be determined by the square root of the lot size.

For packages greater than 1kg on two or more pallets - sampling should be undertaken at a rate of 0.5 Litres for every 5 tonnes of packaged product or 2.25Litres/33.33 tonnes of bulk product, with a minimum of 5 samples across the consignment.

For consignments of packaged goods that are loaded onto a single pallet - draw a minimum of 5 samples, taken from all corners of the pallet to ensure a representative sample is taken.

For consignments 100kg or less draw 0.5 Litres randomly across the consignment

Ensure you sample all grades or types when they are presented in a consignment. Treat each grade or type as a separate lot. Where multiple loads are being combined into one consignment or silo/storage, each inward load should be sampled prior to co-mingling, to form part of the representative sample. The sample/s should be mixed thoroughly and divided into representative lots. Samples should be provided to the laboratory as sampled, not screened or altered in any way.

## 6 Appendix 1 – Definitions

Code of Practice	Australian grain industry Code of Practice for the management of grain along the supply chain.
Company Operations Manual	Document outlining the procedures to be used at each storage and handling facility, including those in relation to grain sampling.
Composite sample	A composite sample is comprised of the combined primary samples taken from the lots being consolidated (and subsequently presented for export). Otherwise known as a bulk aggregate sample.
Consignment	Grain presented for export under a Request for Permit that may comprise multiple consolidated lots.
DAWE	Department of Agriculture, Water & the Environment responsible for the certification of grain for export.
Divider	Device used to reduce the size of a sample to a smaller portion that is considered to be representative of the entire sample. May be of varying design, either manually or mechanically operated.
Grain	Refers to any cereal, pulse or oilseed
GPP	Grain Preparation Plan developed by DAWE
Integrity	Maintaining the consignment or samples as complete, whole or uncompromised. Integrity of a consignment may be inadvertently compromised by taking inadequate sample volume, incorrect handling procedures, contamination, mislabelling, blending with contaminated grain or other influences.
Laboratory Sample	A portion of the Composite sample that is sent to a laboratory for subsequent analysis. This sample is representative of the entire Consignment and thus the Composite sample. May or may not be the entire Composite sample.
Lot	A specified quantity of grain that is physically identifiable by a number or some other code.
MICoR	Manual of Importing Country Requirements. DAWE database depicting for each commodity and country the applicable quarantine requirements.
PEOM	Plant Export Operations Manual, outlining a range of procedures to be followed prior to and during the export of prescribed grains.
Primary sample	A primary sample is an individual sample taken from the lot presented (for sampling). Otherwise known as a sub-sample or incremental sample.
Quarantine Pest	A pest (insect, pathogen, weed seed etc.) that is restricted by an importing country in imported grain.
Representative sample/s	Samples collected from grain combined into composite sample/s that represent the consignment to be presented for export or bulk being sampled. Multiple representative samples may be required to represent the entire consignment presented for export. Where the composite sample volume is more than required for a representative sample the composite should be manually/mechanically split.
Sub-sample	The sample taken from the mixed composite sample for the purposes of conducting quality tests or other tests / purposes as required. A sub-sample is representative of the entire lot. Otherwise known as a primary sample or incremental sample.
TGD 5	Technical Guideline Document No.5 Static Grain Sampling. Referenced to the Code of Practice.

## 7 Appendix 2 – Additional Information by Sampling System

### 7.1 Manual Probes



The manual probe spear is made of aluminium or steel and has two tubes. The tube is inserted into the grain at a depth of the probe. Hence this has limited use for deep grain parcels.

It is generally used for sampling of road trucks to obtain a sample for classification purposes. It may also be used to obtain non-representative samples from a horizontal storage such as a shed to collect a sample to review the quality status of the grain (i.e., if insects are present).

There may be a number of errors associated with using manual probes incorrectly. These include:

- Probe not of sufficient length to reach the bottom of the truck;
- Different types of probes e.g., tapered versus non-tapered;
- Probe physically cannot be inserted into the entire depth of the load due to compaction of the load or physical contamination with a large amount of finer material in the lower part of the load;
- Probe inserted into the grain in the open position, resulting in sample obtained from top portion of the load only;
- Probe not closed prior to removal from load, resulting in sample lost from the probe;
- Probe cleaned by oil, resulting in contamination from the foreign material from the load onto the probe and difficulty in using the probe;
- Probe rusted from water ingress, resulting in difficulty in using;
- Due to operational difficulties of using the manual probe (i.e., Workplace Health & Safety rules preventing the samplers from leaving the sampling platform), probe cannot be inserted into the entire depth of the load; and
- Probe cannot be inserted in all required areas of the truck (i.e., other than in the immediate vicinity at the edge closest to the sample stand).

## 7.2 Vacuum Probes

A vacuum probe is an alternative to the manual probe for sampling of road trucks to obtain a sample for classification purposes. There are a number of different types of vacuum probes available commercially. A typical example is pictured below.



A vacuum probe is an air assisted sampling instrument. The probe is hollow. The probe is connected to a sample collection device by a flexible hose through which the grain flows. Grain flows into the probe and into a collection device located on the sample stand or in/near the sampling and testing location. The flexible hose allows the probe to be moved to enable the probing to occur over the entire area of the truck, generally without moving the truck.

