

APPENDIX A-1  
Automatic Machine Installations

DUST DATA

FACILITY CENTRIFUGAL WHEEL MACHINE, INSTALLATION A-1 LOCATION (STATE) MASSACHUSETTS  
 APPLICABLE STANDARDS OR GUIDELINES OSHA (CFR, TITLE 29), \* MASSACHUSETTS, ACGIH, ANSI 29.4

ABRASIVE	<u>STEEL SHOT</u>	ACCEPTABLE DUST CONCENTRATIONS AND EXPOSURE DURATIONS				
		CRYSTALLINE QUARTZ _____ WT. %	STANDARD	MATERIAL	8-HR TLV	PERMISSIBLE EXCURSION
IF SILICA SAND . . .			OSHA	RES. INERT	5 <u>MG/M<sup>3</sup></u>	OSHA (NONE)
			OSHA	TOTAL INERT	15	OSHA (NONE)
			ACGIH	TOTAL INERT	10	ACGIH (1.5x)
SURFACE (COATING) OF BLASTED OBJECT <u>IRON OXIDE</u>						

ESTIMATED DURATION OF BLASTING 6 HRS/8 HR SHIFT

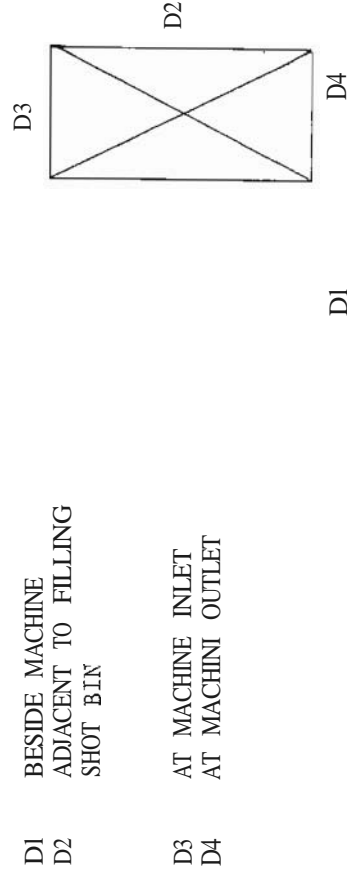
\* INCOMPLETE STANDARD, FROM ACGIH  
 LOCATION OF MEASUREMENT FACILITY SCHEMATIC (TOP VIEW)

ON-SITE DUST CONCENTRATION MEASUREMENTS

• EXTERIOR AMBIENT AIR DUST LEVELS  
 RESPIRABLE | TOTAL  
0.3 MG/M<sup>3</sup>  
3.9

• BLASTING DUST LEVELS  
 RESPIRABLE | TOTAL  
<1.0 MG/M<sup>3</sup> | 1.9 MG/M<sup>3</sup>  
2.1

• DUST LEVEL AT BLASTING SHUTDOWN  
 RESPIRABLE | TOTAL | TIME AFTER SHUTDOWN  
1.5 MG/M<sup>3</sup> | 4.7 MG/M<sup>3</sup> | 1.0 MIN.



SOUND DATA

FACILITY Automatic A-I      SIZE 30' x 8' x 15'      LOCATION Mass.

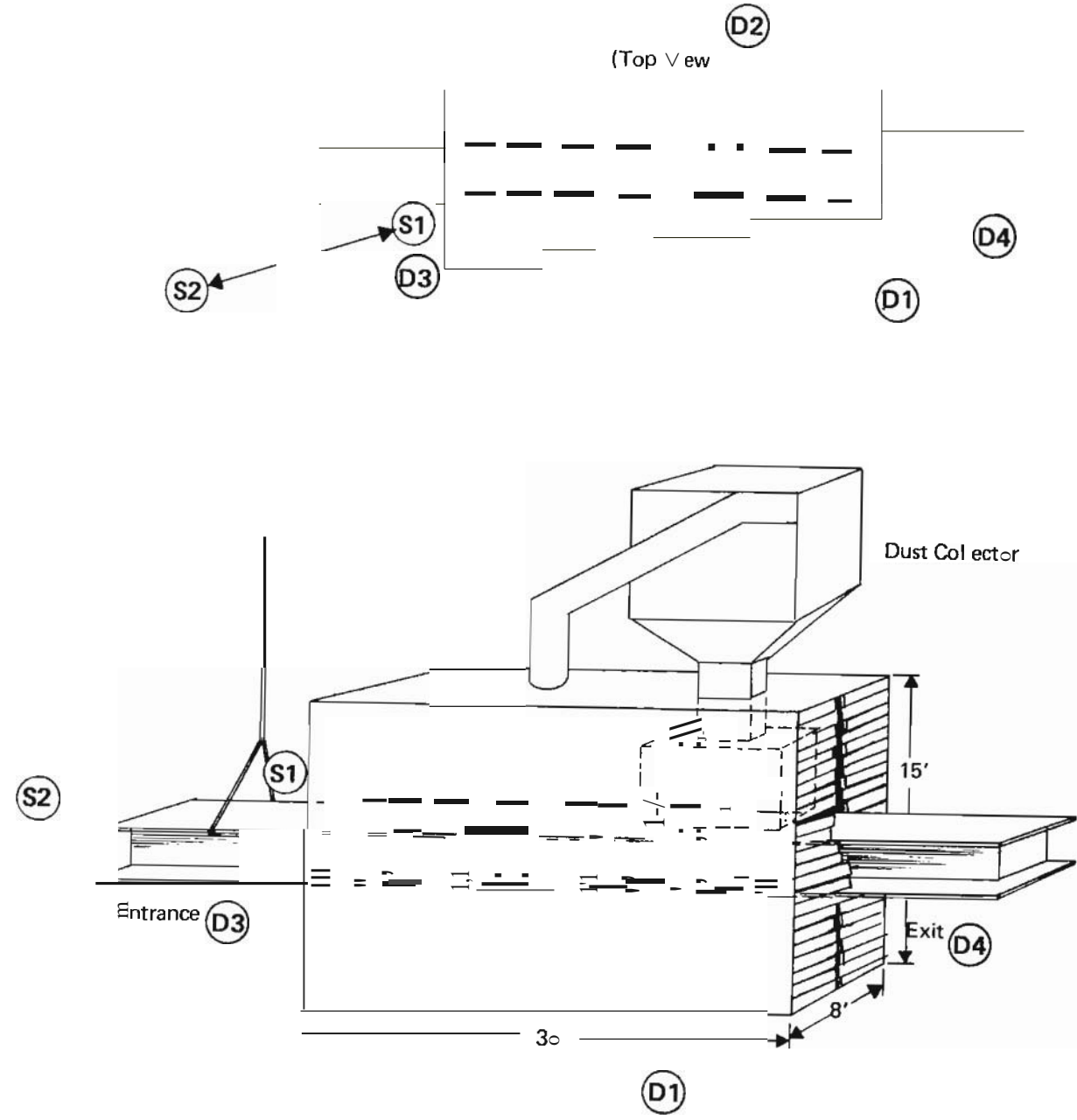
ABRASIVE Steel Shot      (A) dbA, A weighting network

WORK PIECE W 24 x 100, 50' Long      (20) 20KC, Flat response

INDIVIDUAL AT DISTANCE INDICATED	AMBIENT LEVEL	WITH HELMET AND WITH BREATHING AIR	WITH HELMET WITHOUT BREATHING AIR	RANGE DURING BLASTING	AVERAGE DURING BLASTING	NOTES
(1) Air Hose Cleaners	70(20)			108/113(A)	110(A)	Two air hoses manipulated by two workers to clean residue.
(2) Observer 12'	70(20)			94/100(A)	94(A)	Microphone near head.
				95(20)	95(20)	
Octave Band (20 KC flat response) at		observer				
20 - 75	82	6 - 1200	83			
75 - 150	90	12 - 2400	82			
150 - 300	84	24 - 4800	87			
300 - 600	82	48 - 9600	84			

GENERAL NOTES AND COMMENTS:

Operator behind installation.



SCHEMATIC OF INSTALLATION A-1  
CONTINUOUS/CENTRIFUGAL WHEEL MACHINE

DUST DATA

FACILITY CENTRIFUGAL WHEEL MACHINE, INSTALLATION A-2 LOCATION (STATE) MASSACHUSETTS  
 APPLICABLE STANDARDS OR GUIDELINES OSHA (CFR, TITLE 29), \*MASSACHUSETTS, ACGIH, ANSI 29.4

ACCEPTABLE DUST CONCENTRATIONS AND EXPOSURE DURATIONS

ABRASIVE	STEEL SHOT	STANDARD	MATERIAL	BHR TLV	PERMISSIBLE EXCURSION
IF SILICA SAND ...	CRYSTALLINE QUARTZ	OSHA	RES. INERT	5 $MG/M^3$	OSHA (NONE)
	TRIDYMITITE	OSHA	TOTAL INERT	15	OSHA (NONE)
	CRISTOBALITE	ACGIH	TOTAL INERT	10	ACGIH (1.5x)

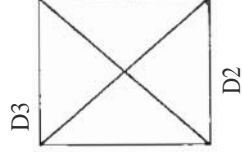
SURFACE (COATING) OF BLASTED OBJECT IRON OXIDE

ESTIMATED DURATION OF BLASTING 5 HRS 10 HR SHIFT \*INCOMPLETE STANDARD FROM ACGIH  
 ON-SITE DUST CONCENTRATION MEASUREMENTS LOCATION OF MEASUREMENT FACILITY SCHEMATIC (TOP VIEW)

• EXTERIOR AMBIENT AIR DUST LEVELS  
 RESPIRABLE | TOTAL  
 <1.0  $MG/M^3$

• BLASTING DUST LEVELS  
 RESPIRABLE TOTAL  
 0.4  $MG/M^3$  0.3  $MG/M^3$   
 <1.0 0.9

• DUST LEVEL AT BLASTING SHUTDOWN  
 TIME AFTER SHUTDOWN  
 RESPIRABLE TOTAL  
 0.5  $MG/M^3$  15 SEC.



D1 BESIDE MACHINE  
 D2 AT MACHINE OUTLET  
 D3 AT MACHINE INLET  
 D1 BESIDE MACHINE

D1

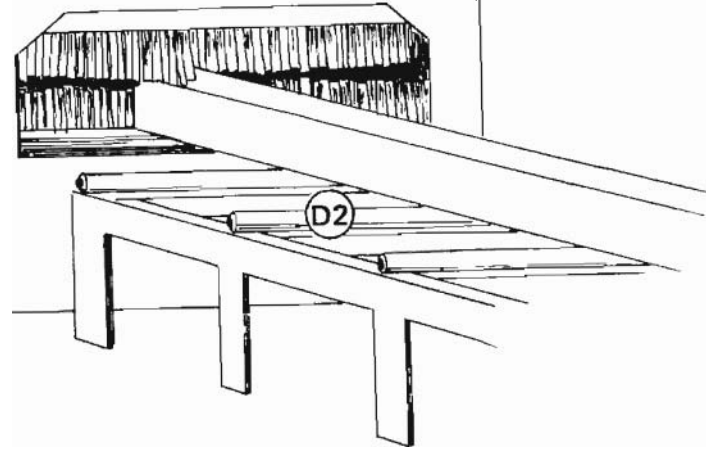
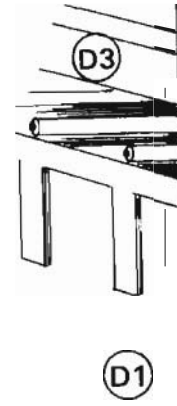
SOUND DATA

FACILITY Automatic A-2 SIZE 30' x 7' x 7' LOCATION Mass.  
 ABRASIVE Steel Shot (AI = dbA, A weighting network)  
 WORK PIECE W 10 x 72 Beams, 20' Long (20) 20KC, Flat response

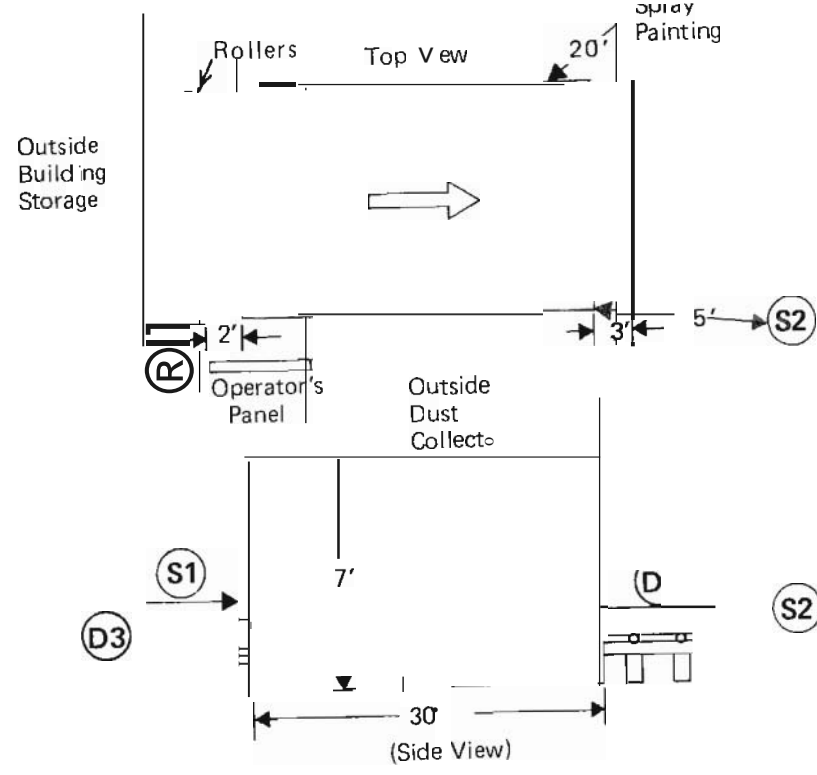
INDIVIDUAL AT DISTANCE INDICATED	AMBIENT LEVEL	WITH HELMET AND WITH BREATHING AIR	WITH HELMET WITHOUT BREATHING AIR	RANGE DURING BLASTING	AVERAGE DURING BLASTING	NOTES
(1) Operator 3'	76(20)			96/99(A)	97(A)	At work entrance.
(2) Helper IS'	76(20)			98/101(20)	99(20)	
Octave Band (20 KC flat response)				94/95(A)	94(A)	At work exit,
20 - 75	90	6 - 1200	89	97/98(20)	97(20)	
75 - 150	86.5	12 - 2400	83			
150 - 300	93	24 - 4800	82			
300 - 600	95	48 - 9600	79			

GENERAL NOTES AND COMMENTS:

Helper data dominated by secondary air blast shot removal at exit.



SCHEMATIC OF INSTALLATION A-2  
CONTINUOUS/CENTRIFUGAL WHEEL MACHINE



DUST DATA

FACILITY TUMBLE BLAST MACHINE, INSTALLATION A-3 LOCATION (STATE) RHODE ISLAND

APPLICABLE STANDARDS OR GUIDELINES OSHA (CFR, TITLE 29), 1, ACGIH (VOLUNTARY), ANSI 29.4 (VOLUNTARY)

ABRASIVE	STEEL SHOT	CRYSTALLINE QUARTZ	95	WT. %	STANDARD	MATERIAL	8-HR TLV	PERMISSIBLE EXCURSION
* IF SILICA SAND . . . . . (CASTING SAND ONLY)					OSHA/ACGIH	RES. $SiO_2$	0.1-0.2 $MGM^3$	OSHA (NONE), ACGIH (3x)
					OSHA/ACGIH	TOTAL $SiO_2$	0.3-0.6	OSHA (NONE), ACGIH (3x)
					OSHA	RES. INERT	5	OSHA (NONE),
					OSHA	TOTAL INERT	15	OSHA (NONE),
					ACGIH	TOTAL INERT	10	• ACGIH (1.5x)
SURFACE (COATING) OF BLASTED OBJECT <u>IRON OXIDE</u>								
CASTING SAND* _____								

ESTIMATED DURATION OF BLASTING 6 HRS/8 HR SHIFT

ON-SITE DUST CONCENTRATION MEASUREMENTS

- EXTERIOR AMBIENT AIR DUST LEVELS

RESPIRABLE	1.6 $MGM^3$
TOTAL	2.9 $MGM^3$

- BLASTING DUST LEVELS

RESPIRABLE	1.9 $MGM^3$
TOTAL	2.9 $MGM^3$
	1.8
	1.3
	2.0
	3.7

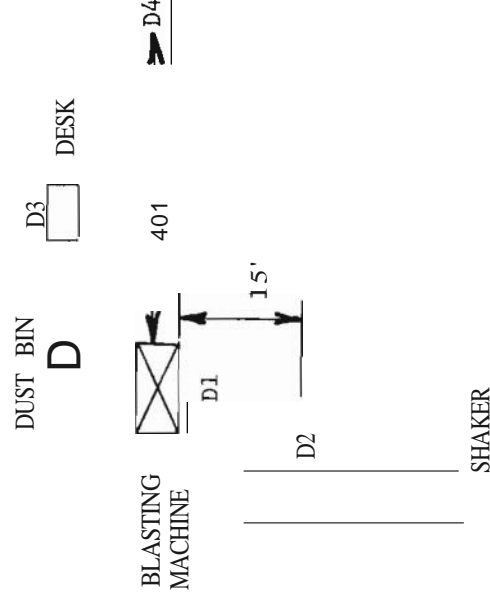
- DUST LEVEL AT BLASTING SHUTDOWN

RESPIRABLE	TIME AFTER SHUTDOWN
TOTAL	

LOCATION OF MEASUREMENT

- D1 IN FRONT OF UNIT
- D2 IN FRONT OF UNIT BY ADJACENT SHAKER
- D3 ADJACENT TO DUST BIN AT WORKER'S DESK
- D4 TO SIDE, BY GRINDING

FACILITY SCHEMATIC (TOP VIEW)



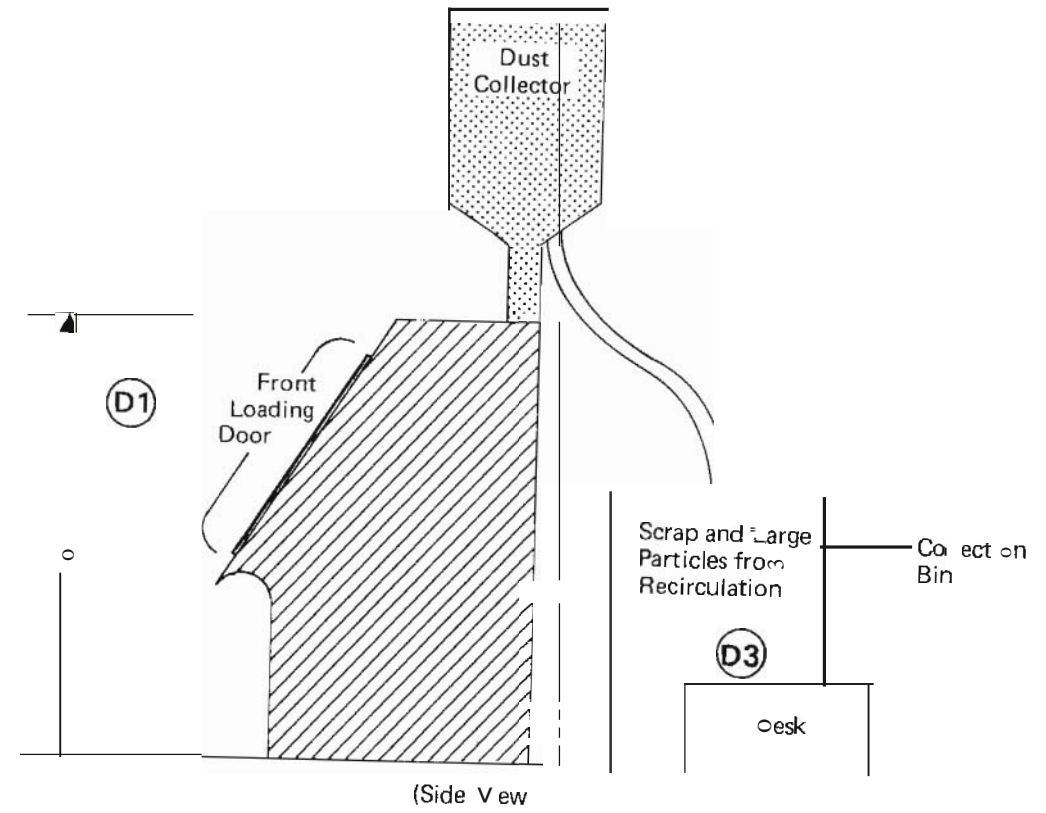
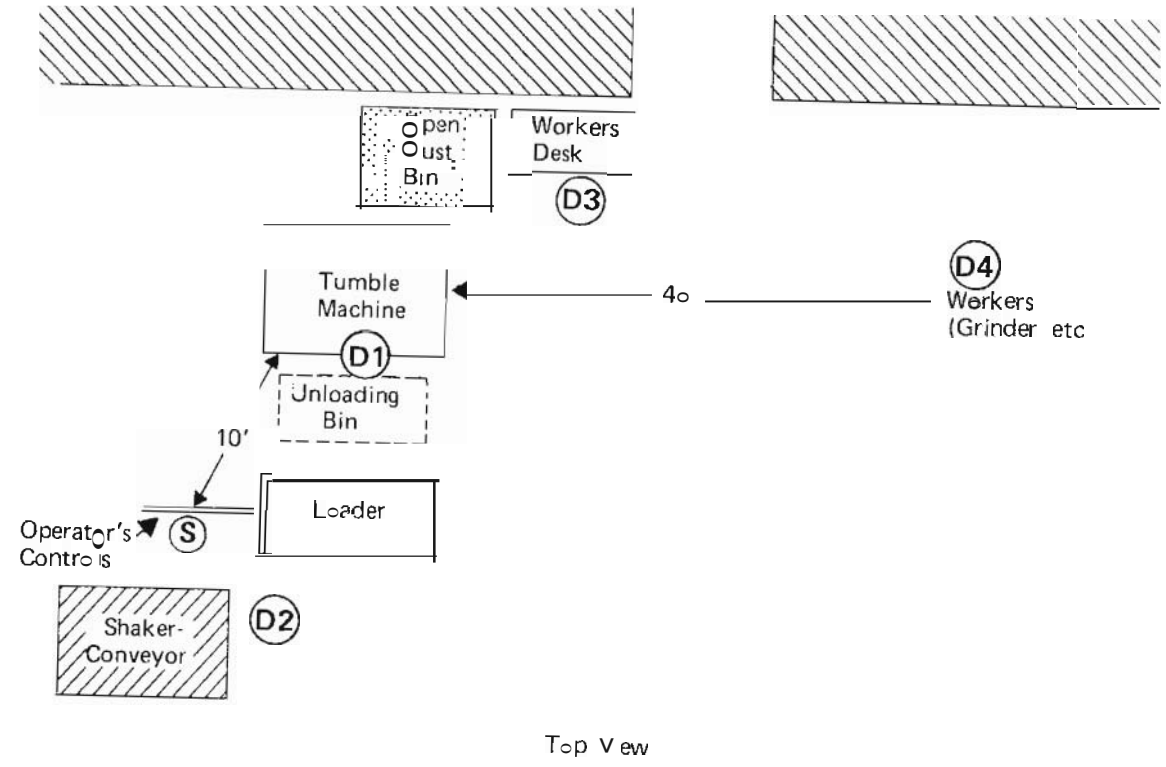
SOUND DATA

FACILITY: Tumble Blast Automatic A-3      Capacity: 14 ft. 3      LOCATION: R. 1.  
 ABRASIVE: Steel Shot      (A)      dbA, A weighting network  
 WORK PIECE: Small Castings      (20)      20KC, Flat response

INDIVIDUAL AT DISTANCE INDICATED	AMBIENT LEVEL	WITH HELMET AND WITH BREATHING AIR	WITH HELMET WITHOUT BREATHING AIR	RANGE DURING BLASTING	AVERAGE DURING BLASTING	NOTES
Operator 10'	82(A)			82!85(A)	83(A)	

GENERAL NOTES AND COMMENTS:

Other shop sources predominate.  
 100!118(A) Chipper at 80 ft.; 80!83(A) Grinding and Cut-off at 40 ft.;  
 108(A) Shaker Conveyor at 10 ft.



