

**THE UNITED REPUBLIC OF TANZANIA
GOVERNMENT CHEMIST
LABORATORY AUTHORITY**



**GUIDELINES FOR
HANDLING AND MANAGEMENT
OF AMMONIUM NITRATE**

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DOCUMENT CONTROL AND APPROVAL

Name of the Document	GUIDELINES FOR HANDLING AND MANAGEMENT OF AMMONIUMNITRATE
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Responsibility	Importers, exporters, warehouse operators, re-bagging, transporters, users, ports of entry/exit, owners of disposal facilities and any other dealers involved in handling of Ammonium Nitrate.
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Applicable to	Importers, exporters, warehouse operators, re-bagging, transporters, users, ports of entry/exit, owners of disposals facilities and any other dealers involved in handling of Ammonium Nitrate.
Purpose	To provide guidance and directives for sound management of Ammonium Nitrate in the country.
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PREFACE

The Government Chemist Laboratory Authority (GCLA) being the competent Authority for implementation of the Industrial and Consumer Chemicals (Management & Control) Act. No.3 of 2003 and its Regulations 2020 has a responsibility for ensuring proper management and handling of chemicals in the country. The United Republic of Tanzania characterized by mining as one of the key economic activities, imports and uses large quantities of chemicals particularly Ammonium Nitrate (AN) for blasting of underground rocks.

In addition, the country is also a gate way for transit to land-linked countries, mostly Democratic Republic of Congo (DR Congo) and Zambia which uses large quantities of Ammonium Nitrate for-mining activities. During the period of January to December, 2023, the amount of AN imported into the country for local or neighboring countries consumption was 66,464.755 Metric Tonnes. On the other hand, the outcomes from mining activities where AN is used, contribute significantly to the economies of the respective countries.

However, despite of its economic contribution, the properties and hazards of AN are well and much known by companies that manufacture it, but less known by companies and people that store, use and transport it. If not properly managed AN can cause severe effects including explosions leading to endangering of life, damage of properties and the environment. The world is still with memories of catastrophes resulting from Ammonium Nitrate mismanagement happened in the recent years at the Port of Beirut and Port of Tianjin, China; also, terrorist attacks and improvised explosive devices where AN was the major and main ingredients in Oklahoma City, United States and Hyderabad, India where all the incidents led to 539+ deaths and 7,398+ injures.

In consideration of the above, these guidelines are aimed at providing guidance and directives for sound management of AN in the country to ensure continuity of business to economic prosperity of the country through its proper handling, management, control and use.



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The Government Chemist Laboratory Authority (GCLA) acknowledges with appreciation to all stakeholders, who cooperated in one way or the other, contributed to this very important process of developing the Guidelines for Handling and Management of Ammonium Nitrate.

The successful preparation of these Guidelines reflects contribution and inputs by individuals and institutions that deserve a vote of thanks. I therefore wish to express our gratitude to various Government institutions, namely, President's Office – Regional Administration and Local government (PO-RALG); Ministry of Defense and National Service; Tanzania Police Force; Tanzania Ports Authority (TPA); Tanzania Shipping Agencies Corporation (TASAC); Land Transport Regulatory Authority (LATRA); National Environment Management Council (NEMC); President's Office; Ministry of Transport; Tanzania Revenue Authority (TRA) and Mining Commission (MC).

Last but not least, we are thankful to all stakeholders from the private sector, who cooperated and contributed to development of the Guidelines for Handling and Management of Ammonium Nitrate in the country. We are tankful in a special way to Nitro Explosive (T) Limited, Simba Logistics Limited, SAS Logistics Limited, PMM Estates (2001) Ltd, Mainline Carriers Ltd, Freight Forwarders Tanzania Limited, Alistair James Company Ltd, E. Awadh & Company Limited, Golden Coach Limited, Vigu Trading Co. Ltd, Barrick Tanzania Ltd, Geita Gold Mine (GGM), just few to mention. Their contributions are highly recognized/honored.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

The Government Chemist Laboratory Authority (GCLA) is the implementing Authority of the Industrial and Consumer Chemicals (Management & Control) Act. No.3 of 2003 and its Regulations. The Act provides for the management and control of the production, importation, usage, transportation, exportation, storage, dealing and disposal of chemicals. The chemicals regulated under the Act are categorized into four groups which includes general chemicals, highly hazardous chemicals, precursor chemicals and severely restricted/banned/eliminated chemicals. Among the chemicals regulated by the law is Ammonium Nitrate (AN) in the list of highly hazardous chemicals under explosives category as classified by the International Maritime Dangerous Goods (IMDGs) and other international classification.

The United Republic of Tanzania imports large quantities of AN mostly for use in mining activities. In addition, Tanzania is a gateway for transit of AN to land-linked countries, mostly Democratic Republic of Congo (DR Congo) and Zambia which uses a large quantity of AN for mining activities. Generally, the economic contribution of this chemical to our country and other land-linked countries that borders Tanzania remains to be of great importance. However, despite of its economic contribution, the properties and hazards of AN are well and much known by companies that manufacture it, but less known by companies and people that store, use and transport it. Monitoring and management of AN is paramount, as if not properly managed they can cause severe effects including explosions leading to endangering of life, damage of properties and the environment. Among the recent explosion caused by AN include the following:

- a) On 4 August 2020 a major fire broke out at the Port of Beirut warehouse and spread to 2,750 tons of AN which had been impounded and stored for six years after it was seized from an abandoned ship in 2014. The incident resulted to 190+ deaths and 6000+ injures. The explosion also caused an immense damage throughout the entire city.
- b) On 12 August, 2015 at the Port of Tianjin, China a nitrocellulose stored at a hazardous goods warehouse spontaneously combusted after becoming overly hot and dry, resulting in a fire that, 40 minutes later, triggered the detonation of about 800 tons of AN stored nearby leading to 165 deaths and 798 injures. Also, there was extensive damage to structures and goods at the port, damage to surrounding apartment blocks, and severe damage to a railway station.
- c) Use in terrorist attacks and improvised explosive devices whereby, the commercial availability of AN in many countries for legitimate use has contributed to its widespread use by criminals, terrorists and other armed groups. Examples of major terrorist attacks involving AN include
 - i. The explosion of a 2,200-kilogram bomb in Oklahoma City, United States on 19 April 1995 leading to 168 deaths and 500 injures. Ammonium nitrate was found to be the main ingredient.
 - ii. On 23 February 2013 in Hyderabad, India, two blasts occurred within 100 meters apart and within a short time leading to 16 deaths and 100+ injures: The bombs, believed to be a mixture of AN and other materials, which were delivered by bicycle.

Therefore, the examples above tell us how it is important to handle and manage AN properly and correctly. Moreover, it should be well

known that, improperly managed and exposed to stress (such as heat and pressure), AN can become increasingly unstable and explode. Thus, in order to ensure proper handling and management of AN, it is very important for countries to have legal framework for dealing with AN so as to facilitate its legitimate use.

Tanzania enacted the Industrial and Consumer Chemical (Management & Control) Act, 2003 to manage and control chemicals including AN. The Act also empowers the Registrar of Industrial and Consumer Chemicals to make guidelines for the sound management and effective control of chemicals. These guidelines therefore, have been prepared as part of an ongoing efforts to improve management and control of AN in the country. The preparation of these guideline is based on the mandate given under the ICCA and its Regulations, and other international literatures. These guidelines do not stand alone, rather it complements relevant available legislations, regulations, guidelines and procedures.

1.2 Objective of the Guidelines

The objectives of these guidelines are to provide guidance and directives for sound management of Ammonium Nitrate (AN) in order to protect human health, the environment and properties in the country.

1.3 Scope

These guidelines shall apply to importers, exporters, warehouse operators, re-bagging, transporters, users, ports of entry/exit, owners of disposals facilities and any other dealers involved in handling of AN. Additionally, these guidelines apply to AN meant for use in industries and mining activities.

CHAPTER TWO

2.0 PROPERTIES AND USE OF AMMONIUM NITRATE

2.1 Properties and hazards of AN

Ammonium Nitrate has three main hazards properties when transported; (Source: SafexTGAN Storage Good Practice Guide)

- a) Fire due to its oxidising nature
- b) Decomposition with formation of toxic gases
- c) Explosion

2.1.1 Fire

- a) Ammonium Nitrate (AN) itself is not combustible and does not burn, but being an oxidizing agent, it can facilitate the initiation of fire and will assist the combustion of other materials, even if air is excluded. Under confinement and exposed to heat from external fire, AN can thermally decompose. This reaction can, in turn, accelerate to an explosion.
- b) AN product contaminated with oil or combustible materials can initiate a fire when hot. Similarly, combustible materials impregnated with Ammonium Nitrate have been known to start burning spontaneously when left on or near hot surfaces.
- c) Hot AN melts or solutions can initiate fires when it comes into contact with combustible materials such as rags, wooden articles, or clothing. Hot Ammonium Nitrate solutions present the additional hazard of causing burns if in contact with the skin.

2.1.2 Decomposition

Pure Ammonium Nitrate melts at 170°C and decomposes above 210°C producing copious clouds of toxic fumes (mainly oxides of nitrogen) that may be yellow or brown. If heated sufficiently (such as in a fire) combined with contamination, confinement, or both (such as in drains or enclosed parts of equipment), other gases including brown vapours of toxic nitrogen dioxide (NO₂) will be given off and the explosive sensitivity of Ammonium Nitrate increases. Through self-accelerating reactions the temperature will keep on rising and a detonation is likely to occur. It has to be noted that fires involving Ammonium Nitrate have caused explosions.

2.1.3 Chemical Reaction

Ammonium Nitrate (AN) is hygroscopic and absorbs water from the atmosphere at high humidity. It is capable of attracting so much water under hot and humid conditions that it dissolves into an aqueous solution (deliquescent).

In the presence of moisture, AN can undergo an electrochemical reaction with copper to form copper tetramine nitrate [Cu (NH₃)₄] (NO₃)₂, which is of the same order of brisance and sensitivity to impact as lead azide (a primary explosive). For this reason, brass or bronze should not be used for equipment or tools that come into contact with AN.

2.1.4 Explosion

AN is ideally set up as an explosive precursor substance since it carries the oxidizing nitrate ion in intimate contact with the fuel element, the ammonium ion. All those require a small amount of contaminants to act as a catalyst which explains the unpredictability of AN under fire conditions.

2.2 Forms and use of Ammonium Nitrate

Ammonium Nitrate is marketed in several forms, depending upon its use. Liquid Ammonium Nitrate may be sold as a fertilizer, generally in combination with urea. Solid Ammonium Nitrate may be produced in the form of prills, grains, granules, or crystals. Prills can be produced in either high- or low-density form, depending on the concentration of the melt. High density prills, granules, and crystals are used as fertilizer; grains are used solely in explosives; and low density prills can be used as explosives.