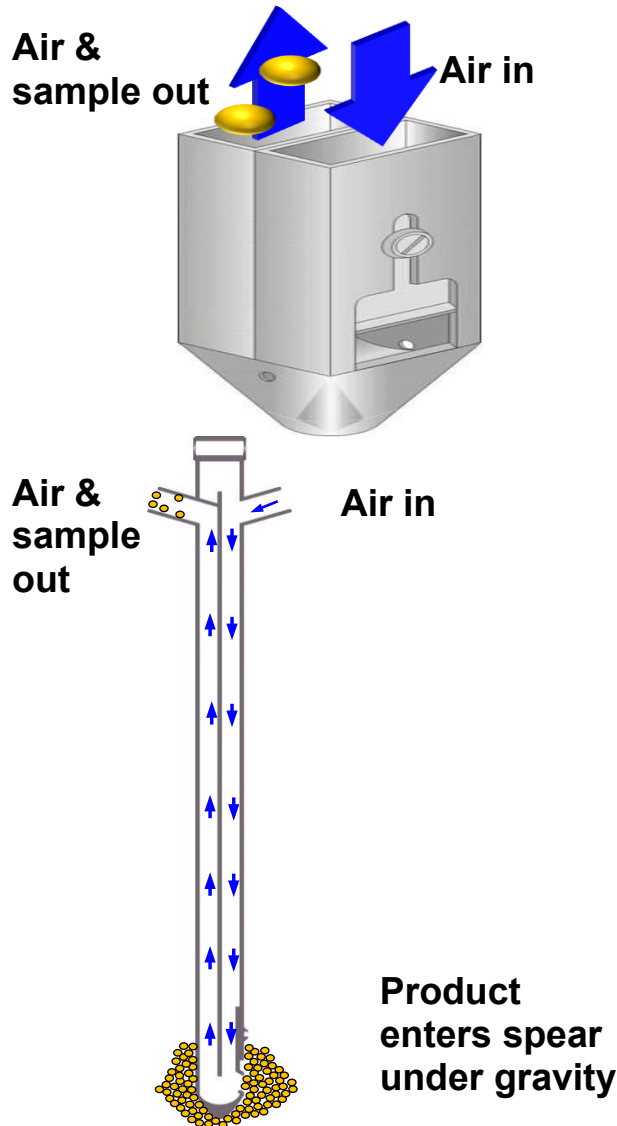
There may be a number of errors associated with using vacuum probes incorrectly. These include:

- Probe not sufficiently robust to withstand being inserted vertically into the truck to the bottom of the load (i.e., probe is bent, made of plastic, bottom opening hole damaged);
- Probe blocked with material from a prior load, leading to reduced suction and inability to obtain a representative sample from entire depth of the load;
- Vacuum hose attached to the probe blocked with material from a prior load (caused by kinking, not operating probe motor until all material is removed before re-inserting probe, hose interior surface is corrugated and not smooth), leading to reduced suction and an inability to obtain a representative sample from the entire depth of the load;
- Vacuum hose has holes in it, reducing the suction and ability to obtain a sample from the entire depth of the load;
- Vacuum probe motor not sufficiently powered to obtain a sample from the entire depth of the load;
- Vacuum probe excessively powered, resulting in collection of an excessive quantity of lighter foreign material when used incorrectly;
- Vacuum probe motor filter not regularly cleaned, reducing suction;
- Probe suction not commenced until probe inserted a long way into load, leading to failure to sample the top part of the load;
- Probe not inserted in a smooth manner throughout the load, resulting in inequitable collection of grain at different points in the load where the probe movement “halts or slows”;
- Probe inserted too slow through the load, resulting in excessive sample collected;
- Probe inserted too rapidly, resulting in insufficient sample collected;
- Probe suction continues while probe is located at the bottom of the load, resulting in excessive amount of material collected from that area in comparison to other areas of the load;
- If suction is too high, too great a quantity of sample is obtained, and the potential exists to draw loose dust and smaller material in the load. This would create a non-representative sample;
- If suction is too low, grain cannot be drawn through the probe and into the sample collection device; and
- Due to operational difficulties of using the vacuum probe (i.e., Workplace Health & Safety rules preventing the samplers from leaving the sampling platform), probe cannot be inserted into the entire depth of the load.

### 7.3 Pneumatic Probes

A pneumatic grain probe is an alternative to the vacuum probe for sampling road trucks to obtain a sample for classification purposes. It is sometimes considered superior to vacuum probes as it is generally able to reach all areas of the truck and to obtain a sample from the entire depth of the load.

A typical design of a pneumatic probe is depicted below.



There may be a number of errors associated with using pneumatic probes incorrectly. These include:

- Probe bottom is not stoppered or does not have an automatic “stop valve”, resulting in the probe going through the floor of truck or being damaged on the bottom of the truck;
- Probe is inserted into the load in exactly the same location each time, potentially leading to trucks being “doctored” with grain where probe is not inserted;
- Probe sensors not working correctly, resulting in the probe not being inserted in the entire depth of the load; and
- Incorrect air flow resulting in sufficient sample not being obtained for each probe.

