GUIDANCE FOR SAFE HANDLING AND UTILIZATION OF NON-CONFORMING FERTILIZERS AND RELATED MATERIALS FOR FERTILIZER PRODUCERS

european fertilizer manufacturers association

CONTENTS

1. INTRODUCTION

This guidance is intended for fertilizer producers, including blenders. It concerns the safe management of solid non-conforming (i.e. off-spec and reject) fertilizer materials and associated raw materials. During production, deviations in process conditions can lead to the manufacture of off-spec materials and, in the handling activities, fines, deteriorated and contaminated materials may be generated. Some of these materials can be potentially more hazardous than the standard products and, therefore, need to be carefully managed as regards handling, storage and safe utilization or disposal. **It should be noted that not all the non-conforming materials covered by this guidance may fall within the scope of major hazard legislation.**

This guidance identifies sources of such materials, brings out relevant aspects of their properties and outlines various methods available for their safe utilization or disposal.

It focuses on solid Ammonium Nitrate (AN) based fertilizers and typical raw materials for the solid fertilizer process, in packaged or loose bulk form. It also covers urea and urea based fertilizers, potassium nitrate, potassium sulphate, ammonium sulphate and other common fertilizer raw materials. **The guidance does not apply to industrial or technical grade, porous AN nor similar materials, for which a stricter guidance may be required. This is, however, outside the scope of EFMA's expertise. Primarily, such reject materials must not be stored with fertilizer reject materials.**

This guidance is not prescriptive in nature; it offers alternative options, which operators should evaluate in relation to their own particular situation, and select the most suitable one, having carried out a risk assessment. It reflects the products and raw materials currently in use and the present knowledge of the inherent nature of these materials and related process technology.

Detailed guidance for storage and handling of fertilizers is covered in EFMA's earlier publication, *Handbook for the Storage of AN Based Fertilizers, 1992,* which is being revised. (Ref.1)

2. OVERALL APPROACH AND DEFINITIONS

2.1. General Guidance

In the Fertilizer Industry a manufacturing or distribution site would typically handle a number of products and/or raw materials, usually in relatively large quantities (i.e. in excess of hundreds of tons). During the manufacturing processes, in storage and in handling there are a number of operations or activities which can give rise to non-conforming materials, either as off-spec or reject materials. Below in this section, there is a summary of the main principles of safe management of such materials and an explanation of various terms used in this guidance. The common range of products and raw materials handled in the Fertilizer Industry are described in Section 3. Various off-spec and reject materials, which are likely to be generated in typical operations or activities, and the potential hazards of materials containing AN, are described in Section 4.

Various methods are theoretically possible for the safe utilization of the non-conforming materials, though they depend on the extent and nature of deviation or degradation. These methods are reviewed in detail for

various types of AN based products, urea based products and a range of raw materials (see section 5). From the various options listed, the most suitable for a particular site or specific rejects would depend on a number of factors: e.g. the availability of suitable manufacturing processes on the site with a potential for recycle; or the availability of other manufacturing processes, which can use them as process material, marketing as saleable products. It should be noted that not all options listed might apply to any particular reject material under consideration.

As the general principles of safety management system (Ref.2), operators should use best practices, such as:

I. Minimization of production of non-conforming materials should be given high priority. This can be achieved by sound process and engineering design, good process controls and provision of reliable equipment.
II. All potential sources of non-conforming materials should be identified as to their types and likely quantities.
III. Schemes should be in place, supported by written procedures, for the handling and treatment of these materials.
IV. Proper records of these materials should be kept: e.g. sources, quantities, types and utilization.
V. Care should be taken to minimize the quantities of rejects accumulated and the period for which they are held. Where necessary, rejects should be promptly diluted to render safe. Procedures must be in place to achieve this.
VI. Plant and floors for storage area should be kept clean, avoiding the accumulation of deposits of fertilizer materials. The use of organic materials such as sawdust for floor drying purposes should also be avoided.
VII. Non-conforming materials should be kept separated from final products, and different types should not be mixed without a prior risk assessment.
VIII. Care should be taken with materials returned from customers due to the possibility of contamination.
IX. Where reject or off-spec material is treated or diluted to render safe, prior to sale, or where it is suitable for sale in its own right, it must conform to relevant national legislation.