SCHEMATIC OF INSTALLATION A 3  
 TUMBLE BLAST AUTOMATIC MACHINE

DUST DATA

FACILITY CENTRIFUGAL WHEEL MACHINE, INSTALLATION A-4 LOCATION (STATE) RHODE ISLAND

APPLICABLE STANDARDS OR GUIDELINES OSHA (CFR, TITLE 29), ACGIH (VOLUNTARY), ANSI Z9.4 (VOLUNTARY)

ABRASIVE	<u>STEEL SHOT</u>	CRYSTALLINE QUARTZ	<u>95</u>	WT. %	STANDARD	MATERIAL	B-HR TLV	PERMISSIBLE EXCURSION
IF SILICA SAND (CASTING SAND ONLY)		TRIDYMITITE			OSHA/ACGIH	RES. <u>SiO<sub>2</sub></u>	0.1-0.2 MG/M <sup>3</sup>	OSHA (NONE), ACGIH (3x)
		CRISTOBALITE			OSHA/ACGIH	TOTAL <u>SiO<sub>2</sub></u>	0.3-0.6	OSHA (NONE), ACGIH (3x)
		ALBITE	<u>5</u>		OSHA	RES. <u>INERT</u>	<u>5</u>	OSHA (NONE)
SURFACE (COATING) OF BLASTED OBJECT		IRON <u>OXIDE</u>			OSHA	TOTAL <u>INERT</u>	<u>15</u>	OSHA (NONE)
<u>CASTING SAND</u> *					ACGIH	TOTAL <u>INERT</u>	<u>10</u>	ACGIH (1.5x)

ESTIMATED DURATION OF BLASTING 6 HRS/8 HR SHIFT

ON-SITE DUST CONCENTRATION MEASUREMENTS

EXTERIOR AMBIENT AIR DUST LEVELS	RESPIRABLE	TOTAL	LOCATION OF MEASUREMENT	FACILITY SCHEMATIC (TOP VIEW)
2.2 MG/M <sup>3</sup>	3.2 MG/M <sup>3</sup>		D1 IN FRONT OF UNIT	
10.7	15.4	D1 IN FRONT OF UNIT		
2.2 MG/M <sup>3</sup>	3.0 MG/M <sup>3</sup>	D2 BEHIND MACHINE BY DUST SEPARATOR BIN		
2.2	4.3	D3 BEHIND MACHINE BY BIN FOR MAGNETIC SEPARATOR ABOVE BIN, DURING BAG SHAKING		

\* DUST LEVEL AT BLASTING SHUTDOWN

RESPIRABLE TOTAL TIME AFTER SHUTDOWN

\* COMPOSITION OF SETTLEINGS INSIDE MACHINE:

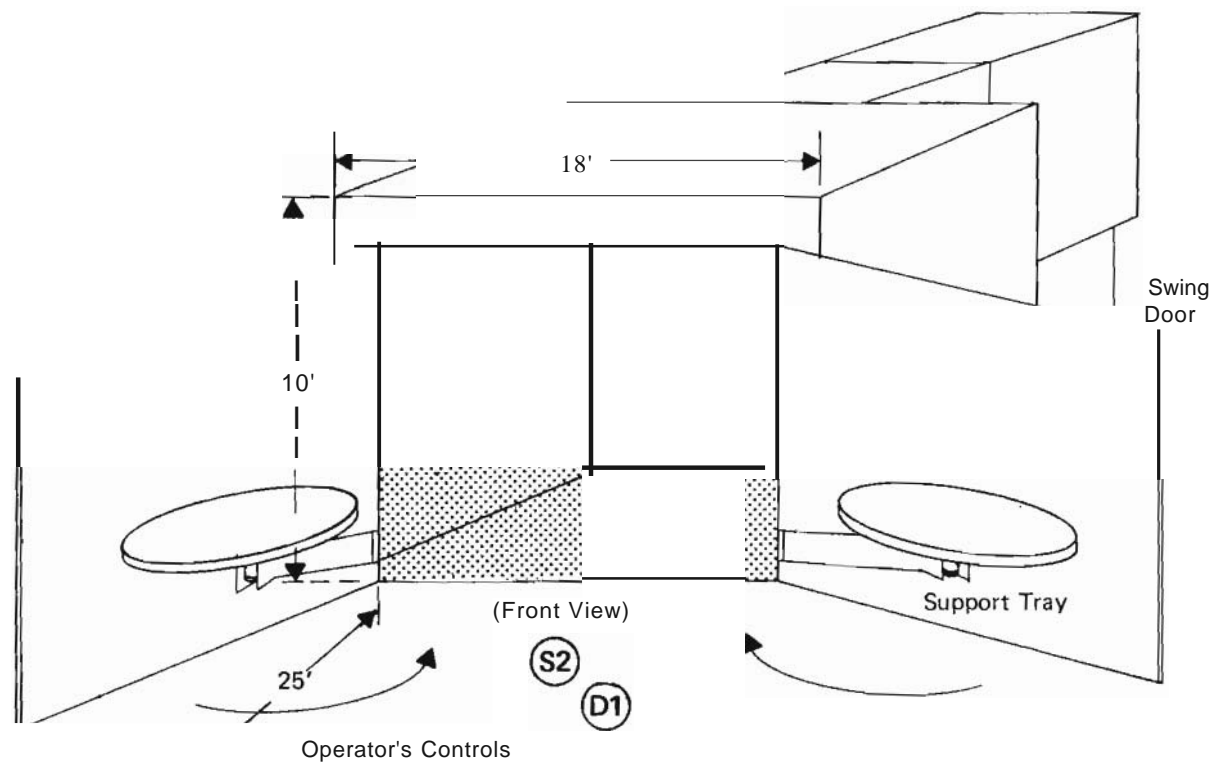
68.3 WT.% STEEL SHOT  
0.4 METAL DUST  
31.3 SAND (SiO<sub>2</sub>)

SOUND DATA

FACILITY	Swing Table Automatic A-4	SIZE	18' x 15' x 10'	LOCATION	R. 1.
ABRASIVE	Steel Shot	(A) = dbA, A weighting network			
WORK PIECE	Iron Castings	(20) 20KC, flat response			

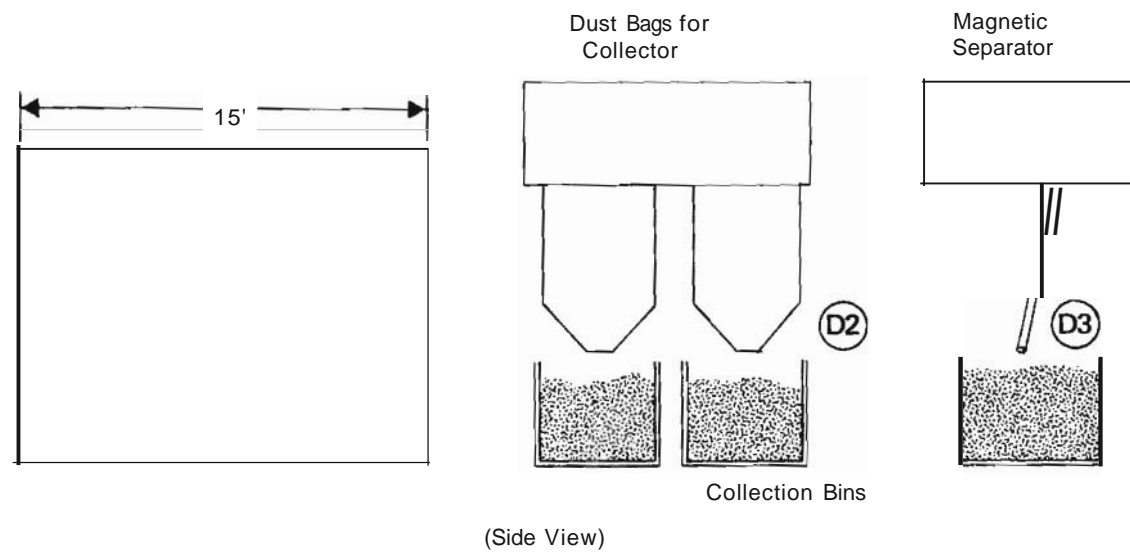
INDIVIDUAL AT DISTANCE INDICATED	AMBIENT LEVEL	WITH HELMET AND WITH BREATHING AIR	WITH HELMET WITHOUT BREATHING AIR	RANGE DURING BLASTING	AVERAGE DURING BLASTING	NOTES
(1) Operator 25'	80/90(A)			85/87(A)	86(A)	
	92/96(20)			94/95(20)	94(20)	
(2) Observer 1'				90(A)	90(A)	Directly in front of loading door.
				95/97(20)	96(20)	

GENERAL NOTES AND COMMENTS:  
Other shop sources predominate  
Data at 1 ft. are probably invalid also.



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APPENDIX A-2  
Portable Machine Installations



**SCHEMATIC OF INSTALLATION A-4  
AUTOMATIC SWING TABLE MACHINE**



FACILITY PORTABLE BLASTING MACHINE, INSTALLATION P-1 LOCATION (STATE) MASSACHUSETTS

APPLICABLE STANDARDS OR GUIDELINES OSHA (CFR, TITLE 29), \*MASSACHUSETTS, ACGIH, ANSI Z9.4

DUST DATA

ABRASIVE SAND ACCEPTABLE DUST CONCENTRATIONS AND EXPOSURE DURATIONS

CRYSTALLINE QUARTZ	100	WT. %	STANDARD	MATERIAL	8-HR TLV	PERMISSIBLE EXCURSION
IF SILICA SAND			OSHA/ACGIH	RES. <u>SiO<sub>2</sub></u>	0.1-0.2 MG/M <sup>3</sup>	OSHA (NONE), ACGIH (3x)
			OSHA/ACGIH	TOTAL <u>SiO<sub>2</sub></u>	0.3-0.6	OSHA (NONE), ACGIH (3x)
SURFACE (COATING) OF BLASTED OBJECT			OSHA	RES. INERT	5	OSHA (NONE),
			OSHA	TOTAL INERT	15	OSHA (NONE),
<u>PAINT</u>			ACGIH	TOTAL INERT	10	- • ACGIH (1.5x)

ESTIMATED DURATION OF BLASTING 6 HRS / 8 HR SHIFT \*INCOMPLETE STANDARD, FROM ACGIH

ON-SITE DUST CONCENTRATION MEASUREMENTS LOCATION OF MEASUREMENT FACILITY SCHEMATIC (TOP VIEW)

- EXTERIOR AMBIENT AIR DUST LEVELS  
RESPIRABLE | TOTAL  
<1.0 MG/M<sup>3</sup> | <1.0 MG/M<sup>3</sup>

D1 UPWIND OF BLASTER

- BLASTING DUST LEVELS  
RESPIRABLE | TOTAL  
<1.0 MG/H<sup>3</sup> | 1.9

D2 AT BLASTER'S FEET  
D1 10' UPWIND OF BLASTER  
D3 15' DOWNWIND OF BLASTER



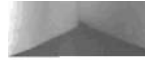
- DUST LEVEL AT BLASTING SHUTDOWN  
RESPIRABLE | TOTAL  
TIME AFTER SHUTDOWN







FIGURE A-1 PORTABLE BLAST CLEANING MACHINE, HAND-HELD NOZZLE (Installation P-1)



DUST DATA

FACILITY: PORTABLE BLASTING MACHINE, INSTALLATION P-2 LOCATION (STATE) MASSACHUSETTS

APPLICABLE STANDARDS OR GUIDELINES OSHA (CFR, TITLE 29), \* MASSACHUSETTS, ACGIH, ANSI Z9.4

ABRASIVE SLAG - - ACCEPTABLE DUST CONCENTRATIONS AND EXPOSURE DURATIONS

CRYSTALLINE QUARTZ	WT. %	STANDARD	MATERIAL	B-HR TLV	PERMISSIBLE EXCURSION
TRIDYMIT		OSHA	TOTAL INERT	5 MG/M <sup>3</sup>	OSHA (NONE)
CRISTOBALITE		OSHA	TOTAL INERT	15	OSHA (NONE)
		ACGIH	TOTAL INERT	10	ACGIH (1.5 x)
SURFACE (COATING) OF BLASTED OBJECT <u>IRON OXIDE,</u>					
PAINT, ENCRUSTED MARINE GROWTH					

ESTIMATED DURATION OF BLASTING 2-1/2 HRS/8 HR SHIFT \* INCOMPLETE STANDARD, FROM ACGIH

ON-SITE DUST CONCENTRATION MEASUREMENTS LOCATION OF MEASUREMENT FACILITY SCHEMATIC (TOP VIEW)

- EXTERIOR AMBIENT AIR DUST LEVELS  
RESPIRABLE | TOTAL  
<1.0 MG/M<sup>3</sup>

D4

- BLASTING DUST LEVELS  
RESPIRABLE | TOTAL  
0.8 MG/M<sup>3</sup> | 3.0 MG/M<sup>3</sup>  
<1.0  
1.0  
<1.0



- DUST LEVEL AT BLASTING SHUTDOWN  
RESPIRABLE | TOTAL  
TIME AFTER SHUTDOWN

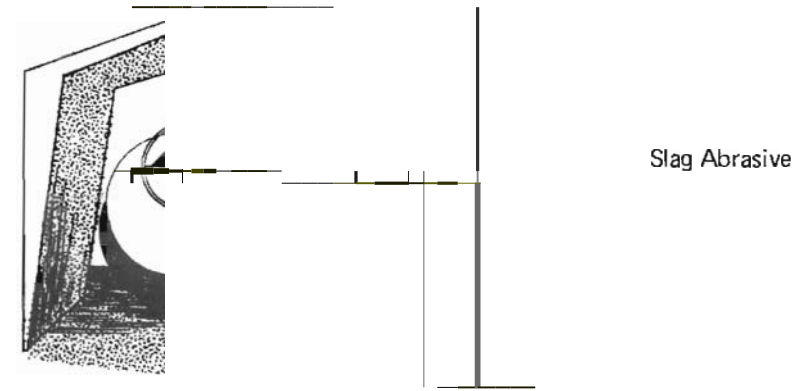
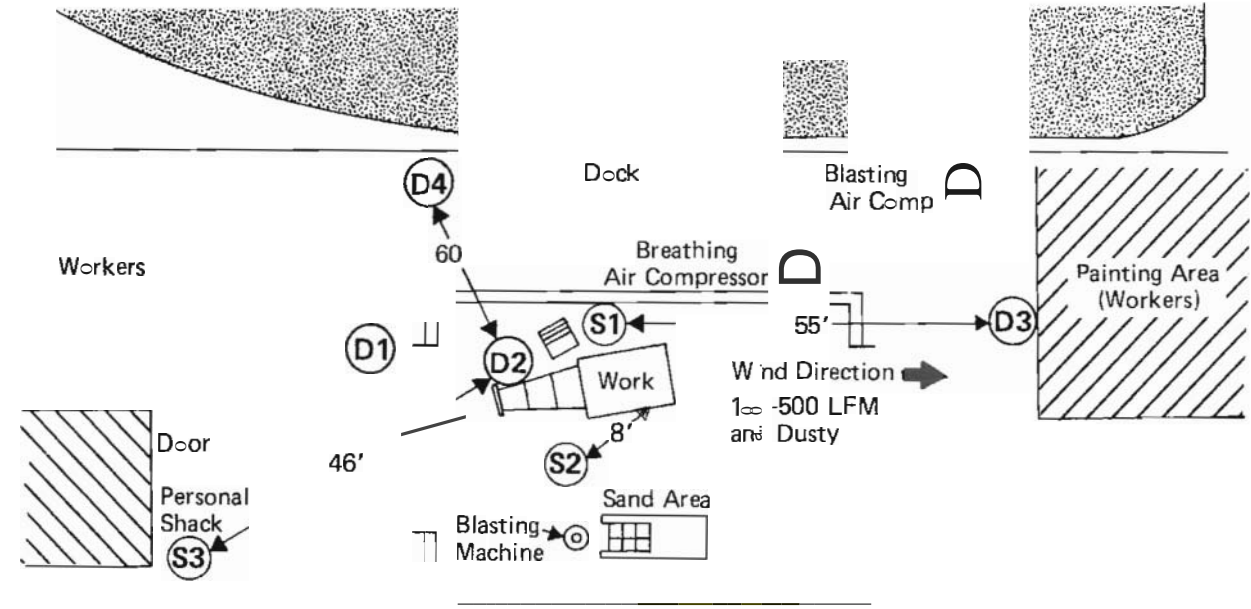
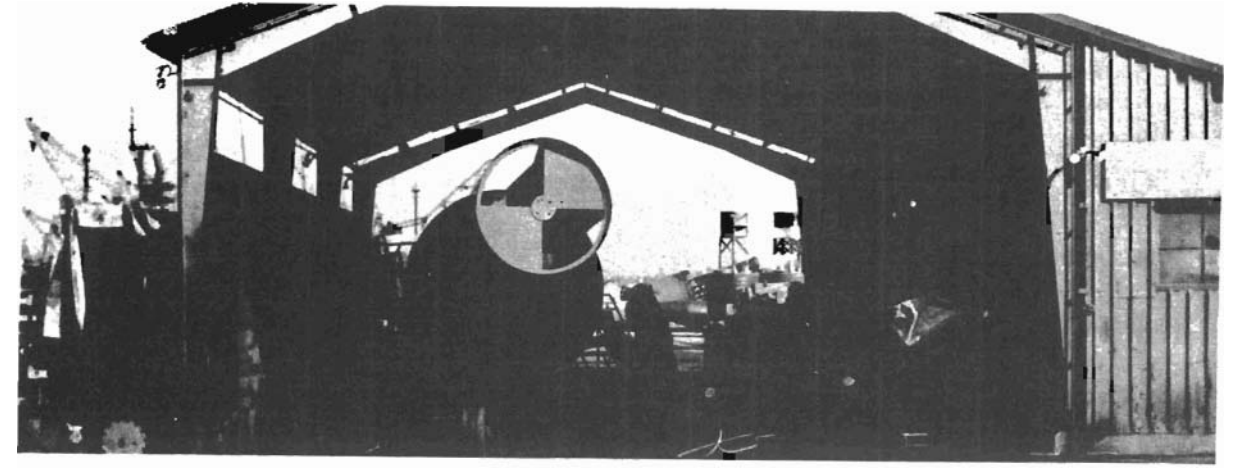
SOUND DATA

FACILITY Portable Unit P-2 SIZE 65' x 35' Open Ended LOCATION Mass.  
 ABRASIVE Slag (A) Shed  
 WORK PIECE 8' dia x 10' Long Tank (201) 20KC, Flat response

INDIVIDUAL AT DISTANCE INDICATED	*AMBIENT LEVEL	*WITH HELMET AND WITH BREATHING AIR	WITH HELMET WITHOUT BREATHING AIR	RANGE DURING BLASTING	AVERAGE DURING BLASTING	NOTES
(1) Blaster	86/89(A)	81(A)		98/104(A)	98(A)	Soft hood
(2) Helper 8'	82(A)	93(20)		98/102(20)	99(20)	
(3) Observer 46'	93.5(20)			102/104(A)	103(A)	
Octave Band	(20 KC flat response)			102/105(20)	104(20)	
20 - 75	85	6 - 1200	87	94/98(A)	96(A)	
75 - 150	91	12 - 2400	84	94/98(20)	96(20)	
150 - 300	90.5	24 - 4800	86			
300 - 600	85	48 - 9600	91			

GENERAL NOTES AND COMMENTS,

\*Includes compressors at more than 50 ft. distance for blaster and helper and 80 ft. distance for observer. Ambient without compressor 70 DB(A).



SCHMATIC OF INSTALLATION P-2  
 PORTABLE BLASTING UNIT

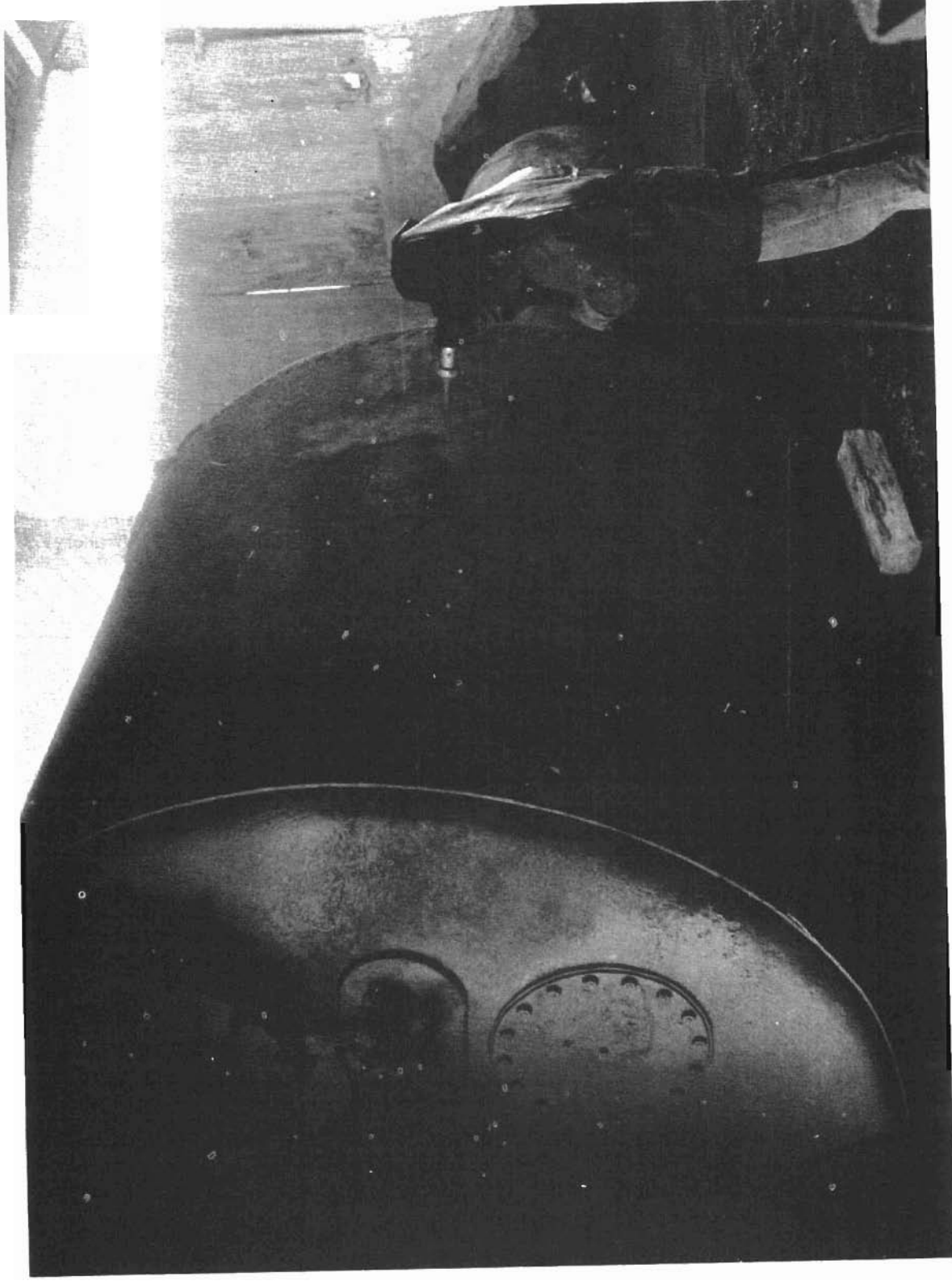
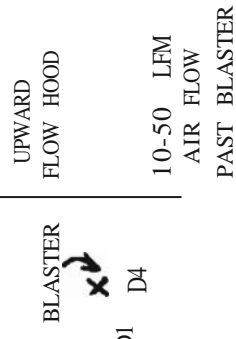


FIGURE A-2 PORTABLE BLAST CLEANING UNIT (Installation p-21)

FACILITY <u>PORTABLE BLASTING MACHINE, INSTALLATION P-3</u>		LOCATION (STATE) <u>MASSACHUSETTS</u>	
APPLICABLE STANDARDS OR GUIDELINES <u>OSHA (CFR, TITLE 29), *MASSACHUSETTS, ACGIH, ANSI Z9.4</u>		* <u>MASSACHUSETTS, ACGIH, ANSI Z9.4</u>	
OUST DATA			
ACCEPTABLE DUST CONCENTRATIONS AND EXPOSURE DURATIONS			
ABRASIVE <u>SAND</u>	CRYSTALLINE QUARTZ	100	WT. %
IFSILICA SAND .....	TRIDYMITITE	_____	STANDARD
	CRISTOBALITE	_____	OSHA/ACGIH
	_____	_____	OSHA/ACGIH
SURFACE (COATING) OF BLASTED OBJECT <u>IRON OXIDE.</u>	OSHA	RES. INERT	5
<u>PAINT</u>	OSHA	TOTAL INERT	15
	ACGIH	TOTAL INERT	10
ESTIMATED DURATION OF BLASTING <u>4 MRS/a</u>		HR SHIFT	
ON-SITE OUST CONCENTRATION MEASUREMENTS		*INCOMPLETE STANDARD, FROM ACGIH	
• EXTERIOR AMBIENT AIR OUST LEVELS		FACILITY SCHEMATIC (TOP VIEW)	
RESPIRABLE	TOTAL	D1	BEHIND BLASTER
<1.0 MG/M <sup>3</sup>		D2	5' BEHIND BLASTER
		D3	10' BEHIND BLASTER
• BLASTING OUST LEVELS		D4	AT BLASTER, 5 FEET
RESPIRABLE	TOTAL		
4.1 MG/M <sup>3</sup>			
5.5			
• DUST LEVEL AT BLASTING SHUTDOWN			
RESPIRABLE	TOTAL		
<1.0 MG/M <sup>3</sup>			
TIME AFTER SHUTDOWN			
2 MIN.			