## 8 Appendix 3 – Sampling Principles

### 8.1 Purpose of Sampling

In the context of this TGD, sampling may be defined as obtaining a sample of the grain and typically the sample is representative of the grain from where the sample was taken.

The entire sampling system should be designed for its intended purpose, that is, in general, to obtain a representative sample of the grain to be/being loaded. The intended purpose of the sampling system should be documented, including where the sample taken is not meant to be representative of the grain. Various other elements of a sampling system operation such as calibration and how variable sampling rates are determined should also be documented.

#### 8.1.1 Industry

A sample may be taken for various purposes including but not limited to:

- For subsequent analysis to determine the quality of the grain for classification purposes;
- To provide a representative sample of grain to be subsequently outloaded;
- To ensure no quality deterioration has occurred (e.g., taken from a storage to determine the presence of high moisture, mould, live stored grain insects).

#### 8.1.2 Regulatory

The sample may need to be taken for regulatory purposes. Under this scenario various aspects regarding the sampling, including location, methodology and who takes the sample are controlled and requirements will be outlined by that regulatory body.

### 8.2 Basics of Obtaining Sampling

While many variations in the design of sampling systems and procedures to obtain a sample exist, the following basic principles apply in all situations:

- The method of sampling as outlined in this TGD is the same for all grain commodities.
- To obtain a representative sample either manually or using mechanical devices, access to the grain stream is required. This is sometimes limited due to the grain stream being fully enclosed to ensure worker safety. Sampling systems should be designed that attempt to overcome these physical locations and logistical issues.
- When sampling a moving grain stream, draw the sample from across the entire consignment to ensure that the sample is representative.
- For high grain flow rates automatic sampling is generally required and the sampling system should be able to be calibrated to vary the sampling rate in order to obtain a representative sample.
- The location of a sampling device or location for manual sampling should be such that access is easy for both collection of the sample and for maintenance and checking of the sampling apparatus.
- Depending on the purpose of sampling and the infrastructure involved, sampling from a moving grain stream may be preferable to sampling from a static grain bulk.
- Where multiple loads are co-mingled into one storage or consignment and a representative sample is required, each inward load is to be sampled in order to obtain a representative sample of that grain parcel.



- In general, when loading grain, the further away from the final load point the sample is collected, the more problematic in terms of maintaining the integrity of the sample and ensuring it is representative.
- When sampling a consignment of different grades or grain types, each grade or grain type is to be sampled and treated as a separate lot.
- Where sampling equipment cannot obtain a sample because material may be too large or it is impractical to alter sampling equipment (i.e., large contaminants such as mould clumps, stones, sticks, rodents), suitable procedures should be developed and implemented to determine the presence of these large contaminants.
- Each sub-sample should be placed in a suitable container. The entire sample should then be mixed thoroughly before obtaining a representative sample.
- Any sub-sample to be inspected or provided to a third party (i.e., laboratory) should be as sampled and not screened or altered in any way.
- If sending a sample to a laboratory or other party for testing, it is recommended that a sub-sample of that grain be retained should it be required for comparison purposes. In this situation the retained sample should be labelled as per the despatched sample to enable traceability.

### 8.3 Number of Samples & Frequency of Collection

The number of samples collected depends on a range of factors including but not limited to:

- The purpose of sampling.
- The requirement for analysis and retention of samples, including sample size for those purposes.
- Location of the sampling device or where manual samples could be collected (some locations prevent sampling due to the inaccessibility to appropriate sampling points by the sampler).
- Tonnage to be out-turned or inspected.
- Commodity type.

In order to obtain a representative sample of the grain:

- Multiple small sub-samples (primary samples) should be taken at regular intervals (i.e., not one sample taken at one point in time).
- As many primary samples as practically possible are to be collected.
- Primary samples should be collected at frequent intervals.
- Each primary sample should be the same size.
- Each primary sample is to be collected:
  - At the same interval where the tonnage flow rate remains the same.
  - At different intervals where the tonnage flow rate varies.
  - At equal distances within a structure if obtaining a static sample.
- Sampling rates should be able to be modified based on the grain flow rate:
  - To take a representative sample of moving grain, flow rate of the grain should be calculated before commencing grain movement. Sampling rates can then be adjusted accordingly. These may need to be altered based on the commodity sampled and throughout the grain movement process if the grain flow rate alters significantly.
  - For mechanically driven samplers, where the sampling rate is not able to be automatically adjusted, it should be manually adjusted.
  - For a manual sample system, the operator should determine the sampling rate to use prior to commencement of sampling and monitor this during the entire sampling period.

- Primary samples are to be appropriately mixed to obtain a representative final composite sample.