2.3 Required Risk Control Measures

The risk control measures that need to be implemented to guard against the top three hazards include:

- a) Prevent external fires from impacting on the Ammonium Nitrate (AN) by removing all combustible material and sources of ignition from the vicinity of the AN. This is the most important of the six principles.
- b) Preserve the purity of AN and prevent incompatible material mixing with AN. All substances must be suspected of being incompatible unless known to be compatible; hence dedicated AN storage buildings are normally required.
- c) Guard against theft and sabotage by preventing unauthorized access to the storage site.
- d) Do not confine decomposing molten AN. Make sure that gaseous decomposition products can escape freely by providing natural ventilation, channel the flow of molten AN to the outside of the building and prevent the flow from entering confining drains and spaces.
- e) Implement safety distances to reduce the consequence of an explosion at nearby occupancies:
 - i. The storage location of AN should be separated from exposed sites or protected works by minimum safety distances

- ii. AN should be divided into sufficiently separated stacks to prevent a sympathetic detonation between stacks and reduce the consequence of an explosion.
- iii. Prepare a site-specific emergency plan, practice the evacuation of people, and ensure firefighting equipment is kept in good condition and maintained as per National and International Standards.

CHAPTER THREE

3.0 SAFE HANDLING, LOADING AND UNLOADING OF AMMONIUM NITRATE

3.1 Pre-arrival Arrangement Requirement for a Vessel Carrying AN

The Shipping agent of a ship carrying Ammonium Nitrate shall inform the receiving port at least seven days of its intended arrival at the Port. The Clearing and Forwarding agent who will be representing the Consignee shall forward the received notification to all relevant & responsible Government institutions and other stakeholders for adequate preparation to enable safe unloading of AN from the vessel.

The Shipping agent shall request in writing to Terminal operator to convene a stakeholder's pre-arrival meeting aiming to ensure the adherence of compliance issues to relevant authorities, preparation of operations equipment, working environment and safety of people who will be involved. Issues to be discussed shall include but not limited to:

- i) Special area where the ship/vessel carrying AN will anchor
- ii) timeframe for clearance and offloading the AN consignment
- iii) Awareness and training of all operational staff on the safe handling
- iv) Availability and enforcement on the use of appropriate person protective equipment
- v) Availability, appropriateness and quality of operational equipment such as forklifts that will be used
- vi) The readiness of each responsible institution and other private stakeholders in facilitating the clearance and offloading of AN within the agreed timeframe

- vii) Availability of Safety Data Sheet (i.e. the Agent of the vessel to submit the SDS to terminal operator and to other relevant institution seven prior arrival)
- viii) General preparedness and response to any emergency that might occur with regard to the properties of Ammonium Nitrate.

3.2 Requirements for Training on Handling of Ammonium Nitrate (AN)

Handling of Ammonium Nitrate shall involve well trained personnel on specific requirements for proper handling. The training shall be conducted by GCLA experts and the respective trainees be issued with certificate as follows:

- a) all supervisors involved in handling of Ammonium Nitrate must have special training and issued certificate by GCLA.
- b) all casual workers involved in handling of Ammonium Nitrate must have basic training on sound Management of chemicals with a focus of Ammonium Nitrate from GCLA.
- c) all casual workers involved in handling of Ammonium Nitrate must be provided with personal protective equipment (PPE) and have basic training on how to use them, with a focus of Ammonium Nitrate from GCLA.

3.3 Requirements for unloading Ammonium Nitrate (AN) From a Vessel

3.3.1 General Safety Principles for Unloading from a Vessel

- a) Avoid unloading of AN near combustible and incompatible substances
- b) Avoid cross contamination of AN with remains of previous cargoes
- c) Avoid cross contamination of next cargo with AN
- d) Avoid sources of heat likely to affect the AN

3.3.2 Requirements for Unloading Ammonium Nitrate (AN) from a Vessel

- a) All safety precautions as per SDS shall be in place and made aware to the employees.
- b) Appropriate protective equipment shall be used during unloading.
- c) Unloading shall be conducted under supervision of trained personnel from the owner or representative of the AN cargo.
- d) Unloading exercise shall be monitored by GCLA.

3.4 Requirements for Loading Ammonium Nitrate on Vehicle

3.4.1 Vehicle Requirements

A vehicle carrying AN shall:

- a) Meet the requirements specified in the Safety Data Sheets and other applicable guidelines of AN.
- b) Be road worthy
- c) Be inspected by vehicle inspector and issued with an inspection report after every six months
- d) Not carry passengers, food items or animals.
- e) Be fitted with a tracking system authorized by relevant Authorities.
- f) Be provided with an appropriate spill or first aid kit as per Safety Data Sheets.
- g) Be fitted with relevant fire-fighting appliances.
- h) Be fixed with AN posters.
- i) Have protective equipment for personal protection.
- j) Avoid hollow sections in equipment to prevent build-up of ammonium nitrate.

3.4.2 Ammonium Nitrate Cargo Requirements

Cargo shall be inspected prior to loading in order to ensure that;

- a) It is accompanied by relevant documents
- b) Quantity corresponds to the specifications contained in the documents

Is not leaking. Any person who is involved in loading of Ammonium Nitrate (AN) into a vehicle shall ensure that:

- a) All safety precautions as per SDS are in place and made aware to the employees
- b) Appropriate protective equipment are used during loading;
- c) Weight of the vehicles containing AN checked
- d) Loading exercise supervised by qualified and trained personnel on handling and management of AN.
- e) Loading exercise shall be monitored by GCLA
- f) Prevent ammonium nitrate contacting fuel, oil or grease during loading.