INSTALLATION P-3

AIR FLOW RATE DATA

1. Air flow determined by average velocity through exhaust duct inlet:

$$\begin{array}{rcl} \text{Average Exhaust Velocity} & \times & \text{Duct Cross-Sectional Area} = \text{Average Air Flow} \\ 1000 \text{ LFM} & \times & 3.98 \text{ Sq Ft} = 3980 \text{ CFM} \end{array}$$

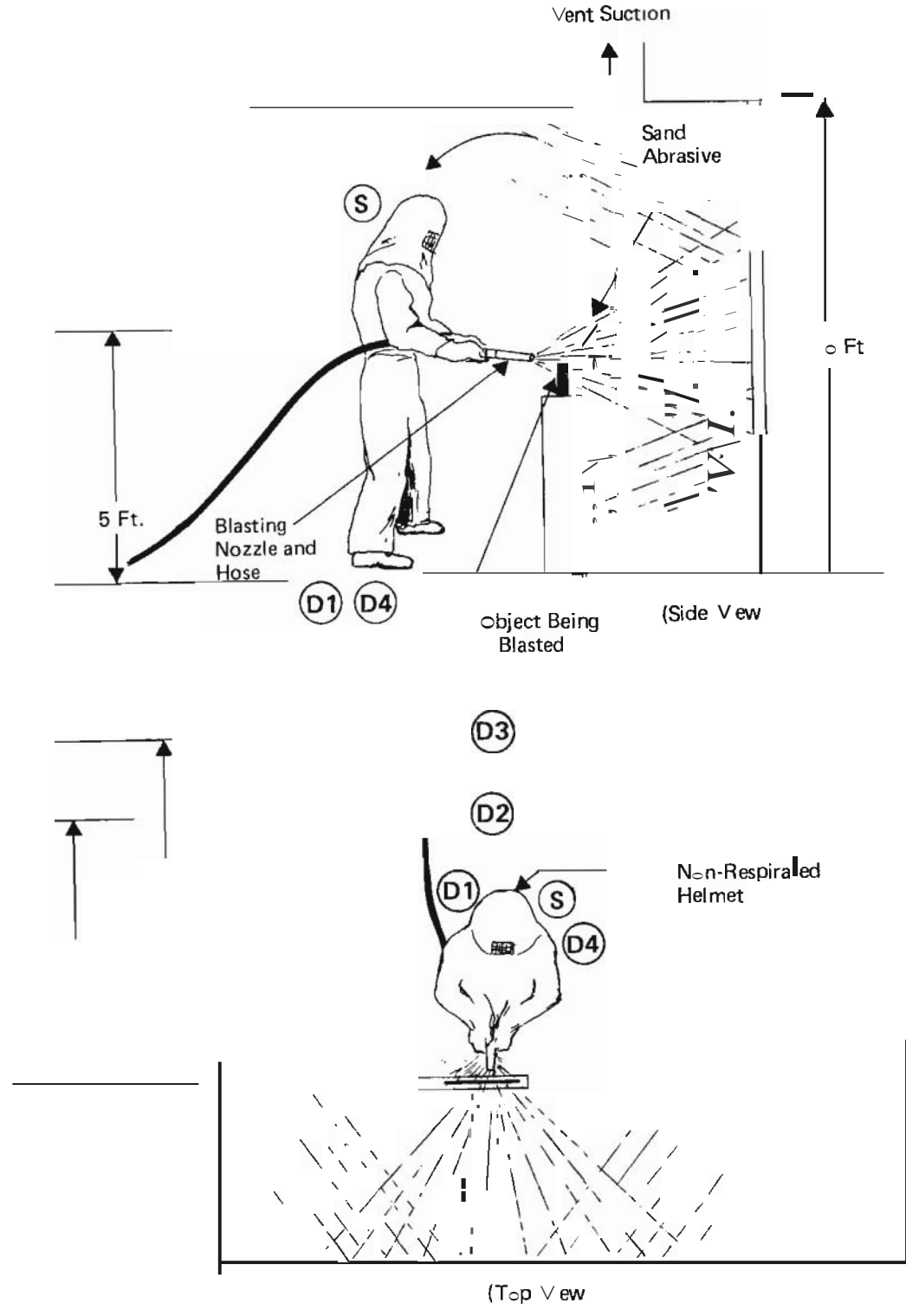
SOUND DATA

FACILITY	Portable Unit P-3	SIZE	19' x 19' x 18'	Room LOCATION	Mass.	
ABRASIVE	Sand	(A)	dbA, A weighting network			
WORK PIECE	Small Grillwork	(20)	20KC, Flat response			
INDIVIDUAL AT DISTANCE INDICATED	AMBIENT LEVEL	WITH HELMET AND WITH BREATHING AIR	WITH HELMET WITHOUT BREATHING AIR	RANGE DURING BLASTING	AVERAGE DURING BLASTING	NOTES
Blaster	70+(20)	No breathing air			100(A)	Either of two style helmets.
Blaster	78(A)	Room hood exhaust fan only--no		98/108(20)	102(20)	
Blaster	96(20)					
Blaster	Blaster talking: Face plate closed					
Octave Band	(20 KC flat response)*					
20 - 75	93	6 - 1200	85			
75 - 150	96	12 - 2400	87			
150 - 300	82	24 - 4800	89			
300 - 600	81	48 - 9600	91			

GENERAL NOTES AND COMMENTS:

\*Normal Blasting. When supply of sand was depleted; octave band data was + 2 DB different; overall was identical.





SCHEMATIC OF INSTALLATION P-3  
PORTABLE MACHINE IN UPDRAFT HOOD

DUST DATA

FACILITY PORTABLE BLASTING MACHINE, INSTALLATION P-4 \* LOCATION (STATE) MASSACHUSETTS  
(THREE NOZZLES)  
APPLICABLE STANDARDS OR GUIDELINES OSHA (CFR, TITLE 29), MASSACHUSETTS, ACGIH, ANSI 29.4

ABRASIVE	SLAG	CRYSTALLINE QUARTZ	WT. %	STANDARD	MATERIAL	B-HR TLV	PERMISSIBLE EXCURSION
SILICA SAND,				OSHA	RES. INERT	5 MG/M <sup>3</sup>	OSHA (NONE)
				OSHA	TOTAL INERT	15	OSHA (NONE)
				ACGIH	TOTAL INERT	10	ACGIH (1.5x)
SURFACE COATING) OF BLASTED OBJECT IRON OXIDE,							
PAINT, ENCRUSTED MARINE GROWTH							

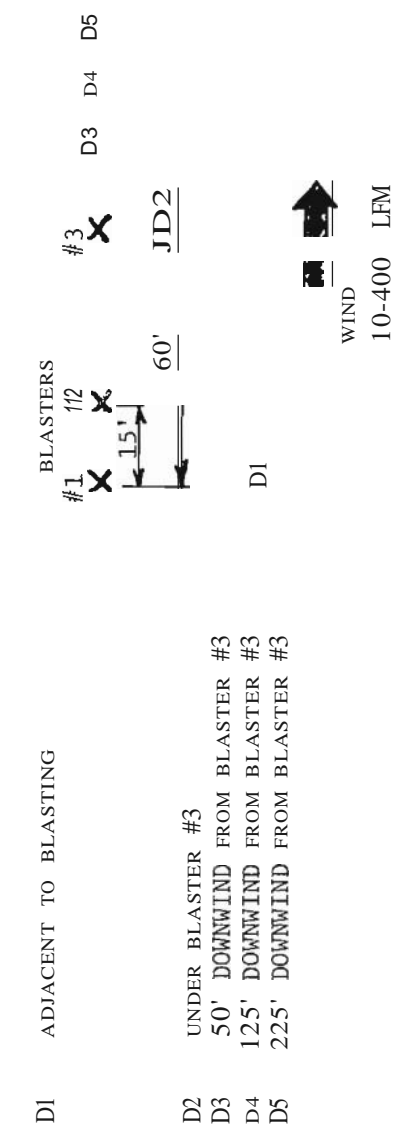
ESTIMATED DURATION OF BLASTING 6 HRS/8 HR SHIFT \* INCOMPLETE STANDARD, FROM ACGIH

ON-SITE DUST CONCENTRATION MEASUREMENTS LOCATION OF MEASUREMENT FACILITY SCHEMATIC (TOP VIEW)

• EXTERIOR AMBIENT AIR DUST LEVELS  
RESPIRABLE TOTAL  
<1.0 MG/M<sup>3</sup> <1.0 MG/M<sup>3</sup>

• BLASTING DUST LEVELS  
RESPIRABLE TOTAL  
1.5 MG/M<sup>3</sup> 2.0 MG/M<sup>3</sup>  
1.3 1.1  
0.8 1.6  
<1.0

• DUST LEVEL AT BLASTING SHUTDOWN  
TIME AFTER SHUTDOWN  
RESPIRABLE TOTAL

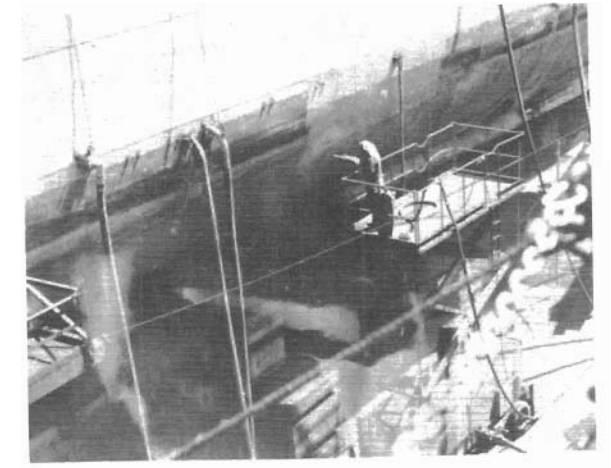
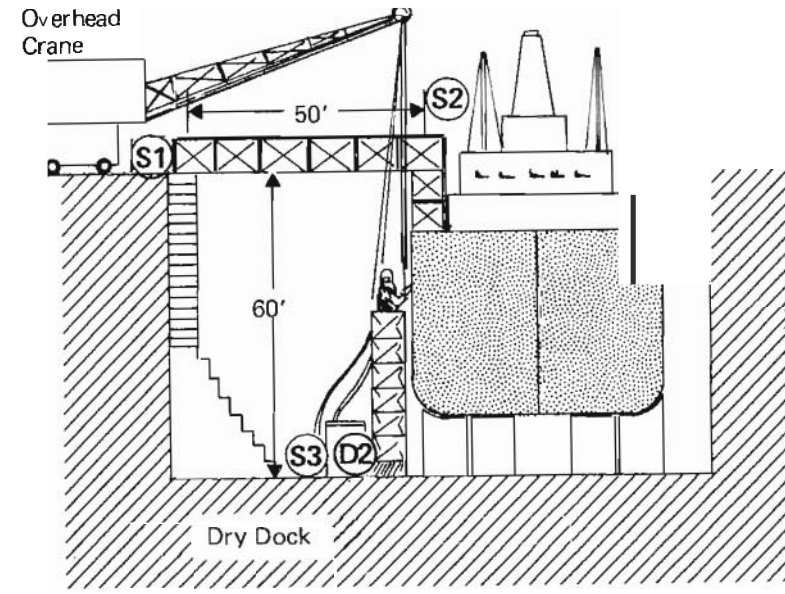


SOUND DATA

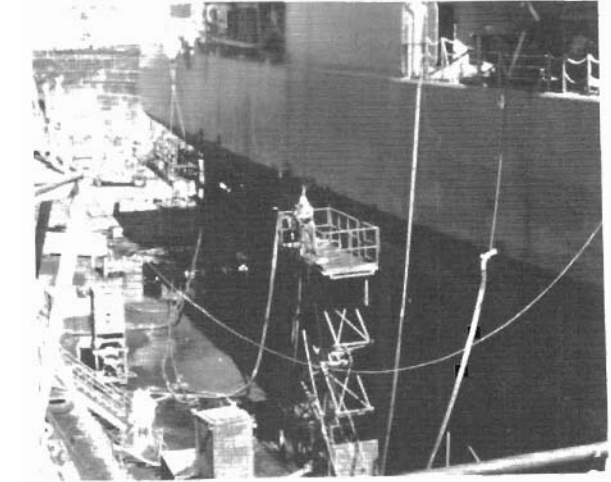
FACILITY	Portable Unit p-4	Outdoor Drydock	LOCATION	Mass.
ABRASIVE	Slag	(A)	dbA, A weighting network	
WORK PIECE	Ship Hull	(20)		

INDIVIDUAL AT DISTANCE INDICATED	AMBIENT LEVEL	WITH HELMET AND WITH BREATHING AIR	WITH HELMET WITHOUT BREATHING AIR	RANGE DURING BLASTING	AVERAGE DURING BLASTING	NOTES
(1) Dockside 70'				87(A)	87(A)	
(2) Ship's Deck 70'				87/89(20)	88(20)	
(3) Hopper Attendant 35'				92/96(A)	94(A)	
(4) Drydock Floor 40'				92 (20)	92(20)	
				99(A)	99(A)	
				100/102(20)	101(20)	
				90/91(A)	90(A)	
				88/90(20)	89(20)	

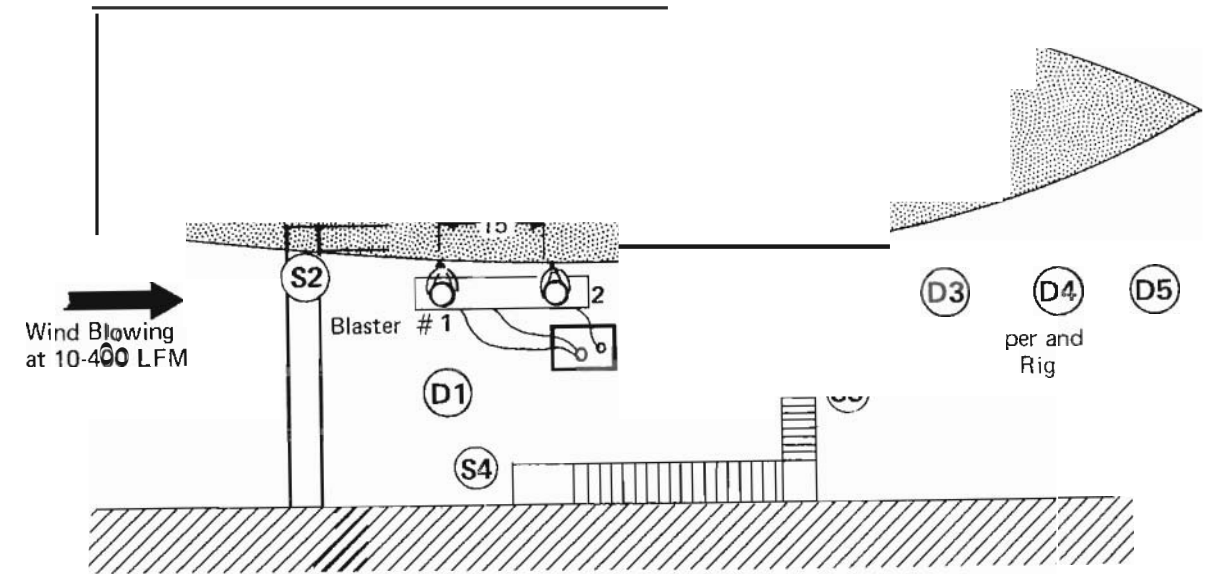
data available - three units in use simultaneously.



Photograph of Blaster No. 3



Photograph of Support Scaffolding for Three Blasters



SCHEMATIC OF INSTALLATION P-4  
THREE PORTABLE HAND-HELD NOZZLES  
BLAST EXTERIOR OF SHIP IN DRY DOCK



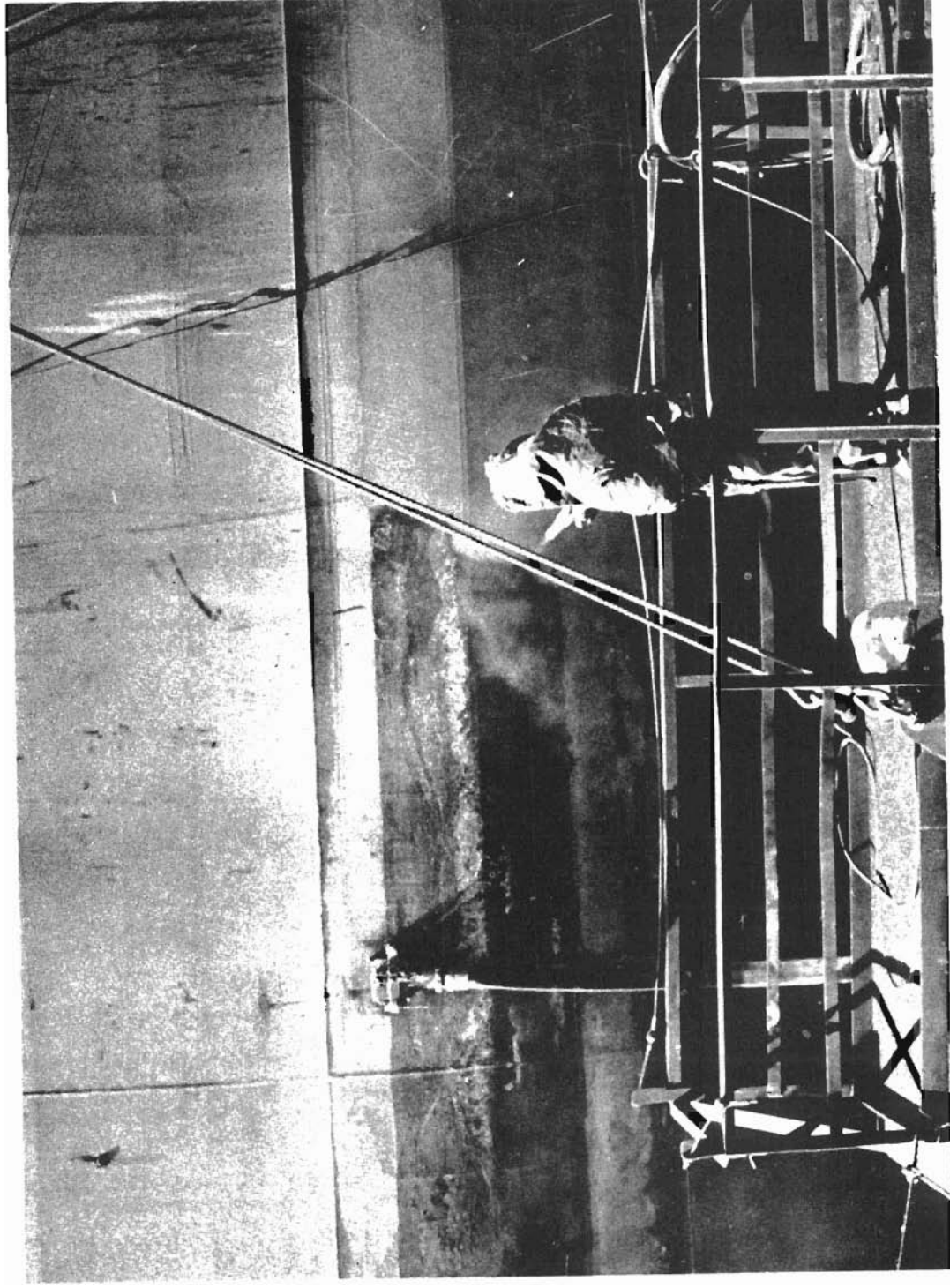


FIGURE A-3 PORTABLE BLAST CLEANING MACHINE, HAND-HELD NOZZLE, CLEANING SHIP IN DRYDOCK (Installation p-41)

DUST DATA

FACILITY PORTABLE BLASTING MACHINE INSTALLATION P-5 LOCATION (STATE) TEXAS  
 APPLICABLE STANDARDS OR GUIDELINES OSHA (CFR, TITLE 29), ACGIH (VOLUNTARY), ANSI 29.4 (VOLUNTARY)

ABRASIVE	SAND	CRYSTALLINE QUARTZ	100	WT. %	STANDARD	ACCEPTABLE DUST CONCENTRATIONS AND EXPOSURE DURATIONS		
						MATERIAL	8-HR TLV	PERMISSIBLE EXCURSION
IFSILICA SAND	.....	TRIDYMITE	_____	_____	<u>OSHA/ACGIH</u>	<u>RES. SiO<sub>2</sub></u>	<u>0.1-0.2 MG/M<sup>3</sup></u>	<u>OSHA (NONE), ACGIH (3x)</u>
					<u>OSHA/ACGIH</u>	<u>TOTAL SiO<sub>2</sub></u>	<u>0.3-0.6</u>	<u>OSHA (NONE), ACGIH (3x)</u>
SURFACE (COATING) OF BLASTED OBJECT	_____	_____	_____	_____	<u>OSHA</u>	<u>RES. INERT</u>	<u>5</u>	<u>OSHA (NONE),</u>
					<u>OSHA</u>	<u>TOTAL INERT</u>	<u>1.5</u>	<u>OSHA (NONE),</u>
					<u>ACGIH</u>	<u>TOTAL INERT</u>	<u>10</u>	<u>- , ACGIH (1.5x)</u>

ESTIMATED DURATION OF BLASTING UP TO 4 MRS/a HR SHIFT

ON-SITE DUST CONCENTRATION MEASUREMENTS

• EXTERIOR AMBIENT AIR DUST LEVELS  
 RESPIRABLE | TOTAL

<1.0 MG/M<sup>3</sup>

• BLASTING DUST LEVELS  
 RESPIRABLE | TOTAL

5.2 MG/M<sup>3</sup> | 5.7 MG/M<sup>3</sup>  
 0.2 | <1.0  
 <1.0 |  
 12.6 |

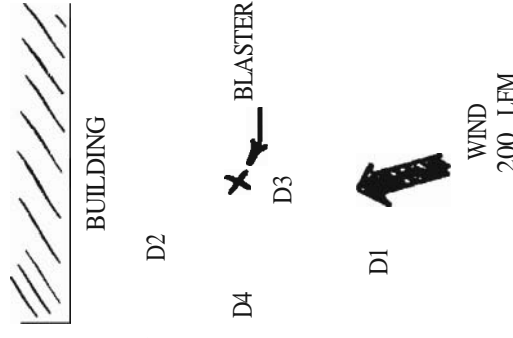
• DUST LEVEL AT BLASTING SHUTDOWN  
 TIME AFTER SHUTDOWN

RESPIRABLE | TOTAL

LOCATION OF MEASUREMENT

D1 UPWIND PRIOR TO BLAST  
 D2 10' DOWNWIND OF BLASTER AT BLASTER'S FEET  
 D3 15' TO BLASTER'S SIDE  
 D4 10' DOWNWIND OF BLASTER (CHANGED FROM CASTINGS TO PIPE SECTIONS)

FACILITY SCHEMATIC (TOP VIEW)



