9.9.4 Alfalfa Dehydrating

9.9.4.1 General[1-2]

Dehydrated alfalfa is a meal product resulting from the rapid drying of alfalfa by artificial means. Alfalfa meal is processed into pellets for use in chicken rations, cattle feed, hog rations, sheep feed, turkey mash, and other formula feeds. It is important for its protein content, growth and reproductive factors, pigmenting xanthophylls, and vitamin contributions.

9.9.4.2 Process Description[1-5]

A schematic of a generalized alfalfa dehydrator plant is given in Figure 9.9.4-1. Standing alfalfa is windrowed in the field to allow wilting to reduce moisture to an acceptable level balancing energy requirements, trucking requirements, and dehydrator capacity while maintaining the alfalfa quality and leaf quantity. The windrowed alfalfa is then chopped and hauled to the dehydration plant. The truck dumps the chopped alfalfa (wet chops) onto a self-feeder, which carries it into a direct-fired rotary drum. Within the drum, the wet chops are dried from an initial moisture content of about 30 to 70 percent (by weight, wet basis) to about 6 to 12 percent. Typical combustion gas temperatures within the gas-fired drum range from 154° to 816°C (300° to 1500°F) at the inlet to 60° to 95°C (140° to 210°F) at the outlet.

From the drying drum, the dry chops are pneumatically conveyed into a primary cyclone that separates them from the high-moisture, high-temperature exhaust stream. From the primary cyclone, the chops are fed into a hammermill, which grinds the dry chops into a meal. The meal is pneumatically conveyed from the hammermill into a meal collector cyclone in which the meal is separated from the airstream and discharged into a holding bin. The exhaust is recycled to a bag filter (baghouse). The meal is then fed into a pellet mill where it is steam conditioned and extruded into pellets.

From the pellet mill, the pellets are either pneumatically or mechanically conveyed to a cooler, through which air is drawn to cool the pellets and, in some cases, remove fines. Fines are more commonly removed using shaker screens located ahead of or following the cooler, with the fines being conveyed back into the meal collector cyclone, meal bin, or pellet mill. Cyclone separators may be employed to separate entrained fines in the cooler exhaust and to collect pellets when the pellets are pneumatically conveyed from the pellet mill to the cooler.

Following cooling and screening, the pellets are transferred to bulk storage. Dehydrated alfalfa is most often stored and shipped in pellet form, although the pellets may also be ground in a hammermill and shipped in meal form. When the finished or ground pellets are pneumatically or mechanically transferred to storage or loadout, additional cyclones may be used for product airstream separation.

9.9.4.3 Emissions And Controls[1-3,5-7]

Particulate matter (PM) is the primary pollutant emitted from alfalfa dehydrating plants, although some odors may arise from the organic volatiles driven off during drying and pellet formation. The major source of PM emissions is the primary cyclone following the dryer drum.

