



Knowledge grows

From Factory to Field

Properties and Handling
of Yara Fertilizers





Contents

Introduction	2
Physical Properties of Fertilizers	3
Handling And Storage of Fertilizers	8
Safe Handling of Yara Belle Plaine Urea	11
Fertilizer Unload Procedure	13
Task Procedure - Removal of Fertilizer with Bobcat	14
Suggested Methods of Dislodging Set Fertilizer	16



Introduction



Yara International produces high quality fertilizer products from a variety of raw materials by different production technologies. Compliance with international legislation and Yara's internal technical standards ensure a high focus on product and process safety as well as protection of personnel and environment by implemented best available techniques.

The Yara product portfolio is broad to fit market requirements. This includes straight nitrogen fertilizers, as well as composite NPK products.

Yara has adopted the Fertilizers Europe and International Fertilizer Association's Product Stewardship program that aims to:

- Take responsibility for the product through the value chain from raw material to use.
- Meet the public demands for openness and communication.
- Share experiences and knowledge.
- Provide a good structure for setting up Product Stewardship on company level.

The standards should be applied throughout the whole handling chain, thus ensuring that every person involved is trained and equipped to follow best practice handling procedures in order to maintain the high quality of Yara fertilizers from the Factory to the Field.

This brochure aims to give best practice advice to people working in the supply chain. More extensive information can be found in the Fertilizers Europe leaflet 'Guidance for the Storage, Handling and Transportation of Solid Mineral Fertilizers' (www.fertilizerseurope.com).

Yara grows knowledge to responsibly feed the world and protect the planet, to fulfill our vision of a collaborative society, a world without hunger and a planet respected. To meet these commitments, we have taken the lead in developing digital farming tools for precision farming and work closely with partners throughout the whole food value chain to develop more climate-

friendly crop nutrition solutions. In addition, we are committed to working towards sustainable mineral fertilizer production. We foster an open culture of diversity and inclusion that promotes the safety and integrity of our employees, contractors, business partners, and society at large.

Founded in 1905 to solve the emerging famine in Europe, Yara has a worldwide presence with about 17,000 employees and operations in over 60 countries. In 2018, Yara reported revenues of USD 12.9 billion.



Physical Properties of Fertilizers

The physical quality of fertilizers at end user level depends on:

- The physical properties of the products from production.
- The storage facilities and the climatic storage conditions.
- Stresses in the handling chain.

A product's physical properties are determined by its chemical composition and how it is produced.

The most important product properties for handling, storage and spreading are:

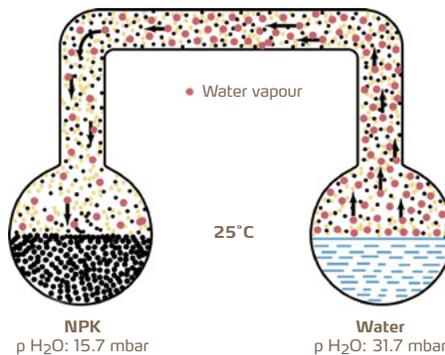
- Hygroscopicity
- Caking
- Particle shape and size distribution
- Particle strength and mechanical resistance
- Segregation
- Tendency to generate dust and fines
- Bulk density
- Compatibility (chemical and physical)

Hygroscopicity

Air contains moisture as water vapour and therefore exerts a water vapour pressure (p_{H_2O}) that is determined by humidity and temperature. Hot air can contain more water than cold air. The water content is expressed by the relative humidity (RH).

When the air is saturated with water vapour the relative humidity is 100 % and 50 % RH if half saturated.

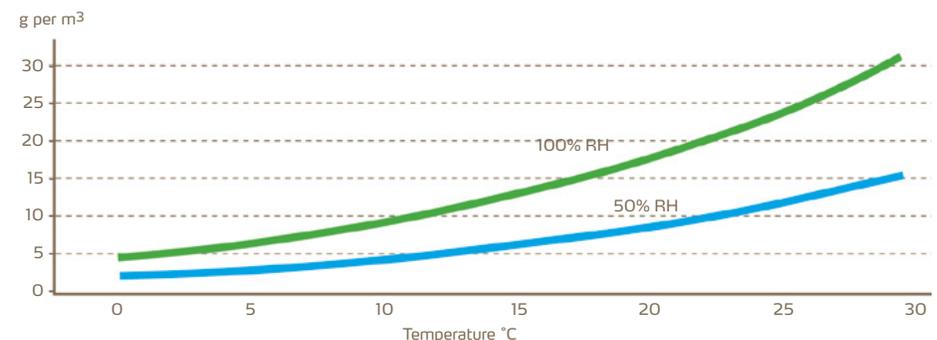
Water vapour will move from both high to low water vapour pressure



At 30°C the air can contain 30.4 g of water per m^3 (100 % RH).

The water vapour pressure of the air varies with humidity and temperature of the air.