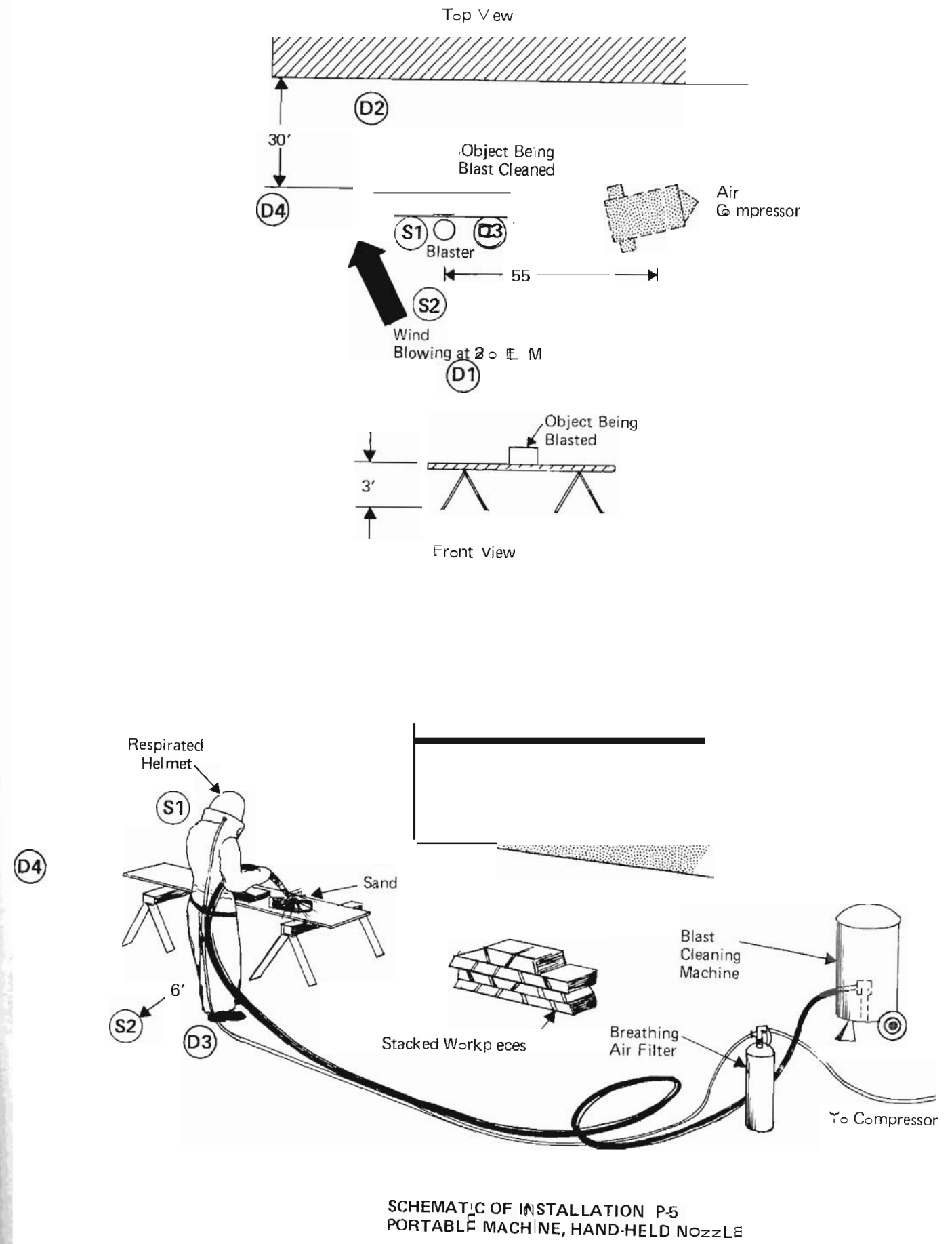
SOUND DATA

FACILITY Portable Unit P-5 SIZE Outdoor LOCATION Texas  
 ABRASIVE Sand (A) dbA, A weighting network  
 WORK PIECE Small 4" Pipe Saddles (201) 20KC, Flat response

INDIVIDUAL AT DISTANCE INDICATED	AMBIENT LEVEL	WITH HELMET AND WITH BREATHING AIR	WITH HELMET WITHOUT BREATHING AIR	RANGE DURING BLASTING	AVERAGE DURING BLASTING	NOTES
(1) Blaster		72 (A)		77/88(A)	82(A)	Helmet
(2) Observer 6'		84(20)		81/88(20)	85(20)	
					94(A)	No helmet on observer.
					96(20)	

GENERAL NOTES AND COMMENTS:

Nearest building-30' distance. Compressor at 55' distance.  
 Work table: 2" x 8" lumber on sawhorses.



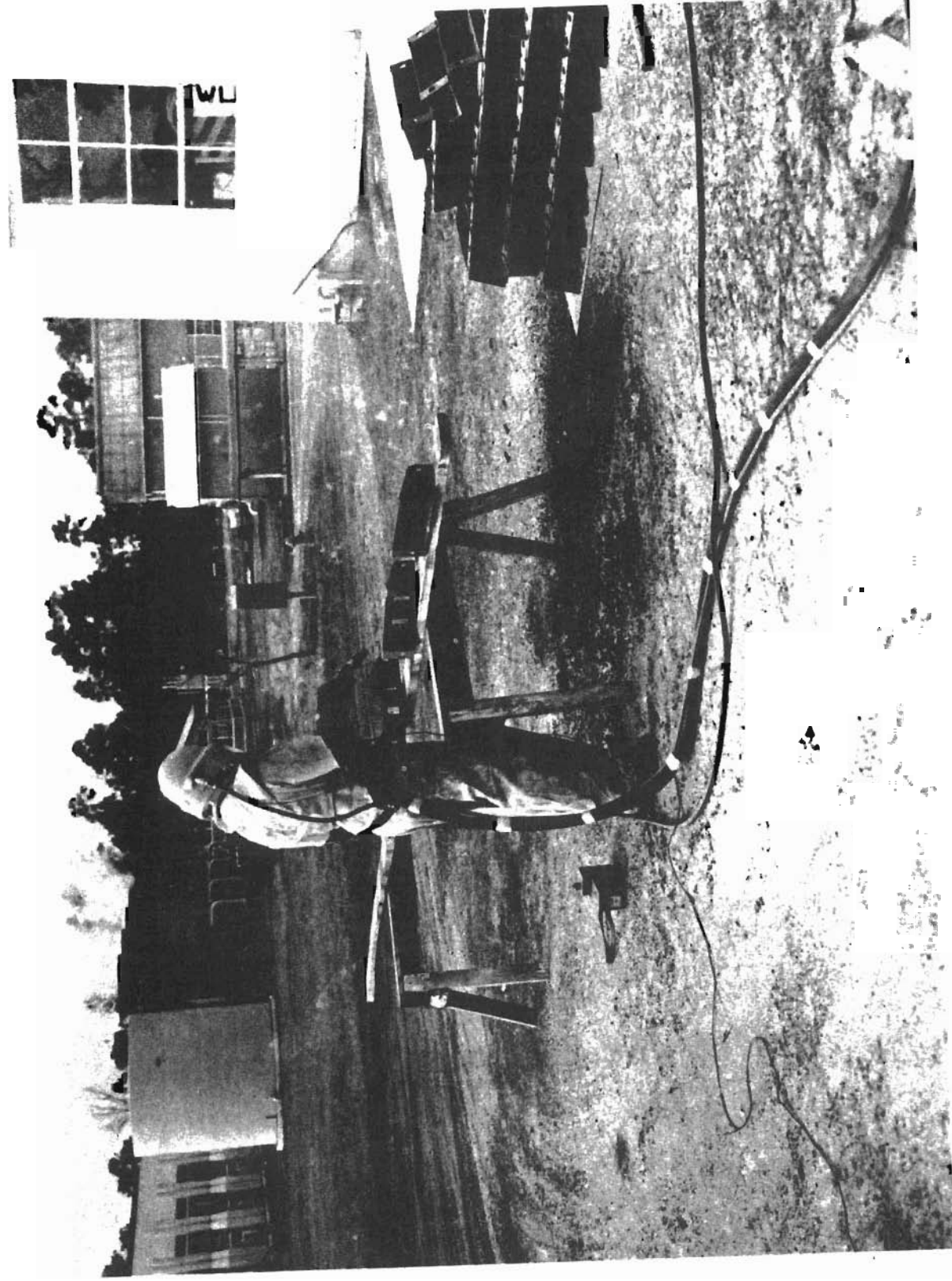


FIGURE A-4 PORTABLE BLAST CLEANING MACHINE, HAND-HELD NOZZLE (Installation p-51)

DUST DATA

FACILITY PORTABLE BLASTING MACHINE, INSTALLATION P-6 LOCATION (STATE) TEXAS

APPLICABLE STANDARDS OR GUIDELINES OSHA (CFR, TITLE 29), ACGIH (VOLUNTARY), ANSI 29.4 (VOLUNTARY)

ABRASIVE	SAND	CRYSTALLINE QUARTZ	100	WT. %	STANDARD	ACCEPTABLE DUST CONCENTRATIONS AND EXPOSURE DURATIONS			
						MATERIAL	B-HR TLV	PERMISSIBLE EXCURSION	
IFSILICA SAND		TRIDYMITITE			OSHA/ACGIH	RES. <u>510<sub>2</sub></u>	0.1-0.2 $\text{MG/M}^3$	OSHA (NONE), ACGIH (3x)	
		CRISTOBALITE			OSHA/ACGIH	TOTAL <u>510<sub>2</sub></u>	0.3-0.6	OSHA (NONE), ACGIH (3x)	
SURFACE (COATING) OF BLASTED OBJECT <u>IRON OXIDE,</u>						OSHA	RES. INERT	5	OSHA (NONE),
PAINT						OSHA	TOTAL INERT	15	OSHA (NONE),
						ACGIH	TOTAL INERT	10	- • ACGIH (1.5x)

ESTIMATED DURATION OF BLASTING 12 HRS/DAY

ON-SITE OUST CONCENTRATION MEASUREMENTS

FACILITY SCHEMATIC (TOP VIEW)

• EXTERIOR AMBIENT AIB DUST LEVELS  
RESPIRABLE | TOTAL

<1.0  $\text{MG/M}^3$

D5

D1 UPWIND PRIOR TO BLAST

• BLASTING DUST LEVELS  
RESPIRABLE | TOTAL

<1.0  $\text{MG/M}^3$   
7.9  
13.0  
5.0

D4

D2 10' UPWIND FROM BLASTER  
D3 5' UPWIND FROM BLASTER  
D4 10' DOWNWIND FROM BLASTER  
D5 30' DOWNWIND FROM BLASTER

WIND  
500 - 800  
LFM



• DUST LEVEL AT BLASTING SHUTDOWN  
TIME AFTER SHUTOOWN

RESPIRABLE | TOTAL

D1



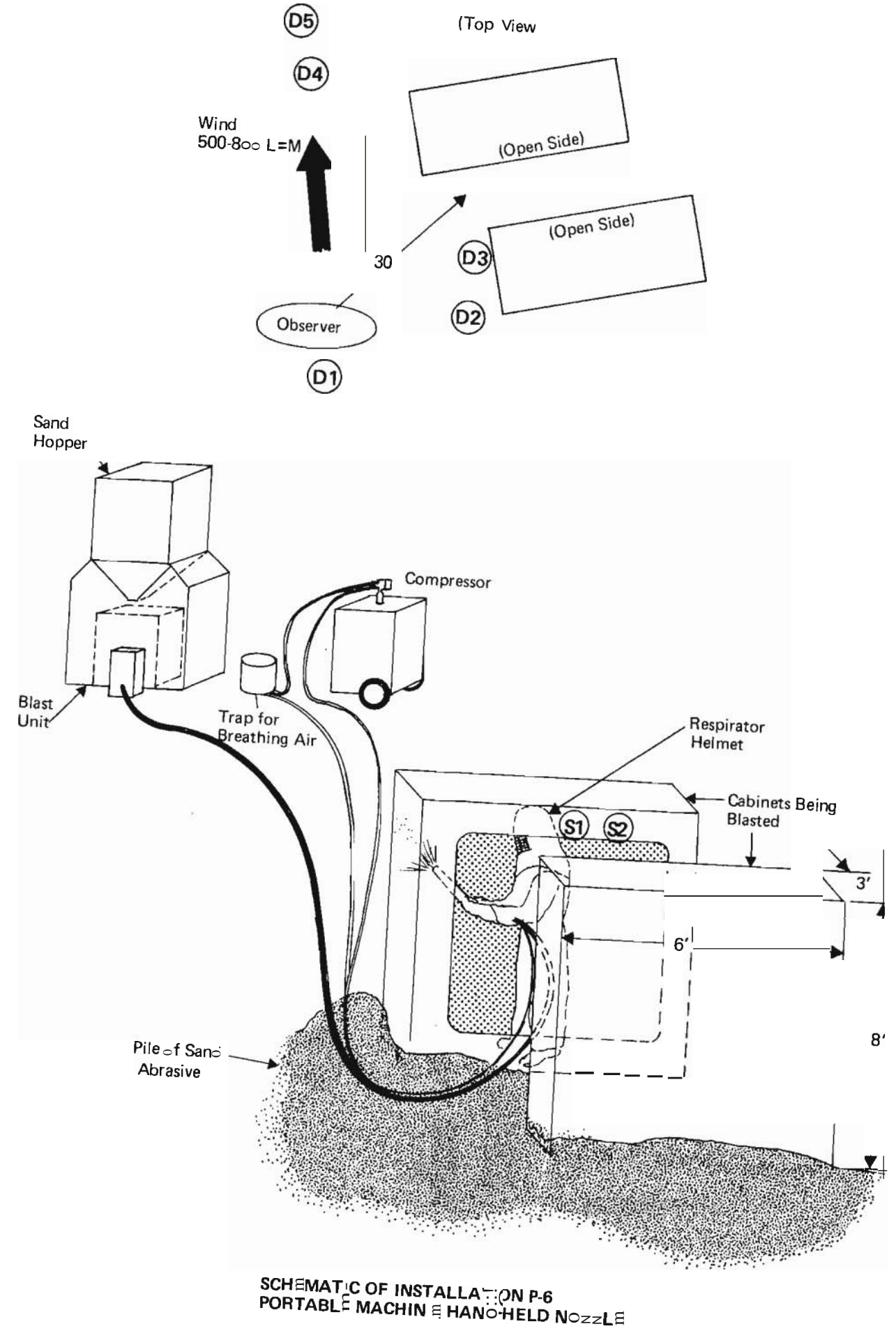
SOUND DATA

FACILITY	Portable Unit P-6	SIZE	Outdoor	LOCATION	Texas
ABRASIVE	Sand	(A)	dbA, A weighting network		
WORK PIECE	5-Sided Cabinet 8' x 6' x 3'	(20)	20KC. Flat response		

INDIVIDUAL AT DISTANCE INDICATED	AMBIENT LEVEL	WITH HELMET AND WITH BREATHING AIR	WITH HELMET WITHOUT BREATHING AIR	RANGE DURING BLASTING	AVERAGE DURING BLASTING	NOTES
(1) Blaster	68(A)	100(A)*		98/102(A)	99(A)	Helmet--Blaster outside cabinet.
		100(20)*		94/102(20)	101(20)	
(2) Blaster	68(A)			104/108(A)	106(A)	Helmet--Blaster inside cabinet.
				100/112(20)	106(20)	

GENERAL NOTES AND COMMENTS:

\*Very high air flow. Nearest observer at 30 ft. 12 Hour workshift usual practice.



SCHMATIC OF INSTALLATION P-6 PORTABLE MACHINE WITH HAND-HELD NOZZLE

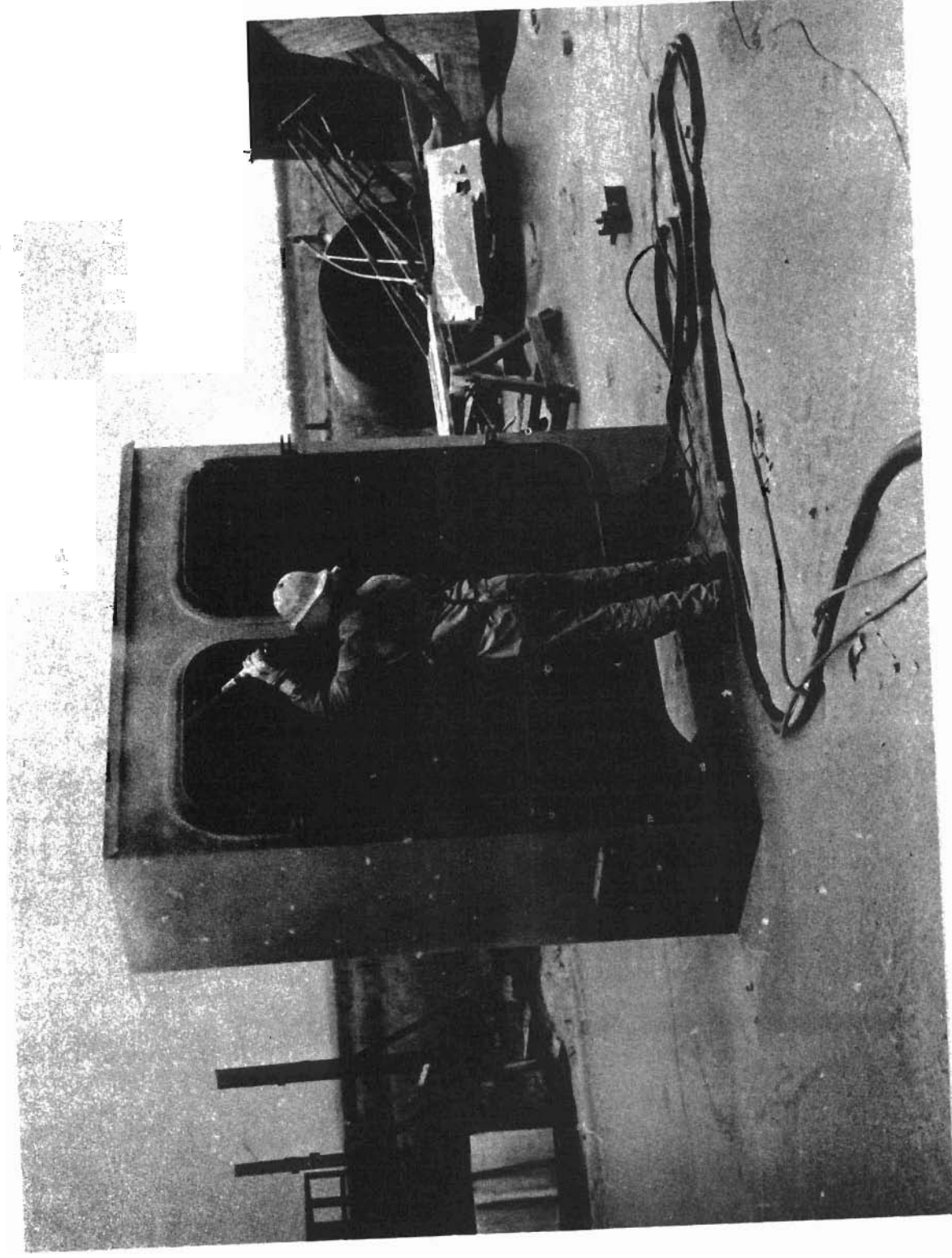


FIGURE A-5 PORTABLE BLAST CLEANING MACHINE, HAND-HELD NOZZLE (Installation P-6)

DUST DATA

FACILITY - PORTABLE BLASTING MACHINE, INSTALLATION P-7 LOCATION (STATE) - TEXAS

APPLICABLE STANDARDS OR GUIDELINES OSHA (CFR. TITLE 29), ACGIH (VOLUNTARY), ANSI 29.4 (VOLUNTARY)

---

ABRASIVE SAND ACCEPTABLE DUST CONCENTRATIONS AND EXPOSURE DURATIONS

CRYSTALLINE QUARTZ	WT. %	STANDARD	MATERIAL	B-HR TLV	PERMISSIBLE EXCURSION
IF SILICA SAND ...	<u>100</u>	<u>OSHA/ACGIH</u>	<u>RES. SiO<sub>2</sub></u>	<u>0.1-0.2</u>	<u>MG/M<sup>3</sup> OSHA (NONE), ACGIH (3x)</u>
		<u>OSHA/ACGIH</u>	<u>TOTAL SiO<sub>2</sub></u>	<u>0.3-0.6</u>	<u>OSHA (NONE), ACGIH (3x)</u>
		<u>OSHA</u>	<u>RES. INERT</u>	<u>5</u>	<u>OSHA (NONE),</u>
		<u>OSHA</u>	<u>TOTAL INERT</u>	<u>15</u>	<u>OSHA (NONE),</u>
SURFACE (COATING) OF BLASTED OBJECT <u>IRON OXIDE,</u>		<u>ACGIH</u>	<u>TOTAL INERT</u>	<u>10</u>	<u>OSHA (NONE),</u>
<u>PAINT</u>					<u>-</u> • <u>ACGIH (1.5x)</u>

ESTIMATED DURATION OF BLASTING 6 HRS/8 HR SHIFT

ON-SITE DUST CONCENTRATION MEASUREMENTS

• EXTERIOR AMBIENT AIR DUST LEVELS

RESPIRABLE	TOTAL
<u>0.4</u>	<u>MG/M<sup>3</sup></u>

• BLASTING DUST LEVELS

RESPIRABLE	TOTAL
<u>30.3</u>	<u>MG/M<sup>3</sup></u>
<u>3.9</u>	<u>9.4</u>
<u>7.9</u>	<u>16.5</u>
<u>8.2</u>	
<u>1.4</u>	

• DUST LEVEL AT BLASTING SHUTDOWN

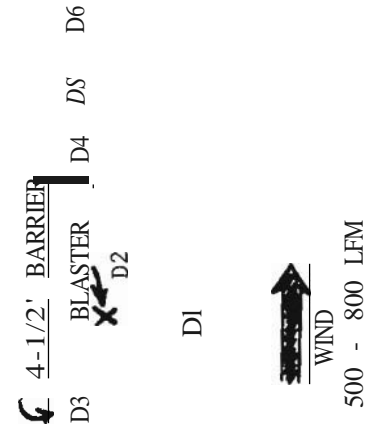
RESPIRABLE	TOTAL	TIME AFTER SHUTDOWN
<u>&lt;1.0</u>	<u>MG/M<sup>3</sup></u>	<u>15</u>
		<u>SEC.</u>

LOCATION OF MEASUREMENT

D1 ADJACENT TO SITE

D2 AT BLASTER'S FEET  
 D3 5' UPWIND OF BLASTER  
 D4 10' DOWNWIND OF BLASTER  
 D5 20' DOWNWIND OF BLASTER  
 D6 75' DOWNWIND OF BLASTER

FACILITY SCHEMATIC (TOP VIEW)



SOUND DATA

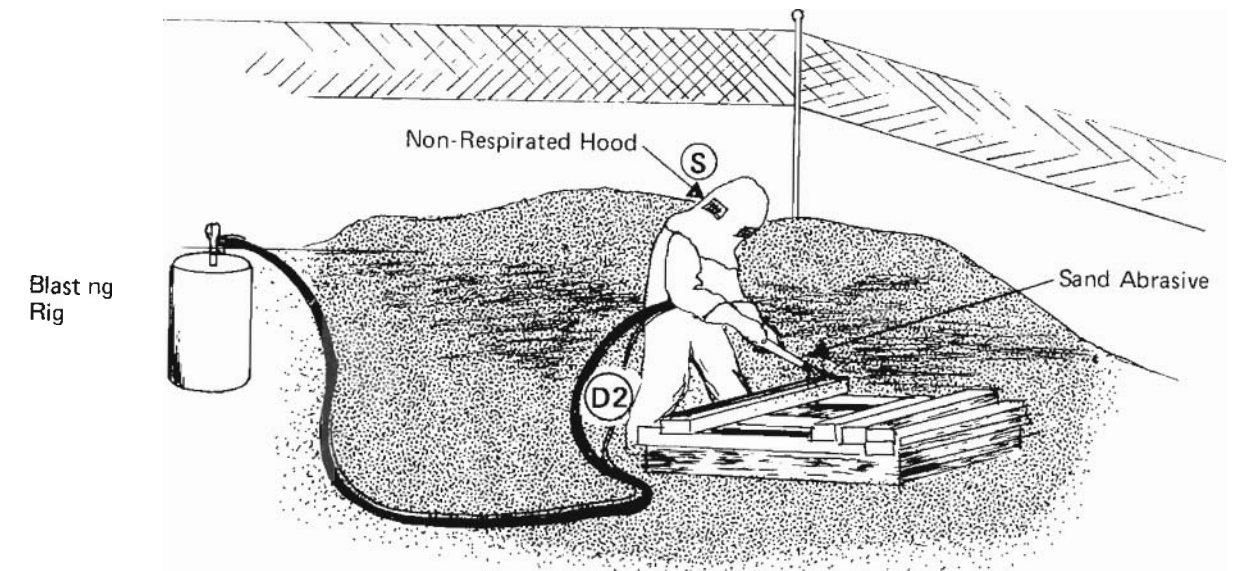
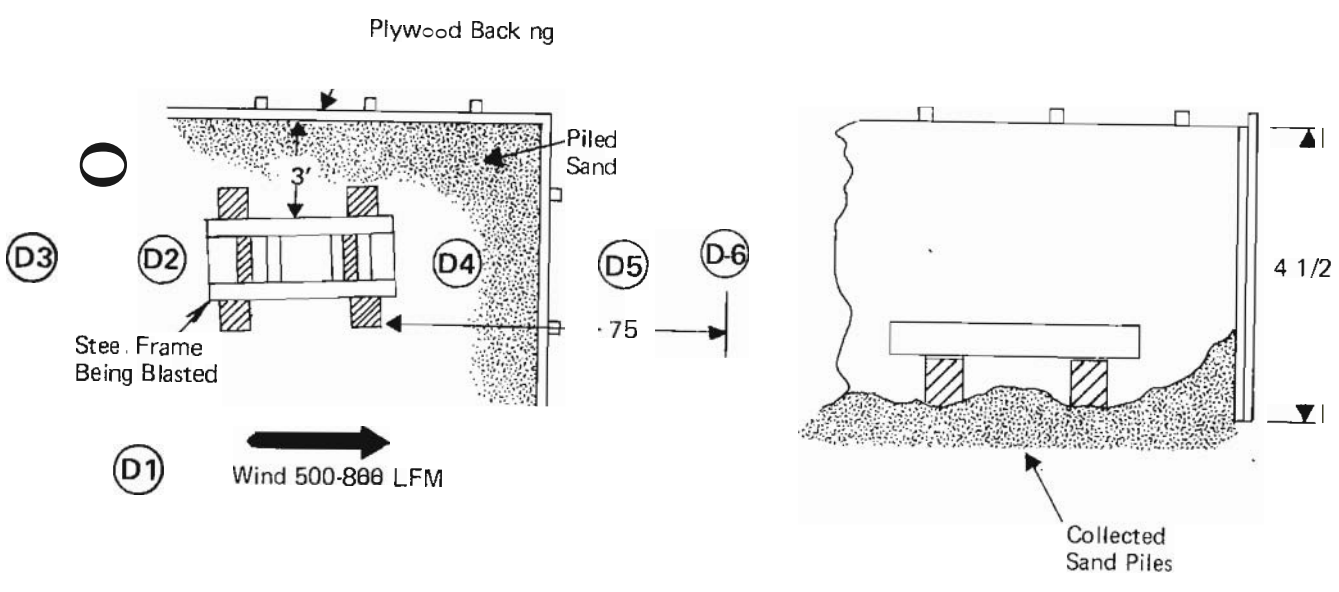
FACILITY Portable Unit P-7 SIZE Outdoor LOCATION Texas

ABRASIVE Sand (A) dbA, A weighting network

WORK PIECE Large Area Steel Frame (20) 20KC, Flat response

INDIVIDUAL AT DISTANCE INDICATED	AMBIENT LEVEL	WITH HELMET AND WITH BREATHING AIR	WITH HELMET WITHOUT BREATHING AIR	RANGE DURING BLASTING	AVERAGE DURING BLASTING	NOTES
Blaster	68(A)	No breathing air	70(A)	98/108(A)	100(A)	Canvas hood
				96/100(20)	99(20)	
					104(A)	2" Outside hood
					98(A)	Inside hood

GENERAL NOTES AND COMMENTS:  
Two plywood walls at right angles. Sand piled against walls.



