FERTILIZER FACTORY

1. Regional strategy for the Promotion of Fertilizers in West Africa (elaborated by ECOWAS in collaboration with UEMOA), through its Program III entitled " Stimulating the supply of fertilizer " aims to increase the attractiveness of the west African region for investment by international and local suppliers in local production units, mixing, packaging and distribution systems tailored to customer needs, and to encourage them to come and offer fertilizers in an attractive way during market handovers. Thus, BOAD encourages fertilizer production factories, and ensure that these factories do not harm the environment.

Description of the sector

Most of fertilizer manufacturing projects target the production of compounds intended to provide plants with nitrogen, phosphorus and potassium, either separately (single fertilizer) or combined (mixed fertilizer) .

2. Ammonia is the basis for all nitrogen fertilizers and most fertilizer factories include facilities for manufacturing this substance, whatever the nature of the finished product. Many of them also produce nitric acid. If, to produce ammonia is preferred to use natural gas, the fact remains that it also uses coal, naphtha and (fuel) oil. The anhydrous ammonia, urea (consisting of ammonia and carbon dioxide), the ammonia nitrate (produced from ammonia and nitric acid), sulfate of ammonia (produced from 'ammonia and sulfuric acid) and ammonia nitrate or calcium ammonium nitrate (calcium produced by adding ammonia to nitrate limestone) are among the most common nitrogen fertilizer.

3. Fertilizer base on phosphate consist of crushed rock phosphate, basic slag (sub-product from iron and steel manufacture), superphosphate (resulting from the reaction of phosphate rock with the ground sulfuric acid), triple superphosphate (result of the reaction of ground phosphate rock with

phosphoric acid) and mono phosphate - and diammonium. The basic raw materials consist of phosphate rock, sulfuric acid (typically produced within the factory from elementary sulfur) and water.

4. All fertilizers are made of potassium from brines or underground potash deposits. The major forms are comprised of chloride, sulfate and potassium nitrate.

5. The mixed fertilizer can be produced from a dry mixture, by granulating more intermediate fertilizer mixed in a solution or by reacting phosphate rock with nitric acid (nitro phosphates).

Potential impacts on the environment

6. Socio- economic advantages of this industry are clear: the use of fertilizers is a key element when it comes to achieving a sufficient level of agricultural production to feed a world population which grows continuously. The appropriate use of fertilizers allows , moreover, to have indirectly positive effects on the environment , employment , for example , chemical fertilizers promotes intensification of production on existing agricultural land while reducing expansion of new land may harbor natural resources or social value .

7. There remains the production of fertilizers can have serious repercussions on the environment. Wastewater is the main problem to the extent that they may contain significant levels and acidic or alkaline, depending on the type of factory, consist of a number of substances with high levels of concentration may be deleterious aquatic organisms: ammonia or its compounds, urea emitted from factories producing nitrogen, cadmium, arsenic and fluorine from phosphate production, if this substance is regarded as an impurity phosphate rock. Suspended solids, nitrates, organic nitrogen, phosphorus, potassium and hence high in biochemical oxygen demand (BOD_5) are substances generally encountered in effluents and in the storm water to the

exception of BOD_5, that flow through the raw materials and waste storage. Phosphate factories can be designed in manner to not reject waste water at the exception of overflow evaporation ponds during heavy rains, although this method is not always practical.

8. Finished fertilizers are also a potential source of water pollution and excessive or unwise use of its may be a factor in eutrophication of surface waters and groundwater pollution by nitrogen. As for the phosphate mining, it may impair the quality of the water. All these aspects should be considered when it comes to anticipate the negative effects of projects whose aim is to open new mines or expand mining operations means, regardless of the location of the factory (see "mining and mineral Processing" section).

9. The air pollution responsible elements include particle emissions from the smoke escaping from boilers and grinding phosphate rock, fluorine (main pollutant produced by phosphate factory), acid vapors, sulfur oxides and nitrogen. Solid waste comes mainly from phosphate factories and consist mainly of ash (if it uses coal to produce steam for the processing methods), and gypsum (a substance that can be considered dangerous due to cadmium and uranium present in the phosphate rock and radon or other toxic gases which they can give birth) .