Water content of humid air



Hygroscopicity is an important property enabling prills and granules to dissolve quickly in the soil and thus supply nutrients readily to the plants after fertilizer application.

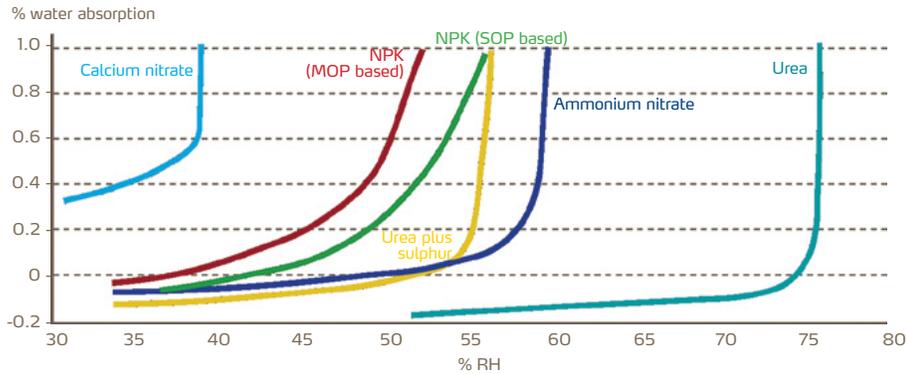
All fertilizers are more or less hygroscopic which means that they start absorbing moisture at a specific humidity or at a certain water vapour pressure.

Some very hygroscopic fertilizers attract moisture much more readily and at lower humidity than others. Water absorption takes place if the water vapour pressure of the air exceeds the water vapour pressure of the fertilizer.

Absorption of moisture during storage and handling will reduce the physical quality. Knowing at which humidity the grades start to absorb large quantities of water is very important.

By knowing the air temperature and humidity and the surface temperature of the fertilizer, it can be determined if water absorption will take place or not.

Critical relative humidity of fertilizers at 25°C



Typically, a water absorption curve ascends slowly at low humidity (as illustrated), but at a certain humidity or humidity range it starts to increase steeply. This humidity is called the critical humidity of the fertilizer. The critical humidity goes down when the temperature increases.

Significant water uptake has undesirable consequences for fertilizer products:

- Particles gradually become soft and sticky.
- Caking tendency increases.
- Formation of dust and fines increases.
- Warehouse floors become damp and slippery.
- Stabilized straight AN loses thermo-stability.
- Quality of spreading can be affected.

Caking

Most fertilizers tend to sinter or cake during storage. Such caking arises due to the formation of strong crystal bridges and adhesive forces between granules.

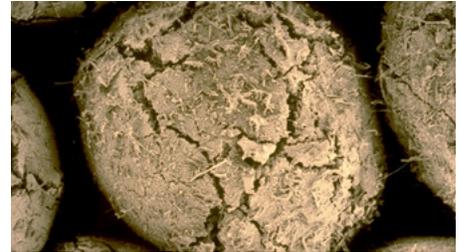
Several mechanisms can be involved; those of most importance seem to be:

- Chemical reactions in the finished product.
- Dissolution and re-crystallization of fertilizer salts on the particle surface.
- Adhesive and capillary forces between surfaces.

Caking is affected by several factors:

- Air humidity
- Temperature and ambient pressure
- Moisture content of product
- Particle strength and shape
- Chemical composition

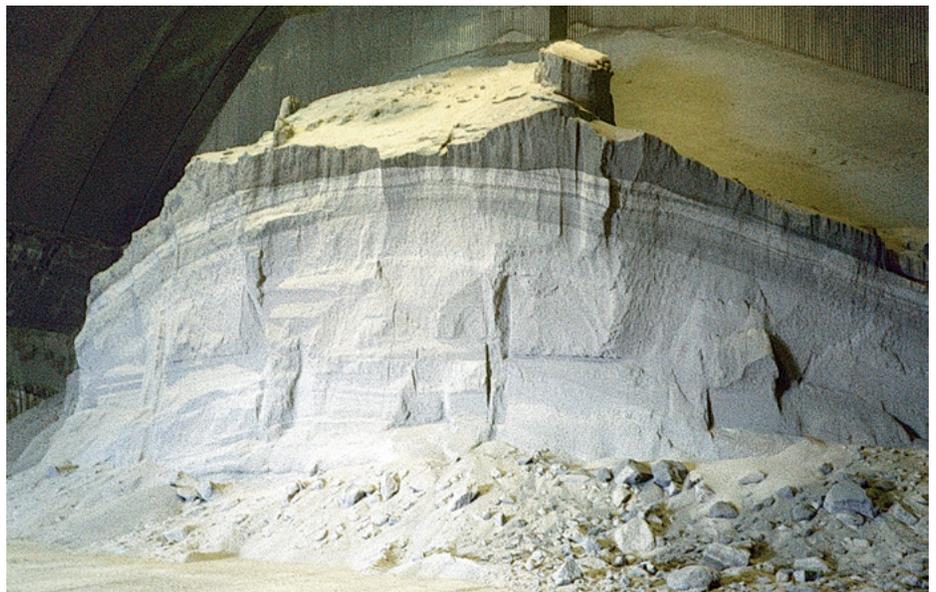
Yara products normally have very low caking tendency provided that absorption of moisture is avoided, and therefore products require protection against high humidity.