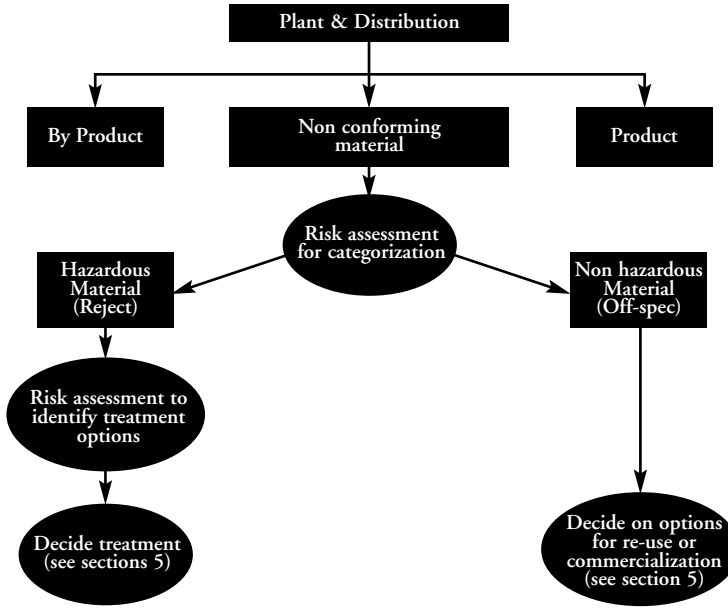
x. Operators should be given relevant training for the selected reject handling measures, including potential hazards of the materials involved, in particular, AN based fertilizers.
xi. **Explosives must never be used to break up caked fertilizer.**
xii. All procedures to render material safe must be carried out with due care and attention to safety.

2.2. Definitions

Non-conforming fertilizer materials

Non-conforming materials are those materials which do not meet the characteristics of the intended products at the time of production or when marketing. They include both off-spec and reject materials, which are defined below. Essentially, they include everything other than marketable specified product.

Various types of products and the associated materials, which can typically be handled on fertilizer installations, are shown below.



Off-spec products

A number of chemical and physical characteristics are specified for fertilizers, for production and/or marketing purposes, which generally relate to quality and/or safety. They include, for example, nutrient contents; moisture level; particle size; pH stabilizer content; presence of proscriptive concentrations of heavy metals, chloride and carbon; bulk density; oil retention (porosity); color; caking tendency; besides detonability and capability in terms of self-sustaining decomposition.

During production, deviations in process controls can lead to products that do not meet one or more of these specifications. Changes can also occur during storage and subsequent handling, taking the product out of specification. These changes include, for example, moisture pick-up, physical breakdown, caking and contamination. Most of such deviations or changes have no significant impact on the potential hazards of the products; they tend to give rise to quality issues. In this guidance, these materials are described as off-spec products. Thus, it does not mean that the product is unsafe or non-saleable. It may be acceptable to sell it as a fertilizer under a new specification or for a different application, or it may be possible to recycle or rework it within the process.

Reject materials

We describe reject materials as products which are out of specification, or have deteriorated during storage and/or handling in such a way that they can be considered potentially hazardous. They cannot be sold as fertilizer products and may require treatment to render safe.

By-products

Products manufactured alongside the main product as a design feature of the process, which may be sold or used as process raw material in another process, e.g. different size fractions. They are not considered as non-conforming materials.

AN based fertilizers
Fertilizers containing nitrogen in both ammonium and nitrate forms are, for the purpose of this guidance document, defined as **AN Based Fertilizers**. These fertilizers are generally supplied in prilled or granular form.

Fillers or diluents
Fillers or diluents are inorganic materials, which may be added to fertilizer materials and which do not affect the hazardous properties of AN in such an adverse way as calcium sulphate, magnesium sulphate, limestone and dolomite.