3.5 Unloading Ammonium Nitrate from Vehicles

Any person who is involved in unloading of AN vehicle shall ensure that:

- a) Unloading is conducted under supervision of trained personnel from the owner or representative of the AN cargo.
- b) Unloading exercise is monitored by GCLA.
- c) Unloading of vehicles conducted outside the warehouse.
- d) Any sources of ignition are avoided (i.e do not smoke and do not use fire and any heating devices during unloading).
- e) Any AN spillage is avoided during unloading.
- f) All safety precautions as per SDS are in place and made aware to the employees.
- g) Appropriate protective equipment is used during unloading.

- h) AN is prevented from contacting fuel, oil or grease during unloading.

3.6 Cleaning of Vehicles

Any person who is involved in cleaning of Ammonium Nitrate (AN) vehicle shall ensure that;

- a) All safety precautions as per SDS are in place and made available to employee
- b) Appropriate PPE are used during cleaning
- c) Spillages are cleaned up promptly and disposed-off contaminated product by dissolving in water before disposal.
- d) Organic matter is not used as a cleaning aid (e.g. sawdust), use inert material, All safety precautions as per SDS are in place and made available to employee
- e) Appropriate PPE are used during cleaning
- f) Spillages are cleaned up promptly and disposed of contaminated product by in water before disposal.
- g) Organic matter is not used as a cleaning aid (e.g. sawdust), use inert materials such as sand.
- h) Any contaminated equipment is thoroughly washed to remove ammonium nitrate before allowing maintenance, particularly which involves heat, such as welding or cutting.

3.7 Personal Protective Equipment

During handling of Ammonium Nitrate the following minimum PPE shall be used;

- a) Gloves (*Butyl* or *Neoprene*).
- b) Eye protection with side shields or goggles.
- c) Protecting clothing (coat, full suits, footwear, headgear).
- d) Dust respirator (N Series).

3.8 Labelling Requirement of Ammonium Nitrate

3.8.1 General Labelling Requirements

- a) All AN shall be properly labeled.
- b) A person shall not alter the name of Ammonium Nitrate provided on the label of a package or container.
- c) The information on the label or outside of a package shall be conspicuously, legibly and indelibly written or printed in both English and Swahili.
- d) The Label shall appear on one exposed face of the package or label; and shall be of a size and color that can be easily read.
- e) No label shall contain any incorrect or misleading information.

3.8.2 Package Labelling Requirements

Every package of Ammonium Nitrate (AN) shall have a label affixed to it on which shall be printed and be labeled with the following information;

- a) Form of the Ammonium Nitrate.
- b) Name and address of the manufacturer/packer and importer/distributor.
- c) Percentage concentration (purity).
- d) Net content by weight.
- e) Country of origin.
- f) Handling instructions-including the words "Use No Hooks".
- g) Batch number.

CHAPTER FOUR

4.0 SAFE STORAGE

Appropriate storage of Ammonium Nitrate (AN) is critical for life, environment and infrastructure safety. AN is a strong oxidizer (support burning) and can react violently with incompatible materials. It is very important to handle, store and monitor AN correctly. When improperly managed and exposed to stress (such as heat and pressure), AN can become increasingly unstable and explode.

4.1 Storage of AN Requirements

Storage requirements for Ammonium Nitrate (AN) are:

- a) Storage shall be buildings constructed of non-flammable materials such as brick, concrete or steel.
- b) Storage buildings shall be well-ventilated to allow in and out air circulation.
- c) Floors should be non-flammable material with no open drains, pits, or voids, to prevent accumulation of molten AN.
- d) If AN is stored in a shade, such shades shall be secured and protected from any ignition sources, the weather (i.e. waterproof material), direct sunlight.
- e) AN should not be stored in enclosed and confined manner.
- f) There shall be at least one-metre-wide lanes between AN stack and between the stack and the walls, roof and lights of the storage building (this keeps the AN away from sources of contamination and heat). These spaces also allow access by authorized professionals for checkup in case of an emergency.
- g) AN shall not come into contact with materials such as flammable liquids, powdered metals, acids, chlorates, nitrates, zinc, copper and its salts, oils, grease, gas cylinders and chemicals of incompatible, organic materials or unknown properties.

- h) Combustible materials (such as wooden pallets and empty packaging, saw dusts) must be stored away from AN or separated by a suitable non-flammable barrier. This should also apply to a designated distance outside the building.
- i) Any spillages are to be cleaned up quickly and the waste disposed off in accordance with approved disposal method.
- j) Never allow water to contaminate AN because it will form a cake which detonate easily, since it is highly soluble in water and is hygroscopic (it absorbs water from the air).
- k) Avoid storing large amounts of AN in one stack, where the weight of the stack compresses it into a solid mass. This compacting effect, or caking as it is called, increases the likelihood of a detonation if the AN is exposed to heat or shock. The maximum number of bags is three and the height of stacks from the roof is 1 meter.
- l) If the storage warehouse is located in an industrial area near residential areas, the Registrar will prescribe additional conditions including installation of thermometers for alerting in case of extreme rise of temperature, fixing of insulation material for regulation and control of temperature and setting of maximum time for storage of Ammonium Nitrate under such situations.
- m) If ammonium nitrate is stored outside it should be protected from the weather.
- n) Keep Ammonium Nitrate dry as the risk of explosion increases once the product becomes caked.
- o) Avoid drains, channels and pits where molten Ammonium Nitrate from a fire could become confined.
- p) Locate storage away from sources of heat, fire or explosion.
- q) Do not store Ammonium Nitrate in the same stack as other products.

- r) It is preferable to store Ammonium Nitrate in a separate building from urea. If this cannot be achieved, store it so accidental mixing is prevented in any foreseeable accident situation. For example, use separate bays.
- s) Wooden pallets are a fire risk; do not store unused wooden pallets in the store unless separated by a suitable distance or barrier. Remove empty AN bags from the storage area.
- t) Prohibit smoking in storage areas and display NO SMOKING signs or symbolic prohibition signs.
- u) Outside the store there should be no combustible material within 8 metres and no standing timber within 15 metres.