## 8.4 Workplace Health and Safety

It is the responsibility of all staff involved in sampling to:

- Adhere to all relevant Workplace, Health and Safety regulations and rules of the company where the sampling is to occur.
- Report to the company site office (or equivalent) and comply with all company site procedures such as the requirement to undergo a site induction and / or safety training.
- Wear appropriate clothing, including any safety apparel required by the company. This normally includes one or more of the following:
  - Safety hat (Hard hat)
  - Safety boots or shoes
  - Safety glasses
  - Dust mask if sampling is to occur in a dusty or confined area
  - Ear protection
  - High visibility safety vest
- Only conduct sampling where it is safe to do so i.e.,
  - Appropriate safety guard rails are in place.
  - Where safe access to any moving grain stream is available (i.e., only sample from a conveyor belt that is higher than your centre of gravity at the sampling point).
  - Never attempt to manually take a sample from a screw auger, drag chain conveyor or similar equipment.
- Adequate lighting is in place in the sampling location and for all activities associated with sampling.
- Adequate ventilation is available in the sampling location.
- Never attempt to move foreign objects from a moving grain stream.
- Report any unsafe conditions and practices to relevant persons.

## 8.5 Equipment to be Used

There is a range of equipment available for use to collect samples:

- Use suitable equipment for the grain to be sampled. This includes the correct size sampler for the grain size and volume being sampled.
- Each sampler is to be appropriately calibrated.
- Sampling equipment is to cover the range of available calibrations capable of covering the range of grain moving (i.e., loading or flow) rates.
- Any calibration adjustments are to be conducted by appropriately trained personnel.
- Calibration adjustments are to be recorded and made available where required for auditing purposes.
- All sampling equipment is to be of a design that allows inspection, cleaning and disinfestation as required.

When sampling, the following ancillary equipment may assist the task:

- Bucket or other suitable sample collection device for collecting samples:
  - May need to be sealable.
  - Is to be suitably clean to preserve the integrity of the samples obtained during sampling.

- Sample bags. May be calico or plastic but should be new and preserve the integrity of the grain.
- Labels or markers.
- Various report forms as required.
- Notebook, pen etc.
- Stop watch to time sample collection.
- Manual sample collector (hand-held scoop, sample cup) with extendable pole if needed:
  - Where required to be used, the opening of the sampling device should be at least 2.5 times greater than the largest particle size of the commodity (or expected admixture/contaminant, whichever is greater) to be sampled.
  - Be of a size suitable to obtain the required quantity of primary sample.
- Grain Divider. Best practice is for the composite sample to be mixed and sub-divided down using a mechanical device such as a grain divider.

## 8.6 Monitoring of Sampling Equipment

Where relevant the following will apply to all sampling systems. More specific requirements apply to mechanical sampling systems.

Regular inspection of all elements of the sampling system should occur:

- Initially before the sampling system can be used.
- At a frequency as documented in the Company Operations Manual:
  - At a minimum, all mechanical sampling systems should be examined and determined to be operating correctly on an annual basis.
  - During periods of continual use, equipment should be checked more frequently.
- As required following repairs or any time there are concerns with its operation.
- On a routine basis to ensure no obvious issues are apparent such as leaks, worn parts.
- On a regular basis to ensure the system is adequately clean, dry, soundly constructed and does not compromise the integrity of grain being collected:
  - Following detection of insect infestation and/or treatment.
  - Prior to movement and thus sampling of a different commodity.

Each type of mechanical sampling equipment should be monitored to verify the sampling system is operating correctly, including the frequency of sample collection occurs as stipulated.

Where appropriate, the sampling system should have an inspection plate to enable examination of the sampler condition and operation. The removal of the inspection plate enables the relevant components of the inspection equipment to be examined to verify a range of issues such as wear of equipment, cleanliness, freedom from pests etc.

## 8.7 Training & Qualification of Samplers

There are various requirements for the personnel involved in sample collection.

General:

- Only staff that are appropriately trained samplers may take samples.
  - For industry purposes, this generally involves:
    - Personnel associated with the company where the grain is sourced; or
    - Using external qualified samplers where required.
  - For obtaining samples for regulatory purposes:

- Only staff trained and authorised for that purpose.
- There should be an auditable sampling program identifying staff roles and responsibilities involved in sampling.
- Checking of all sampling equipment including any calibration should be done by a person appropriately qualified to carry out such a task. Personnel may be external to the company or internal staff skilled in that task.

#### Qualifications Required:

- At present there are no formal industry qualifications for personnel involved in sampling. That is, there is no “industry defined sampling course” that could be attended to achieve such qualifications.
- Qualifications are generally achieved for the purposes of industry sampling:
  - By guidance and instruction “on the job” training over time or prior experience in the task.
  - May be dedicated samplers or personnel with a range of tasks.
  - Job descriptions are to be kept up to date with the skills required.
  - Any “on the job training” or education of samplers is to be appropriately recorded in personnel employment records.

## 8.8 Sample Retention

Grain samples are to be retained following sampling for the purposes of providing a record of the consignment if required for quality assurance, or for other purposes such as provision to an external party or for investigation during a dispute. While there is no industry accepted sample retention period, samples should be retained for a period as outlined in the Company Sampling Manual or the Operating Procedures (e.g., a minimum of three months or the period until the grain is used).

All grain samples collected should be stored and labelled appropriately to preserve their integrity during this sample retention period. This may involve:

- Storage in a suitably clean container to maintain its integrity.
- Storage in a container that is able to be sealed to prevent moisture incursion.
- Placement in a secure area to prevent adulteration.
- Placement in an area away from light and moisture.
- Stored to prevent insect infestation, contamination and/or rodent and pest damage.
- Stored preferably in a controlled climate, using air conditioning.