Total combustible material
The total combustible/organic material calculated as carbon.

Nitrogen or AN content
Nitrogen content (percentage in weight) derived from AN is related to AN percentage as follows:

% Nitrogen	15.75	24.5	28	31.5
% AN	45	70	80	90

Self-sustaining decomposition (SSD)
Decomposition in fertilizers, initiated by an external heat source, that continues even when the heat source is removed. The relevant official test is the Trough Test (Ref.3).

3. MATERIALS

These include the main fertilizer products, related materials and raw materials. Some *raw* materials for compound fertilizers can be considered to be *fertilizer products* in their own right: e.g. mono-ammonium phosphate and potassium nitrate. They are discussed in the Raw Materials section (3.2). The presence of these materials is considered on production units, on-site and external stores, loading/off-loading areas and harbor areas.

3.1. Products

The main types of products currently produced are listed below; other products may be possible.

- AN: fertilizer grade, prilled or granulated, containing >80%AN (i.e. >28% N derived from AN) may contain inert additive such as magnesium nitrate. Main criteria specified in regulation (EC) No. 2003/2003 (Ref.4).
- High N AN based products containing >70% AN (i.e. >24.5% N) with inert additive and/or inert substances such as kieserite, calcium sulphate (e.g. gypsum, anhydrite), etc.

- Calcium Ammonium Nitrate (CAN): chemical mixtures of AN with limestone or dolomite, containing no more than 80% AN (i.e. 28% N derived from AN).
- Ammonium sulphate nitrate (ASN): fertilizers containing <70% AN (i.e. <24.5% N derived from AN), ammonium sulphate (AS) and diluents, if any.
- AN based NPK (including NK and NP) fertilizers.
- Urea and urea based NPK fertilizers.

3.2. Raw Materials

In addition to AN, the main range of solid raw materials used is as follows:

- Ammonium sulphate;
- Potash and various phosphates: e.g. mono-ammonium phosphate (MAP), di-ammonium phosphate (DAP), single super-phosphate (SSP), triple super-phosphate (TSP) and rock phosphate;
- Potassium nitrate;
- Potassium sulphate;
- Fillers, additives and diluents such as limestone, dolomite, magnesite, gypsum, calcium sulphate, anhydrite, sand and clay.

4. VARIOUS NON-CONFORMING MATERIALS AND THEIR POTENTIAL HAZARDS

4.1. Typical Sources and Activities

Non-conforming materials can be generated during various activities and in different places. For example, during production, deviations in process control parameters can sometimes lead to the manufacture of products which may not be fully within the agreed manufacturing or selling specification. Although the product may be safe, it may not be possible to sell it, as it could be outside the selling specification. Equipment failures can lead to spillages and, similarly, bags can be damaged, causing spillage of product or moisture ingress in storage, handling and transport activities. Maintenance-related activities, e.g. cleaning can also give rise to non-conforming material. All these types of materials need to be managed properly for safe utilization or disposal.

The following main activities are identified as being capable of generating the before-mentioned materials:

- Production (granulation, prilling and blending);
- Packaging;
- Storage;
- Plant maintenance activities;
- Cleaning operations related to plant areas, floors and in/around process equipment;
- Loading for transportation into, for instance, road vehicles, rail cars, barges or ships;
- Transfers at harbor and other similar areas in the distribution chain;
- Storage at locations outside of manufacturing facilities; and
- Quality control and marketing functions: products returned by customers.

4.2. Potential Hazards

The three main potential chemical hazards of relevance concerning AN based materials are:

- Fire;
- Decomposition (including self-sustaining decomposition); and
- Explosion: e.g. detonation.

The affecting factors are briefly discussed here.

AN is an oxidizing substance and can therefore provide oxygen in the absence of air. However, **AN itself does not burn**. Fire hazard can increase if the nitrate based products, particularly spillages, are contaminated with combustible materials. For example, sawdust is sometimes inappropriately used as a drying agent on wet floors. In a fire situation AN can give off toxic fumes such as NO_2.