4.1.1 Ignition Sources Consideration

- a) AN shall be stored away from sources of heat, fire and explosion (e.g. fuels, compressed gas, fireworks and ammunition).
- b) AN shall be moved to a safe distance and the area cleaned before any hotwork (exposing electrical systems, cutting, welding etc.) is conducted.
- c) Suitable firefighting precautions shall be in place whilst the work is conducted.
- d) AN is a fire hazard and explosive substance, therefore, for its safe storage, it is necessary to ensure reliable protection against direct lightning strikes.
- e) Avoid artificial light.
- f) The permanent storage facility for AN also must be fitted security camera, fire alarm with security fencing/walls to prevent access of unauthorized personnel.
- g) Store ammonium nitrate away from combustible materials by a distance of at least 8 metres or use a barrier of inert material of at least 1.5 metres width.

4.2 Location of Storage Facility

Ammonium Nitrate (AN) storage shall base on minimizing the risk of an event within the storage facility. Factors to be considered must look at likelihood and related consequences of an incident associated with AN at the storage facility. Initial planning processes for a risk assessment must be undertaken to determine the risk to thirdparty premises, especially domestic residences and high-risk facilities:

- a) Storage of Ammonium Nitrate for Clearance Process of Transit Cargo shall abide to quantity and distance requirements as provided in Table 1.
- b) Warehouses of Ammonium Nitrate located in Tanga, Mtwara and Dar es Salaam regions located within densely populated areas, shall be temporary storage and serve as receiving warehouses from the ports with a maximum quantity of 10,000 Metric Tonnes and maximum time of Sixty days (60) per single company at a time. No company shall be allowed to store Ammonium Nitrate more than the located quantity and time to this kind of warehouses.
- c) The permanent storage facility of AN for a quantity between 1,000 to 20,000 Metric Tonnes, shall be far away from populated area not less than 15km to 20km.
- d) The permanent storage facility of AN for a quantity above 20,000 Metric Tonnes, shall be far away from populated area not less than 20km to 25km.

Note: Populated areas include residential areas, public assembly, water and pipelinessuch as gas and oil that are difficult to evacuate such as hospitals, markets and schools. Specific storage facility requirements for a single company based on location, volume of AN and intended storage requirements are as provided in Tables 1, 2 and 3.

Table 1: Storage Requirements for Keeping for Clearance Process of Transit Cargo

Quantity of AN to be Stored in Metric Tones	Minimum Distances (in Km) from Populated Area
1000	1.4
5000	2.4
10000	3.0
15000	3.5
20,000	3.7

Note¹:

Table 2: Storage Requirements for Distribution/ Storage/ Manufacturing

Quantity of AN to be Stored in Metric Tones	Minimum Distances (km) from Populated Area
1000 to 20,000	Not less than 15 to 20
Above 20,000	Not less than 20 to 25

Table 3: Minimum Separation Distances to On-site and Off-site Protected Works as well as Vulnerable Facilities

Quantity of AN to be Stored in Metric Tones	Minimum Distances (in Km)		
	on-site protected works (m)	off-site protected works (m)	vulnerable facilities (m)
Quantity of AN stored in the largest stack (T)			
<10 T	5	15	50
10 < T < 500	15	390	1,110

Note²:

4.3 Storage in Bags, Drums or Other Containers

- a) Piles of bags, drums and other containers should be no closer than three Meter below the roof or supporting beams.
- b) Bags should be stored no less than One meter from walls or partitions.
- c) Piles of bags, drums, and other containers should not exceed a height of three- meter, width of six meter, and length of 15 meter, unless the building is of noncombustible construction or protected by automatic sprinklers.
- d) Maintain passageways of at least one-meter width between piles.
- e) For stability purpose and assurance of enough ventilation, stacks of AN shall be stored in the form of pyramid.

4.4 Unplanned/Unexpected Storage of Ammonium Nitrate

Port authorities, customs officials, logistic hubs and distribution centres may experience situations where loads of hazardous materials, including Ammonium Nitrate (AN), may have to be stored for unexpected reasons. Proper planning for such an event shall enable the correct initial procedures in safe handling and storage, communication, and security thus helping to minimize risks. All ports key stakeholders on the matter, must be involved during the planning stage and operation stage under the lead of GCLA and TPA.

4.5 Firefighting Consideration

- a) Ammonium Nitrate storage area should be equipped with an automatic sprinkler system, or have an automatic fire detection and alarm system if the areas are not continuously occupied. This is especially important when the facility in question is close to the public surroundings the facility.
- b) Facilities should NOT store more than 2500 tons of bagged AN without an automatic sprinkler system.

- c) Each facility storing AN shall have Fire Compliance Certificate as per requirement of OSHA Act, 2003.
- d) An automatic sprinkler system, if installed, should be provided in accordance with set Standards for the Installation of Sprinkler Systems.
- e) Suitable fire control devices such as hoses and appropriate portable fire extinguishers (AN is an oxidizer and not all fire extinguishers are appropriate) shall be provided throughout the warehouse and loading areas.
- f) Water supplies and fire hydrants should be available.
- g) Smoking and other flame producing materials should be banned in the storage location. Display NO SMOKING notices.
- h) Do not extinguish AN fire by oxygen deprivation i.e. The only effective means for firefighting in this case is with water.
- i) Personnel should be trained in the use of firefighting equipment and be given training and guidance on when to engage in firefighting activities.
- j) Fixed firefighting equipment and hydrants should be maintained regularly to ensure they do not leak water and contaminate the ammonium nitrate.
- k) When a fire involving ammonium, nitrate is judged to be out of control it is recommended that evacuation is conducted to an appropriate separation distance.
- l) Water from hoses and fixed monitors should be able to reach all parts of the store
- m) Foam and dry chemical extinguishers should be available to deal with vehicle and electrical fires before the fire gets out of control and involves the AN
- n) Firefighting systems should be automated or capable of single person operation where AN store is operated by a small number of people

- o) For stores located within cities, towns and major hazard facilities consideration should be given to installing automatic fire water sprinkler systems and “Very Early Smoke Detection Apparatus”, known as VESDA fire detection systems.