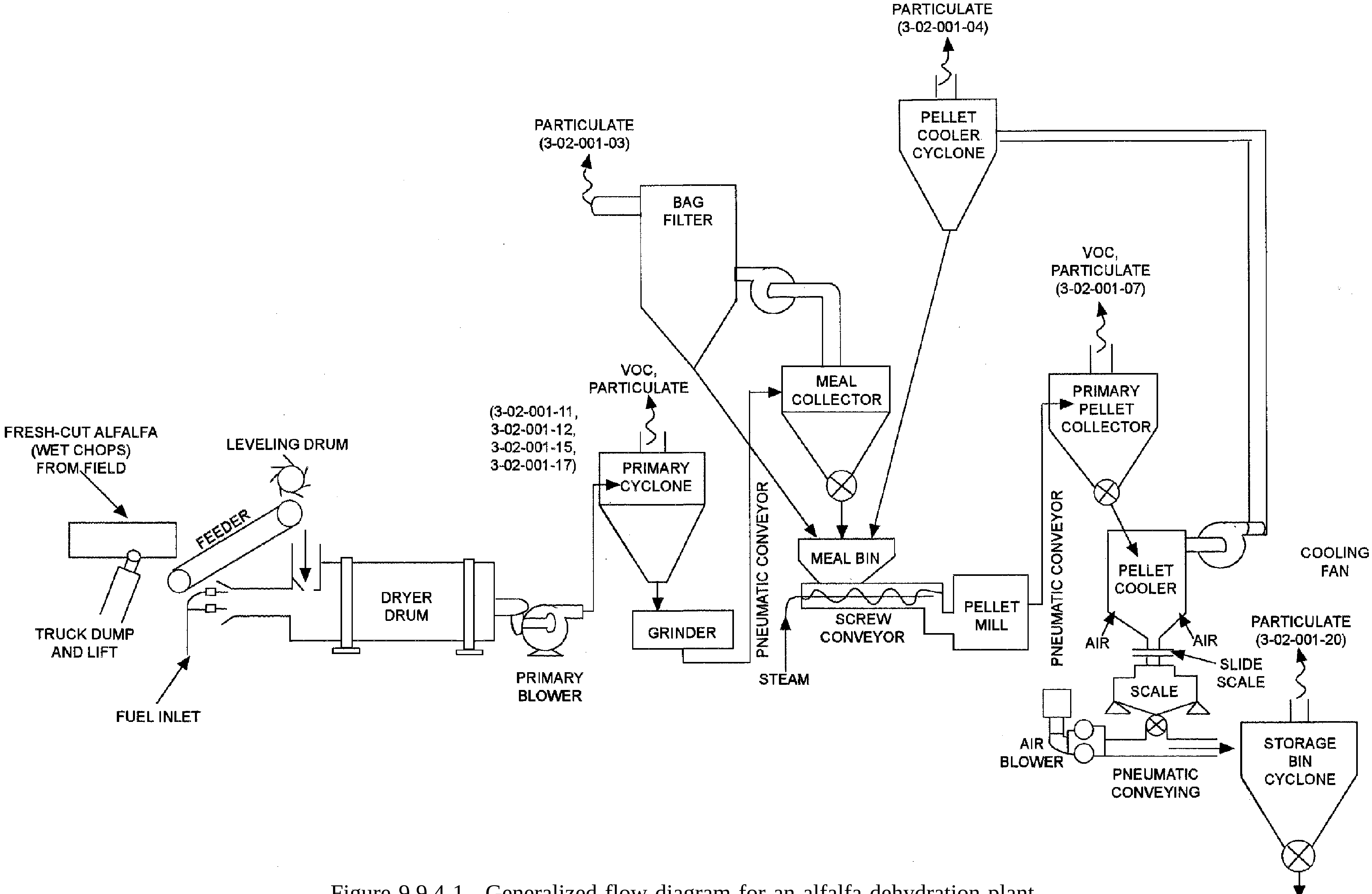

Figure 9.9.4-1. Generalized flow diagram for an alfalfa dehydration plant.
(Source Classification Code in parentheses.)

Lesser emission sources include the downstream cyclone separators and the bagging and loading operations.

Emission factors for various dryer types utilized in alfalfa dehydrating plants are given in Table 9.9.4-1. Note that, although these sources are common to many plants, there will be considerable variation from the generalized flow diagram in Figure 9.9.4-1 depending on the desired nature of the product, the physical layout of the plant, and the modifications made for air pollution control.

Table 9.9.4-1. EMISSION FACTORS FOR ALFALFA DEHYDRATION[a]

EMISSION FACTOR RATING: D

Source	Particulate (PM)		VOC	Ref.
	Filterable	Condensible		
Triple-pass dryer cyclone				
- Gas-fired (SCC 3-02-001-11)	4.8	1.0	ND	8-9
- Coal-fired[b] (SCC 3-02-001-12)	7.5	ND	ND	13
Single-pass dryer cyclone				
- Gas-fired (SCC 3-02-001-15)	4.1	0.65	ND	10-11
- Wood-fired (SCC 3-02-001-17)	3.1	1.3	ND	12,14
Meal collector cyclone (SCC 3-02-001-03)	ND	ND	NA	
- Bag filter				
Pellet collector cyclone (SCC 3-02-001-07)	ND	ND	ND	
Pellet cooler cyclone (SCC 3-02-001-04)	ND	ND	NA	
Storage bin cyclone (SCC 3-02-001-20)	ND	ND	NA	

[a] Emission factor units are lb/ton of finished pellet produced, unless noted. To convert from lb/ton to kg/Mg, multiply by 0.5. SCC = Source Classification Code. ND = No data. NA = Not applicable.
[b] Emission factor based on quantity of dried alfalfa to hammermill.

Air pollution control (and product recovery) is accomplished in alfalfa dehydrating plants in a variety of ways. A simple, yet effective technique is the proper maintenance and operation of the alfalfa dehydrating equipment. Particulate emissions can be reduced significantly if the feeder discharge rates are uniform, if the dryer furnace is operated properly, if proper airflows are employed in the cyclone collectors, and if the hammermill is well maintained and not overloaded. It is especially important in this regard not to overdry and possibly burn the chops as this results in the generation of smoke and increased fines in the grinding and pelletizing operations.

Equipment modification provides another means of particulate control. Existing cyclones can be replaced with more efficient cyclones and concomitant air flow systems. In addition, the furnace and burners can be modified or replaced to minimize flame impingement on the incoming green chops.

In plants where the hammermill is a production bottleneck, a tendency exists to overdry the chops to increase throughput, which results in increased emissions. Adequate hammermill capacity can reduce this practice. Recent improvements in process technique and emission control technology have reduced particulate emissions from dehydration facilities. Future technology should contribute to further reductions in particulate emissions.

Secondary control devices can be employed on the cyclone collector exhaust streams. Generally, this practice has been limited to the installation of secondary cyclones or fabric filters on the meal collector, pellet collector or pellet cooler cyclones. Primary cyclones are not controlled by fabric filters because of the high moisture content in the resulting exhaust stream. Medium energy wet scrubbers are effective in reducing particulate emissions from the primary cyclones, but have only been installed at a few plants.

Some plants employ cyclone effluent recycle systems for particulate control. One system skims off the particulate-laden portion of the primary cyclone exhaust and returns it to the alfalfa dryer. Another system recycles a large portion of the meal collector cyclone exhaust back to the hammermill. Both systems can be effective in controlling particulates but may result in operating problems, such as condensation in the recycle lines and plugging or overheating of the hammermill.

References For Section 9.9.4

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