AN undergoes thermal decomposition when heated well above its melting point (169°C) by means of a number of reactions. Some of the product gases are toxic in nature, for example NO_2. The onset temperature can reduce and the rate of decomposition is enhanced by a number of sensitizing materials. Sensitizing materials can be:

- Acids, chromates, chlorinated chemicals and various metals such as zinc and copper and their salts;
- Other substances at those sites which produce a range of chemical products;
- Contaminants during transport and/or storage;
- Products returned from customers; or
- Mixing of NPK fertilizer products or their dust.

Owing to the nature of AN, contaminants must be avoided.

As described above, both fire and decomposition can lead to the evolution of toxic gases.

All AN based fertilizers are produced to have a high resistance to detonation; they pass the EU Detonation Resistance Test. The sensitivity to detonation of these products can, however, increase due to a substantial reduction in particle size, to an increase in porosity (hence a decrease in bulk density), to physical characteristics of additives or increase in levels (above safe limits) of combustible, and also due to organic and other sensitizing materials such as copper and chloride. Thus, fines or dust can be more sensitive than the standard product (Ref 5,6). It is worth noting that in processes where organic coating is applied to products, fines may take up relatively more coating agent, thus enhancing the sensitivity. The addition of AS within certain limits can increase the sensitivity to detonation and SSD. Since various factors such as those mentioned above can affect the detonation behavior, it is not possible to exclusively rely on the chemical composition, e.g. in terms of AN content.

5. DETAILED GUIDANCE FOR FERTILIZER PRODUCERS

5.1. AN Based Fertilizers

5.1.1. Introduction

This section deals with AN based fertilizers such as straight AN/CAN, ASN and NPK products. These fertilizer products can become non-conforming in various ways: e.g. as a result of deviations during production or contamination during storage or handling (various types/sources of non-conforming materials are considered in sections 5.1.3 to 5.1.9). In doing so, exact upper limit values of the potentially hazardous substances which are likely to be present (e.g. combustible material calculated as carbon, heavy metals, etc.) are not specified. This is because these values depend on the compositions, and production/selling specifications may vary depending on factors such as whether the product is a blending component. The concentration of combustible matter (calculated as carbon) is specified in a number of regulations (Ref.7): the upper limits are 0.2% in fertilizers containing 90% or more of AN, and 0.4% where the AN content is more than 45% but less than 90%.

5.1.2. Practical Options for Utilization

A number of practical methods are available for utilizing off-spec and reject materials as described below.

Reworking and blending: Clean spilled products, or those with minor deviations from the standard products, can be fed back into the tail end of the process, i.e. reworking. This involves simple physical operations such as screening, mixing and bagging. Blending simply involves mixing with good product.

Recycling into process: Some materials, though free from contamination, may not be suitable for blending with the standard product due to, for instance, significant size difference. These can be recycled into the main process allowing the material to be reprocessed. The recycling can be direct, into the main process, or indirect, via scrubbing systems, drain solutions, etc. From the safety standpoint, it is very important that no hazardous contamination enters the process. Special care must be taken when the material contains organic coating, trace elements or other potentially hazardous ingredients; a hazard study must be carried out.

Utilization in another process: Manufacturing processes for NPK, CAN and blends can accommodate certain types of solid non-conforming materials.

Dissolving to form aqueous solution: Most fertilizer plants have effluent recovery systems involving solutions. Solid non-conforming materials can be conveniently dissolved in such systems to generate solutions. Depending on the purity, concentration and similar factors, such solutions can be recycled into the process or utilized in other processes such as UAN or NPK fertilizer production.

Selling as product with different specification or application: Off-spec materials with minor deviations such as those relating to size, appearance, pH, or caking tendency can be sold, for example, as fertilizers with a different specification of nutrient levels; or as raw materials in manufacture of blends/ NPK fertilizers or other products.