4.6 Security Requirements

There are various security measures to put in place to safeguard ammonium nitrate. The minimum-security requirements shall include:

- a) Identification of existing security measures and examine the level and type of security risks (internal and external) to the ammonium nitrate stockpile.
- b) Consideration of whether current security arrangements leave the ammonium nitrate vulnerable to diversion (theft or loss), fraud or deliberate interference, and consider security improvements appropriate to manage the assessed risk.
- c) Informed development of a security plan, which will identify the security risks and the measures for identifying and addressing these risks.
- d) Identification of hazards from ammonium nitrate in the context it is being handled, transported, stored or used in.
- e) Installation of CCTV Camera for monitoring of security and detection of any crime
- f) Determination of nature, likelihood and severity of an incident (e.g. spillage, fire or explosion) and its consequences to persons, infrastructure and environment.
- g) Informed development and implementation of preventive and mitigation measures for minimizing the risk to people, infrastructure and environment.
- h) Access to areas where ammonium nitrate is stored should be limited to authorized individuals only.

- i) Authorized individuals should go through relevant training on proper management of AN provided by GCLA or other recognized institution.
- j) Maintain record keeping; record keeping and inventory procedures should be in place and records maintained and retrievable for a determined period of time.
- k) Keep records of ammonium nitrate including purchase/acquisition and sales/supply of ammonium nitrate, loss due to leakage, movement of ammonium nitrate, and security incidents (e.g., theft, loss).
- l) Report the transactions of each consignment of AN to the registrar after every three months
- m) Production date and expiry date.

CHAPTER FIVE

5.0 SAFE TRANSPORTATION OF AMMONIUM NITRATE

In order to ensure safe transportation of Ammonium Nitrate, all equipment used to lift and transport Ammonium Nitrate should be suitable and fit for the purpose. It should be:

- a) Mechanically sound.
- b) Fitted with appropriate fire extinguishers suitable for fighting electrical and vehicle fires.
- c) Free of any leaks of fuel, lubricating oil or hydraulic oil.
- d) Fitted with appropriate measures to prevent initiation of fire.
- e) Trucks transporting Ammonium Nitrate shall use diesel as a source of power.

5.1 Requirement for Road Transport

The Truck transporting AN shall be fitted with a system to monitor the location of truck and the consignment. For transportation of AN, the following requirements shall be met;

- a) Driver shall be aware on any temperature increase or ignition sources during transportation.
- b) Have the correct transport documentation.
- c) Label goods correctly.
- d) Offload carefully.

5.1.1 Refueling

Fueling of vehicle shall be done before loading of Ammonium Nitrate into vehicles. Refueling of vehicle transporting Ammonium Nitrate shall be done at petrol stations or service stations located away from densely populated area.

5.1.2 Parking

The following applies to the parking of all Ammonium Nitrate vehicles:

- a) Vehicles loaded with AN should be parked no closer than 10 m from Ammonium Nitrate store, except for the loading of mobile processing units.
- b) Parking of AN vehicles loaded with AN shall be parked at designated areas.
- c) In case there is no designated parking area, vehicles loaded with AN shall be parked away from densely populated areas, any sources of heat and, or 50 meters from fuel tanker or petrol station.
- d) The parking areas and vehicle bays for AN shall be clearly marked.
- e) Access and escape routes should be clearly defined and kept clear at all times.
- f) Parked vehicles should be able to drive away without reversing and with minimal maneuvering.
- g) Spill kits should be available to clean up and recover any AN spill and fuel and oil spills. Separate spill kits should be available for AN and fuel/oil spills.
- h) Before leaving the parked vehicle, the driver should ensure that wheel and bearing temperatures of the parked vehicles are within safe operational limits to prevent vehicles.
- i) Disconnected lead trailers should be supported by braced landing legs, or equivalent external support, to prevent a potential trailer collapse.
- j) No any person or driver shall be allowed to sleep inside the vehicle and cook in or near the vehicle carrying AN.

- k) Be attended at all times when they are inside the AN store and have direct access e from the store that does not involve the vehicle having to manoeuvre or reverse
- l) Remain inside the store only for the time required to unload or load the vehicle.
- m) Vehicles carrying AN in a private yard with restricted access, where vehicles are in transit.
- n) "In transit" means vehicles carrying AN do not park for longer than five consecutive days
- o) The transiting of AN on private property with restricted access shall be licensed by GCLA.
- p) All parked dangerous goods vehicles, including those carrying AN should be separated in parallel from each other by at least 3 Meter.
- q) Vehicles carrying flammable or combustible liquids and/or flammable gases should be parked in a separate area, at least 10 m from vehicles carrying AN or other oxidizing agents.