Distintegrated fertilizer due to water absorption



Crystal bridges between fertilizer particles cause caking



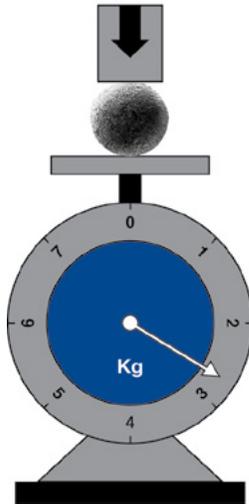
Severe caking

Particle surface, shape and size

Prills have a smooth and glassy surface, whereas the surface of the granules can vary a lot; normally granules are more rough and uneven than prills. The colour of the particle surface can vary according to raw materials applied in the process or due to mineral or organic pigments added to colour the particles.

Prills have a broad size distribution, but are usually smaller than granules. Both types of products can be evenly spread in the field given a correctly calibrated spreader.

Crushing strength of fertilizers



	Type	Crushing strength kg								
		1	2	3	4	5	6	7	8	
NPK PRILLS	25-7-7			■						
	21-9-12				■					
	20-11-11					■				
	16-11-14						■			
	21-7-14 + S							■		
	15-15-15 + S								■	
NP	12-11-18 + S						■			
	26-14							■		
	23-23								■	
Misc.	CN-granule								■	
	AN-prill			■						
	Urea-prill	■								

Particle strength and mechanical resistance

The crushing strength of fertilizer particles differs greatly depending on the chemical composition. Crushing strength measured for various fertilizer types is illustrated above.

Water absorption has negative effects on most fertilizers. Particles can become sticky and tend to disintegrate.

Mechanical resistance is the ability of the fertilizer to resist the stresses imposed upon them in the handling chain. The mechanical resistance depends on surface structure and particle strength.

Provided correct handling, fertilizers produced by Yara have high crushing strength and good mechanical resistance.

Segregation

Fertilizers consist of particles of varying size. When in motion or vibrated, the smaller and larger particles tend to separate - the fertilizer segregates.

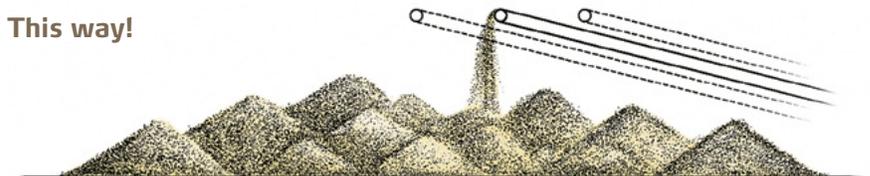
This phenomenon can take place at many points in the distribution system and especially when the material is piled in big heaps. The smaller particles will have a higher concentration in the centre of the pile. It is advisable to build up heaps by using many small ones and to ensure good mixing during reclaiming.

Minimising segregation in a pile

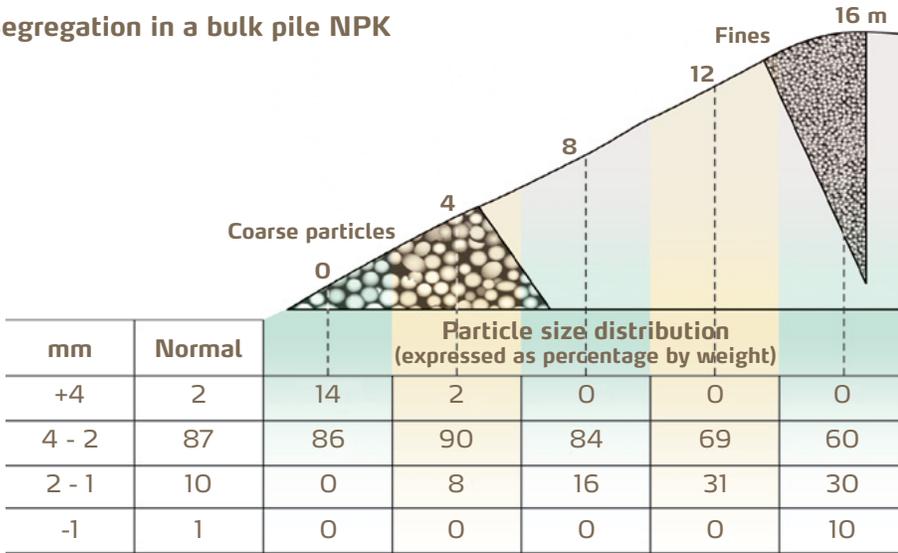
NOT this way!