Dilution with fillers (inert materials): Reject materials, which are potentially hazardous and cannot be readily treated by any of the above methods in a safe manner, can be rendered safe by dilution with non-reactive diluents such as limestone, sand, etc. A ratio of 1:1 by weight is recommended, based on the work done with AN fines and the practical simplicity of the process (Ref.5,6). This work shows that limestone, china clay, dolomite, gypsum, phosphate rock, sand and magnesium oxide are safe and effective diluents when considering detonation sensitivity. Fertilizer materials such as MAP, DAP, SSP and TSP do not appear to have an effective desensitizing effect and, therefore, they are not recommended as diluents. The selection of dilution ratios other than 1:1 should be based on a risk assessment. The treated material can be sold or utilized in blending following risk assessment. Mixing AN fines with NP, NK and NPK fines should be avoided since chloride, for instance, can enhance the sensitivity of AN. This may be permitted when justifications are based on a risk assessment.

5.1.3. Non-Conforming Fertilizer Materials Resulting from Production Process Deviations

Below various deviation(s) in chemical and/or physical characteristics are considered: nutrient contents, pH, stabilizer contents, heavy metals, chloride, carbon contents, moisture level, particle size, bulk density, oil retention (porosity), color, caking tendency, detonability, and SSD capability). Deviations from some of these characteristics do not necessarily render the product unsafe. Detailed guidance follows for two categories: AN, high N, CAN/ASN and NPK.

NON-CONFORMING STRAIGHT NITROGEN FERTILIZERS
AN, HIGH N, CAN AND ASN

Parameter or aspect	Deviation and likely practical options
pH	Too low (e.g. pH<4.5 for AN) For CAN, low pH is unlikely. ▮ Recycle into process but beware of organic coating, trace elements, etc. ▮ Dissolve to produce solution. ▮ Sell. (See 2.1, IX) ▮ Carry out risk assessment and consider reworking or blending with good product.
Particle Size	Too small/too large compared with manufacturing and selling specification ▮ See 5.1.4. ▮ Screen out good product and treat the remainder. ▮ Blend with standard product, provided final product remains within size specification. ▮ Recycle into process. ▮ Dissolve. ▮ Sell. (See 2.1, IX)
Stabilizer content	Too low. ▮ Recycle into process. ▮ Dissolve to produce solution. ▮ Dilute with inert materials in ratio 1:1. ▮ Use/sell as feedstock for fertilizers or other products. (See 2.1, IX) ▮ For ASN not relevant on safety grounds. Too high ▮ Generally not a safety issue, but carry out a risk assessment in order to select a suitable option.
Heavy metals content	Too high. Options similar to stabilizer content (too low); but: Beware of Cu, Zn etc which can sensitize AN

Chloride content	Too high. Beware of potential sensitizing effect on AN. Carry out risk assessment. Options similar to stabilizer content (too low)
Carbon content (organic carbon)	Too high ▮ Beware of potential impact on material classification. ▮ Carry out risk assessment. ▮ Dilute with inert materials in ratio 1:1. ▮ Dissolve with care to produce solution. ▮ Use in NPK production if safe to do so. ▮ For ASN consider recycling into granulation
Moisture content	Too high ▮ Sell. (See 2.1, IX) ▮ Recycle into process. ▮ Screen to remove good product and treat remainder. ▮ Use in NPK production. ▮ Dissolve to produce solution.
Oil retention (Porosity) (AN >80%)	Too high (>4%). Take care if milling/crushing. ▮ Recycle into process, if safe to do so. ▮ Dissolve to produce solution. ▮ Dilute with inert materials in ratio 1:1 ▮ Sell. (See 2.1, IX)
Bulk density (AN >80%)	High: not a safety issue. Too low: can influence detonability. For options see Oil retention above.
Caking tendency	Too high Options as stabilizer content deviation (see Too Low, above) or after risk assessment blend with good product /treat with anti-caking agent.

