Any comments or questions, please let me know by COB Friday May 15.

GENERIC EXPOSURE AND RELEASE SCENARIO **DRAFT**

USE OF PMN IN POWDER COATING

K. Franklin 5-7-92

Processing

Description

PMN is mixed with other resins, pigments, fillers and other additives. This mixture is further blended in a kneader at 100°C to produce a hot melt. The mixture is extruded, cooled, ground, seived, and bagged or drummed as a powder paint. Assume 2000 kg of coating formulated per day at 20 -200 days/year. Worker activities include unloading the granules and operating equipment to mix, knead, extrude grind, seive and bag the powder paint.

processing sites

Assume that each processing site formulate 2000 kg of coating containing the PMN per day. Assume 20-100 days per year per site operation. Number of processing sites equals:

$$\frac{\text{PMN prod. vol. (KG)}}{\text{year}} \times \frac{\text{kg coating}}{\text{? kg PMN}} \times \frac{\text{day}}{\text{2000 kg coating}} \times \frac{\text{year}}{\text{20 days}}$$

Example: If production volume is 45,000 kg/yr and PMN is 10% concentration in toner, then # of use sites equal:

45,000 / 0.1 / 2000 / 20 = 11 sites

If more than 20 days/site, than number of sites will be less.

workers

Assume 12 workers per site. Assume 1 worker per shift for transfer operation and operating mixing equipment, 1 worker per shift for operating extrusion and cooling equipment, and 1 worker per shift for operating grinding and sieving equipment, and 1 worker per shift for packaging operation and cleanup. Assume 2 shifts per day.

Inhalation Exposure

If premixed PMN is powder or crystalline pellet form, assume inhalation exposure to particulates (dust) for the transfer/mix operator (3 total). If PMN is a waxy solid in form of pellets, then assume no inhalation exposure for the transfer/mix operator. Assume inhalation to particulates for the grinding/sieving operator and the packaging/cleanup operator (6 total). Use the OSHA PEL for nuisance dust, 15 mg/m^3. Inhalation dust exposure for the 3

transfer/mix workers will be :

$$\frac{15\ mg}{m^3} \times \frac{1.25\ m^3}{hr} \times \frac{8\ hours}{day} \times \frac{\%\ PMN\ as\ manuf/imported}{100} = \text{mg/day PMN as dust}$$

Inhalation dust exposure for the 6 grinding and packaging workers will be :

$$\frac{15\ mg}{m^3} \times \frac{1.25\ m^3}{hr} \times \frac{8\ hours}{day} \times \frac{\%\ PMN\ in\ coating}{100} = \text{mg/day PMN as dust}$$

Dermal exposure

For filling/dumping containers of powders, flakes, granules, use 18,200 mg/day times fraction of PMN in the powder. Note this concentration will be different for the premixed PMN and the packaged PMN.

Releases

Assume 2% of the production volume is lost as waste from residue in empty containers, scrap pellets, and equipment cleanup. Assume waste is landfilled in non-hazardous waste landfill.

USE

Description

Assume the coating is electrostatically sprayed onto a metal substrate. In a typical operation, the paint is unloaded from 100 lb. fiber drums transfer the powder to an air fluidized bed. Oversize particles are then removed in a sieve and then goes to a second fluidized bed or feed hopper which feeds the elctrostatic spray guns. Automatic operated spray guns (3 per booth) with applied voltage spray the coating onto the metal substate in a powder spray booth. Some manual spraying may be done in powder booths for touchups ~~of~~ to paint areas that the automatic guns don't cover. After spraying, the metal parts are cured in an oven and the polymers i~~s~~n the paint crosslink into a fused solid coating.

Electrostatic spraying of powders have a high (95%) transfer efficiency. The overspray is collected in the powder booth and sent to a filter type dust collector. The filter are cleaned by a pulse of compressed air which recycles the powder to the feed hopper for reuse. Cyclones and bag filters may also be used to collect and separate dust particles. The filtered air for the dust collector is blown through a final filter and then exhausted to air. The final filter is a high-efficiency catridge filter that is changed out periodically.