This way!



Segregation in a bulk pile NPK



Excessive dust during loading vessel



Loading dust free fertilizer

Dust can still be experienced occasionally mainly due to water absorption and abrasion in the supply chain.

Bulk density

Bulk density or volume weight (kg/m^3) differ between products. Variations in particle distribution due to segregation will influence the bulk density. For mechanical spreading it is important that variations within a specific product are minimal.

Correct handling will minimize variation in bulk density for Yara fertilizers.

Dust formation

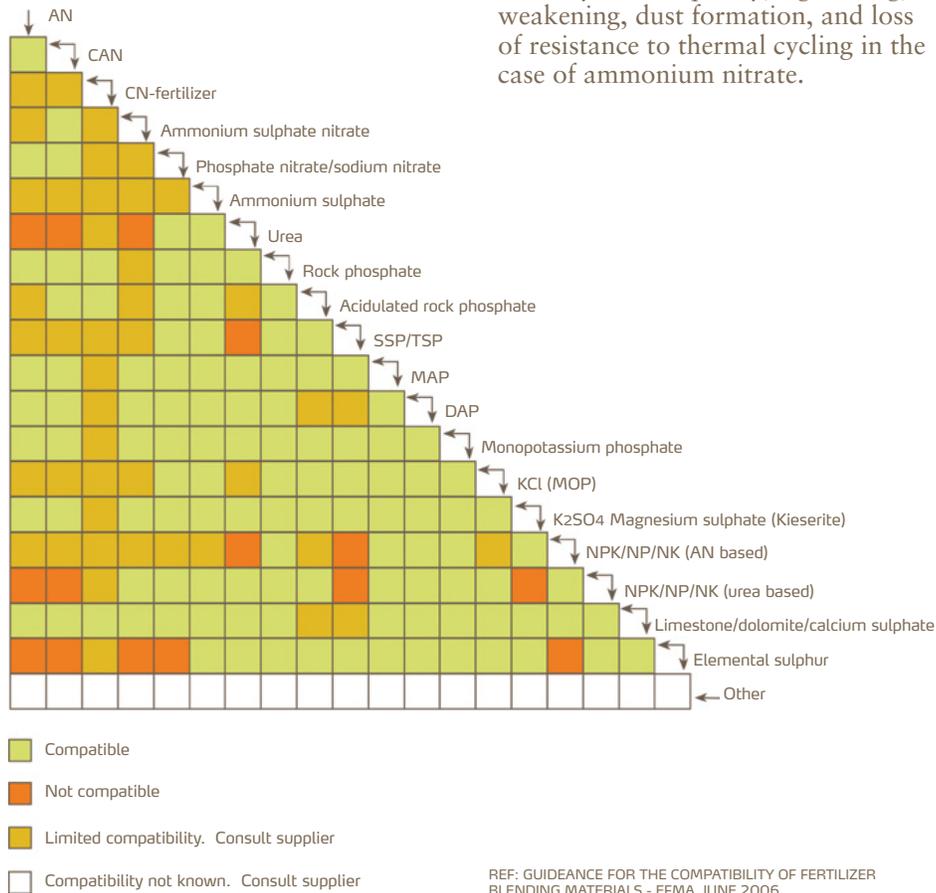
Large amounts of fertilizer dust causes discomfort in the work place. Therefore, in most countries dust emission from handling operations is restricted by law.

Dust and fines normally arise during handling from:

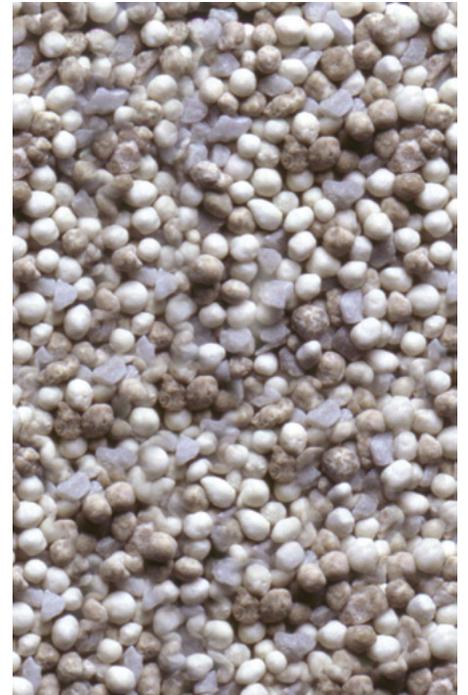
- Water absorption.
- Poor surface structure and particle strength
- Low mechanical resistance.
- Mechanical stresses in the handling chain.
- Wear and tear from equipment (scrapers, screw feeders, grain trimmers etc).

Compatibility

Compatibility matrix



Compatibility primarily relates to blending of different fertilizers, cross-contamination and other problems in safety and/or quality; e.g. caking, weakening, dust formation, and loss of resistance to thermal cycling in the case of ammonium nitrate.