Detonability	Could fail the EU resistance to detonation test. Take care if milling/crushing. ▮ Recycle into process. ▮ Dissolve to produce solution. ▮ Dilute with inert materials in ratio1: 1. ▮ Sell. (See 2.1, IX)
Self Sustaining Decomposition (SSD)	Not generally relevant. However, high organic carbon content or presence of certain materials can enhance decomposition hazard.
Nutrient content	Outside specification and/or permitted tolerances. ▮ Sell under new specification. (Beware of classification change) ▮ Rework. ▮ Recycle into process.
Color/appearance	Abnormal. Check if caused by some contamination. If contaminant is not potentially hazardous, it is not a safety issue. ▮ Sell. (See 2.1, IX) ▮ Rework/blend with good product. ▮ Recycle into process.

NON-CONFORMING COMPOUND FERTILIZERS
NPK (INCLUDING NK AND NP)

Parameter or aspect	**Deviation and likely practical options**
pH	Low pH: could cause slow decomposition; generally not a serious hazard. Recycle into process. ▮ Dissolve to produce solution. ▮ Sell. (See 2.1, IX) ▮ Blend subject to risk assessment and testing
Particle Size	Too small/too large compared with manufacturing or selling specification. (See 5.1.4) ▮ Screen good product out and treat the remainder.

	▮ Mix with standard product, provided final product remains within size specification. ▮ Recycle into process. ▮ Dissolve. ▮ Sell. (See 2.1, ix)
Stabilizer content	Not applicable
Heavy metals	Too high. Potential SSD hazard. ▮ Assess the risks. ▮ Check saleability. ▮ If necessary, rework or recycle. ▮ Dilute with inert material to sell.
Chloride	Abnormal levels can give rise to self-sustaining decomposition. See Self sustaining decomposition.
Carbon content (Organic carbon)	Too high. Beware of potential impact on classification and SSD hazard. Subject to risk analysis. ▮ Recycle into process. ▮ Rework (with good product). ▮ Dissolve to produce solution. ▮ Dilute with inert materials in ratio 1:1.
Moisture Content	Too high. Product likely to cake and further deteriorate (e.g. to dust). ▮ Sell. ▮ Recycle into process. ▮ Screen to remove good product and treat remainder. ▮ Dissolve to produce solution.
Oil retention	Not applicable.
Color/appearance	Abnormal. Check if caused by some contamination. If the contaminant not potentially hazardous, it is not a safety issue. ▮ Sell. ▮ Rework/blend with good product. ▮ Recycle into process.

Caking tendency	High. ▮ Screen out good product and treat the remainder. ▮ Sell. ▮ Rework/blend with good product. ▮ Recycle into process. ▮ Treat with anti-caking agent.
Detonability	Could fail the EU resistance to detonation test, but generally not an issue with most of these materials, particularly when AN<70%. Take care if milling/crushing. ▮ Dilute with inert materials to make it non-detonable in ratio 1:1. ▮ Rework/blend with good product. ▮ Dissolve to produce solution. ▮ Recycle into process subject to risk assessment.
Self sustaining decomposition (SSD)	If produced inadvertently, take precautions relevant to those for SSD materials. ▮ Recycle into process following risk assessment. ▮ Rework (with good product). ▮ Dilute with inert material materials in ratio 1:1. ▮ Dissolve to produce solution. ▮ Sell as an SSD product.
Nutrient content	Outside specification and/or permitted tolerances ▮ Sell under new specification (beware of classification change). ▮ Rework. ▮ Recycle into process.

5.1.4. Fines and Dust

Within the production processes, the fines and dust of one product are not generally mixed with the fines and dust of another. However, small amounts of "mixed" dusts may be generated, as in bag filters. Dust and fines which are produced during normal operation as per the process design, and which are either recycled within the process, removed (as by-products) for sale or recycled into another process, are not off-spec or reject materials and therefore do not fall within the scope of this guidance. Care should be taken to ensure that process safety is not compromised when recycling.

Fines or dusts can also be generated in storage and handling operations, or due to gross loss of process control or due to product deterioration.

Options for treatment of such reject materials are summarized in the tables above in section 5.1.3. and more detailed information about various product dust is given in Ref.2,5,6.

