JUSTIFICATION FOR ALLOWING APPLICATION OF WATER AND OIL FOR DUST SUPPRESSION

The large number of dust explosions and associated loss of life in the 1970's was the principle stimulus in the search for effective low cost methods for dust control. The decision by FGIS to allow the application of additives to grain for dust suppression was prompted by grain industry requests, and the ruling was issued only after research had demonstrated the effectiveness and safety of oil and water-based additives. "Industry research has shown that spraying grain with either a water- or mineral-oil based additive may significantly reduce dust emissions. The suppression of dust may be vital both in preventing elevator explosions and in reducing atmospheric pollution of the areas surrounding elevators. ... The FDA investigated the effect that additives have upon grain. FDA determined that mineral oil- and water-based additives are safe. Additionally, research conducted by and for FGIS found no conclusive evidence that mineral oil- and water-based additives are detrimental to grain quality". [Federal Register, 1984b] FGIS supplemented these research results with an investigation and supervision of an experimental oil/water dust suppression system installed at an export facility in the early 1980's. A patent for water and oil application for grain dust suppression was issued to The Andersons, March 27, 1984. [U.S. Patent Office, 1984]

Air pollution regulations, OSHA standards, insurance costs, and grain quality are other factors that must be considered in handling grain dust. Each of these four factors is discussed in the following pages.

<u>Air pollution regulations</u> limit the amount of dust that may be emitted that can impact the public. Prior to 1987, all particulate emissions were based upon Total Suspended Particulate (TSP). TSP was measured using a High Volume sampler that in effect samples particulates less than 45 μm [McFarland and Ortiz, 1982 and 1983]. In 1987, the criteria pollutant was changed from TSP to particulate matter less than 10 micrometers (PM10).

PM10 is measured with a special size selective inlet that removes the particles larger than PM10 so that theoretically only PM10 is sampled. Raina and Parnell [1995] reported that PM10 samples tend to under-sample PM10 and over-sample particulate matter larger than 10 μm.

In 1977, the New Source Performance Standards (NSPS) for grain handling facilities were promulgated by EPA under authority of section 111 of the Clean Air Act that limited emission concentrations from abatement devices to less than 0.01 grains per dry standard cubic foot (gr/dscf) or 23 milligrams per dry standard cubic meter (mg/dscm) (<u>TSP</u>). The perception of EPA and the grain industry was that the only air pollution abatement device that could achieve the 0.01 gr/dscf was a bag filter. Hence, all grain elevators with pneumatic dust control systems covered by NSPS were required to install bag filters to comply with air pollution regulations. It should be noted that the NSPS limit for Hazardous Waste Incinerators was 0.08 gr/dscf (<u>TSP</u>). OSHA also promulgated a new standard for grain elevator safety that included a limit of 1/8 inch fugitive dust accumulation (dust layer) near elevator legs to assist in regulating housekeeping [OSHA,1984].

Prevention of air pollution is a consequence of the enabling legislation referred to as the Federal Clean Air Act (FCAA) and its associated amendments. The FCAA empowers EPA to regulate air pollution but allows for delegation of air pollution regulatory authority to State Air Pollution Regulatory Agencies (SAPRAs). In order to be delegated the authority to regulate air pollution, a state must demonstrate an ability to perform this task effectively to include formulation of rules and regulations, permitting and enforcement. All SAPRA regulatory activities are subject to EPA oversight and scrutiny.

Air pollution regulations are typically enforced by SAPRA personnel. All SAPRA regulations must be as stringent as those established by EPA. They can limit allowable pollutant emissions to levels below that allowed by EPA but they can not allow a pollutant emissions rate in excess of these rates established by EPA.

The New Source Performance Standards for grain elevators were promulgated by EPA in August 3, 1978 [EPA, 1984]. As specified by the FCAA, the grain elevator's NSPS applies only to grain elevators with permanent grain storage capacity of 2.5 million bushels or greater and grain storage elevators, including processing plants, with permanent storage capacity of one million bushels or greater. These standards affect truck loading and unloading stations, rail car loading and unloading stations, ship loading and unloading stations, barge loading and unloading stations, grain dryers, grain handling operations, and emission control devices. Affected facilities are those facilities which commenced construction or modification after August 8, 1978. Opacity limits for particulate matter and visible emissions for grain elevators are given in Table 1.

The FCAA standards include self unloading ships, which are required to apply for an alternative emission control method, and which have for the most part selected mineral or vegetable oils. Apparently, water spray is also used in some instances. Other than for barges and ocean-going vessels, the EPA standards do not specify any particular control method. The use of water as a dust suppressant was not even anticipated by the EPA at the time the original standards were developed. All of the dust control methods discussed above can be used to comply with State and Federal air pollution emission limits. [Seitz, 1993].