5.1.3 Requirements for Driver

Any driver of a vehicle transporting consignment of Ammonium Nitrate (AN) shall fulfil the following requirements;

- a) Safety card for AN shall be in vehicle during transportation.
- b) The driver shall be properly trained having a satisfactory driver record history.
- c) Drivers shall be knowledgeable in chemical handling skills.
- d) Drivers should walk around their vehicle every time they stop for a break to check safety.
- e) The driver shall possess during transportation a copy of GCLA driver's training certificates, the packing list; Contingency plan for hazardous, an invoice and permit to transport Ammonium nitrate.

5.1.4 Requirements for Transporter

Before transportation of Ammonium Nitrate, a registered transporter shall notify the Registrar on the details of the chemical consignment and produce invoice, import permit and purchase order. Every transporter of AN shall:

- a) Conduct route risk assessment and communicate the findings to drivers
- b) Request and be issued transport permit by Registrar.
- c) Maintain appropriate and adequate personal protective gears, first aid facilities and ensure enforcement of their use.
- d) Provide adequate and appropriate transportation facilities to ensure that all chemicals and equipment are in safe condition.
- e) Submit a contingency plan for safe handling and transportation of AN.
- f) Create awareness to the public on the inherent risks of AN along the route of transportation.
- g) Conduct a mock drill of their contingency plan every six months.
- h) Have drivers with skills training in transporting AN provided by GCLA and /or any other recognized institution.
- i) Provide training and information to other workers and laborers on handling AN on a continuous basis.
- j) Provide emergency preparedness techniques for handling spills, leakages, fire and explosion of AN.
- k) Conduct a tool box meeting to all drivers before loading and commencement of transportation to remind them on safe handling and transportation of AN

5.1.5 Convoy Requirements

Transportation of Ammonium Nitrate shall;

- a) Be in a convoy under GCLA escort marked with legible warning signs written in English or Kiswahili language.
- b) Be in a convoy of not more than ten vehicles and each vehicle shall not be loaded with not more than specified metric tons.
- c) Avoid high speed, the recommended maximum speed limit for tarmac road is 70 KPH and 50 KPH in rough road.
- d) Avoid road haulage during peak hours.

5.1.6 Requirements for Railway Transport

The transport of Ammonium Nitrate (AN) by rail shall be in locked and sealed containerized units or in open rail wagon with substantial seals. The following requirements shall be met;

- a) All openings to these containers are to be sealed with substantial tamperproof seals that will require forceful breakage with bolt cutters to enter the container.
- b) Consignments of AN must have a schedule whereby the location of the wagon is continually monitored. This schedule is to be checked for the duration of the transport by a responsible person designated by the operator.
- c) Containers, tanks or vessels that are continually sealed with substantial tamperproof seals will be deemed to meet the requirements of a secure location. These containers are to be received, loaded, transported and delivered in a manner clearly detailed in the AN guideline.

5.1.7 Firefighting Requirements During AN Transportation

The requirements to be adhered before transportation of AN must abide with the Fire and Rescue Force guidelines. Addition to such requirements, other requirements which must be complied includes:

- a) Avoid any sources of fire such as smoking while transporting AN
- b) Vehicles must be in good mechanical condition and regularly serviced to minimise the likelihood of a fire starting.
- c) Water-based fire protection should be carried to suppress a wheel, brake or tyre fire.
- d) Electrical systems should be designed and maintained to minimise fires.
- e) The driver should monitor the temperatures of the wheel hubs, tyres and brakes to ensure that they are not overheating.

In case of decomposition or fire involving transportation of AN, the following should be done:

5.1.7.1 Small Fire

Use water, dry chemicals or foams, CO₂.

5.1.7.2 Large Fire

- a) Flood fire area with water from a distance
- a) Do not move cargo or vehicle if cargo has been exposed to heat
- b) If it can be done safely, move undamaged containers away from the area around the fire.

5.1.7.3 Fire Involving Tanks or vehicle/Trailer Loads

- a) Fight fire from maximum distance or use unmanned master stream devices or monitor nozzles
- b) Cool containers with flooding quantities of water until well after fire is out.
- c) Always stay away from tanks engulfed in fire.
- d) For massive fire, use unmanned master stream devices or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

5.1.7.4 For massive fire

For massive fire, use unmanned master stream devices or monitor nozzles; if this is impossible, go away from the vehicle at a distance of at least 500 m and warn other road users. Warn the fire service which arrives about the risk of explosion.

5.2 Responsibility of an Escorter

A person escorting Ammonium Nitrate (AN) convoy shall: -

- a) Ensure that the AN is delivered to the respective destination or port of exit as per transport permit.
- b) Ensure that the AN transported is accompanied by relevant documents and that the quantity corresponds to specifications in the transportation documents.
- c) Ensure that relevant documents are given to the authorized person.
- d) Ensure reporting to authorities of any loss, theft, attempted theft or any other security incident.
- e) Ensure record keeping of transported AN.

5.3 Labelling and Placarding

5.3.1 Labelling

During transportation, the following requirements shall be adhered to:

- a) Ammonium Nitrate (AN) luggage or bags must be clearly labeled.
- b) Label should be legible and in good condition
- c) Vehicle shall have respective labels warning signs and symbol of AN
- d) Ensure that the vehicle is labeled with conspicuous legible, indelible AN identity written in English or Kiswahili language.
- e) Placarding Requirements

Ammonium Nitrate (AN) is placarded as an oxidizer that is transported under a hazard classification 5.1. The consignment will be marked with international transportation number UN 1942.

- a) Transporter shall ensure the vehicle is correctly placarded for AN.
- b) Escorting personnel shall not allow a vehicle to move without placarding.
- c) Placarding shall be removed once the vehicle no longer carries AN.

