pci PRECAST/PRESTRESSED CONCRETE INSTITUTE TECHNOTES

RESULTS OF SANDBLASTING — ENVIRONMENTAL POLLUTION SURVEY

A number of producers have been cited for air pollution caused by sandblasting. In an attempt to determine current practices (1990), problems and solutions regarding sandblasting, all producers, both structural and architectural precast concrete, were surveyed in 1990.

Dust concentrations in areas adjacent to sandblast operations can be excessive as far as 75 ft from the operator, even with only a light wind. Silica particles sand remain airborne for up to 20 minutes.

- The frequency of blasting of the responding plants was: daily – 52; and occasionally – 33.
- Percent of production which is sandblasted is shown in Table 1.
- Material used for blasting (by number of producers) is:
  Silica Sand: 58
  Natural Sand: 21
  Blasting Grits (ie. Black Beauty): 20
  Ground Shells or Corn Cobs: 1
  Slag: 1

Note: Silica sand does not break down as readily as bank or river sand, thus much less fine-sized dust is formed. Hardness of abrasive should be checked.

- No producer was recycling abrasive. One producer had a hauler who rescreened and resold sand to others.
- A retarder was used as a blasting aid by 65% of plants. Initially a larger plume of dust results, however, the total time involved in blasting is significantly decreased when a retarder is used, thereby reducing the total air pollution.

One plant reported that in order to avoid a dust plume they have gone to using a light retarder and high pressure water washing and then blasting with slag to dull the surface. They report slag is clean and does not produce dust.

- The reported pressure at the nozzle ranged from 60 to 150 psi (average 101 psi). Three producers exceeded manufacturers' maximum working pressure of 125 psi. However, they may have been reading it on the compressor and/or on the sandblast machine, while these are indicators of the pressure at that point, they do not indicate the pressure that exists at the nozzle. To determine the pressure at the nozzle, it is necessary to use a hypodermic needle gauge inserted into the sandblast hose (while operating).

  The compressor size used varied from 30 to 250 H.P. (average 109 H.P.) with the air volume varying from 100 to 1500 cfm. (average 428 cfm). The number of pots used per compressor varied from ½ to 8 (average 1½ pots) with 62% of respondents using 1 pot per compressor.
- The nozzle orifice size used by various plants is shown in Table 2.
- 14 out of 85 plants were blasting wet. PCI is aware of 9 plants not responding that also have used wet blasting. Several plants stated that EPA has stopped the use of dry blasting due to plumes of dust.
- The most popular method of water blasting was using the water ring at the nozzle (12 responses).

TABLE 2 Nozzle Orifice Size (in.)

	1/8	1/4	5/16	3/8	7/16	1/2	5/8
No. of Plants	1	9	14	24	3	8	4

TABLE 1 Percent of Production Sandblasted

	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
No. of Plants	16	18	12	4	10	2	6	7	7	3

In addition, two plants used a sand siphon (sand induced nozzle) on a high pressure water blaster and one plant used a system where water was injected between the nozzle holder and nozzle.

- Only 2 plants responded that sandblasting is done in an enclosed area with exhaust fans and only one of these plants has both mechanical collectors and clean air emission. The latter facility, which has 2 overhead cranes, cost approximately 1 million dollars to construct. The building improved productivity of blasting and also quality due to blasting under the same light conditions at all times according to the plant.

  PCI is aware of 2 plants that did not respond that have an enclosure but no fans or dust collectors.

  Note: Reference should be made to OSHA regulations (29CFR1910.134 and 1926.103) for worker respiratory protection against dusts produced during abrasive blasting operations. Supplied air respirator, hood style, type CE should provide a minimum protection factor of at least 1000.

- Nine plants are required to have permits for sandblasting. One plant pays an annual fee of over $10,000 per year based on usage of silica sand. Table 3 has the reported limits.

- In all cases, the best available technology is being accepted by the inspection agencies.

- Plants are being cited for pollution by the following agencies:
  EPA: 6 State: 6 County: 3

TABLE 3 Permit Limitations on Sandblasting

Panels/Year	Sq. Footage	Tons of Sand
12,500	1,131,000	—*
3,000	375,000	2,080
6,000	750,000	—
—	no number given	—
3,000	—	800
1,800	400,000	700
—	—	no number given
4,500	120,000	650

*Note: Plant is also required to use wet blasting and a moveable cover over the units being blasted.

- For those plants that have been cited, the proximity of the nearest potential complaining neighbor varied from 50 ft to one mile.

- The survey indicates a number of production inefficiencies within the industry.

  Productivity is in direct proportion to the volume of air pushed through the nozzle at high pressure. The largest possible nozzle should be used to fit the available air supply (see Table 4).

  Example: If a production rate of 100 sq ft/hr is averaged with a 1/4 in. nozzle; provided proper air and sandblast hose sizes are used; and sufficient air is available, by switching to 3/8 in. nozzle, 220 sq ft/hr will be obtained or 1/2 in. nozzle results in 400 sq ft/hr.

  The importance of nozzle pressure is shown by the following chart, indicating productivity with identical equipment with the exception of nozzle pressure:

Pressure at Nozzle (psi)	Area Coverage (%)
100	100
80	66
60	50

TABLE 4*

Orifice Size (in.)	Pressure at Nozzle (psi) 60	80	100
1/4	54.0[2]	68.0	81.0
	312.0[3]	408.0	494.0
	12.0[4]	15.5	18.0
3/8[1]	126.0[2]	161.0	196.0
	764.0[3]	960.0	1152.0
	28.0[4]	36.0	44.0
1/2[1]	224.0[2]	280.0	338.0
	1336.0[3]	1680.0	2024.0
	50.0[4]	62.5	75.0

*Requirements for air (cfm), sand (lbs/hr) and compressor horsepower. Air requirements were measured by a flow meter under actual blasting conditions, and are therefore lower than figures for air alone, with no abrasive. H.P. requirements are based on 4.5 cfm per H.P. Figures may vary for different working conditions.

[1] Blast machines should be equipped with 1 1/4" piping and valves to provide sufficient air volume.

[2] Required air (cfm)

[3] Required sand (lbs/hr)

[4] Required H.P.