Article in Products Finishing Magazine, June 1991. pg. 48

R. Cornell and M. Helvey. "It's Clear, They're Here", Products Finishing Magazine. February 1992. Pgs. 42-46.

"Focus: Powder-Coating Systems, "Seventy Colors, One Booth"", Products Finishing Magazine. December 1991. Pgs. 48-52.

AP-42. Compilation of Air Pollutant Emission Factors. 4th ed. September 1985. Section 4.2.2.4- Other Metal Coating. USEPA, OAQPS.

AFP/SME. 1985. User's Guide to Powder Coating. Association for Finishing Processes of the Society of Manufacturing Engineers.

Appendix

a. In the NIOSH case study, spray guns having a maximum capacity of 40 lbs/hr were operated at 11 and 22 lbs/hr. Therefore, an average througput can be calculated as:

$$\frac{22\ \text{lbs}}{\text{hr}} \times \frac{8\ \text{hrs}}{\text{day}} \times \frac{250\ \text{days}}{\text{yr-site}} \times \frac{3\ \text{guns}}{\text{booth}} \times \frac{1\ \text{booth}}{\text{site}} \times \frac{\text{kg}}{2.2\ \text{lb}} =$$

60,000 kg powder coating per site-year

b. The Lee-Rowan Co. uses more than 100,000 pounds of powder coatings per month to coat wire-shelving. They utilize 10 automatic guns and 2 manual touch-up guns. They operate 2-3 shifts per day for 6 days/week (312 days/yr). Therefore, their usage rate would be:

$$\frac{100{,}000\ \text{lbs}}{\text{month}} \times \frac{\text{kg}}{2.2\ \text{lb}} \times \frac{12\ \text{months}}{\text{year}} = 545{,}000\ \text{kg coating/year} \quad \text{or}$$

$$\frac{100{,}000\ \text{lbs}}{\text{site-month}} \times \frac{\text{month}}{4\ \text{weeks}} \times \frac{\text{week}}{6\ \text{day}} \times \frac{\text{day}}{16\ \text{hr}} \times \frac{\text{site}}{12\ \text{guns}} = \frac{21.7\ \text{lbs coating}}{\text{hour-gun}}$$

c. Angola Wire Co. sprays 6,000 to 8,000 lbs. of powder paint per month.

$$\frac{8000\ \text{lbs coating}}{\text{month}} \times \frac{12\ \text{months}}{\text{year}} \times \frac{\text{kg}}{2.2\ \text{lbs}} = 44{,}000\ \text{kg coating/yr}$$

d. 120 million pounds of powder coatings are manufactured in North America per year. Of this approximately, five million pounds are clear powders.

$$\frac{120{,}000{,}000\ \text{lbs. coating}}{\text{year}} \times \frac{\text{kg}}{2.2\ \text{lb}} \times \frac{\text{avg. site}}{100{,}000\ \text{kg}} = 545\ \text{sites total}$$

Maximum number of use sites for powder coating would probably not exceed 1000.

# of use sites

Assume a typical powder coating site would use 100,000 kg/yr coating containing the PMN based on data presented in Appendix. Number of use sites equals:

$$\frac{\text{prod. vol. PMN-kg}}{\text{year}} \times \frac{\text{kg coating}}{\text{kg PMN}} \times \frac{\text{site-yr}}{\text{100,000 kg coating}} = \text{\# of use sites}$$

Maximum number of sites would probably not exceed 1000.

# of workers

For one site, assume 2 workers/shift, 2 shifts per day. One operator loads new paint, cleans paint lines, starts up and shutdowns equipments for color changes, and monitors equipment. Another operator manually sprays parts.

Inhalation exposure

Most facilities probably have good ventilation and dust collection systems to minimize loss of paints and to prevent static buildup. The NIOSH case study 8-hr time-weighted-average dust levels for the equipment operator and spray operator, were 1.3 and 1.5 mg/m^3, respectively. Therefore PMN inhalation exposure would be:

$$\frac{1.5\ \text{mg}}{\text{m}^3} \times \frac{1.25\ \text{m}^3}{\text{hr}} \times \frac{8\ \text{hour}}{\text{day}} \times \frac{\%\text{PMN in coating}}{100} = \quad \text{mg/day PMN as dust}$$

Dermal exposure

For spray painting, use 18,200 mg/day times fraction of PMN in coating. Note, the manual spray operator has bare hand contact with the spray gun to ground him and prevent static buildup.