10. The manufacture and handling of sulfuric and nitric acid are risks to the health and workers safety. The release of ammonia cannot only endanger the health of the factory personnel but also the people who live or work nearby. Explosions and damage to eyes, nose, throat and lungs belong to other accidents that may occur.

11. The judicious selection of a location helps to avoid or mitigate an entire number of impacts that are described therein and, at least, mitigate the costs.

Specific issues

Solid waste

12. Solid wastes generated by the manufacture of fertilizers are complex and cannot be eliminated on land recklessly. Dangerous materials may contain vanadium catalysts produced by sulfuric acid factory as well as arsenius sludge if they employ pyrites, require that they be handled and carefully eliminated. Removal of gypsum can be a problem if toxic metals have polluted. The ashes produced by the ammonia factory that rely on coal liquefaction technologies also represent an evacuation problem. Sufficient discharge areas should be available for depositing solid waste. Recycling of solid waste while possible, each project should consider this solution (see next paragraph). It is essential that the planning of the project establish evacuation measures of critical solid waste and that it be thoroughly evaluated during the project feasibility studies.

Waste minimization

13. Fertilizer factories involve major water used for manufacturing processes, cooling operations and to reduce pollution volumes. Liquid wastes are generated by manufacturing processes, cooling towers, boilers and drain from spills, leaks and runoff. It is possible, however, to recycle the water and reduce, thereby, the amounts collected or processed while reducing the demand of the plant on local resources. The waste water from the production of phosphoric acid could be used as water production in the same facility or be used in condensers, scrubbers and cooling systems.

14. The gypsum from phosphate fertilizer factory can be recycled in the cement and in the production of building materials and plaster panels. Gypsum also served as cover material for landfills. Gypsum contaminated with toxic metals or radioactive substances require proper handling.

15. The American water companies that practice fluoridation use generally hydro-fluosilicic acid, a waste product from manufacturing phosphate

fertilizer significantly less expensive than sodium fluoride plants. While transport of this acid is made in the United States over long distances, we must admit that its export does not have an economic interest. There are, however, instances where it may be reused in the developing countries, particularly if it has been converted to the sodium salt. It can also be used for the production of aluminum fluoride.

Ammonia

16. The production, use and storage of ammonia must be based on a wisely calculated design and on good practices maintenance and monitoring to reduce the risk of spills and explosions. An emergency plan to protect factory personnel and neighboring communities is required.

Alternatives solutions to projects

Selection of the location

17. The nature of a fertilizer factory is such that the effects on the environment, which are responsible for the production, storage and transport activities, require that one pays particular attention to the evaluation of other all possible locations. Waters whose quality or flow does not even allow you to receive well-treated effluents are not appropriate . If the demand for raw materials mean that we should open new quarries , there would be whether , firstly , identified (if known) and, secondly, their impact on the environment are considered in the project.

Manufacturing processes

18. Although there are various ways to design and implement a project, the raw material supply and demand for certain finished products restrict the manufacture of fertilizers. The choice of a phosphoric acid factory depends on the quality of the gypsum since the manufacturing hemidihydrate is

capable of producing gypsum can serve directly as adjuvant in the production of cement.

19. Coking production of iron and steel as well as being an alternative account, however, limited fertilizer containing ammonium sulfate (produced from ammonia and sulfuric acid) source; sulfate ammonium is a byproduct coke and caprolactam (nylon). Natural gas, oil, naphtha and coal belong to alternative raw materials for the production of ammonia. The sulfur and pyrite can be used to produce sulfuric acid.

20. Vapor production in fertilizer factory can rely on alternative fuels such as natural gas, oil and coal.

Means to fight against air pollution

21. It should be important to consider the following air emissions control measures caused by the operationalization of the factory: design of manufacturing means and selection of equipment, electrostatic dust collectors, chimney gas cleaner, bag house and cyclones.

Means for controlling the water quality

22. It is possible to fight against water pollution if proper monitoring of liquid effluent or runoff flowing from stacked waste is ensured. There should be that the following solutions must be part of the project design in the treatment and rinsing of wastewater:

• recycling of waste water;

• Ion exchange or membrane filtration (phosphoric acid plants);

• Neutralization of acidic or alkaline waste water;

• Sedimentation, flocculation and filtration of suspended solids;

• Application of production water;

• Biological treatment (nitrification and non-nitrification).