CHAPTER SIX

6.0 PREVENTION, PREPAREDNESS, RESPONSE AND RECOVERY PLAN

6.1 Emergency Response

Generally, fire causes most of accidents resulting from AN explosion as the main initiating factor. The resulting casualties are predominantly emergency personnel, where in most cases they fought the fires at a time when the molten AN was undergoing dangerous decomposition. Deciding on the correct time for firefighters to evacuate to a safe distance can be difficult.

6.1.1 Emergency plan

- a) The process of promptly evacuating on-site and off-site people in the event of a fire involving AN should be documented in detail in the site-specific emergency plan
- b) The emergency plan should establish an efficient process for assigning specific roles and alerting key managers that take part in the evacuation and control of the fire.
- c) The emergency plan should be practiced in order to ensure it works efficiently.
- d) The emergency plan should alert fire fighters to protect against the release of toxic nitrogen oxides that would result from an uncontrolled fire causing the decomposition of AN.
- e) The emergency plan should determine at what point emergency personnel and non-emergency persons need to evacuate to a safe distance to protect from a potential explosion.

CHAPTER SEVEN

7.0 REQUIREMENTS FOR REPORTING INCIDENTS OF AMMONIUM NITRATE (AN)

- a) Any person dealing with importation, exportation, transportation, distribution of AN shall inform Registrar on any occurrence of incidences as per format provided in the seventh schedule of the ICCA Regulations 2020.
- b) During transportation of AN, trained personnel leading the convoy or vehicle carrying AN shall inform the nearest Police Station and Registrar of any occurrence of incidences while in-route.

CHAPTER EIGHT

8.0 MANAGEMENT OF SPILLS AND DISPOSAL OF WASTE AMMONIUM NITRATE

8.1 Management of Spillage

Spillage of AN can result in an environmental issue and/or contamination. In case of a spillage or leakage, the responsible person shall:

- a) Ensure that spillage is dealt with or handled by people vested with the knowledge of handling AN spillage.
- b) Prevent further leakage or spillage if it is safe to do so.
- c) Use appropriate protective gear when dealing with spillage or leakage.
- d) Clean the spillage, but avoid generating dust. Collect in properly labelled containers or drums for disposal. DO NOT return spilled material to original container.
- e) Not mix spilled AN with other solid wastes.
- f) Spillage recovery needs to be appropriately documented and materials accurately accounted for.
- g) Report to the registrar for any spilled AN on quarterly basis
- h) Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area).
- i) Ensure adequate ventilation.
- j) Avoid contact with skin, eyes, and clothing.
- k) Wash thoroughly after handling AN.

- l) Keep combustibles (wood, paper, oil, etc.) away from spilled material.
- m) Prevent entry into waterways, sewers, basements or confined areas. Do not flush into surface water or sanitary sewer system. Prevent product from entering drains.
- n) Ensure that contaminated material (clothing, pallets) is thoroughly washed.
- o) In the case of a transport accident:
 - i. Notify the Police, Regulatory Authority (GCLA, TANROAD) and other relevant Authorities;
 - ii. All precautions should be taken to minimize the risk of fire, e.g. battery disconnection;
 - iii. If the incident involves spills of fuel, the fuel and AN spill should be kept separate to the fullest extent possible. The fuel spill should have priority in clean up.

8.2 Disposal of Ammonium Nitrate Waste

8.2.1 Disposal Consideration

Ammonium Nitrate (AN) Waste or AN that is contaminated, increases the explosion sensitivity, therefore, should be segregated from usable AN and labelled. The disposal of waste AN should take into consideration of the following;

- a) Avoid disposing AN waste into drainage systems and environment.
- b) Burying ammonium nitrate residues with hot earth and organic material can result in a violent underground reaction and is not recommended.

- c) AN waste shall not be transported without a permit issued by the Registrar.
- d) The selection of disposal method shall depend on a proper risk assessment
- e) Ensure that the employees are made aware on the inherent nature and risks of improper handling of AN waste.
- f) Ensure that it is handled in the same manner as usable AN.
- g) Ensure that is disposed of in an environmentally friendly manner in consultation with GCLA.
- h) Shall not incinerate and not dispose AN waste in sewers or waterways.

8.2.2 Disposal of Waste Ammonium Nitrate

Ammonium Nitrate (AN) Waste may be disposed of as a fertilizer, dissolving it in water or blending; but these methods of disposal must be agreed with GCLA. However, the selection of one method or another will depend on a proper risk assessment.

9.0 REFERENCES

- 1) The Industrial and Consumer Chemicals (Management and Control) Act. No. 3 of 2003 and its Regulations 2020
- 2) <https://www.imo.org/en/OurWork/Safety/Pages/DangerousGoods-default.aspx>
- 3) Australian dangerous goods code (<http://www.ntc.gov.au/heavy-vehicles/safety/australian-dangerous-goods-code>).
- 4) <http://www.ichca.com/>
- 5) Explosives Information Bulletin 51 Approved transport authority holders of low-risk loads of explosives (<https://www.dnrm.qld.gov.au/mining/safety-and-health/alerts-bulletins-search/alerts-bulletins/explosives/approved-transport-authority-low-risk-loads>)
- 6) Guidance for the Storage, Handling and Transportation of Solid Mineral Fertilizers. (2007). European Fertilizers Manufacturers Association, Brussels, Belgium, www.efma.org.
- 7) Department of Mines, Government of Western Australia, Industry Regulation and Safety 2021. Safe storage of solid ammonium nitrate. CODE OF PRACTICE Fourth edition (reissued).
- 8) On-site protected works (m) refer to single operation within the unit. Off-site protected works (m) refer to other works apart from AN with the facility. Vulnerable facilities (m) refer to facilities near the AN facility.