Releases

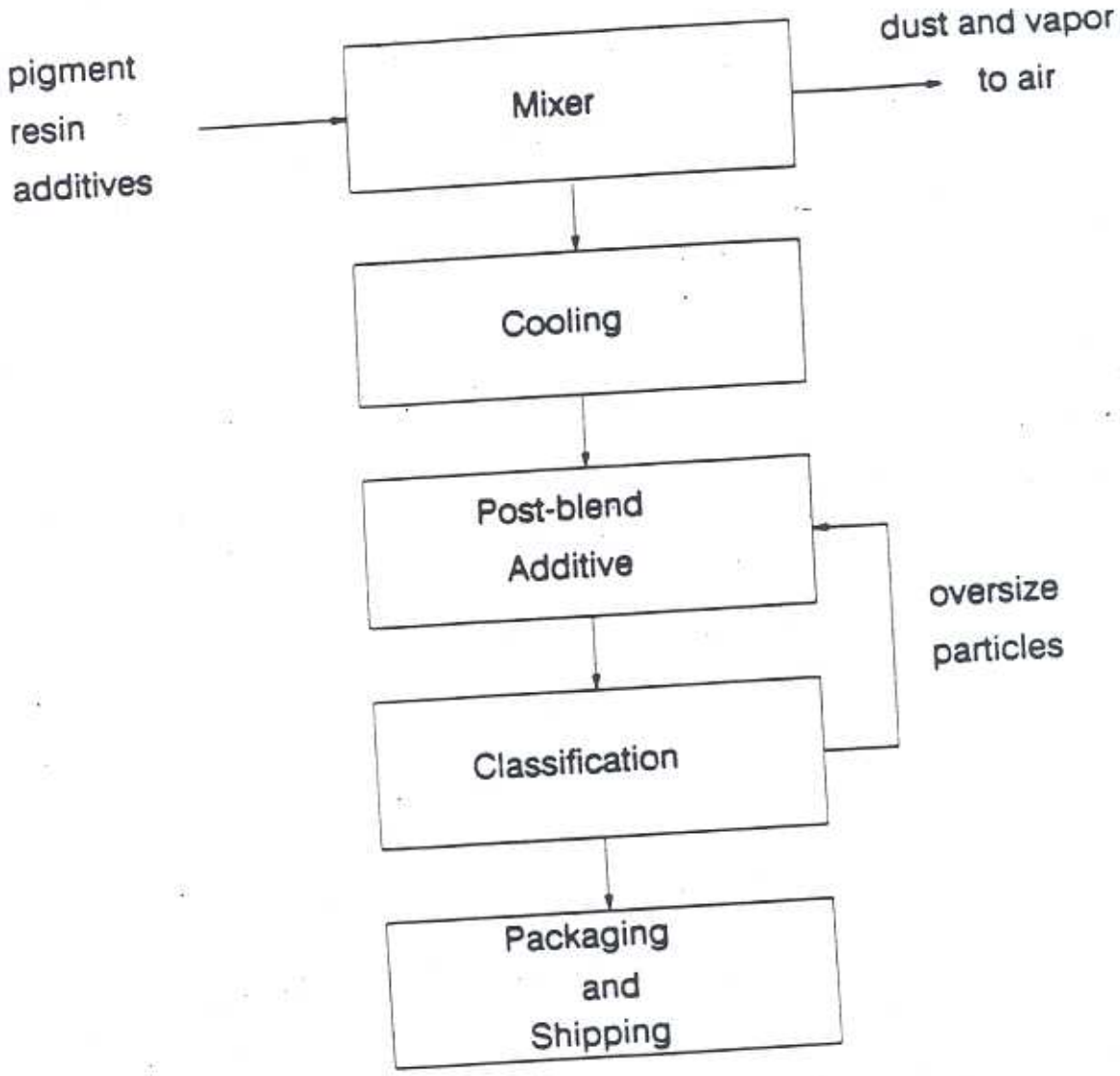
~~Since~~ About 99% ~~the most~~ of the overspray, which is only about 5% of amt. sprayed, ~~(99%)~~ is collected and reused. Assume that losses are about 1%, mostly in the form of spent filters, empty container residue, and equipment cleanup. Assume lost powder is landfilled.