Management and training

23. The potential impacts of fertilizer factories on air quality, water and soil makes a necessary institutional support for manipulating substances, apply control measures to reduce waste and to monitor these activities effectively. Staff should be aware of the techniques used against pollution of water and air. Manufacturers are usually willing to provide training sessions explaining how to operate and maintain the equipment. Standard operating procedures should be established and implemented by the factory management. Means of pollution control and monitoring air quality and water should be part of as well as instructions for the operating personnel of the company explaining the ways to control noxious emissions; guidelines alerting authorities of an accidental discharge of pollutants should also be implemented. Detectors, alarm devices, for example, and a special training given to operating staff should improve the handling and management of toxic and dangerous substances.

24. It is essential to provide emergency and rapid response to incidents such as a spill, fire or explosion, the consequences for the environment and the surrounding community are extremely dangerous. Insofar as the local government officials as well as local agencies and services (medical and firefighters, etc play a crucial role in this type of intervention, it would be appropriate to participate in planning process. Periodic evacuation drills are important aspects of contingency plans (see the section "Management of Industrial Risks" for further details).

25. Regulations on health and safety should be developed and implemented in the factory. These regulations should include:

• Provisions to, firstly, stop the accidental release of ammonia or sulfuric acid spill, phosphoric and nitric acids.

• Procedures to minimize the risk of explosion of ammonia nitrate calcium.

• Procedures to keep within the limits recommended by the Bank's exposure to ammonia to nitrogen oxide vapors (in factories producing nitrogenous fertilizer), fumes of carbon dioxide and sulfur trioxide and that sulfuric acid mist.

• Means to verify the presence of phosphoric acid radioactive scale filters.

• A program of routine medical visits.

• A continuous training program on issues of health and safety aspects and on maintenance practices that respect the environment.

(For more information, see guidelines for health and safety at work of the Bank and refer to the sections of this chapter entitled "Management of industrial risks", "Dangerous Materials Management " and " Location of factories and development of land for industrial purposes.")

26. Standards for emissions and effluents applying to the plant should be guided by national regulations, if they exist, or be derived from advocated by the Bank standards. Government agencies responsible for performing monitoring of pollution control equipment, enforce standards and supervise all activities related to dangerous waste destruction are likely to require specialized training, they should also receive the necessary equipment and be invested with power. The environmental assessment should take into account an estimate of local capacity in relation to these issues and recommend principles of assistance needed to be included in the project.

Monitoring

27. It is essential for fertilizer factories, to establish specific monitoring plans of factory control, location and processing methods which include the following:

• Continuous opacity gas fireplace;

• Periodic testing (in phosphate factories only) to monitor emissions of particulates, fluorine compounds, nitrogen dioxide and sulfur oxides;

• Control of sulfur oxides from sulfuric acid factories and nitrogen produced by nitric acid plants oxides;

• Periodic reviews supervisor (in nitrogen factories only) particles emissions, ammonia and nitrogen oxides;

• manufacturing parameters (on a continuous basis) to ensure the operation of the pollution control equipment (eg temperature readings stack gas indicating when the washer broke down.)

• Quality of work areas in the factory and manufacturing types: nitrogen oxides, ammonia, sulfur dioxide, fluorine compounds and particles;

• Quality of ambient nearby facilities by monitoring potential pollutants air;

• Quality of receiving waters by monitoring dissolved oxygen and potential pollutants;

• flow control of liquid waste by monitoring pH and monitoring suspended solids and total dissolved solids, ammonia, nitrate, organic nitrogen, phosphorus, BOD_5, oil and grease (if the (fuel) oil is used);

• Control of discharges of rainwater examining phosphorus, fluorine compounds, suspended solids and pH level;

• Analysis of gypsum examining cadmium and other heavy and its level of radioactivity metals;

• monitoring work areas of all facilities by monitoring their noise levels;

• monitoring compliance with security measures and procedures pollution control, their updating and modernization plans and emergency safety.