Blended fertilizer

Yara advises not to store non-compatible bulk products in adjacent storage space.

Handling and Storage of Fertilizers

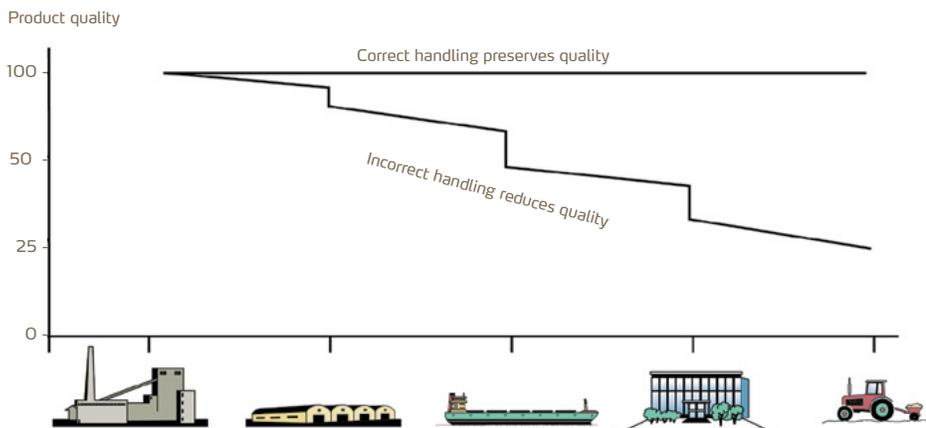


The handling chain exposes the products to multiple steps and mechanical stresses before arriving with the end user. It is crucial that upon delivery the product is of satisfactory quality to be applied readily without affecting its application or subsequently crop yield.

To minimize deterioration in quality and to avoid safety problems in transport, attention should be paid both to the initial fertilizer properties and correct handling procedures.

Most Yara fertilizers are handled in bulk. To preserve top quality throughout the entire handling chain it is important to train operators to follow correct handling routines and procedures.

The handling chain



Safety and quality inspection of vessels and warehouses

- Vessels shall be inspected according to international (IMO) quality and safety procedures and according to the uniform Yara inspection standard.
- Ensure no cross-contamination during transshipments or in the warehouse.
- The dynamic Angle of Repose (angle of slide) of the product can be measured by the tilting box method (IMO).
- No electric installation shall come in direct contact with the fertilizer.
- DO NOT SMOKE signs should be displayed and respected.
- Warehouse floor, conveyor belts and equipment must be clean, dry and free of remainders.
- Do not store off-spec/rejects close to the product.



Ultrasound leak detector (ULD)

Precautionary measures for preserving fertilizer quality

Loading of vessels barges and trucks

- Clean, dry holds, free of contamination and loose rust.
- Tight hatch covers, sea-going vessels to be tested by using ULD. Repair when the hatch covering is not tight (rubber gaskets, compression bar).
- Bulkheads of wood should be covered with plastic.
- Treat tank tops with rust remover before loading technical urea and calcium nitrate.
- Cargo should be covered completely with plastic sheeting and fastened with sticks.
- Loading must not occur during precipitation or heavy fog.
- Transport by truck or wagon should be dry, clean and covered against weather and spillage.
- Avoid high product drop during loading. Cascade loading spout or conveyor belts are preferred.

- The cargo shall be trimmed according to IMO-regulations (BC-code). If possible, trimming should be restricted to the end of the loading.



Trimming of cargo must be done with care

Discharging

- Shore cranes or ship cranes equipped with grabs are recommended.
- Inspect the cargo before start of discharge, check the hatch coamings and the cargo surface. If the product is damaged (contamination/water ingress), call for surveyors and inform the master about this decision.
- Ensure that water damaged cargo and contaminants are separated from sound product.
- Do not discharge during precipitation or heavy fog. Close the hatches.
- Do not mix spilled or wet material on the quay or deck of vessel with sound product.
- When cleaning holds, put the bobcat into the hold as soon as a significant area of the tanktop is reached. Minimise driving into the product to reduce formation of dust and fines.



Collecting lumps in the cargo



Acceptable bobcat driving

Equipment for loading, discharge, storage and transport

- Grabs, hoppers, trucks, conveyor belts and transfer points should be clean and tight.
- Empty the hoppers and conveyor belts before breaks. Clean if necessary.
- Pneumatic conveyors, Redler (chain conveyors), screw feeders are not recommended.