SCHEMATIC OF INSTALLATION P-7 PORTABLE MACHINE, HAND-HELD NOZZLE



DUST DATA

FACILITY PORTABLE BLASTING MACHINE, INSTALLATION P-8 LOCATION (STATE) TEXAS  
 APPLICABLE STANDARDS OR GUIDELINES OSHA (CFR, TITLE 29), ACGIH (VOLUNTARY), ANSI 29.4 (VOLUNTARY)

ACCEPTABLE DUST CONCENTRATIONS AND EXPOSURE DURATIONS

ABRASIVE	<u>SAND/WATER SPRAY</u>	STANDARD	MATERIAL	BHR TLV	PERMISSIBLE EXCURSION
	CRYSTALLINE QUARTZ	100	WT. %		
IF SILICA SAND	TRIDYMITITE	<u>OSHA/ACGIH</u>	RES. <u>SiO<sub>2</sub></u>	<u>0.1-0.2</u> <u>MG/M<sup>3</sup></u>	OSHA (NONE), ACGIH (3x)
	CRISTOBALITE	<u>OSHA/ACGIH</u>	TOTAL <u>SiO<sub>2</sub></u>	<u>0.3-0.6</u>	OSHA (NONE), ACGIH (3x)
		<u>OSHA</u>	RES. <u>INERT</u>	<u>5</u>	OSHA (NONE),
		<u>OSHA</u>	TOTAL <u>INERT</u>	<u>15</u>	OSHA (NONE),
SURFACE (COATING) OF BLASTED OBJECT	<u>IRON OXIDE,</u>	<u>ACGIH</u>	TOTAL <u>INERT</u>	<u>10</u>	<u>ACGIH (1.5x)</u>
	<u>PAINT</u>				

ESTIMATED DURATION OF BLASTING \_\_\_\_\_ FACILITY SCHEMATIC (TOP VIEW) \_\_\_\_\_  
 ON-SITE DUST CONCENTRATION MEASUREMENTS \_\_\_\_\_ LOCATION OF MEASUREMENT \_\_\_\_\_

EXTERIOR AMBIENT AIR DUST LEVELS

RESPIRABLE TOTAL <1.0 MG/M<sup>3</sup>

BLASTING DUST LEVELS

RESPIRABLE TOTAL 16.5 MG/M<sup>3</sup>  
 5.3 1.0 MG/M<sup>3</sup>

DUST LEVEL AT BLASTING SHUTDOWN

RESPIRABLE TOTAL SHUTDOWN TIME AFTER SHUTDOWN

DI ADJACENT TO SITE

(DRY) D2 AT BLASTER'S FEET  
 (WET) D2 AT BLASTER'S FEET

BLASTER 

D2

DI



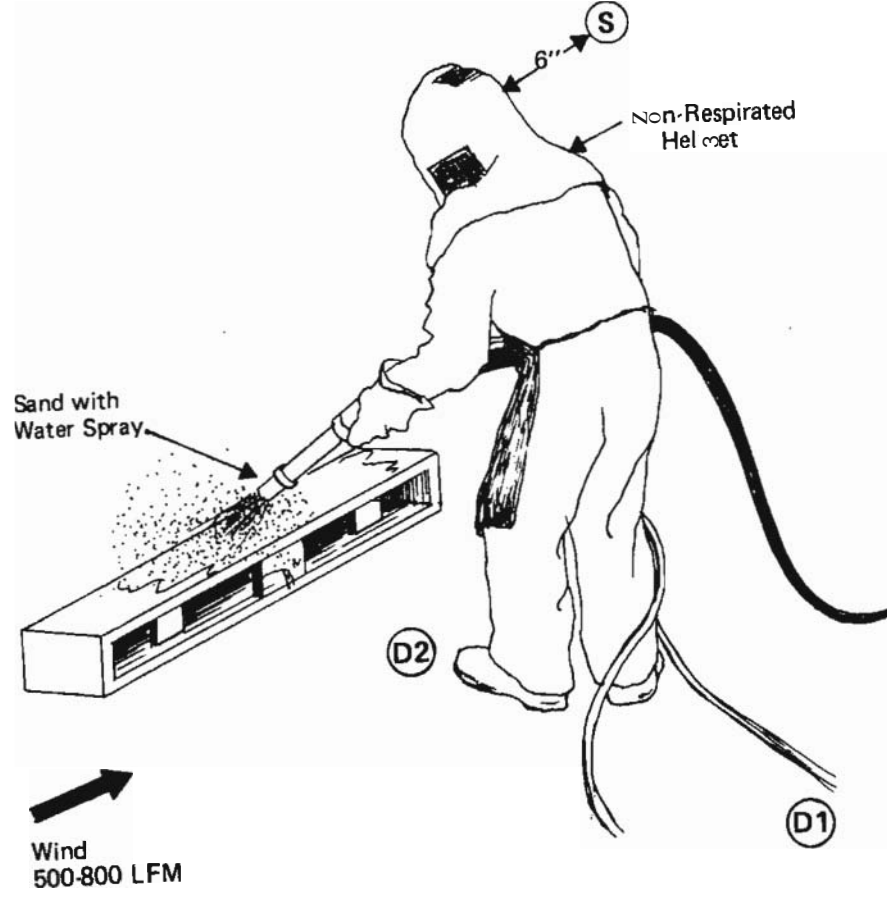
SOUND DATA

FACILITY Portable Unit P-8 SIZE Outdoor LOCATION Texas  
 ABRASIVE Sand - Wet (AI) dbA, A weighting network  
 WORK PIECE Large Area Steel Frame (20) 20 KC, Flat response

INDIVIDUAL AT DISTANCE INDICATED	AMBIENT LEVEL	WITH HELMET AND WITH BREATHING AIR	WITH HELMET WITHOUT BREATHING AIR	RANGE DURING BLASTING	AVERAGE DURING BLASTING	NOTES
Blaster	<68(A)	No breathing air		108/110(A)	109(A)	Special test for dust. 6" Outside canvas hood

GENERAL NOTES AND COMMENTS:  
 Blacktop ground area; no nearby structures.

**SCHEMATIC OF INSTALLATION P-8  
PORTABLE MACHINE, WET BLAST NOZZLE**



**DUST DATA**

FACILITY PORTABLE BLASTING MACHINE, INSTALLATION P-9 LOCATION (STATE) \_\_\_\_\_ T. F. N. S. \_\_\_\_\_  
 APPLICABLE STANDARDS OR GUIDELINES OSHA (CFR, TITLE 29), ACGIH (VOLUNTARY), ANSI 29.4 (VOLUNTARY)

ABRASIVE	SAND	ACCEPTABLE DUST CONCENTRATIONS AND EXPOSURE DURATIONS			
		STANDARD	MATERIAL	8HR TLV	PERMISSIBLE EXCURSION
SILICA SAND	CRYSTALLINE QUARTZ	100	WT. %		
	TRIDYMITITE			RES. <u>510</u> <sub>2</sub>	0.1-0.2 MG/M <sup>3</sup> OSHA (NONE), ACGIH (3x)
	CRISTOBALITE			TOTAL <u>510</u> <sub>2</sub>	0.3-0.6 OSHA (NONE), ACGIH (3x)
SURFACE (COATING) OF BLASTED OBJECT				RES. INERT	5 OSHA (NONE),
PAINT				TOTAL INERT	15 OSHA (NONE),
				TOTAL INERT	10 - • ACGIH (1.5x)

ESTIMATED DURATION OF BLASTING 10-12 HRS/8 HR SHIFT

ON-SITE DUST CONCENTRATION MEASUREMENTS

- EXTERIOR AMBIENT AIR DUST LEVELS

RESPIRABLE	TOTAL
1.3 MG/M <sup>3</sup>	1.3 MG/M <sup>3</sup>

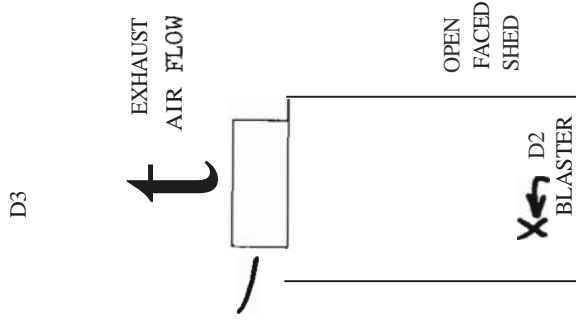
- BLASTING DUST LEVELS

RESPIRABLE	TOTAL
<1.0 MG/M <sup>3</sup>	2.5 MG/M <sup>3</sup>
1.0	2.1

- DUST LEVEL AT BLASTING SHUTDOWN

RESPIRABLE	TOTAL	TIME AFTER SHUTDOWN
<LO MG/M <sup>3</sup>		15 SEC.
<1.0 MG/M <sup>3</sup>		15 SEC.

FACILITY SCHEMATIC (TOP VIEW)





INSTALLATION P-9

AIR FLOW RATE DATA

1. Air flow determined by average velocity through exhaust ducts

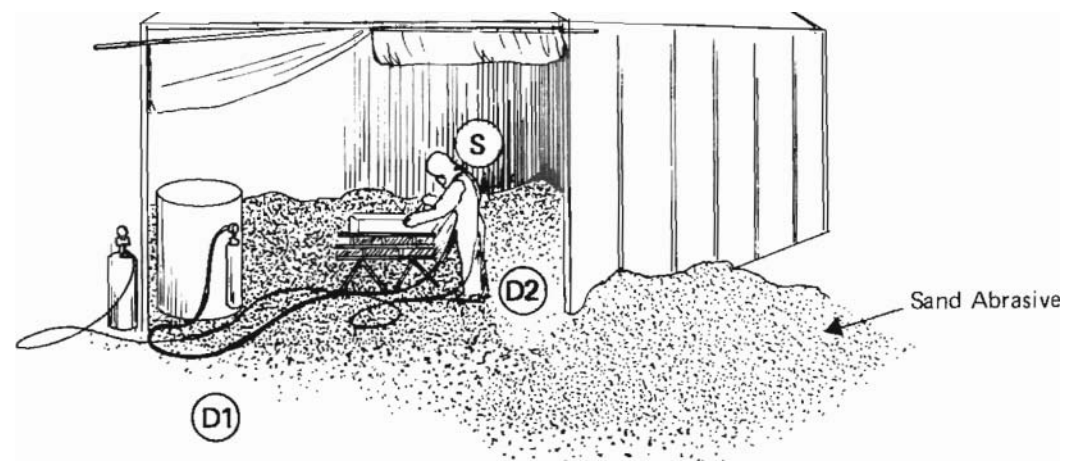
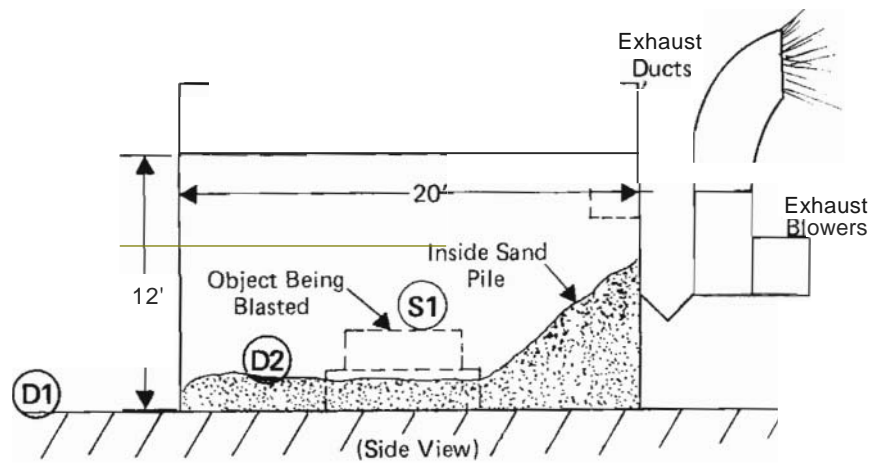
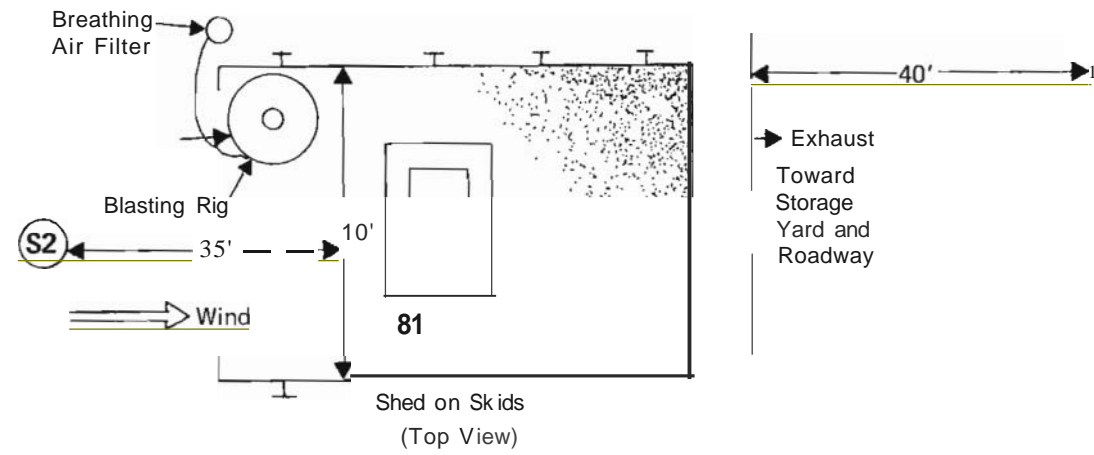
$$\begin{array}{rcl}
 \text{Estimated Average} & \times & \text{Duct Cross} \\
 \text{Duct Velocity} & & \text{Sectional Area} \\
 \hline
 4500 \text{ LFM} & \times & (15'' \times 18'' = 1.88 \text{ Sq Ft}) \\
 \hline
 \text{Two Blowers, So Total} & = & 8460 \text{ CFM} \\
 \hline
 & & 16,920 \text{ CFM}
 \end{array}$$

**SOUND DATA**

FACILITY	Portable Unit P-9	SIZE	Open End Shed	LOCATION	Texas	
ABRASIVE	Sand					
WORK PIECE	Miscellaneous Pieces					
			(AI = dbA, A weighting network)			
			(201 = 20KC, Flat response)			
INDIVIDUAL AT DISTANCE INDICATED	AMBIENT LEVEL	WITH HELMET AND WITH BREATHING AIR	WITH HELMET WITHOUT BREATHING AIR	RANGE DURING BLASTING	AVERAGE DURING BLASTING	NOTES
(1) Blaster	80(A)*	87(A)**		95/102(A)	98(A)	Helmet
		92(20)**		96/107(20)	101(20)	
(2) Observer 35'	~74(A)			92(A)	92(A)	No helmet on observer
				91/96(20)	93(20)	

GENERAL NOTES AND COMMENTS:

- \*Exhaust Fan noise.
- \*\*Heavy breathing, + 5 DB
- 10-12 hour shifts, -7 days per week.



S2  
 SCHEMATIC OF INSTALIA1JON P-9  
 ENCLOSED, PORTABLE MACHINE  
 HAND-HELD NOZZLE

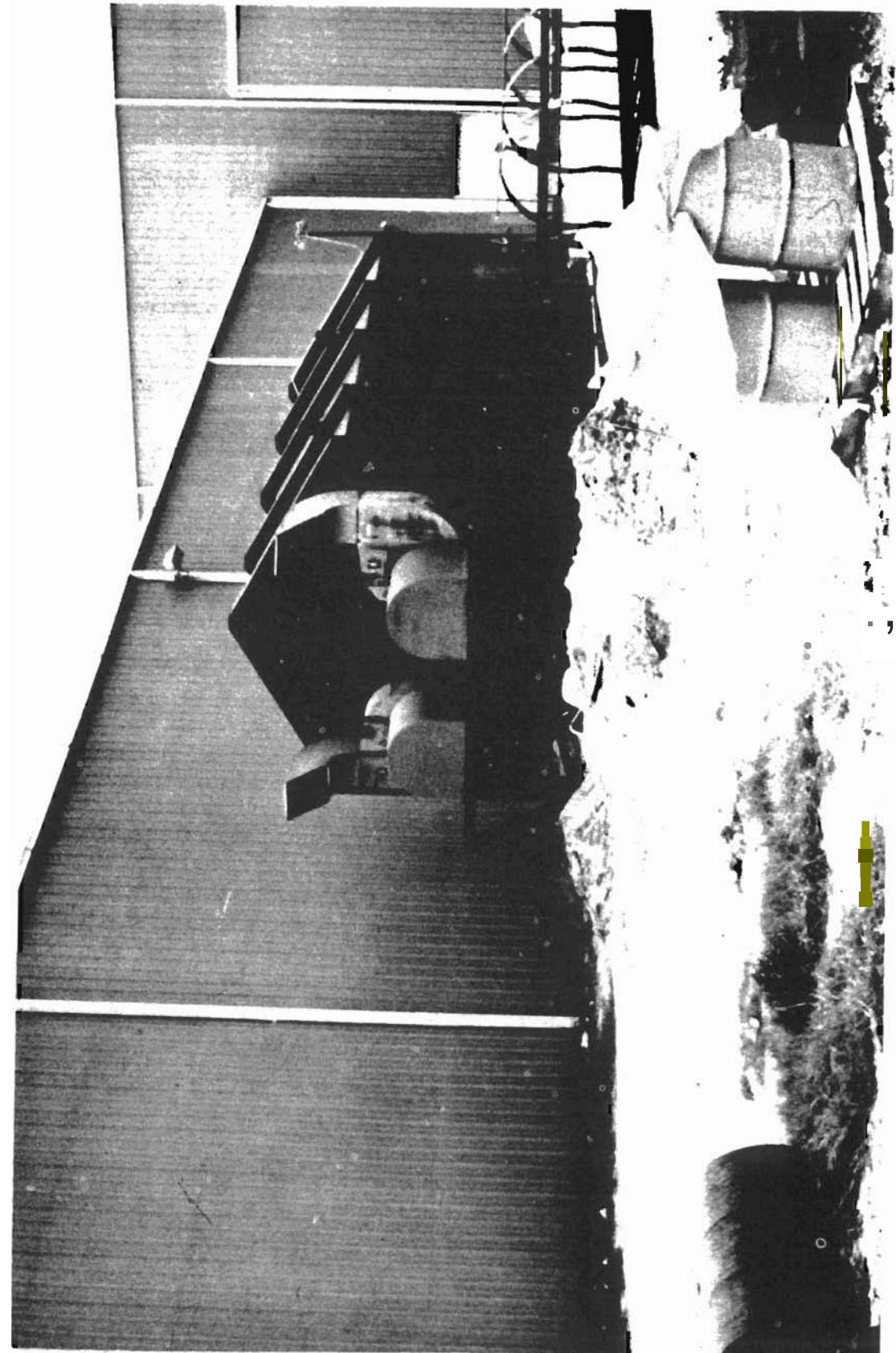


FIGURE A-6 EXHAUST BLOWERS AND DUCTING TO OPEN VARIOUS INSTALLATIONS P-9

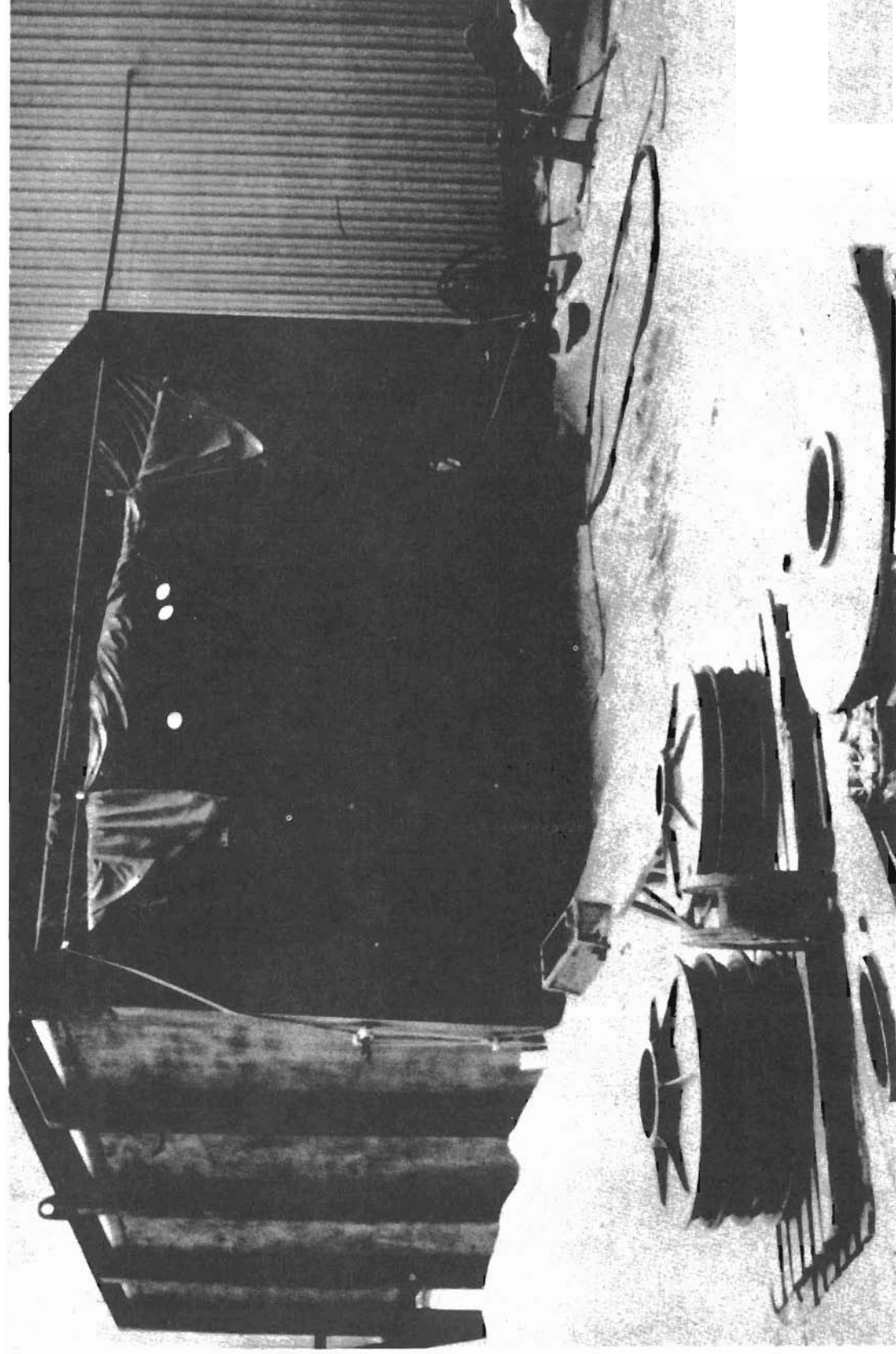


FIGURE A-7 BLAST OPERATOR WORKING INSIDE OPEN-ENDED SHED (Installation P-91)