5.1.5. Returns from Storage, Loading Departments and Dedicated Areas

Such returns mainly comprise fines and coarse material from screening operations.

- Preferably use separate belts for conveying AN/High N/CAN and other materials: e.g. NPK.
- Screened fines should be stored in loading departments or dedicated areas. Maximum quantities of each product type, typically less than 50 tons stored in dedicated areas, shall be defined and documented. The dedicated areas shall be inspected at least once per day, and the storage cleared at least once every 3 months.
- Returns of AN/High N/CAN, NPK, ASN, urea should be stored separately from each other in order to avoid cross-contamination.
- Returns from the loading department to the manufacturing unit should be visually inspected and checked for contamination.
- Returns of uncontaminated AN/High N/CAN can be recycled into granulation section (dry part) at controlled rates.
- Returns of NPK and ASN can be recycled at controlled rates (based on risk assessment) into the granulation section or into the slurry section (wet part).

- Alternative options: dissolve to form a solution or dilute with suitable inert materials in ratio 1:1, unless a risk assessment allows a different ratio.
- Contaminated materials. (See Section 5.1.9.)

5.1.6. Returns from Off-Site Sources

Returns from off-site sources comprise, in the main, deteriorated product from within the distribution chain, intermediate processors and from the end user. In practice, this applies mainly to packaged material and is usually due to water ingress or caking. However, it can also include damaged bags containing good product, which is covered in the next section. In operations involving loose bulk products, deteriorated products are generally not returned to the producers, who give appropriate advice to those in the distribution chain as to the actions to take. In abnormal situations, contaminated product, fines or oversize material may be returned in packaged or bulk form to the producers by agents/customers in the distribution chain. Only those products which can be traced back to the producer in a reliable way should be accepted as returns.

- Keep detailed records (see Section 2.1).
- Check to ensure product is not contaminated. If contaminated, identify the nature of the contamination and, following risk assessment, treat accordingly. (See Section 5.1.9)
- As appropriate, screen out good product and treat the remainder. Rework in a manner appropriate to the material, as described in Section 5.1.3.

5.1.7. Good (i.e. Standard) Product in Damaged Bags

- Check to confirm the product is good.
- Temporarily seal the bags to protect the product and re-bag as soon as possible.

5.1.8. Spilled Material

Clean Spillages

Clean spillages from conveyers; elevators and split bags can be collected and reworked.

Contaminated Spillages

See Section 5.1.9.

5.1.9. Contaminated Material (Including Cross-contamination)

Avoid contamination as much as possible. It can occur, for example, by mixing product spillage with non-fertilizer material. The various ways in which this can happen are considered below with appropriate recommendations to avoid such mixing.

Mixing of product spillage with non-fertilizer material: e.g. wood, sand, plastic, rubber and sawdust.

Recommendations include:

- Keep inventory to a minimum. For larger inventory keep in bags.
- Sell with precautionary safety conditions following a risk assessment.
- If possible, remove the contamination and re-bag/rework.
- Dissolve to remove contamination and recycle.
- Where appropriate, dilute with suitable material in ratio of 1:1 unless a risk assessment allows a different ratio (Ref.2,5,6).

Mixing with oil, grease, etc

This refers to dirty spillages, which may be contaminated with oil or grease, and are usually damp or wet. Do not allow to accumulate and keep inventory to a minimum. Options for disposal include:

- Rework into dry section, if safe to do so based on risk assessment.
- Dissolve, filter and sell as solution (do not recycle into hot solution process).
- Dispose of as a waste material using authorized waste handling procedures.

Contamination with non-fertilizer chemicals

Risk depends on the nature of the contaminant. If the mixture can be predicted to be non-hazardous, sell or rework. Otherwise, carry out a risk assessment; if necessary contact the supplier for information about the contaminant, and carry out the recommended action based on the conclusions.