## 8.9 Records

A number of records are required before, during and after use of the sampling equipment. These vary based on the type of sampling equipment and intended use of the sampling equipment and samples subsequently obtained. Record requirements may be outlined:

- In contracts
- In Individual Company Sampling Manual or the Operating Procedures.

The following is not meant to over-ride those requirements, however in general the major records required may include the following where applicable:

### 8.9.1 Prior to Use

- Date the sampling system / equipment was last inspected.
- Date the last accuracy check / calibration was made.
- Date and nature of the last adjustment to the system.
- Date the sampling system was cleaned and/or disinfested.

### 8.9.2 During Sampling

- Buckets or sample collection devices used for collection of samples obtained during sampling are to be appropriately labelled. This labelling may include details such as:
  - Commodity type.
  - Date and time collected.
  - Unit number (storage, container etc.).
  - Tonnage represented.
  - Grain flow rate.
  - Number of primary samples.

### 8.9.3 Following Sampling

- Sampler identification/contact details.
- Identification and reason for sample (e.g., client, destination, reason (i.e. pest ID; commercial requirement etc.)).
- Number of sub-samples collected.
- Number of units (storage, container etc.) sampled.
- Method and location of collection.
- Number and size of composite sample collected.
- Method of obtaining composite sample.
- Any unusual incidents identified during sampling.

As outlined above depending on the purpose of sampling, a range of other relevant records should also be kept:

- Calibration checks and changes.
- Sampling equipment maintenance and checks, including disinfestation.
- Staff training.
- Documentation demonstrating the linkage of samples collected, their method of collection, other relevant identification details and the linkage to each grain parcel or consignment.

## 9 Appendix 4 – Sample Compilation

### 9.1 Running Sample Collection

Running samples are a representative grain sample (i.e., of all loads delivered into that storage site by grade). They are generally compiled on a tonnage basis. Depending on the size of the grain being sampled (i.e., delivery) a sub-sample is taken from each delivery and placed in a receptacle.

Running samples are generally compiled on a fixed (e.g., 500 tonne) tonnage basis. As soon as the tonnage for that grade or grain parcel is reached, the bag is sealed, and the process repeated for the next parcel of the same tonnage. In this way, the running sample represents the (e.g., 500) tonnes of deliveries for that commodity and grade.

These samples may then be used to compile a range of other samples or for subsequent analysis. However firstly they should be adequately:

- Mixed;
- Labelled;
- Stored; or
- Sub-divided as required.

### 9.2 Sample Division

Where a reasonably large volume of sample is collected:

- It is preferred that a sample divider is used to reduce the size of the composite sample to the size required.
- Where a sample divider is not available manual mixing and dividing can be undertaken.

There are various sample dividers available commercially. Each has its own positive and negative attributes and industry is required to conduct their own due diligence to select the most appropriate device for their circumstances.

Typical available examples include:

Riffle Divider



Boerner Conical Divider



Gamet Divider



## 10 Appendix 5 – Errors during Sampling

### 10.1 General Errors – All Probe Types

There are many errors that may occur when using equipment to obtain a representative sample. Each error may have a significant impact on the ability to accurately determine the quality of the grain in the truckload tendered for delivery. Potential errors when sampling with a potential impact on the outcome obtained are outlined below, noting the impact may vary (refer to Appendix 3 for issues associated with each probe type).

- Insufficient number of samples taken for the composite sample to be considered representative of the load;
- Insufficient size of sample taken for accurate assessment of the load or for all quality tests to be conducted;
- Entire truckload of grain not exposed to sampling process resulting in sample not being representative of the load;
- Truck parked too far from sample stand resulting in samples unable to be taken from the required area of the load;
- Sample stand too low resulting in sample not being taken from lower areas of the load;
- Sample stand too high meaning full access to the load cannot be achieved;
- Lesser number of samples taken for the tonnage delivered, resulting in sample not being representative;
- Probe is deliberately inserted into areas of high contamination or poor quality, that is not reflective of the entire parcel quality;
- Probe used cannot reach the bottom of the load, increasing the potential for not sampling poor quality grain that may be present on the bottom of the load;
- Probe is not inserted in a vertical position into the load but at an extreme angle, meaning parts of the load are not sampled;
- Sample probe not placed in recommended areas of the load, leading to non-representative sample being obtained;
- Incorrect sample size per probe taken, if lower amount, risk of mis-classification;

- Probe not clean, leading to contamination of subsequent sample obtained from truck;
- Sampling equipment (hoses, collection chamber etc.) not clean, leading to contamination of subsequent sample obtained from truck or inability to obtain required volume of sample;
- Sampling hose interior surface not smooth (i.e., corrugated), leading to potential contamination with material remaining from prior load;
- Sample obtained from probing the truck not adequately mixed prior to assessment;
- Excessive amount of sample obtained from probing the truck creating difficulty in adequately mixing prior to assessment;
- Sample stand and truck to be sampled not physically located or placed in required position in order for safe sampling to occur or for the probe to be properly inserted in the required positions (e.g., truck too far from sample stand);
- Sample collection chamber or container collecting probe samples not adequately cleaned and thus contaminated from prior load;
- Surface of load not visually observed during sampling, resulting in non-detection of prohibited nil tolerance material that may not “fit/be collected” into the probe type being used;
- Settlement of fine particles during transit of load and failure to ensure probe is inserted the full depth of the load due to this material being compacted; and
- Deliberate tampering or layering of load or general unevenness of grain during loading may not be detected if the entire depth of the load is not sampled.
- 