DUST DATA

FACILITY \* PORTABLE BLASTING MACHINE, INSTALLATION P-10 LOCATION (STATE) MASSACHUSETTS  
 APPLICABLE STANDARDS OR GUIDELINES OSHA (CFR, TITLE 29) \*\* MASSACHUSETTS, ACGIH, ANSI 29.4

ABRASIVE SLAG

ACCEPTABLE DUST CONCENTRATIONS AND EXPOSURE DURATIONS

IF SILICA SAND	CRYSTALLINE QUARTZ _____ WT. %	STANDARD	MATERIAL	8-HR TLV	PERMISSIBLE EXCURSION
		OSHA	TOTAL INERT	15	OSHA (NONE)
		ACGIH	TOTAL INERT	10	ACGIH (1.5x)

SURFACE (COATING) OF BLASTED OBJECT VINYL-BASED  
PAINT, IRON OXIDE

ESTIMATED DURATION OF BLASTING 5 HRS/8 HR SHIFT \*\* INCOMPLETE STANDARD, FROM ACGIH

ON-SITE DUST CONCENTRATION MEASUREMENTS

FACILITY SCHEMATIC (TOP VIEW)

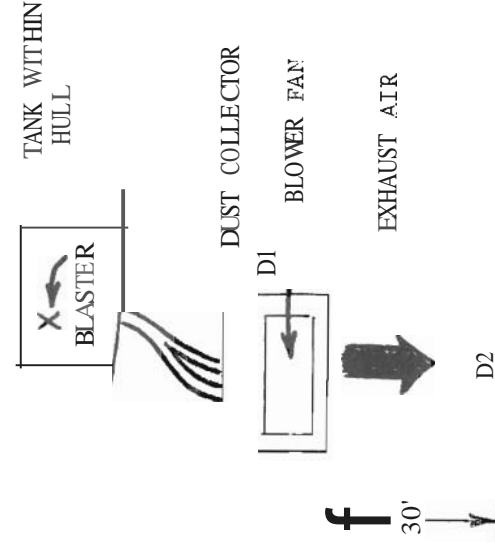
• EXTERIOR AMBIENT AIR DUST LEVELS  
 RESPIRABLE | TOTAL  
<1.0  $MG/M^3$

D1 ADJACENT TO DUST COLLECTOR

• BLASTING DUST LEVELS  
 RESPIRABLE | TOTAL  
<1.0  $MG/M^3$

D2 BY DUST COLLECTOR EXHAUST

• DUST LEVEL AT BLASTING SHUTDOWN  
 RESPIRABLE | TOTAL  
 TIME AFTER SHUTDOWN



\* USED TO CLEAN INSIDE OF A SEALED, BUT VENTILATED, TANK WITHIN A SHIP'S HULL

INSTALLATION P-10  
AIR FLOW RATE DATA

1. Air flow determined by average velocity through dust collector exhaust vent:

$$\frac{\text{Exhaust Vent Centerline Velocity}}{3200 \text{ LFM} \times 0.9^*} \times \frac{\text{Vent Open Area}}{(15' \times 20' = 2.1 \text{ Sq Ft})} = \frac{\text{Average Air Flow}}{6048 \text{ CFM}}$$

\* 0.9 is an averaging factor for the centerline velocity measurement to give an approximate overall average velocity.

- 2 Air flow determined by average velocity through inlet opening

$$\frac{\text{Average Inlet Velocity (Nine Data Points)}}{1633 \text{ LFM}} \times \frac{\text{Inlet Area}}{(20' \times 26' = 3.6 \text{ Sq Ft})} = \frac{\text{Average Air Flow}}{5897 \text{ CFM}}$$

SOUND DATA

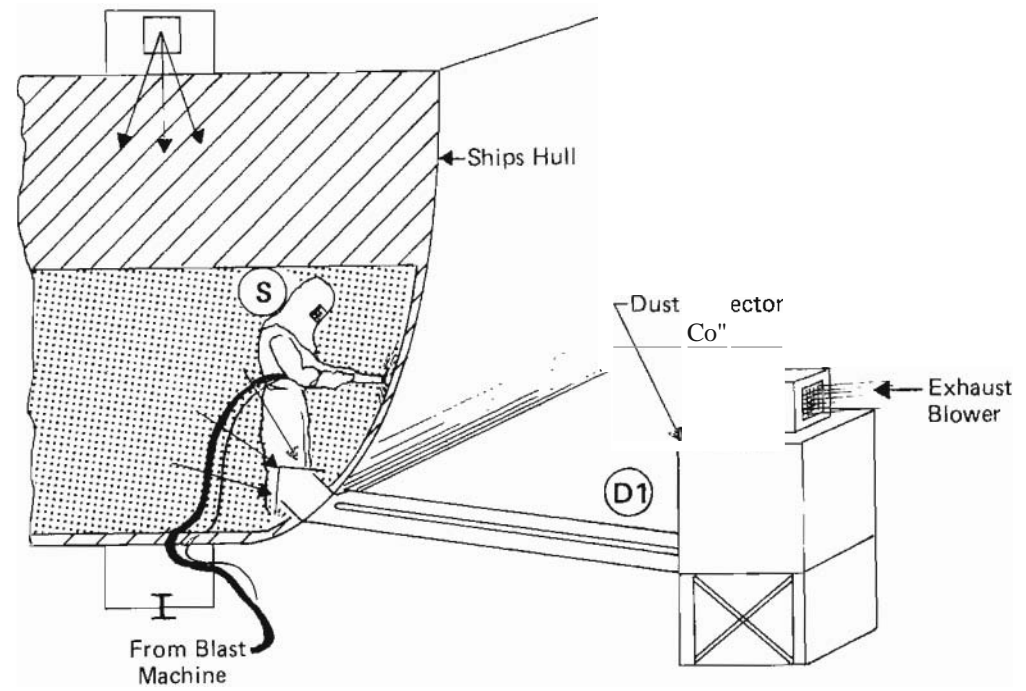
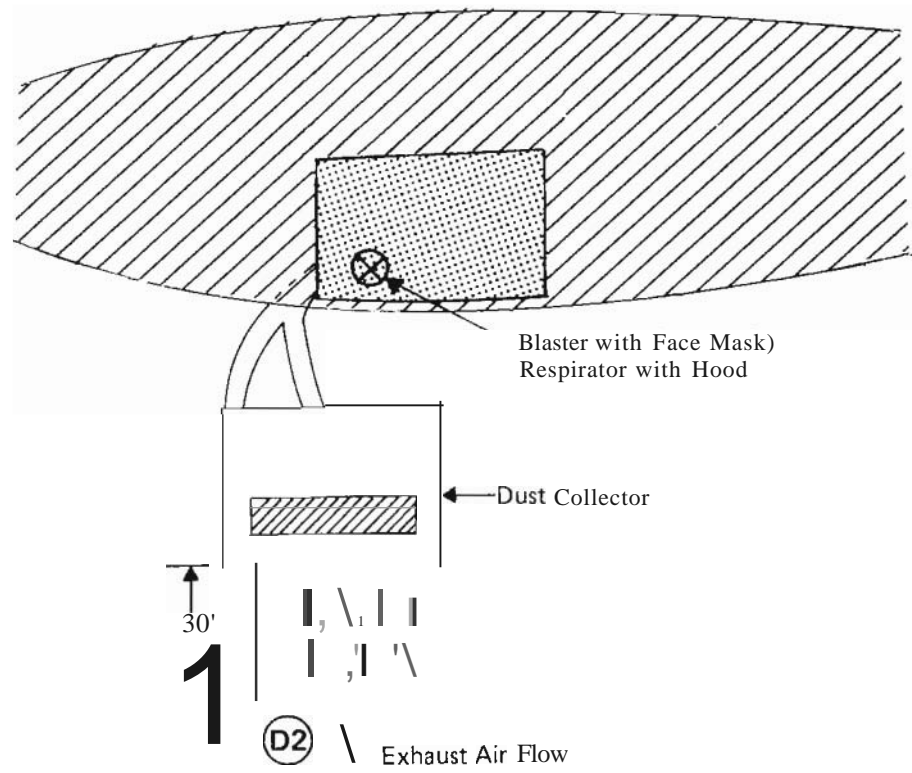
FACILITY	Portable Unit P-10	SIZE	In room-like tank 12-1/2' x 12' x 7-1/2' LOCATION	Mass.
ABRASIVE	Slag	(A)	dbA, A weighting network	
WORK PIECE	Tank Interior Walls	(20)	20KC, Flat response	

INDIVIDUAL AT DISTANCE INDICATED	AMBIENT LEVEL	WITH HELMET AND WITH BREATHING AIR	WITH HELMET WITHOUT BREATHING AIR	RANGE DURING BLASTING	AVERAGE DURING BLASTING	NOTES
Blaster	66(A)	*	*	113/126(A)	118(A)	Face mask for breathing air-Soft hood*
	77(20)	*	*	113/122(20)	118(20)	

GENERAL NOTES AND COMMENTS:

\*Breathing air noise did not contribute since air was supplied directly to face mask.  
Ear plugs only recently used because of workers' difficulty in sleeping and other tasks.





**SCHEMATIC OF INSTALLATION P-10  
BLAST CLEANING TANK INSIDE SURFACE**

APPENDIX A-3  
Cabinet Machine Installations

DUST DATA

FACILITY BLASTING CABINET, INSTALLATION C-1 LOCATION (STATE) MASSACHUSETTS  
 APPLICABLE STANDARDS OR GUIDELINES OSHA (CFR, TITLE 29), \* MASSACHUSETTS: ACGIH, ANSI Z9.4

ABRASIVE	<u>SILICA</u> <u>SAND</u>	CRYSTALLINE QUARTZ	100	WT. %	STANDARD	ACCEPTABLE DUST CONCENTRATIONS AND EXPOSURE DURATIONS		
						MATERIAL	B-HR TLV	PERMISSIBLE EXCURSION
IF SILICA SAND . . . . .		TRIDYMITITE			<u>RES. SiO<sub>2</sub></u>	0.1-0.2 MG/M <sup>3</sup>	OSHA (NONE).	ACGIH (3x)
		CAISTOBALITE			<u>TOTAL SiO<sub>2</sub></u>	0.3-0.6	OSHA (NONE).	ACGIH(3x)
					<u>OSHA</u>	<u>INERT</u>	5	OSHA (NONE).
		SURFACE (COATING) OF BLASTED OBJECT		<u>IRON OXIDE</u>	<u>OSHA</u>	<u>INERT</u>	15	OSHA (NONE).
	<u>PAINT</u>				<u>ACGIH</u>	<u>TOTAL INERT</u>	10	<u>ACGIH (1.5x)</u>

ESTIMATED DURATION OF BLASTING -

\* INCOMPLETE STANDARD. FROM ACGIH

**ON-SITE** DUST CONCENTRATION MEASUREMENTS

LOCATION OF MEASUREMENT

FACILITY SCHEMATIC (TOP VIEW)

- EXTERIOR AMBIENT AIR DUST LEVELS  
RESPIRABLE | TOTAL

• BLASTING DUST LEVELS  
RESPIRABLE | **TOTAL**  
 <1.0 MG/M<sup>3</sup>  
 0.1

D1 **TWO** FEET FROM MACHINE  
 D2 AT VIEWING WINDOW



D1

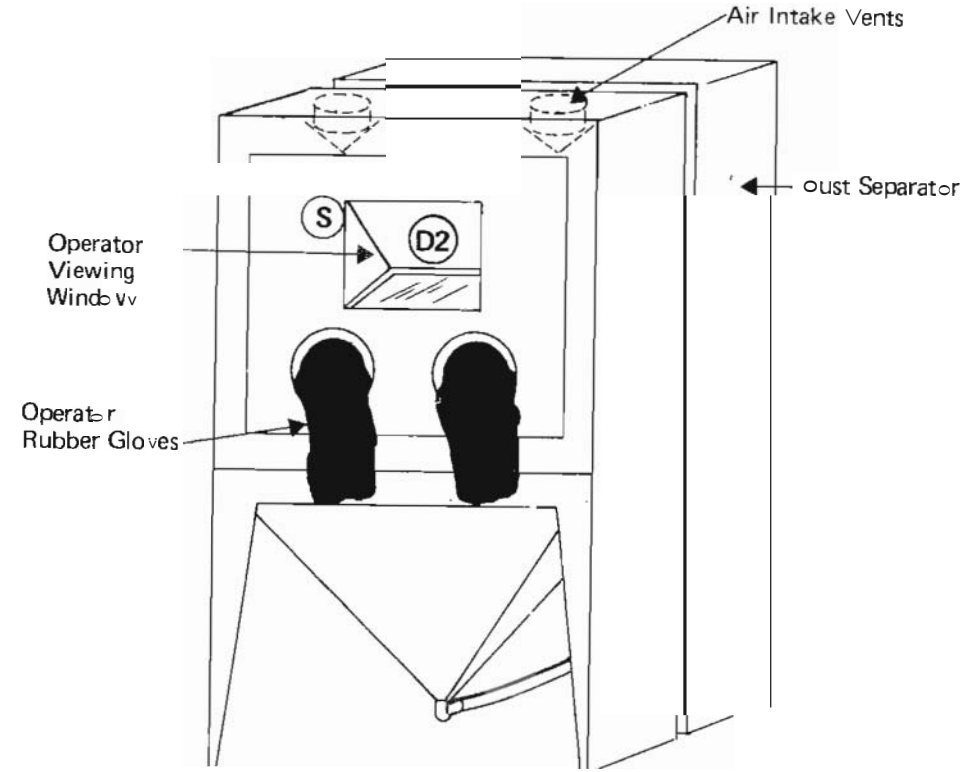
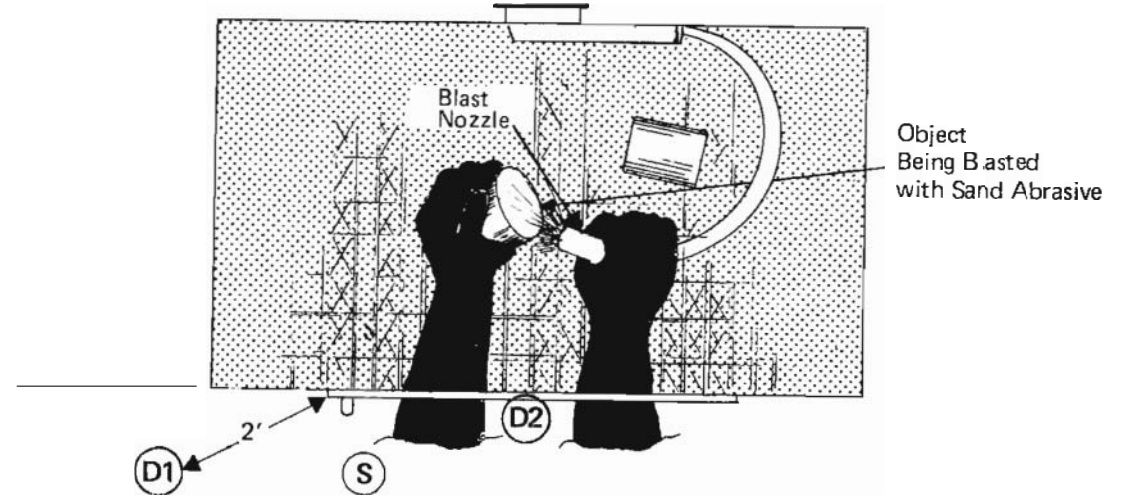
- DUST LEVEL AT BLASTING SHUTDOWN  
RESPIRABLE | TOTAL | TIME AFTER SHUTDOWN

SOUND DATA

FACILITY Cabinet C-1 SIZE 2-1/2' x 3-1/2' x 7' LOCATION Mass.  
 ABRASIVE Sand (A) dbA, A weighting network  
 WORK PIECE Small Piece (20) 20KC. Flat response

INDIVIDUAL AT DISTANCE INDICATED	AMBIENT LEVEL	WITH HELMET AND WITH BREATHING AIR	WITH HELMET WITHOUT BREATHING AIR	RANGE DURING BLASTING	AVERAGE DURING BLASTING	NOTES
Operator	65(20)			87/90(A)	88(A)	Mike 3" from operator ear 6" from view glass.
Octave Band	(20 KC Flat Response)			87/90(20)	88(20)	
20 - 75	72	6 - 1200	70			
75 - 150	66	12 - 2400	74			
150 - 300	68	24 - 4800	80			
300 - 600	70	48 - 9600	81			

GENERAL NOTES AND COMMENTS:



SCHEMATIC OF INSTALLATION C-1  
 SMALL CABINET SANDBLASTING MACHINE

APPENDIX A-4  
Blasting Room Installations



DUST DATA

FACILITY BLASTING ROOM, INSTALLATION R-1

LOCATION (STATE) MASSACHUSETTS

APPLICABLE STANDARDS OR GUIDELINES OSHA (CFR, TITLE 29),

\* MASSACHUSETTS, ACGIH, ANSI Z9.4

ABRASIVE	SLAG	( CRYSTALLINE QUARTZ _____ WT. %	STANDARD	ACCEPTABLE DUST CONCENTRATIONS AND EXPOSURE DURATIONS		
				MATERIAL	B:HR TLV	PE RMISIBLE EXCURSION
IF SILICA SAND	TRIDYMITTE { CRISTOBALITE	_____	OSHA	RES. INERT	5 MG/M <sup>3</sup>	OSHA (NONE)
			OSHA	TOTAL INERT	15	OSHA (NONE)
			ACGIH	TOTAL INERT	10	ACGIH (1.5x)
SURFACE (COATING) OF BLASTED OBJECT <u>IRON OXIDE</u>						
ESTIMATED DURATION OF BLASTING <u>6 HRS / 8 HR SHIFT</u> * INCOMPLETE STANDARD, FROM ACGIH						

ON-SITE DUST CONCENTRATION MEASUREMENTS

LOCATION OF MEASUREMENT

FACILITY SCHEMATIC (TOP VIEW)

- EXTERIOR AMBIENT AIR OUST LEVELS  
RESPIRABLE | TOTAL  
<1.0 MG/M<sup>3</sup> | <1.0 MG/M<sup>3</sup>

D1 IN FRONT OF ROOM

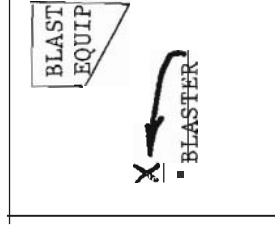
- BLASTING DUST LEVELS  
RESPIRABLE | TOTAL  
17.8 MG/M<sup>3</sup> | 13.8 MG/M<sup>3</sup>

ROOM DOORS OPEN TO ACCOMODATE LONG PIECES

- D2 AT OPEN DOOR, BLASTER INSIDE
- D3 AT OPEN DOOR, 3' FROM BLASTER
- D3 AT OPEN DOOR, 4' FROM BLASTER
- D3 AT OPEN DOOR, 8' FROM BLASTER

- DUST LEVEL AT BLASTING SHUTDOWN

RESPIRABLE | TOTAL  
TIME AFTER SHUTDOWN



D1

INSTALLATION R-1

AIR FLOW RATE DATA

1. Air flow determined by average downflow velocity within enclosure at 3 feet above floor:

<u>Average Downflow Velocity</u>	x	<u>Enclosure Cross-Sectional Area</u>	<u>Average Air Flow</u>
70 LFM	x	(12' x 12' = <b>144</b> Sq Ft)	10,080 CFM

2. Air flow determined by average velocity through side exhaust plenums:

<u>Average Exhaust Velocity (Seven Data Points Each)</u>	x	<u>Plenum Open Flow Area</u>	<u>Average Air Flow</u>
Right 2100 LFM	x	(3.75"x6'-8" 2.1 Sq Ft)	4410 CFM
Left 2740 LFM	x	(3.50"x7'-4" 2.1 Sq Ft)	5750 CFM
<b>TOTAL</b>			<b>10,160 CFM</b>

3. Air flow determined by average velocity through ceiling air inlet cones (18 total):

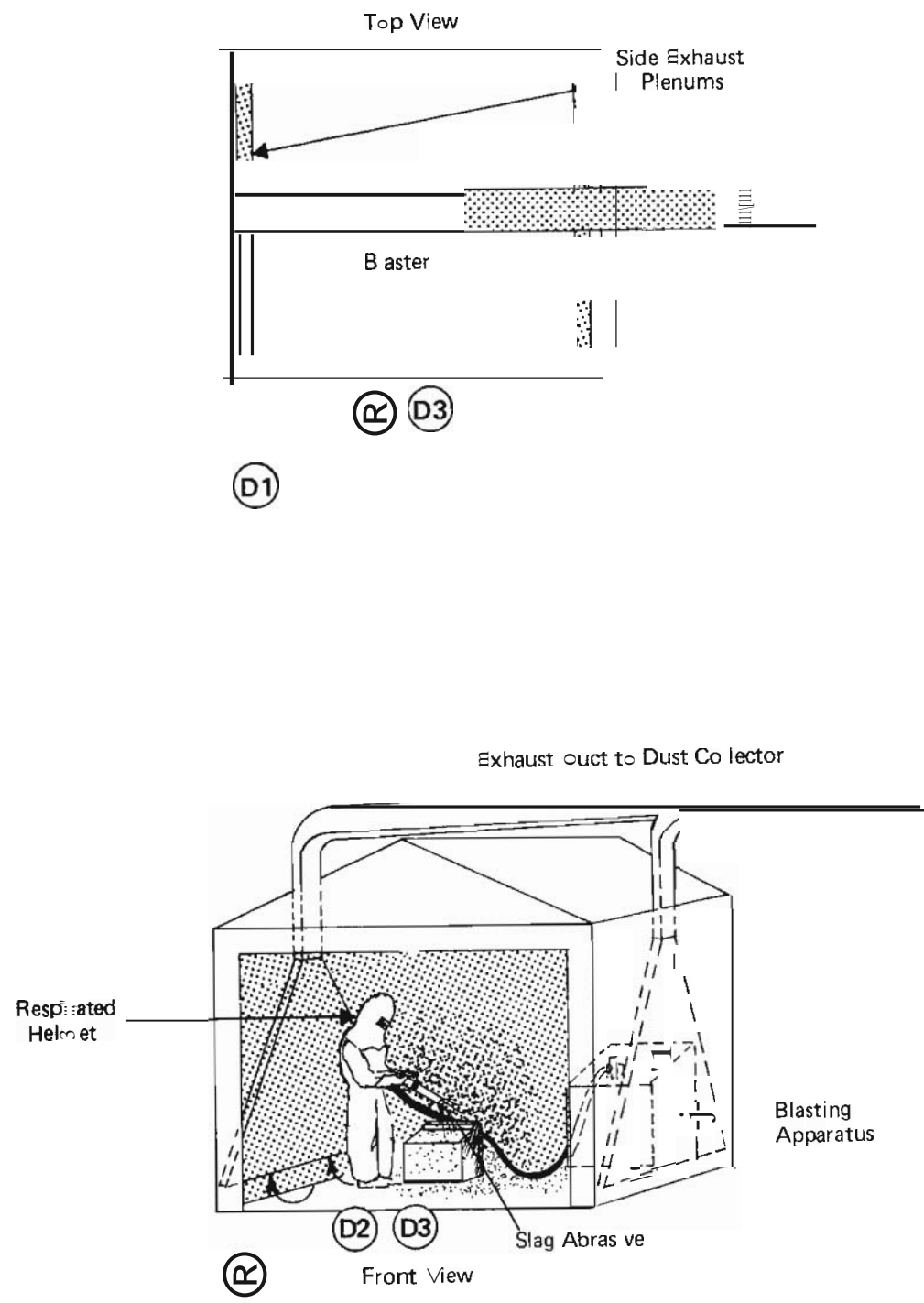
<u>Average Inlet Velocity</u>	x	<u>Estimated Inlet Area</u>	<u>Average Air Flow</u>
600 LFM	x	17 Sq Ft	10,200 CFM