References:

NIOSH. June 1981. An Evaluation of Engineering Control Technology for Spray Painting. "Case Study 1- Powder Coating- Small Parts". pgs. 1-1 thru 1-9. NIOSH Publication No. 81-121. US Dept. of Health and Human Services.

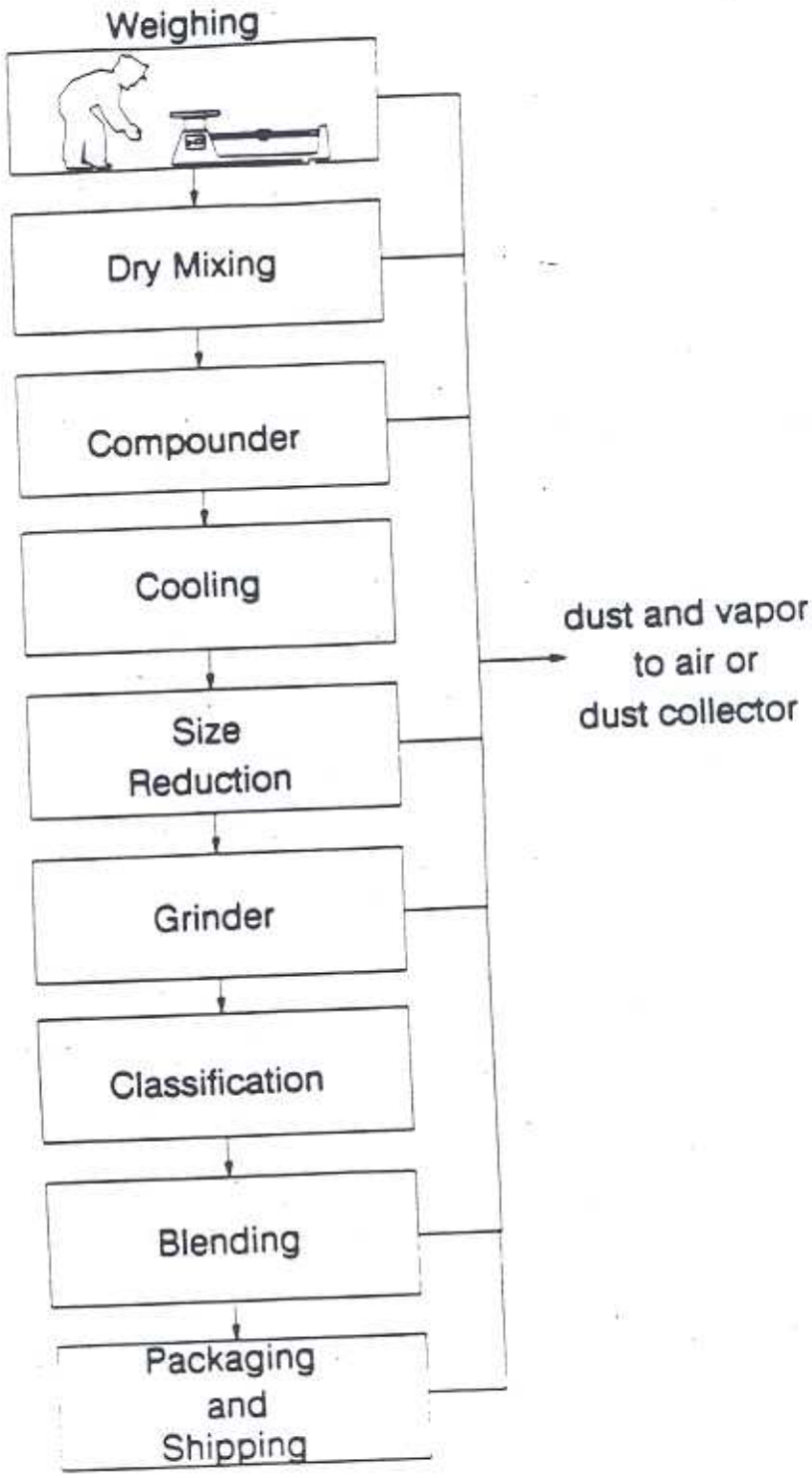
Kirk-Othmer. 1981. Encyclopedia of Chemical Technology. "Powder Coatings". Volume 19.