## 10.2 Impact of Incorrect Method/Equipment & Potential Actions to Take to Rectify

There may be significant consequences arising from the incorrect sampling of a load. To minimise the occurrence of such events, or the impact, a range of measures as outlined in this Technical Guideline Document can be undertaken. Other measures can also be taken as outlined below.

When using any sampling apparatus and method, industry is strongly encouraged to:

- Set-up equipment based on manufacturer recommendations;
- Document the procedure to be done, including routine maintenance and cleaning;
- If possible, certify the equipment a minimum of once a year (e.g., it is operating as per manufacturers specifications and intended purpose);
- Regularly monitor the condition of all equipment ensuring it is operating correctly, at an adequate standard, is clean and contaminant free;
- Damaged equipment should be inspected prior to commencement of use and repaired where required;
- Operate the equipment exactly the same each time it is used for the purposes of sampling;
- Follow industry sampling protocols;
- When upgrading or purchasing new sampling equipment, only purchase equipment suited to the “sample stand set-up”;
- Ensure all staff are adequately trained in the use of equipment and that training is ongoing to ensure staff are deemed competent at all times (e.g., annual refresher training); and
- Have a documented dispute assessment procedure that outlines the processes to be followed when a result obtained from assessing a representative sample is disputed.

## 11 Appendix 6 – Overseas v Australian Sampling Systems

### 11.1 International Sampling Methods and Equipment



There are a range of international standards relevant to the sampling and testing of grain. Several of these outline specific sampling processes for “static grain bulks”, as per truckloads sampled according to this Technical Guideline Document. These include:

- ISO/TC 34 Standards: ISO 542, ISO 5500, ISO 6497;
- ISO 6644, ISO 7002, ISO 13690;
- ISO/DIS 24333;
- [ISO/TC 69: ISO 2859 family, ISO 3951 family];
- Codex Sampling Standard;
- National country documents e.g., USDA GIPSA, Canadian Grain Commission;
- Independent Inspection and Surveyor methods; and
- Trade contracts e.g., GAFTA.

While differing, the majority include some common principles of sampling. For example, in ISO 24333:2009(E) Cereals, pulses and milled products – Sampling of Static Batches, it states:

- Samples should be as representative as possible from the lots from which they are taken.
- As the composition of a lot is seldom uniform, a sufficient number of increments shall be taken and carefully mixed, thus giving a bulk sample from which, the laboratory samples are obtained.
- The lot should be sampled over its entire depth.

Many include principles that are outlined in Australian standards. For example:

- “Where grain samples are required to be taken from wagons or vehicles at loading, the increment samples shall be taken by spear from not less than 3 sampling points from each wagon or vehicle.”
- “Mechanical sampling devices can be used if the principle of sampling according to which they function does not create any segregation at the probe tube intake and do not cause damage to the grains.”

The Codex General Guidelines on Sampling (GGS) provides guidance on sampling and sets out sampling plans intended for use by Codex commodity committees or, if applicable, by governments in case of international trade disputes.

- The General Standard for Contaminants and Toxins in Food and Feed (GSCTF, Codex Standard 193) lists the maximum levels and associated sampling plans of contaminants and natural toxicants in food and feed.
- The Codex Commodity Standards Procedural Manual sets out a number of procedures for the development of conformity assessment provisions in commodity standards. There are a wide range of provisions for conformity assessment. Some standards do not mention sampling plans, some refer to general guidance on sampling plans, some refer to specific sampling plans and some specify a sampling plan and acceptance procedure in the standard itself.

Research into improved sampling methods, including sampling equipment continues internationally. For example, issues being considered by the Codex Committee on Methods of Analysis and Sampling include:

- Sampling variability;
- Sub-sampling methods and variability;
- Considerations on measurement uncertainty;

- Contractual obligations;
- Consideration of preventive measures in exporting countries to ensure exported foods meet requirements;
- The possible implications of those measures for the design of sampling and testing procedures at the point of import; and
- Reducing the probability of a subsequent dispute occurring through pre-market procedures.

Further, there are a number of principles outlined in those various international standards to be considered in any review leading to a potential change to sampling and testing processes. These include:

- “Risk management decisions should be commensurate to the assessed risk and should take into account the economic consequences and feasibility of risk management options. Risks due to conditions during storage and transport should be considered by all business operators in the food distribution chain. In order to achieve this there should be an understanding of the impacts of sampling and testing options on all affected parties.”
- “Risk management itself should be a continuing process that takes into account all newly generated information, including scientific information, in the evaluation and review of risk management decisions based on sampling and testing.”
- “The sampling and testing procedure applied should be appropriate to the commodity or lot to be sampled and tested, fit for intended purposes and applied consistently”.
- Practical considerations should be taken into account. “The choice of a sampling and testing procedure should take account of practical matters such as cost and timeliness of the assessment and access to lots, provided that consumers’ risk is not significantly compromised.”
- Review procedures are required. “Sampling plans and test methods should be reviewed periodically to ensure they take account new science and information.”