Table: Impacts of fertilizer factories on the environment and mitigation measures

Negative potential impacts	**Mitigation measures**
Direct impacts: selection of the location	
1. Establishment of a factory on or near sensitive habitats, such as mangroves, estuaries, wetlands and coral reefs.	1. • Locate, as far as possible, the factory in an industrial area, to reduce or concentrate pressure on the local environment and to facilitate the monitoring of spills. • Involve technical services in charge of environmental management in the choice of location to carry out the examination of possible solutions.
2. Location along a watercourse that may result in degradation	2. • The selection of the location should consider alternatives that reduce impacts on the environment and that do not compromise the use of water by other users. Residents must be consulted before the selection of the area • Factories producing liquid discharges should only be located near a stream which assimilate waste capacity is adequate.
3. Situation that could create serious air pollution problems in the locality.	3. Locate the factory in an elevated area which does not undergo atmospheric inversions and where prevailing winds are towards relatively sparsely populated areas.
4. Location that could exacerbate problems of	4. It would be important to assess the choice of location using the following guidelines:

solid waste in an area.	• size sufficient land to accommodate a landfill or disposal site; • proximity to a suitable discharge; • accessibility for the public or private collection transport solid waste to its final destination; • Solutions to remove or recycle gypsum.
Direct impacts: exploitation of the factory	
5. • Water pollution caused by discharges of liquid effluents, cooling water or runoff from waste piled up. • phosphate factory: phosphate, fluorine, BOD_5, total dissolved salt content, pH • nitrogen factory: ammonia, urea, ammonium nitrate, COD, pH • dribbles stored heap materials: MES, pH, metal	5. It should be important to analyze in the laboratory liquid effluents, including fluorine, BOD_5, TSS and monitor the temperature locally. All types of factories • No discharge of cooling water. If recycling is not shown, they will be discharged in the condition that the temperature elevation of the outlet does not exceed 3 ° C. • Maintain pH level of effluent discharge between 6.0 and 9.0. • Effluent control according to the restriction set by each country for specific processes. Materials storage areas and heap areas of solid waste elimination • Avoid rainwater and runoff from seeping through the pile excessively. • Proceed to the coating storage areas.
6. Atmospheric emissions of particles from factory operations in general.	6. Control of particles by installing collectors fabric filter or electrostatic precipitators.

7. Emission of SOx and NOx, ammonia, acid vapor and fluorine compounds in the atmosphere.	7. • Controlling emissions by purifying the gas. • Analyze raw materials during the feasibility phase of the project; • Develop a judicious design of sulfuric acid factory and nitric acid by providing equipment to reduce NOx emissions.
8. Accidental release of potentially dangerous solvents, acids and alkalis.	8. • Maintain areas used for the storage and elimination of substances to stop accidental releases. • Provide spill control equipment. • Install ditches around storage tanks.
9. Surface runoff compounds, raw materials and solid waste usually crammed into the confines of the factory can be factors of pollution of surface water and seep into groundwater	9. • Providing good storage conditions during the design phase. • Cover or coat storage areas (especially in the case of gypsum deposits) to prevent pollution of surface and subsurface. • The diked areas should be of sufficient size to contain an average rainfall of 24 hours.
10. Impact on the health of workers exposed to fugitive dust due to the manipulation of materials or other reasons related to treatment processes and abnormal frequency of accidents due to the skill level of the workforce.	10. The factory managers should implement a program of health and safety designed to: • identify, assess, monitor and combat, specifically, against risks to health;

11. Regional problem of solid waste management system exacerbated by the inadequate storage places or lack of disposal facilities.	11 • responding to the risks to the health and safety of workers; • propose measures to protect employees; • provide training on safety. Provide an outlet on the premises taking into account the classification of dangerous characteristics of leachate system.
12. Disruption of transit circuits, noise emissions and increased traffic, increased risk of accidents to pedestrians entails the comings and goings of trucks carrying raw material	12. • The choice of location can help alleviate some of these problems. • should be conducted during the feasibility study of the project, studies on transport to determine the safest routes. • Provide regulations that apply to entrepreneurs and accidents in order to reduce the risk of accident response plan.
Development of diseases relate to the factory	Make a periodic assessment of the impact of pollution on the health of the population surrounding the factory; Caring by factories, the reported cases of diseases
13. Increasing nitration of groundwater due to the use of nitrogen fertilizers.	13. It would be important to provide instructions for use in order to reduce the risk of nitrate pollution.
14. Eutrophication of natural water systems	14. There is a need to provide user manuals in order to reduce the risk of pollution by nitrate and phosphate

	Encourage and support water sanitation activities in the area