POWDERED COATINGS DRY-BLENDING PROCESS



Reference:
Industrial Hygiene Aspects of Plant Operations - Volume 1

POWDERED COATINGS MELT-MIXING PROCESS



Reference:
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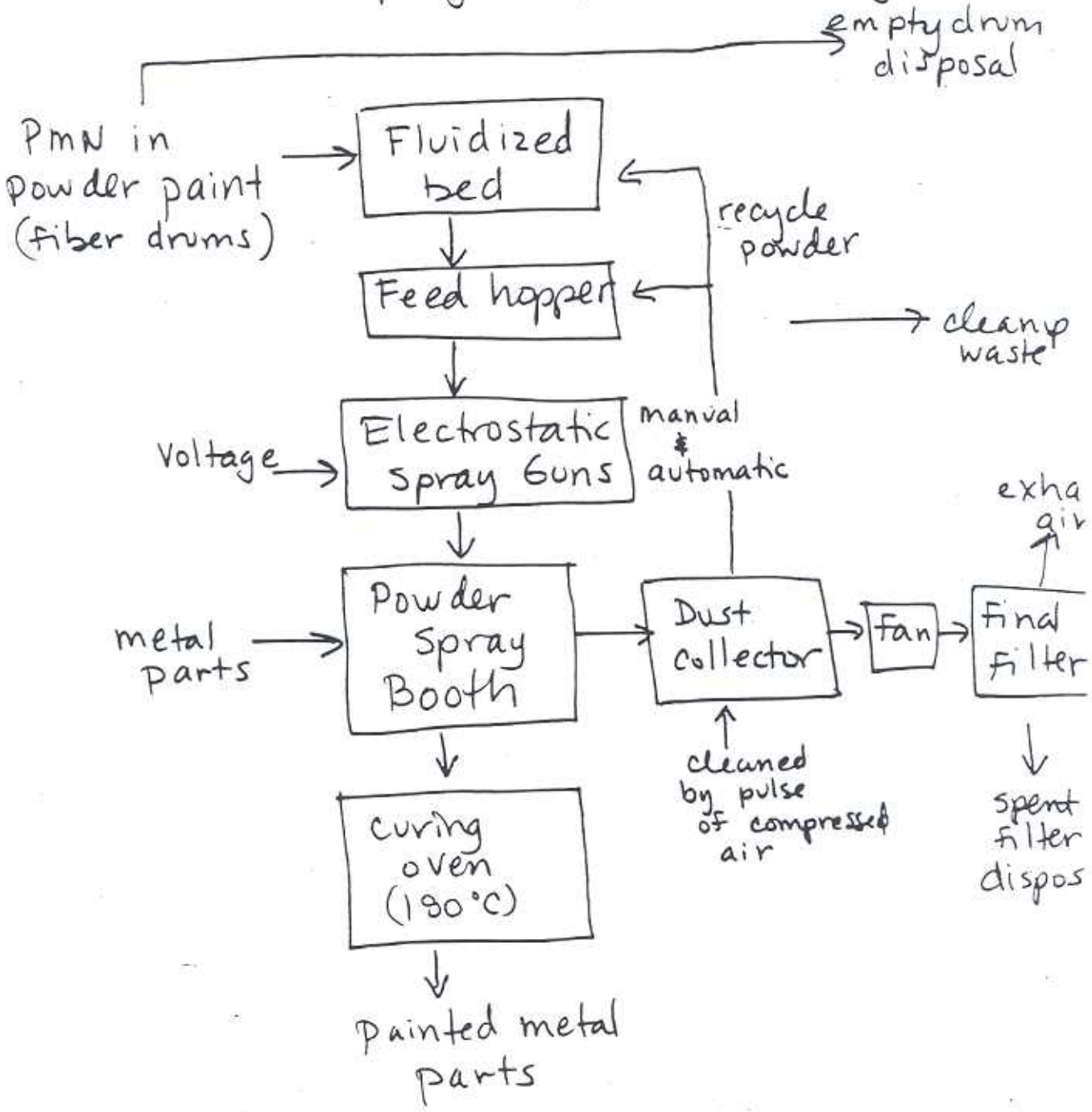
Electrostatic sprayed powder coating