Heavy equipment will crush the product

Bulk storage and loading off

- Fertilizers must be stored on clean and dry floors. Traces left on the floor will soon form a solution when exposed to humid air.
- Doors should be tight fitting and other openings closed.
- Bulk walls of wood must be covered with plastic if not impregnated.
- Bulk products should be covered with plastic sheets or other covering immediately after completed discharge.
- Coverings should overlap by at least 0.5 m, and be fastened with sticks.
- When removing product from the pile do not unnecessarily expose the product to air.
- Re-cover immediately when the operation is completed.
- First In - First Out rule should be followed.
- Avoid cross-contamination of product.
- If spillage, sweep and clean immediately.
- Avoid spillage when re-building the pile with a front-end loader; do not overfill shovel, do not drive into the pile.
- If lumps are observed in the pile, the product must be sieved on delivery or before dispatch.
- Avoid contact with heat sources.



Storage of bulk fertilizer

On-farm storage

- Keep the fertilizer away from diesel, hay, grain etc.
- Where possible store the fertilizers in an enclosed, secure store.
- If outdoor storage, follow best practice recommendations.



UNACCEPTABLE driving into pile



Use the right equipment for piling

Use of payloaders

A payloader is convenient to use when moving bulk material. However, to avoid damaging the material, it is advised that the following precautions are taken:

- Keep a correct angle between the bucket and the floor to minimise crushing. Do not keep it flat.
- Avoid spillage on the floor.
- Do not drive the wheels into the pile.



Correct angle

Safe Handling of Yara Belle Plaine Urea



Long Term Storage of Fertilizer

Modern manufacturing practice has improved the quality and consistency of Urea dramatically. Beyond that most plants include an internal conditioning agent to improve long term stability of material. We feel that there are four inherent product characteristics which if understood and properly managed can reduce product set and enhance the degree of “ease of handling”. Those characteristics are:

1. Urea has hygroscopic properties which cause it to attract and hold moisture. Process control is monitored and moisture controlled at the production facility. Their final sampling occurs at the shipment. At any stage of the process that takes material from the plant to the field, Urea can be exposed to moisture. It takes very little additional moisture to dramatically increase the problems you may have with set up and flowability. Take extra care that Urea is never exposed to water or wet equipment.

2. Temperature differentials between the product and outside air can contribute to movement of moisture within the product. This movement can contribute to the formation of crystalline bridging between particles which will manifest itself in pile set up. This situation will be magnified in tank storage with the exposed metal surface of the tank. Urea is a good insulator and will hold temperature from the

product and ambient air at unload for a long period of time. This is a concern when you go from summer to winter conditions.

3. The generation of fines in material flows and concentration of fines during fill, in direct spout systems, provides a means to bridge the gaps that should be present between the granules of Urea. This additional contact surface will magnify any moisture problem that is being created. At the production facility, product is screened to ensure minimal fines in your products. Excessive handling or high impact flows will generate product breakage and fines. Therefore the presence of excess fines in your material should be investigated immediately.

4. As the depth of your storage pile increases, the dual impact of a large drop from the fill system, and the compression on material at the lower levels of the pile create a compaction problem which causes a physical change in the material (particle plasticity). As is the case with fines, this has the effect of increasing the contact surface of the granules, and will magnify the degree of set up in the material. Time in storage can add to the magnitude of this compression effect.

You may experience these elements singly or in combination. If this occurs, you can experience a VERY HARD set up which will take a great deal of extra labour and can expose your people to hazards. Prevention is the critical step to keeping yourself out of this situation.





Metal Bin Storage

Product will set up in bins and any problems in the quality of material just makes that worse. The strategy for long term storage would be to keep enough room to turn the product. If you do this after a couple of weeks in storage to break any initial bond formed, and then turn it when the weather cools for winter, to reduce the temperature differential material condition in the spring will be much improved. Ensure that the system is checked to identify any place where moisture can be introduced to product. Any problems identified need to be corrected immediately. It is not recommended to store summer fill beyond fall.

Small Flat Sheds

Product may set up in bins but since material is generally placed into storage by conveyors, the fines (spout lines) and fill depth won't be a great challenge. Ensure that the storage shed and handling system is checked to identify any place where moisture can be introduced to product. Any problems identified need to be corrected immediately. Fill the shed at a controlled pace (i.e. a load or two a day) to allow the material to equalize before additional product covers it and the insulating properties create temperature pockets.

High Profile Sheds

These sheds will manifest challenges of fines and compaction. The ideas below can reduce the degree of pile set at your facility.

It would be to your advantage to unload trucks in the morning before the shed temperature and the product temperature in the truck have raised by the sun's heat. As with the small sheds, fill the shed at a controlled pace (i.e. a load or two a day) to allow the material to equalize before additional product covers it and the insulating properties create temperature pockets. Because the shed design results in the likely occurrence of some of the problem area identified, it is **ESSENTIAL** that the storage shed and handling system be checked to identify any place where moisture can be introduced to product. Any problems identified need to be corrected immediately. Failure to take these actions can result in severe product set up which would expose your staff and facility to serious risks.



Fertilizer Unload Procedure



1. Check that fertilizer was ordered and truck is at correct location. All reasonable precautions must be taken to avoid the loading, transport, and unloading of urea during inclement weather. This requirement is to be communicated with all carriers and if the weather changes while the load is in transit, then the receiving location is to hold the load and defer unload until such time as it has stopped raining and unload equipment is completely dry.

