

Fertilizer Plants

Fertilizer is used to amend soils to promote the growth of desirable plants. The main components of fertilizer are nitrogen, phosphorous, and potassium. There are other elements, such as iron and sulfur, that are important to the vigorous growth of plants but they are needed in much lower concentrations and are generally available in the native soil. In Washington, chemical fertilizers are produced by a combination of large fixed facilities. They produce nitric acid and ammonia to react with each other, with phosphates, and with other elements and smaller mobile facilities that generate ammonium phosphate. There are also a limited number of facilities that process metal fume to produce blends of trace elements of soil amendments.

There are four distinct types of fertilizers:

- ❖ ammonium nitrate
- ❖ normal superphosphate
- ❖ triple superphosphate (TSP):
 - Run Of the Pile (ROP)
 - Granular Triple Superphosphate (GTSP)
- ❖ ammonium phosphate

Phosphorus pentoxide (P₂O₅) is used to measure the phosphorous content of fertilizer.

In Washington, there are approximately 14 facilities that fall under SIC code 2873 Nitrogenous Fertilizers and 2 facilities that fall under SIC code 2874 Phosphate Fertilizers (Ecology, 1/20/98).

In 1996 the 54th Legislature passed Substitute House Bill 2338 on March 1, 1996. Chapter 70.94 RCW will be amended to state that the Department of Ecology will not regulate ammonia emissions resulting from the storage, distribution, transportation, or application of ammonia for use as an agricultural fertilizer. Manufacturing of ammonia based products are still subject to regulation.

Description of Process

Ammonium Nitrate Fertilizer

Approximately 60 percent of the ammonium nitrate produced in the U.S. is sold as a solid product. To produce a solid product, the ammonium nitrate solution is concentrated in an evaporator or concentrator. The resulting "melt" contains about 95 to 99.8 percent ammonium nitrate at approximately 300°F. This melt is then used to make solid ammonium nitrate products.

The manufacture of ammonium nitrate involves several unit operations including solution formation and concentration; solids formation, finishing, screening and coating; and product bagging and/or bulk shipping. All ammonium nitrate plants produce an aqueous ammonium nitrate solution through the reaction of ammonia and nitric acid in a neutralizer. In some cases, solutions may be blended for marketing as liquid fertilizers.

The number of operating steps employed depends on the end product desired. For example, plants producing ammonium nitrate solutions alone use only the solution formation, solution blending and bulk shipping operations. Plants producing a solid ammonium nitrate product may employ all of the operations. (AP-42¹, Section 8.3)

There are several 10-34-0 (10% nitrogen, 34% phosphorus pentoxide and 0% potassium) granulators and generators in this state. They include portable and permanent generators.

Normal Superphosphate Fertilizer

Normal superphosphate fertilizer contains between 15 and 21 percent P₂O₅. It is manufactured by reacting ground phosphate rock with 65 to 75 percent sulfuric acid. This is described by the following equation: (U.S. EPA, May 1979)



Fluorapatite (phosphate rock) + sulfuric acid + water → mono-calcium phosphate monohydrate + calcium sulfate + hydrogen fluoride

Chapter 40 C.F.R., Part 60, Subpart U regulates the standards of performance for the phosphate fertilizer industry. The Standard Industrial Code (SIC) for normal superphosphate fertilizer is 2874.

Triple Superphosphate Fertilizer

Triple superphosphate fertilizer contains greater than 40 percent P₂O₅. There are two processes Run Of the Pile Triple Superphosphate (ROP-TSP) and Granular Triple Superphosphate (GTSP). Chapter 40 C.F.R., Part 60, Subpart W regulates the superphosphoric acid plants.

Ammonium Phosphate Fertilizer

Ammonium phosphate fertilizer is either in granular or liquid form. Granular ammonium phosphate (NH₄H₂PO₄) is produced by reacting phosphoric acid (H₃PO₄) with anhydrous ammonia (NH₃). Ammoniated superphosphates are produced by adding normal superphosphate or triple superphosphate to the mixture. (AP-42, Section 8.5)

For liquid 10-34-0 fertilizer production, ammonia and superphosphoric acid are reacted in an inverted U-tube reactor creating temperatures in excess of 600°F. Water is added and the product is cooled and stored prior to application. (Ryan, June 18, 1992) For portable units, the stack is limited to 13.5 feet so that it may travel under bridges and overpasses.

¹ U.S. Environmental Protection Agency, *Compilation of Air Pollutant Emissions Factors Volume 1: Stationary Point and Area Sources*, Fifth Edition with Supplements, October 1997, Document No. AP-42.

Methods of Determining Emissions

EPA's SPECIATE database has identified the following toxic pollutant emissions from normal superphosphate and triple superphosphate production: hexane, methyl alcohol, formaldehyde, methyl ethyl ketone, benzene, toluene, and styrene (*AP-42*).

Several stack test for toxic emissions have been performed in the U.S., please see references for details.

Emissions factors are available in *AP-42* for particulate matter. There are also emissions factors for ammonia for ammonium nitrate production, and for fluoride and ammonia for ammonium phosphate production.

References

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Washington State Department of Ecology, *Facility/Site on the Web*, accessed 1/20/98. (<http://www.wa.gov/ecology/iss/fsweb/fshome.html>)