## 11.2 Competitor Sampling Methods and Equipment

The need for appropriate sampling is recognised by many overseas countries that compete with Australia for grain export markets.

### 11.2.1 Canada

The following information is obtained courtesy from the Canadian Grain Commission website, not cited verbatim:

- The key to having dependable and representative samples is sampling often and thoroughly mixing and dividing down the selected sample. Equipment used at a grain handling facility usually copes with variable quality by taking multiple samples or by using a sampling process that takes samples at regular intervals.
- Automatic mechanical sampling systems used for inward receipt of grain at licensed terminal elevators is outlined in the Sampling Systems Handbook and Approval Guide produced by the Canadian Grain Commission (CGC).
- A grain handling facility mandated or requesting CGC inspection services should install CGC-approved automatic sampling equipment to sample grain in the facility. There are a range of written procedures and protocols to follow to ensure the equipment is “operating as intended”.
- In general, the CGC will give approval only to automatic sampling systems that extract a complete and proportional cross-section of the grain stream (both height and width),

proportionally reduce the sample size, and deliver the sample to the inspection area. Samplers of this type are commonly referred to as cross-stream diverter-type samplers.

- Samplers that are considered by the CGC to be in use “seasonally” will be evaluated prior to commencement of the season.
- Each company shall establish, document, implement and maintain a Grain Sampling System Manual.
- Manual sampling of the grain stream may occur.
- A Boerner-type divider is the only divider approved for use by the CGC.
- As some of the requirements and stipulations stated may not be appropriate or necessary in all situations, official agency staff may develop local quality control procedures.

Thus, the Canadian system relies to a large extent on sampling from the grain stream for bulk grain. Note that small static parcels (greater than 100kg) can be probed using officially recognised double sleeved triers, procedures etc.

### 11.2.2 United States of America

The following information is obtained courtesy from the United States Department of Agriculture website, not cited verbatim:

- The United States Department of Agriculture Federal Grain Inspection Service Program Handbook on Grain Sampling outlines the policies and procedures for sampling grain in accordance with the regulations under the United States Grain Standards Act.
- Obtaining a representative sample from a lot of grain is an important and essential part of the grain inspection process. If the sample is not representative, the inspector's final grade will not reflect the true grade of the lot. For a sample to be considered representative it should be obtained by official personnel using official procedures and FGIS approved equipment.
- The depth of the carrier or container dictates the length of probe that is used to draw the sample. Probes to be used are specified. Whenever the bottom of a carrier/container is not reached by all probes, show the special statement "Top X feet sampled. Bottom X feet not sampled."
- The carrier may be entered for the purposes of sampling.
- The in-load suction probe has a tendency to overestimate foreign material and should not be used for trade.
- Non-compartmented grain probes and open-ended grain probes are not approved for official sample-lot inspections but may be used for official commercial inspection.
- For each type of carrier, there is an established sampling pattern also based on the amount of grain held (over or under 4ft deep) and whether the truck floor is flat or coned.
- Probe-type mechanical samplers are only approved for sampling trucks.
- Diverter-type (D/T) mechanical samplers are used to sample moving grain, and may be mounted in grain spouts, at the end of belts, or at the head of elevator legs.
- Manual sampling of the grain stream may occur.
- As some of the requirements and stipulations stated may not be appropriate or necessary in all situations, official agency staff may develop local quality control procedures.
- The major components of any mechanical system should be of a model and type approved by the FGIS.
- For mechanical truck probes, the model and type of probe-type mechanical sampler should be approved by FGIS. Only 2 are approved, being gravity filled and core probes. In-load suction probes are not approved as “they draw air through the load of grain and vacuum excessive amounts of fine foreign material into the sample”.

### 11.3 Comparison with Australian Sampling Systems

A general comparison and general reasons why the Australian system (in relation to sampling only) differs from those applying in some overseas countries is outlined in table 1 below. Note the list is not prioritised and the issues are not listed in any specific order. The importance placed on each item listed varies over time and based on the specific commercial arrangement applying in the industry sector.

In addition, statements made are generalisations only, based on interpretation and are not necessarily official policy of overseas Governments or bodies.