SOUND DATA

FACILITY	Blasting Room R-1	SIZE	12' x 12' x 8'	LOCATION	Mass				
ABRASIVE	Slag	WEIGHTING NETWORK	A) dbA, A weighting network						
WORKPIECE	Small Area Open Mesh/± Beam Length	RESPONSE	20) 2° KC, F at response						
INVOICED AT DISTANCE IN CATEGORY	(1) Blaster	W T - E L M E T A N O W T - B E A T - N G A R E	73(A)	WIT - E L M E T WIT - O U T B E A T - N G A R E	95(A)	AVERAGE SOUNDING BLASTING	1° 1(2°)	NOTES	Soft helmet
			94(2°)				99/1° 4(2°)	Small area open mesh	
	(2) Blaster		73(A)				95/1° 5(A)	Soft helmet	
			94(2°)				101/1° 6(2°)	± Beam lengths	
Octave Band	(2° KC flat response)								
2° - 75			6 - 12°						
75 - 15°			12 - 24°						
15° - 3°			24 - 48°						
3° - 6°			48 - 96°						

GENERAL NOTES AND COMMENTS

Octave band is average for 2 runs of ± beam workpiece



**SCHEMATIC OF INSTALLATION R-1  
 ABRASIVE BLASTING ROOM WITH  
 SIDE PLENUM DOWNDRAFT VENTILATION**

**DUST DATA**

FACILITY **BLASTING ROOM, INSTALLATION R-2**

LOCATION (STATE) **MASSACHUSETTS**

APPLICABLE STANDARDS OR GUIDELINES **OSHA (CFR, TITLE 29), \* MASSACHUSETTS, ACGIH, ANSI Z9.4**

LOCATION (STATE) **MASSACHUSETTS**

**ABRASIVE STEEL SHOT**

**ACCEPTABLE DUST CONCENTRATIONS AND EXPOSURE DURATIONS**

CRYSTALLINE QUARTZ	WT. %	STANDARD	MATERIAL	B-HR TLV	PERMISSIBLE EXCURSION
TRIDYMITE	—	—	—	—	—
CRISTOBALITE	—	—	—	—	—
—	—	—	—	—	—
SURFACE (COATING) OF BLASTED OBJECT <b>IRON OXIDE,</b>					
<b>PAINT</b>					

ESTIMATED DURATION OF BLASTING **4-5 HRS/8 HR SHIFT**

\* **INCOMPLETE STANDARD, FROM ACGIH**

**ON-SITE DUST CONCENTRATION MEASUREMENTS**

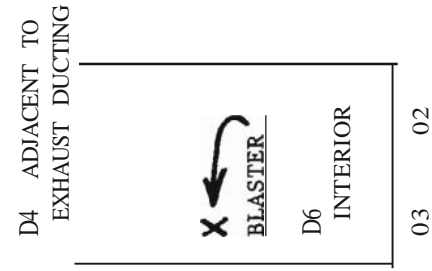
**LOCATION OF MEASUREMENT**

**FACILITY SCHEMATIC (TOP VIEW)**

- EXTERIOR AMBIENT AIR DUST LEVELS  
 RESPIRABLE | TOTAL  
 <LO MG/M<sup>3</sup>



RESPIRABLE	TOTAL	LOCATION OF MEASUREMENT
<LO	3.2	D1 IN FRONT OF ROOM
<LO	3.2	D2 AT DOORWAY
<LO	3.2	D3 AT DOORWAY
<LO	3.2	D4 ADJACENT TO EXHAUST DUCT
<LO	3.2	D5 ADJACENT TO DUST SEPARATOR



- BLASTING DUST LEVELS  
 RESPIRABLE | TOTAL  
 <LO MG/M<sup>3</sup>  
 <LO  
 3.2

<1.0

**DUST LEVEL AT BLASTING SHUTDOWN**

RESPIRABLE	TOTAL	TIME AFTER SHUTDOWN
4.2 MG/M <sup>3</sup>	—	1.5 SEC.
<LO	—	1.5
<1.0	—	3.0

LOCATION OF MEASUREMENT	MEASUREMENT
D6 INSIDE CLOSED ROOM	—
D6 INSIDE CLOSED ROOM	—
D6 INSIDE CLOSED ROOM	—

D1

INSTALLATION R-2

AIR FLOW RATE DATA

1. Air flow determined by average downflow velocity within enclosure at 3 feet above floor:

<u>Average Downflow Velocity (Eight Data Points)</u>	x	<u>Enclosure Cross- Sectional Area</u>	<u>Average Air Flow</u>
18 LFM	x	(10' x 15' = 150 Sq Ft)	2700 CFM

2. Air flow determined by average velocity through exhaust duct (12" diameter):

<u>Average Exhaust Velocity (Five Data Points)</u>	x	<u>Duct Cross- Sectional Area</u>	<u>Average Air Flow</u>
3300 LFM	x	0.785 Sq Ft	2590 CFM

3. Air flow determined by average velocity through ceiling air inlet ports (five total):

<u>Average Inlet Centerline Velocity (Five Data Points)</u>	x	<u>Roof Inlet Area (Five Ports)</u>	<u>Average Air Flow</u>
286 LFM x 0.9*	x	(18"x18"x5 = 11.25 Sq Ft)	2896 CFM

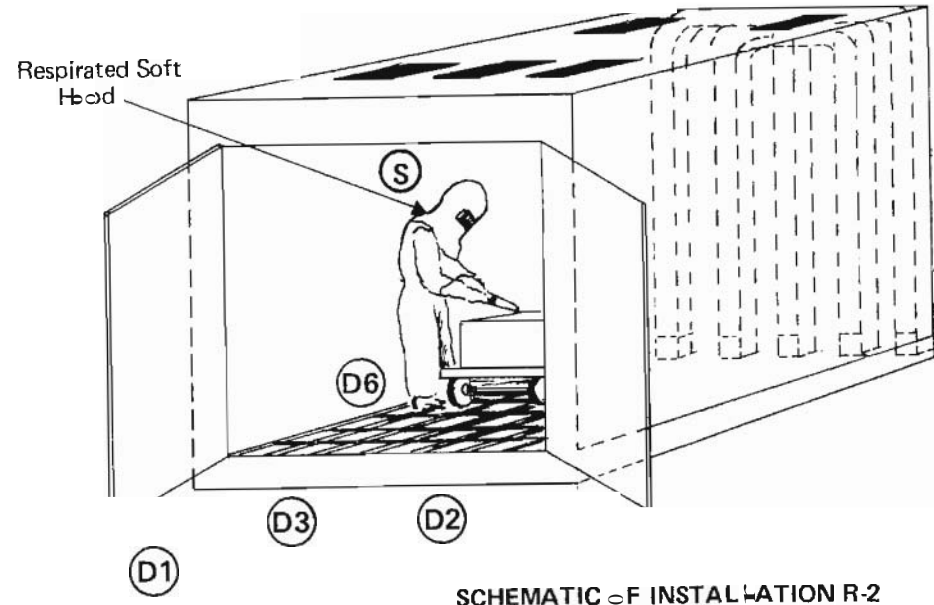
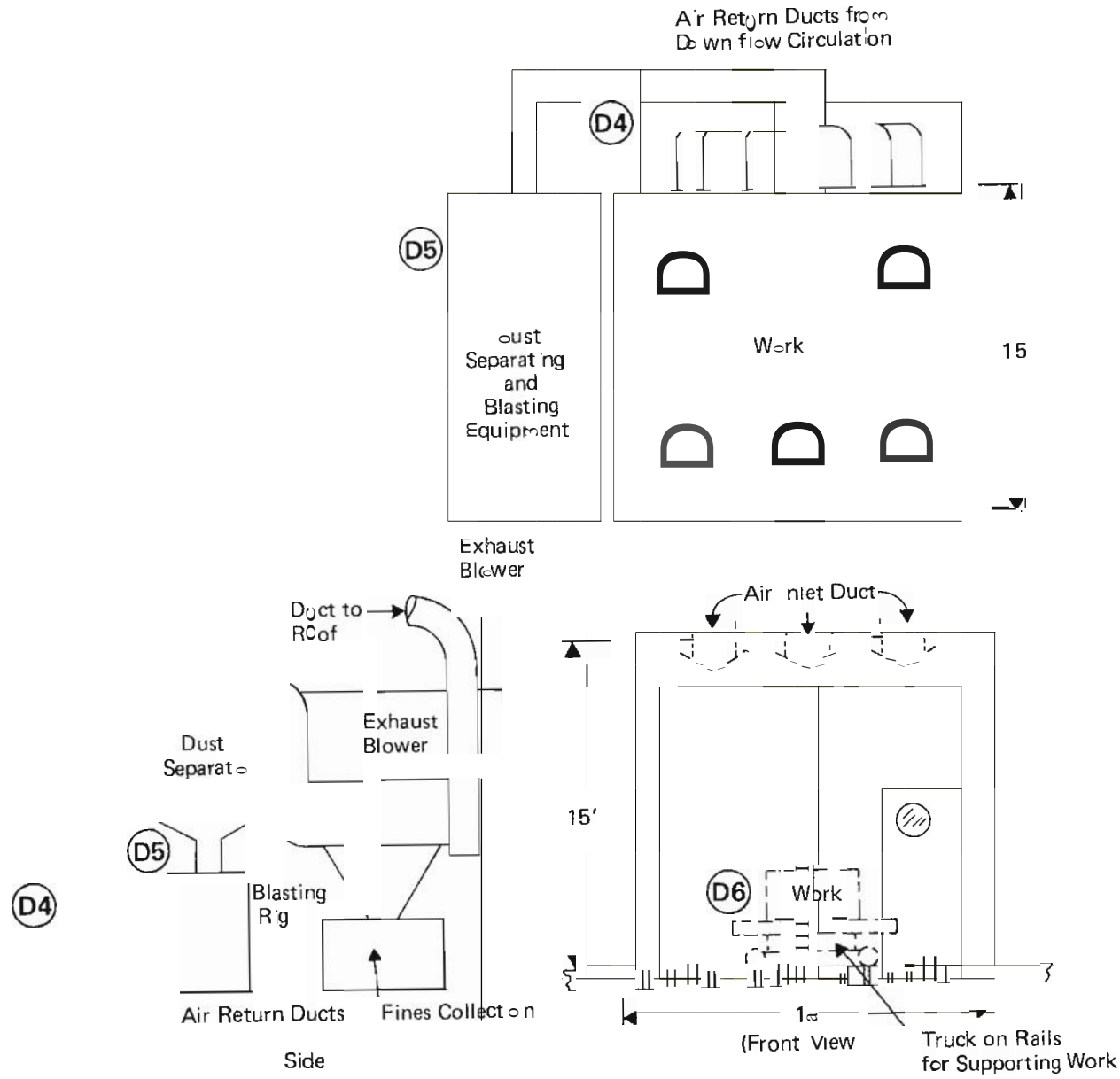
\* 0.9 is an averaging factor for centerline velocity measurements to give an approximate overall average velocity.

SOUND DATA

FACILITY	BLASTING ROOM R-2	SIZE	15	X	10	X	15	LOCATION	Mass
ABRASIVE	Steel Shot	(A)	dbA, A weight		net weight		k		
WORKPIECE	Large Casting	(20)	2PKC, F at response						
INVESTIGATOR STANCE	AMBENT LEVEL	WITH HELMET WITHOUT BREATHING APP.	RANGE PURGING BLASTING	AVERAGE PURGING BLASTING	NOTES				
		WITH HELMET AND WITH BREATHING APP.	103/116(A)	107(A)	Soft hood with breathing air				
Blaster			04/116(2°)	11°(2°)					

GENERAL NOTES AND COMMENTS

Ear plugs were used at all times



SCHEMATIC OF INSTALLATION R-2  
ABRASIVE BLASTING ROOM WITH  
DOWNDRAFT VENTILATION

DUST DATA

FACILITY BLASTING ROOM, INSTALLATION R-3 LOCATION (STATE) RHODE ISLAND  
 APPLICABLE STANDARDS OR GUIDELINES OSHA (CFR, TITLE 29), ACGIH (VOLUNTARY), ANSI 29.4 (VOLUNTARY)

ABRASIVE	STEEL SHOT	* CRYSTALLINE QUARTZ <u>95</u> WT. %	STANDARD	MATERIAL	B-HR TLV	PERMISSIBLE EXCURSION	
						OSHA/ACGIH	RES. $SiO_2$
IF SILICA SAND, (CASTING SAND ONLY)	TRIDYMITE	(CASTING SAND ONLY)	OSHA/ACGIH	TOTAL $SiO_2$	0.3-0.6	OSHA (NONE), ACGIH (3x)	OSHA (NONE), ACGIH (3x)
			OSHA	RES. INERT	5	OSHA (NONE),	OSHA (NONE),
			OSHA	TOTAL INERT	15	OSHA (NONE),	OSHA (NONE),
SURFACE (COATING) OF BLASTED OBJECT <u>CASTING SAND*</u>			ACGIH	TOTAL INERT	10	-	ACGIH (1.5x)
IRON OXIDE, PAINT							

ESTIMATED DURATION OF BLASTING 6 HRS/B HR SHIFT

ON-SITE DUST CONCENTRATION MEASUREMENTS

EXTERIOR AMBIENT AIR DUST LEVELS  
 RESPIRABLE TOTAL  
 1.2  $MG/M^3$  2.2  $MG/M^3$

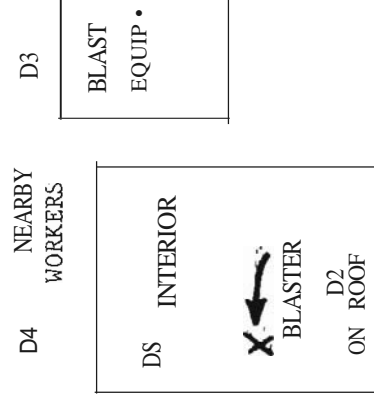
BLASTING DUST LEVELS  
 RESPIRABLE TOTAL  
 1.7  $MG/M^3$  4.2  $MG/M^3$   
 1.6  
 1.6

DUST LEVEL AT BLASTING SHUTDOWN  
 RESPIRABLE TOTAL  
 1.1  $MG/M^3$  2 MIN.

LOCATION OF MEASUREMENT

- D1 IN FRONT OF ROOM
- D2 ON ROOF BY SPLIT RUBBER SEAL
- D3 BY RECYCLE ELEVATOR
- D4 NEARBY WORKERS (GRINDING, PAINTING)
- D5 INSIDE CLOSED ROOM

FACILITY SCHEMATIC (TOP VIEW)



D1

INSTALLATION R-3  
AIR FLOW RATE DATA

1. Air flow determined by average velocity through side exhaust plenums:

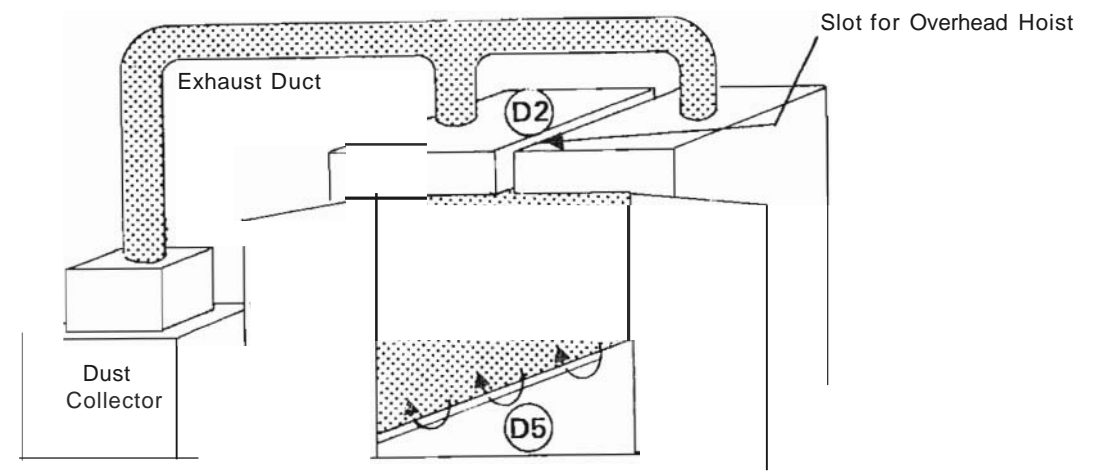
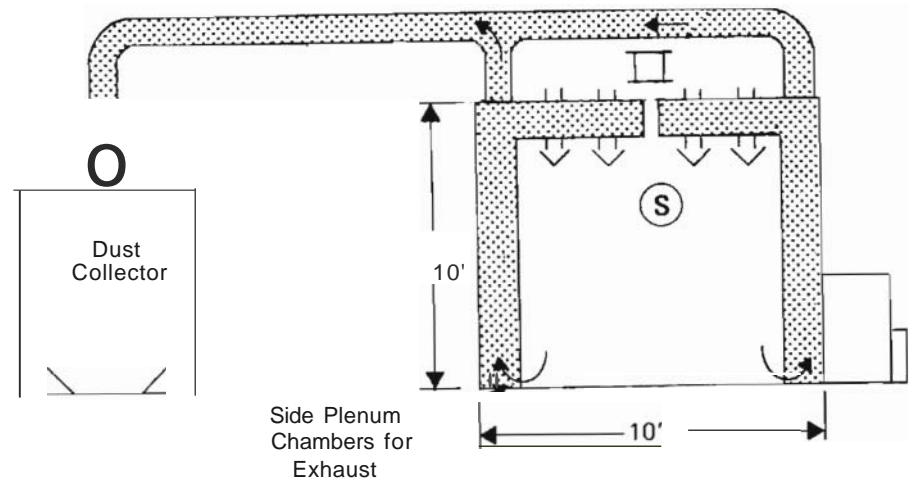
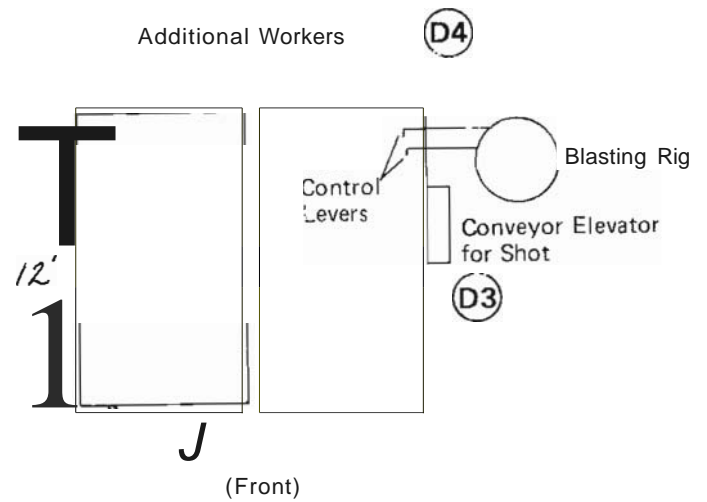
Average Exhaust Velocity (Four Data Points Each)	x	Plenum open Flow Area	=	Average Air Flow
Right      242 LFM	x	(3 x 12' = 3 Sq Ft)	=	726 CFM
Left        362 LFM	x	(3 x 12' = 3 Sq Ft)	=	1086 CFM
TOTAL				1812 CFM

SOUND DATA

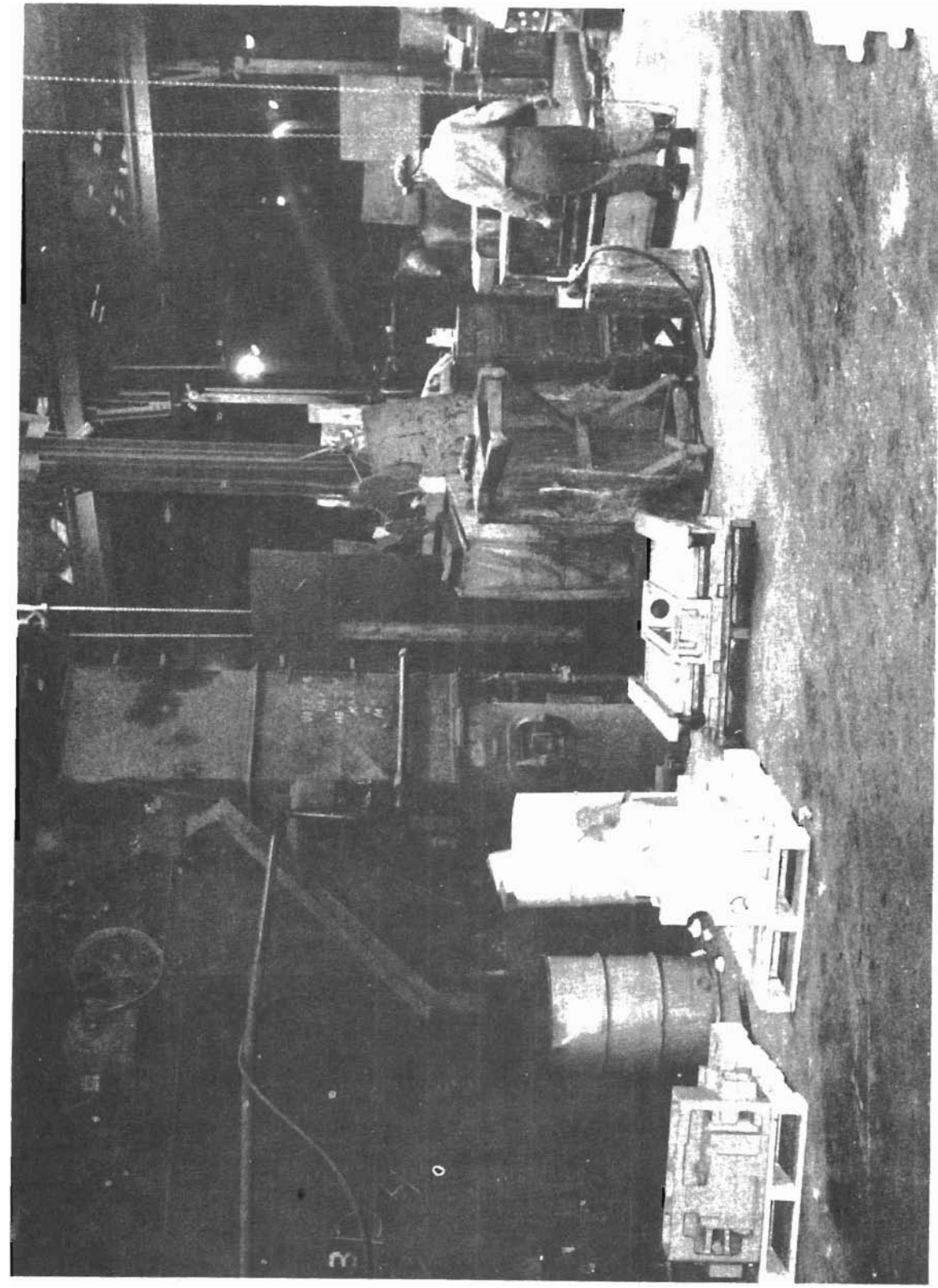
FACILITY	Blasting Room R-3	SIZE	10' x 12' x 10'	LOCATION	R. I.	
ABRASIVE	Steel Shot	(A)	dbA, A weighting network			
WORK PIECE	Castings	(20)	20KC, Flat response			
INDIVIDUAL AT DISTANCE INDICATED	AMBIENT LEVEL	WITH HELMET AND WITH BREATHING AIR	WITH HELMET WITHOUT BREATHING AIR	RANGE DURING BLASTING	AVERAGE DURING BLASTING	NOTES
Blaster	80/88(A)	87/88(A)		112/124(A)	120(A)*	Rubber hood
	92/94(20)	94/96(20)		1114/122(20)	118(20)	

GENERAL NOTES AND COMMENTS:  
\*10 minute average; operation was 4 to 5 hours per day.