2. Prior to starting, unload equipment, (overhead conveyor/auger, receiving leg/bucket elevator, under truck conveyor/auger) each piece, should be inspected for signs of water, particularly the under truck conveyor/auger. If water is present, the water needs to be removed and the equipment run until dry. The equipment is not to be started with water in the unload pit, as this could introduce water into the storage area.

3. Ensure that fertilizer unload conveyor is clear of any obstructions or foreign material prior to positioning truck; sweep pad if necessary to remove any waste material or debris.

4. Position truck over unload conveyor, ensuring that hopper is positioned to drop product directly into the unload conveyor/auger.

5. Prior to starting unload procedure, unroll tarps on truck to verify correct product and quality; the truck should be completely inspected for any signs of water intrusion in transit. If there are

signs of water intrusion, communicate with the Yara Belle Plaine to determine the course of action to be taken. Do not unload as this will only compromise any urea that is currently in the storage area.

Note: Checking trucks can be a work-at-heights risk and will require a safe work plan or procedure, i.e. the use of proper fall protection or use of a mirror-on-pole device to prevent climbing on truck.

6. Select appropriate bin that will hold the product and open receiving bin fully; ensure all equipment is clear of obstructions.

7. Ensure all other bins are closed completely to avoid product contamination.

8. Start the overhead conveyor/auger.

9. Start receiving leg/conveyor.

10. Start under truck conveyor/auger.

11. Open slide of truck slightly to allow fertilizer to flow; open slide on truck to match the uptake of the system.

12. Take samples from each compartment of truck while unloading to monitor fertilizer quality. A small (50-60 grams) portion of each sample taken from the bins of the truck during unload should be kept as a single sample; this should be identified by order number and kept for one year from date received.

13. Monitor plant unload system continually for sign of stoppage or back up.

14. Ensure each compartment of truck completely empty prior to repositioning truck to next hopper. Trucker should sweep each compartment to ensure proper clean out.

15. After truck has been emptied, allow system to clear and shut down equipment.

16. Have trucker pull off unload pad.

17. Restart equipment to clean and spilled product off pad area if necessary.

18. Sign bill of lading.

19. Service the unload system of plant in preparation for the next load closing bin if applicable.

20. Process receiving report; update inventory.

21. Measure cubic weight of product delivered adjusting blend factors of plant if applicable.

22. All product receiving must take place under the direct supervision of the retail outlet; under no circumstances is product to be unloaded by the carriers in the absence of the retail outlet.

Task Procedure

Removal Of Fertilizer With Bobcat



Process description:

Once fertilizer has been placed into a storage shed (wooden construction with straight walls) it must be removed by means of a bobcat or some similar type of small loader. The initial stage of this activity is made by removing material from under the bin overhead door and transferring to the shipping system. Once the initial material has been cleared away from the door it will be lifted to allow access to the whole storage bin.

General hazard:

Fertilizer can be subject to setting up in storage, especially prolonged storage. This is especially true for Urea, but can also be the case in other products. This setting process will be magnified by the addition of moisture (in transit, in receiving process, through leaks in the shed) and can result in a material pile that must be brought down through the use of poke poles. With a storage pile that might be 30+feet deep, the exposed face of this CLIFF can represent a significant risk to person and machine.

A secondary risk comes from the operation of the machine in a restricted and dusty environment. It is important to restrict persons moving around while the machine is in operation since the operator may not have good visibility or may be distracted while concentrating on their task.



(assume that you are starting with a full bin and the door down)

1. Turn the area lighting on and start up the ventilation fan(s). Start up the leg and ensure it is set to discharge on the correct bin. Once you have gone through the pre operation checklist on your machine (bobcat), start it up. The machines should be allowed to warm up prior to use. Refer to the task procedures that deal specifically with machine operation.

2. Proceed to the bin which contains the product which you need to elevate. The bucket of the machine should be flat on the floor. You will be in close proximity to the door and walls, so it is important to operate machine under complete control. When the bucket has been filled, tilt it back and back away from the door. The machine will then be driven to the transfer hopper, elevated to the transfer point, and dumped. Return for the next bucket.

Potential Hazard:

If the material has set up it will not flow freely into the door opening. This may result in a surge of product being released from the pile and hitting the wall/door. The shed's design does not allow for this impact force and we have suffered failures where this impact has knocked out a wall section. This puts the operator and machine at risk, since they may be under this material. Anyone on foot in this area will similarly be at risk.

Control:

Several buckets of product will have to be removed before the door can be raised. Material should flow freely throughout this process, and can be checked by observation through the overflow hole in the bin. If the bin has not been touched for several months, product flow must be observed to ensure there is movement through the face of the pile. If product stops flowing, check the bin status through the overflow protection holes with a hand light. If there is a vertical face on the pile, stop your operation and ensure that the machine and people are moved back out of area. In many cases if the pile is allowed to sit, material will be shed off the pile as it is exposed to the air. Contact your sector office to discuss the situation and develop a plan of attack.