<u>OSHA regulations</u> in the interest of worker health and safety, require standards of cleanliness. Following the widely publicized series of explosions in the 1970's, OSHA promulgated a new standard for grain elevator safety, which states that grain dust must not accumulate to levels in excess of 1/8" in priority areas. Priority housekeeping areas shall include at least the following: A) Floor areas within 35 feet of inside bucket elevators; B) Floors of enclosed areas containing grinding equipment, and C) Floors of enclosed areas containing grain dryers located inside the facility [29 CFR 1910.272]. This standard was based on a USDA task force report, which derived the ambient dust concentrations that would result if certain levels of accumulated dust concentrations were evenly dispersed into the air inside a grain elevator. [USDA, 1984]. This empirical derivation was based on a number of assumptions and the judgement of the members of the task force.

Insurance rates are influenced by the risks of fire and explosion. Dust control and suppression systems reduce the danger of fire and explosions. The National Fire Protection Association in NFPA 61B provides standards for the prevention of fires and explosions in grain elevators and facilities handling bulk raw agricultural commodities, NFPA (1994). NFPA (1994) lists requirements for explosion relief venting, antifriction bearings on shafts, dust collection systems, electrical wiring, sprinkler systems to protect the structure, and techniques to prevent or reduce dust generation. These techniques may include "reducing handling speeds, dead boxes, choke feeds, snorkel loaders, dust tight enclosures, short vertical runs, cleaning, and additives, as well as many others." Further, NFPA states that "preventative dust control is encouraged since it can effectively reduce total dust control costs as well as the demands placed on the performance of subsequent dust control techniques." The above reference to "additives" is the closest the NFPA 61B standards come to discussion of water or oil additive systems for grain.

Walker and Associates are a firm that provide inspections of grain elevator facilities and ratings which are used by some of the insurance companies which insure grain elevators. According to Walker (1994) insurance rates are adjusted to reflect risks. Risk of fire or explosion has been classified into seven risk categories based on construction to allow relief venting, fire suppression systems, sprinklers and dust collection systems, [Walker, 1994]. In addition, Walker and Associates also take into consideration whether dust control systems including oil application and formerly water application are used at grain transfer points [Walker 1994]. Lack of adequate dust control will result in a higher insurance risk. The risk categories range from "superior" to "poor" and a downgrade can increase insurance rates by about $6000 per year for an elevator of a size typically handling an average of 1 million bushels per month. The rating conditions used by one firm that provides ratings for insurance purposes provided the rating definitions shown in Appendix C. [Walker, 1994].

Grain quality has often been used as a justification for reducing the quantity of dust in grain. However, the net effect on quality is indeterminate and not easily demonstrated or proven. The removal of dust could improve the quality of grain. However, pneumatic systems remove only a small proportion of the total dust in the grain mass and once removed it is often returned before the grain is shipped. The addition of even small quantities of water to grain is usually considered detrimental to quality since it increases average moisture content. Although a few people have argued that the application of water or oil to grain improves the appearance of the grain mass, dust that sticks to the kernel worsens the appearance of the kernels and may conceal the true levels of foreign material. The use of water suppresses dust only temporarily. It is reported that following the next handling or transfer of the grain, dust emissions will return to their original level. There is an additional potential for quality losses if improper procedures or technologies are used. Even application rates less than 0.3% can create quality problems. For example, if the appropriate quantity of water is added to the grain on a moving belt, but only the top kernels of the grain mass absorb that moisture, then obviously there will be a wide diversity in the moisture content between the kernels on the top part of the belt and the kernels on the bottom part of the belt resulting in potential quality deterioration. The addition of water has also been linked to quality deterioration on the assumption that the presence of surface water on the kernels will enhance microbiological activity. [U.S. Senate, 1993].

Oil is effective for a longer period than water but still may not provide a permanent effect [Lai, et al, 1979, 1982, 1984]. In addition oil on the surface of the grain may attract small particles of foreign material which are no longer free in the grain stream to be sampled. Some buyers, especially for food use, complain that the application of any substance to the grain reduces its purity and therefore the value of the grain for use in the food processing industries.

Congressional actions and threat of legislation increased the intensity of the debate. Congress also continued to pressure the industry to reduce dust and foreign material. Prohibitions on recirculation of dust were included in several bills between 1981 and 1985, including HR-455 introduced by Neal Smith of Iowa, HR-1206 introduced by Byron Dorgan of North Dakota, and S-1121 introduced by Mark Andrews of North Dakota. These bills specifically prohibited the reintroduction of dust into the grain stream once it was removed. These controls were opposed by the FGIS industry advisory committee because of the costly and restrictive nature of the methods. However a modification of the Smith and Andrews bill was later included in the 1986 Grain Quality Improvement Act [FGIS, 1985]. The actions and threat of legislation by congress provided increased visibility and publicity that undoubtedly had an effect on strategies for dust control adopted by industry and regulatory agencies.