Mixing with floor sweepings

Floor sweepings can contain various materials such as fertilizers, raw materials, floor coverings and/or rubber. Do not allow these to accumulate. Options for disposal or utilization include:

- Selling with precautionary safety conditions following risk assessment;
- Reworking into dry section; if safe to do so, based on risk assessment.
- Dissolving, filtering and selling as solution (do not recycle into process); and
- Disposing of as a waste material using authorized procedures.

Cross-contamination with other fertilizers, e.g. from adjoining bulk bays.

Avoid accidental and/or potentially hazardous mixing of different types.

- Carry out a risk assessment taking into consideration safety aspects such as AN content, detonability, or SSD. Options include selling in a controlled way, reworking, blending or diluting.

5.1.10. Build-up and Deposits in Equipment

In plants producing solid fertilizers, it is a common phenomenon that process materials gradually build up in the processing equipment. For example, in rotary granulators, driers and coolers, the lifters and inner walls get deposited with fertilizer materials over a period of time. In prilling, plants build-up can occur in the base and on the walls of the tower. Materials can also collect on and around conveying equipment. Plants are periodically shut down to clear such accumulated materials and to carry out preventative maintenance. Except where organic coating process is involved, these materials are generally similar to the manufactured products in composition terms and are therefore best recycled into the process, reworked or utilized in other ways. For treatment of contaminated materials from organic coating equipment, refer to section 5.1.9: 'Mixing with oil, grease etc.'

5.2. Detailed Guidance for Urea and Urea based Fertilizers

Urea is non-hazardous in nature, other than when involved in a fire. Therefore, fines, wet product, etc., do not generally affect safety.

Contamination with AN in solid form must be avoided, as urea can enhance the detonation hazard of AN.

A solution of Urea and AN (UAN) is widely used as liquid fertilizer and is not classified as hazardous. Urea based NPKs are also non-hazardous other than in a fire.

Contamination with nitric acid could lead to the formation of urea-nitrate, which is shock sensitive in nature and can thus give rise to a detonation hazard; if this is suspected seek expert advice.

5.3. Detailed Guidance for Raw Materials

5.3.1. Ammonium Sulphate

AS does not present a fire or explosion hazard on its own. As explained in section 4.2, it can form hazardous mixtures with AN. Appropriate precautions should be taken as outlined.

5.3.2. MAP, DAP, TSP, SSP, Potash (KCl)

These materials are non-hazardous by themselves and are widely used in NPK production. However, they are not efficient for reducing sensitivity towards detonation from AN fines/dust and, therefore, their use as a diluent to render AN rejects safe should be avoided (Ref.2,5,6).

5.3.3. Potassium Nitrate

Potassium Nitrate is an oxidizer and, as such, needs to be kept away from combustible materials. Avoid inadvertent mixing with AN-based fertilizers because it will increase nitrate level, and this could result in enhanced sensitivity of the mixture. On its own, it does not present a detonation hazard and in this respect fines are not a safety hazard.

5.3.4. Potassium Sulphate

Potassium Sulphate is non-hazardous and widely used in NPK production. It can be used as a component in NPK fertilizers for reducing the potential for SSD.

5.3.5. Limestone, Dolomite, Magnesite, Phosphate Rock, Gypsum, Calcium Sulphate, Anhydrite, Sand and Clay

These materials are non-hazardous by themselves and can be used as dilution media for reject material. No special precautions are necessary.

5.3.6. Calcium Nitrate Fertilizer

Commercial grade of calcium nitrate fertilizer is non-hazardous when it consists mainly of a double salt (calcium nitrate and AN) and contains not more than 10% of AN, and at least 12% water of crystallization – see provision 208 of the U.N. Orange book, Ref.7. Material not conforming to these criteria is classified as oxidizer and shall be handled accordingly. Fines of the fertilizer grade are not hazardous.

6. REFERENCES

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5. Chys, Jan, T. Legard and T. Jenssen. *Investigation on Hazard Reduction of Non-conforming Material by Dilution*. Internal Report: Hydro Agri, 2002.
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* Regulation (EC) No. 2003/2003 replaces Directives 76/116/EEC; 77/535/EEC; 80/876/EEC and 87/94/EEC.

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