3. The door is now ready to be lifted. By this time the pile has been reduced to take the pressure off the door, and the slope of the pile is similar to its normal angle of response. This uses the bobcat to lift the door and may require a second person, who will place the support blocking mechanism in place. Then use the bobcat to lift the door. It may require a second person, who will place the support blocking mechanism in place.

Potential Hazard:

The door is heavy so it is important to ensure the bobcat is securely under the door prior to lifting. Once the door is up to the necessary height, ensure contact is made between the machine operator and assistant so that no machine action is taken during the placement of the block. Damage may be done to the door or wall by excess travel on the lift. Do not try to reach from the cab to place the blocks since this puts the operator at risk.

Control:

Switch over to forks to lift the door. Ensure the block mechanism can be placed without having to lift past the door opening. Ensure two people are present to do the task.

4. You now have full access to the bin with the machine. As before, approach the pile with the bucket on the floor. It is best practice to work across the face of the pile. In the wooden structures, the wooden wall seems to release material easier than the product will. If you approach down the walls and from there work toward the middle the process will be more successful.

Potential Hazard:

During this operation, the operator must be constantly aware that the pile is not starting to develop a vertical face. The extreme of this vertical face would be where material is holding up and overhanging the base. Material on this face can release in a sudden surge which can bury the machine or persons if they are in close proximity.

Control:

If material does NOT continue to flow freely off the pile, stop work immediately before cliffs are formed. Advise location staff of the hazard. Keep everyone out of the area. Contact Yara Belle Plaine to develop plan. Note: Prevent formation of face cliffs - keep face cliffs to a minimum (the lower the better, 10 feet maximum).

Suggested Methods Of Dislodging Set Fertilizer

Fall protection and/or confined space entry may be required depending on the circumstances.

A. Flat Storage Sheds

- Barricade (rope) off the area of concern.
- Do not dig into the base of any cliff with the loader/bobcat bucket. Take only the loose material off the floor.
- Prevent formation of a cliff face. Always keep the cliff face at a minimum.
- Do not work directly under any cliff. Work the area to either side. This will help to bring the cliff down on its own. The cliff will typically break away and drop straight down, surging outwards when it reaches the floor or any low point in the pile.
- If using a poker to assist bringing down the pile, wherever possible, approach from the side and poke straight in and out. Do not try to cut the pile with the poker. If you need to approach face on, ensure the poker is of sufficient length to keep the operator from risk when the pile drops.
- Do not try to bring large quantities down at one time. Start high up the cliff face and work the pile down in smaller amounts.

- Try to work evenly across the cliff face.
- Large lumps can be crushed using the bucket of the loader/bobcat and then picked up and loaded out.
- Use of mobile equipment (backhoe, etc) should be considered as an option for bringing down the pile.

B. High Profile Sheds

- Prevent formation of a cliff face. Always keep the cliff face at a minimum.
- Use of a backhoe or other type of mobile equipment may not be possible due to the structure support rods.
- Work the pile from above using long pokers to manually knock down the pile. This may require removal of roof panels or wall panels to gain access from above.
- Work the cliff evenly, beginning at the outside, working towards the middle, keeping the cliff face even.
- Do not cut any pathway into the pile or between the building walls and pile. This increases the risk of a person or equipment being buried.

C. Tank Bin Storage

- Tank farm bins with urea set up due to moisture intrusion will be the most difficult to handle. Proper safety precautions (fall protection) will be needed for the operator working from on top of the bin.
- Use long steel rods with flat scraper blades and break the urea up from the top manway.
- It may be necessary to shutdown the conveyor (ensure proper lock out followed) and reach into the bottom outlet to remove lumps to allow the urea to flow out.
- If there is a need to enter the bin to break up the pile/lumps, proper confined space entry procedures will need to be followed.
- Close observation from the top manway of the bin emptying is advised to ensure the urea does not start to bridge such that there may be a danger of the bin being damaged or collapsing. In instances like these it may be necessary to unload the bin from the top manway. Vacuum trucks have been used for this purpose.





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About Yara

Yara grows knowledge to responsibly feed the world and protect the planet, to fulfill our vision of a collaborative society, a world without hunger and a planet respected. To meet these commitments, we have taken the lead in developing digital farming tools for precision farming and work closely with partners throughout the whole food value chain to develop more climate-friendly crop nutrition solutions. In addition, we are committed to working towards sustainable mineral fertilizer production. We foster an open culture of diversity and inclusion that promotes the safety and integrity of our employees, contractors, business partners, and society at large.

Founded in 1905 to solve the emerging famine in Europe, Yara has a worldwide presence with about 17,000 employees and operations in over 60 countries. In 2018, Yara reported revenues of USD 12.9 billion.

www.yara.com