Table 1: Factors influencing Australian Sampling Methods and Procedures

Factor	Australia
Regulated Standards	<ol style="list-style-type: none"> <li>1. Industry voluntary standards are based on commercial requirements of the marketplace.</li> <li>2. Generally, industry applies common standards.</li> </ol>
Regulated Sampling Method	<ol style="list-style-type: none"> <li>1. The market or Government regulator does not stipulate which method is to be used to obtain a representative sample.</li> <li>2. Method was designed many years ago based on research and is still essentially the same today.</li> </ol>
Regulated Equipment	<ol style="list-style-type: none"> <li>1. The market does not stipulate which equipment is to be used to obtain a representative sample.</li> <li>2. Historically there are many smaller receival sites, thus not requiring or is it commercially viable to install costly mechanical systems.</li> <li>3. Equipment used has satisfactorily met market requirements and the industry need of managing “quality in versus quality out”.</li> </ol>
Storage Site Design, Operation and Control	<ol style="list-style-type: none"> <li>1. Major reliance on receival of harvested grain into country elevators, with a need for rapid receival but at the same time to be accurate and appropriate for the individual storage site.</li> <li>2. Commercial operations apply throughout the supply chain with no government oversight. Regulations apply only on export.</li> <li>3. On outturn to bulk export terminals the opportunity then arises to blend that grain. On export regulated sampling processes are employed for the purposes of quarantine. Those same sampling protocols are used for grain quality assessment under commercial arrangements.</li> <li>4. Mandatory approved Sampling Manual and auditing of systems are not required however elements are being phased in under the Code of Practice.</li> <li>5. As listed in this TGD, there are many principles and documents relating to sampling to be considered. To include all provisions in determining a revised sampling system that covers standards, commercial contracts, testing and certification etc. is complex. Thus, industry has chosen to “keep it simple”.</li> </ol>

### 11.4 Developments in Australian Sampling Systems

Despite the current system having a satisfactory history of operating effectively, industry is rapidly undergoing a process of review and continuous improvement in relation to sampling and testing methods. This is being undertaken for a number of reasons, only partly in response to those systems in use overseas.

Potential future improvements and changes already underway are outlined below:

#### 11.4.1 Manual Systems

- There are virtually no manual probes now used commercially, although some do exist.

#### 11.4.2 Vacuum and Pneumatic Systems

- It is recognised that vacuum and pneumatic systems are operationally more flexible and appropriate to high throughput receival sites and are being introduced as required.
- Such systems are also being introduced for Workplace Health and Safety reasons at some locations.
- These systems enable sampling to the bottom of large trucks, often travelling large distances prior to tendering the load. Subsequent compaction of the load creates difficulty in using hand-held or vacuum probes. This is exacerbated for large pulse commodities such as faba beans. Thus, systems are changing as required.

#### 11.4.3 Industry Responsibility & Continuous Review

- An industry Code of Practice has been developed to outline acceptable sampling and testing practices. Elements of that Code include but are not limited to the following, recognising the level of sophistication and accuracy will vary by organisation, location used, purpose of use and commodity being assessed:
  - Only equipment suited to its intended purpose is to be used;
  - Staff training;
  - Documented procedures for equipment use and sampling and testing procedures are outlined in the company Sampling Manual or the Operating Procedures;
  - Equipment checked and audited on a regular basis;
  - Industry committed to continually evaluate and improve processes and systems; and
  - The preference is for the use of automated versus manual probes.
- The change to mechanical systems is not market driven, as to date there has been no evidence of a failure to correctly identify the quality of grain received. That is, the quality of grain outturned (domestic or export market, bulk, container or road truck/rail wagon) has generally been as expected based on receival sampling and testing. This policy was emphasised by industry to several grains exporting countries during the recent revision of ISO 24333 “In developing ISO 24333, industry needs revised ISO methods that conform to current practices, noting that current practice(s) have not been identified as deficient”.
- Through membership on a Grain Quality Measurement Committee, industry works closely with Government (National Measurement Institute) on all aspects related to sampling and testing of grain for the purposes of trade. Industry is assisting the Government in its endeavours to achieve international standards for relevant equipment involved in the classification of grain.
- Through members of the Grain, Plant Products Export Industry Consultative Committee, industry is reviewing applicable sampling systems used at the point of export. Consultation with the Australian Government involves input into development of appropriate sampling regimes for export grain parcels where static sampling is required.

#### 11.4.4 Research into Sampling Systems

- Australian Standards are revised based on Australian requirements and taking into account any relevant overseas systems or regulations.
- The results of studies on the effects of different types of probes, the number of samples and how the probe is inserted into a load of grain (angle etc.) have influenced the development of current and will influence future changes to standards. Many studies have been done and the outcomes are variable. For example, in one study on corn and soybeans:
  - “The hand probe overestimated the Foreign Material content”.
  - “Different models of mechanical probes provided different results and those were significantly different than handheld probes”.

- “In all corn tests and in all soybeans tests except one, vacuum probes overestimated FM content”.
- Prior Australian research led to the development of the existing sampling protocols. It is recognised that work was conducted many years ago, however it is still cited in documents such as the NMI M8 as noted previously. That prior research identified that inappropriate sampling techniques, including incorrect use of the vacuum probe, would lead to a non-representative sample being taken from the load tendered for delivery.
- Studies indicate variability among probe types. The variability in mechanical probes is shown by choice of equipment when industry has introduced those systems to replace existing probe systems (verbal communication).
- As outlined, vacuum probes are difficult to use for some commodities and in some circumstances cannot reach the bottom of the load. Thus, obtaining a representative sample is not possible. In these circumstances industry uses other sampling methods to identify any issues with grain in the load (e.g., tailgate sampling during discharge).

To undertake a major upgrade in sampling systems is an expensive exercise. For this to occur at a rate faster than current adoption, further research would be required that indicates the current systems used are not appropriate.