**SCHEMATIC OF INSTALLATION R-3  
 ABRASIVE BLAST CLEANING ROOM WITH  
 SIDE PLENUM, DOWNDRAFT VENTILATION**



**FIGURE AREA SURROUNDING BLAST CLEANING APPARATUS Installation R-3**

DUST DATA

FACILITY BLASTING ROOM, INSTALLATION R-4 LOCATION (STATE) TEXAS

APPLICABLE STANDARDS OR GUIDELINES OSHA (enit, TITLE 29), ACGIH (VOLUNTARY), ANSI Z9.4 (VOLUNTARY)

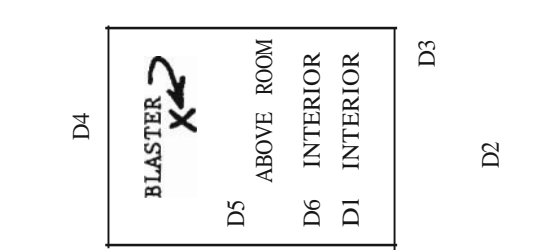
ACCEPTABLE DUST CONCENTRATIONS AND EXPOSURE DURATIONS

ABRASIVE	<u>STEEL GRIT</u>	CRYSTALLINE QUARTZ	WT. %	STANDARD	MATERIAL	B-HR ILY	PERMISSIBLE EXCURSION
IF SILICA SAND . . . .		TRIDYMITITE		OSHA	RES. INERT	5 MG/M <sup>3</sup>	OSHA (NONE)
		CRISTOBALITE		OSHA	TOTAL INERT	15	OSHA (NONE)
				ACGIH	TOTAL INERT	10	ACGIH (1.5x)
SURFACE (COATING) OF BLASTED OBJECT <u>IRON OXIDE,</u>							
<u>PAINT</u>							

ESTIMATED DURATION OF BLASTING 5 MRS/a HR SHIFT

ON-SITE DUST CONCENTRATION MEASUREMENTS

EXTERIOR AMBIENT AIR DUST LEVELS	RESPIRABLE	TOTAL	LOCATION OF MEASUREMENT
0.3 MG/M <sup>3</sup>	0.4 MG/M <sup>3</sup>		D1 INSIDE OPEN ROOM
<1.0	1.1		D2 IN FRONT OF ROOM BETWEEN BLASTING EVENTS
• BLASTING DUST LEVELS			
RESPIRABLE	TOTAL		
2.0 MG/M <sup>3</sup>	4.1 MG/M <sup>3</sup>		D3 AT 1" HOLE IN WALL
1.2	<1.0		D3 AT PLUGGED 1" HOLE
	3.6		D4 BEHIND ROOM
	1.0		D5 ABOVE ROOM BY AIR INTAKE
• DUST LEVEL AT BLASTING SHUTDOWN			
RESPIRABLE	TOTAL	TIME AFTER SHUTDOWN	
6.8 MG/M <sup>3</sup>		1 MIN.	D6 IN&IDE CLOSED ROOM
1.7		3 MIN.	D6 INSIDE CLOSED ROOM



INSTALLATION R-4  
AIR FLOW RATE DATA

- 1 Air flow determined by average velocity through exhaust duct
 

Average Exhaust Velocity (Four Data Points)	x	Duct Cross- Sectional Area	=	Average Air Flow
46± LFM		(14.5 x 14.5 = 1.46 Sq Ft)		= 675 CFM
  
2. Air flow determined by average velocity through ceiling air inlet ports (four total):
 

insufficient data for accurate CFM determination. However, single port sampled showed inlet air at 250 LFM. Area was 8 x 8 = 0.44 Sq Ft.



DUST DATA

FACILITY BLASTING ROOM, INSTALLATION R-5 LOCATION (STATE) PENNSYLVANIA  
 APPLICABLE STANDARDS OR GUIDELINES OSHA (CFR, TITLE 29), \* PENNSYLVANIA, ACGIH, ANSI Z9.4

ABRASIVE STEEL SHOT ACCEPTABLE DUST CONCENTRATIONS AND EXPOSURE DURATIONS

CRYSTALLINE QUARTZ	WT. %	STANDARD	MATERIAL	8-HR TLV	PERMISSIBLE EXCURSION
IF SILICA SAND.		OSHA	RES. INERT	5 MG/M <sup>3</sup>	OSHA (NONE)
		OSHA	TOTAL INERT	15	OSHA (NONE)
SURFACE (COATING) OF BLASTED OBJECT <u>IRON OXIDE</u>		PENN/ACGIH	TOTAL INERT	10	ACGIH (1.5x)

ESTIMATED DURATION OF BLASTING 4 HRS/8 HR SHIFT \* TAKEN FROM ACGIH

ON-SITE DUST CONCENTRATION MEASUREMENTS

• EXTERIOR AMBIENT AIR DUST LEVELS

RESPIRABLE TOTAL  
 < 1.0 MG/M<sup>3</sup> 1.0 MG/M<sup>3</sup>

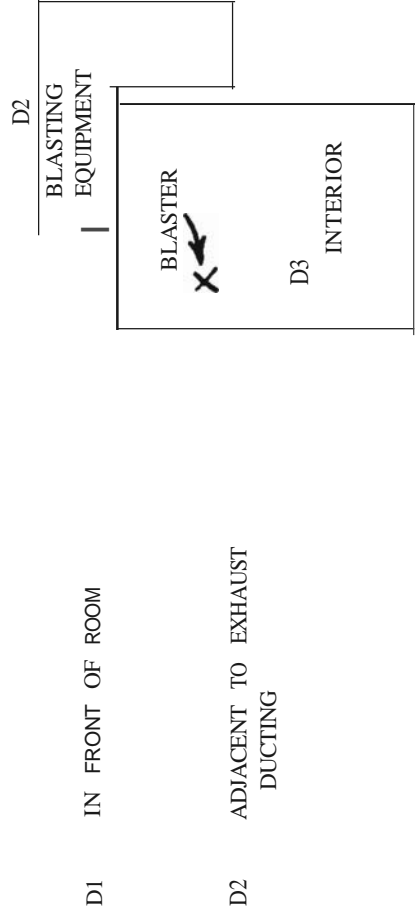
• BLASTING DUST LEVELS

RESPIRABLE TOTAL  
 0.2 MG/M<sup>3</sup>

• DUST LEVEL AT BLASTING SHUTDOWN

RESPIRABLE	TOTAL	TIME AFTER SHUTDOWN
1.2 MG/M <sup>3</sup>		15 SEC.
1.0		2 MIN.

FACILITY SCHEMATIC (TOP VIEW)



INSTALLATION R-5  
AIR FLOW RATE DATA

1 Air flow determined by average velocity through three faces of exhaust plenum:

Average Exhaust velocity (Seven Data Points Each)	x	Face Open Flow Area	=	Average Air Flow
Left Side	880 LFM	x (12" x 15 = 1.25 Sq Ft)	=	1100 CFM
Front Side	910 LFM	x (12" x 15 = 1.25 Sq Ft)	=	1137 CFM
Right Side	980 LFM	x (12" x 15 = 1.25 Sq Ft)	=	1225 CFM
TOTAL				3462 CFM

SOUND DATA

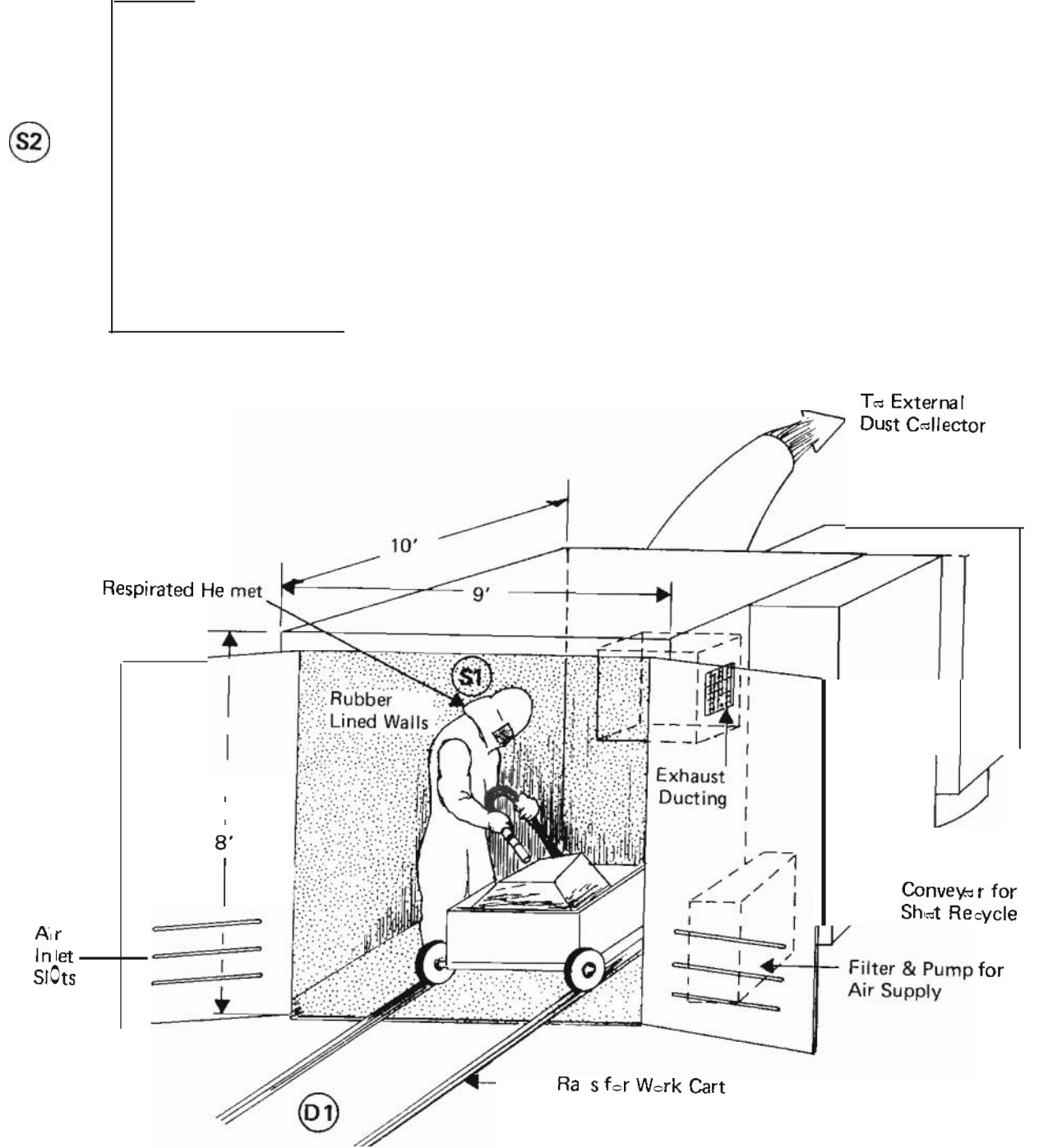
FACILITY: **Blasting Room R-5**      SIZE: **10' x 9' x 8'**      LOCATION: **Penn.**

ABRASIVE: **Steel Shot**      [A] = dbA, A weighting network

WORK PIECE: **14" Solid Shaft**      (20) = 20KC, Flat response

INDIVIDUAL AT DISTANCE INDICATED	AMBIENT LEVEL	WITH HELMET AND WITH BREATHING AIR	WITH HELMET WITHOUT BREATHING AIR	RANGE DURING BLASTING	AVERAGE DURING BLASTING	NOTES
(1) Blaster		88(A)	58(A)	106/113(A)	111(A)	Helmet
(2) Outside room walls-3'		92(20)		108/116(20)	111(20)	
		At front door		102/104(A)		
		External Equipment side		93/96(A)		
		Far side		90/91 (A)		
		Rear		86/89(A)		

GENERAL NOTES AND COMMENTS:



SCHMATIC OF INSTALLATION R-5  
ABRASIVE BLASTING ROOM,  
CROSSBLAST VENTILATION

DUST DATA

FACILITY BLASTING ROOM, INSTALLATION R-6 LOCATION (STATE) PENNSYLVANIA  
 APPLICABLE STANDARDS OR GUIDELINES OSHA (CFR, TITLE 29), \* PENNSYLVANIA, ACGIH, ANSI Z9.4

ABRASIVE STEEL SHOT ACCEPTABLE DUST CONCENTRATIONS AND EXPOSURE DURATIONS

CRYSTALLINE QUARTZ	WT. %	STANDARD	MATERIAL	B-HR TLV	PERMISSIBLE EXCURSION
IF SILICA	---	OSHA	RES. INERT	5 MG/M <sup>3</sup>	OSHA (NONE)
SAND	---	OSHA	TOTAL INERT	15	OSHA (NONE)
		PENN/ACGIH	TOTAL INERT	10	ACGIH (1.5x)
SURFACE (COATING) OF BLASTED OBJECT <u>IRON OXIDE</u>					
<u>PAINT</u>					

ESTIMATED DURATION OF BLASTING 6 HRS/8 HR SHIFT \* TAKEN FROM ACGIH

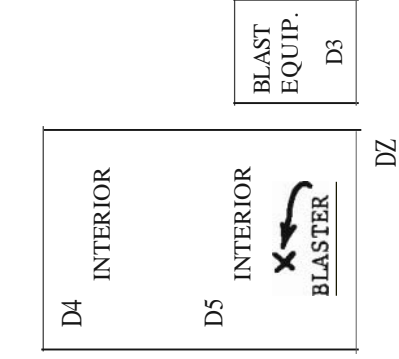
ON-SITE DUST CONCENTRATION MEASUREMENTS

EXTERIOR AMBIENT AIR DUST LEVELS  
 RESPIRABLE | TOTAL  
 <1.0 MG/M<sup>3</sup>

BLASTING DUST LEVELS  
 RESPIRABLE | TOTAL  
 3.8 MG/M<sup>3</sup> | 0.3 MG/M<sup>3</sup>  
 4.2 | 8.7

DUST LEVEL AT BLASTING SHUTDOWN  
 TIME AFTER SHUTDOWN  
 RESPIRABLE | TOTAL  
 2.2 MG/M<sup>3</sup> | 30 SEC.  
 1.5 | 2 MIN.  
 1.5 | 3.5 MIN.

FACILITY SCHEMATIC (TOP VIEW)



D1 IN FRONT OF ROOM

D2 AT 1" Ø HOLE IN WALL  
 D3 AT RECYCLE ELEVATOR  
 D4 INSIDE DURING BLAST

D5 INSIDE CLOSED ROOM  
 D5 INSIDE CLOSED ROOM  
 D5 INSIDE CLOSED ROOM

INSTALLATION R-6

AIR FLOW RATE DATA

Air flow determined by average velocity through side exhaust plenums.

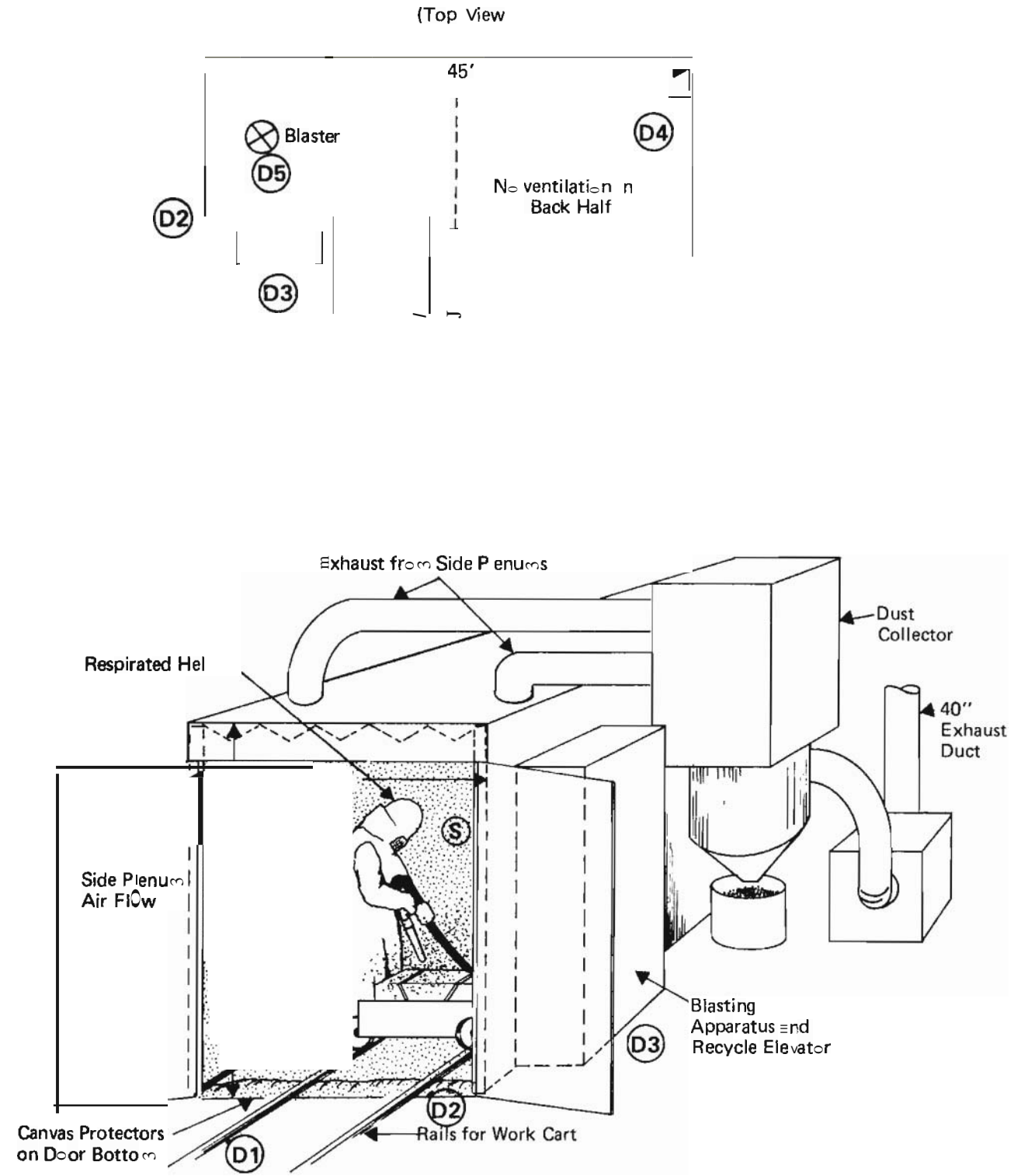
Average Exhaust Velocity (Eight Data Points Right Seven Left)	x	Plenum open Flow Area	Average Air Flow
Right 800 LFM	x (5' x 20')	8.3 Sq Ft	= 6640 CFM
Left 1017 LFM	x (5' x 7.9')	3.3 Sq Ft	= 3356 CFM
(Two Sections) 875 LFM	x (3' x 12.1')	= 3.0 Sq Ft	= 2625 CFM
TOTAL			12621 CFM

SOUND DATA

FACILITY Blasting Room R-6 SIZE 45' x 12' x 15' LOCATION Penn.  
 ABRASIVE Steel Shot (A) dbA, A weighting network  
 WORK PIECE 15" Pipe (20) 20KC, Flat response

INDIVIDUAL AT DISTANCE INDICATED	AMBIENT LEVEL	WITH HELMET AND WITH BREATHING AIR	WITH HELMET WITHOUT BREATHING AIR	RANGE DURING BLASTING	AVERAGE DURING BLASTING	NOTES
Blaster	64(A) 77(20)	89(A) 100(20)		90/98(A) 94/104(20)	97(A) 99(20)	Helmet
*Blaster	64(A) 77(20)	86(A) 96/100(20)	Usual Configuration of Microphone			
	64(A) 77(20)	86(A) 98/100(20)	Windscreen on Microphone			

GENERAL NOTES AND COMMENTS:  
 \*See Appendix on Test Equipment and Procedures.



SCHEMATIC OF INSTALLATION R-6  
 ABRASIVE BLAST CLEANING ROOM  
 SIDE PLENUM DOWNDRAFT VENTILATION



SOUND DATA

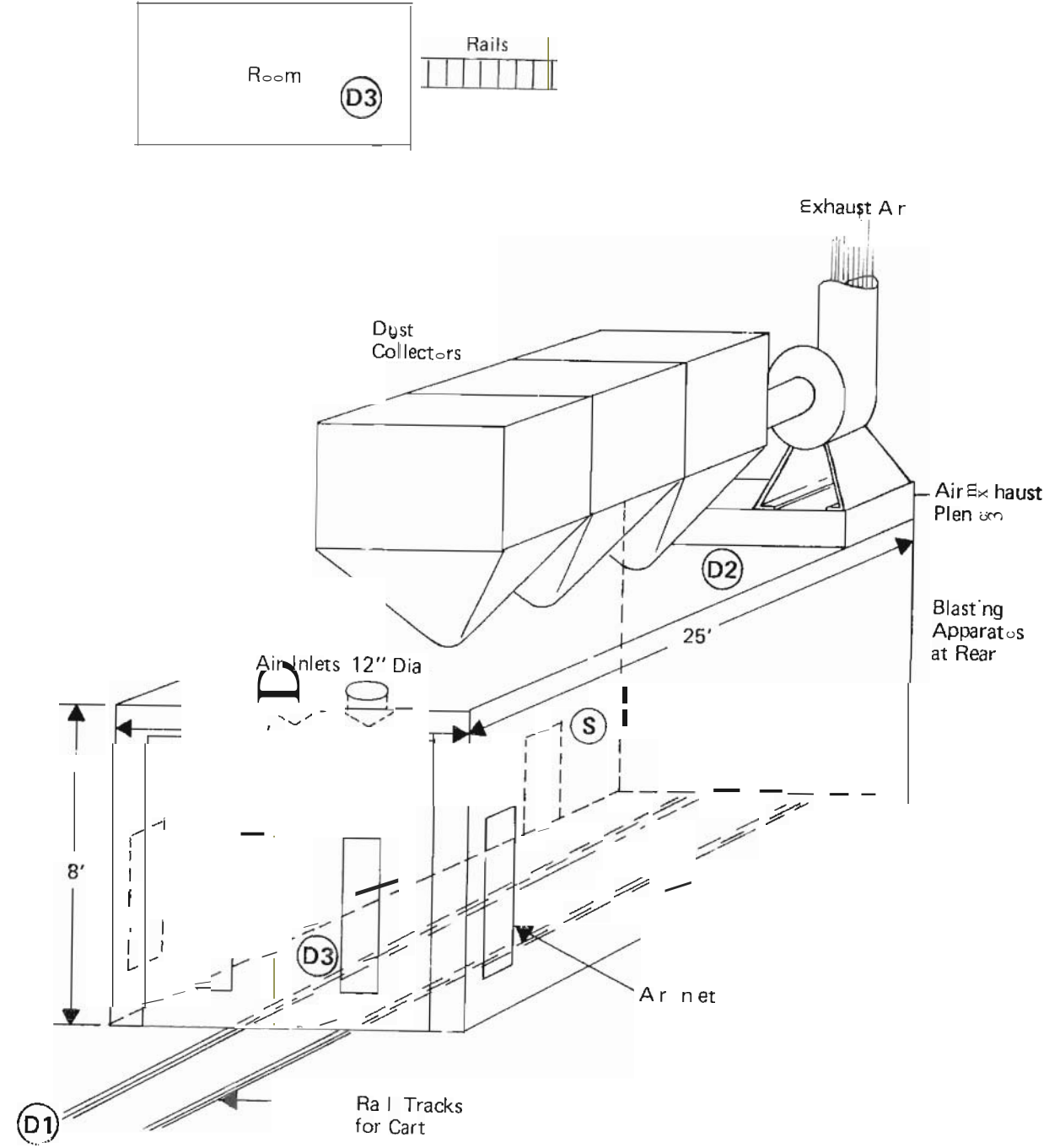
FACILITY Blasting Room R-7 SIZE 25' x 7' x 8' LOCATION Penn.

ABRASIVE Steel Shot (A) dbA, A weighting network

WORK PIECE Castings (20) 20KC, Flat response

INDIVIDUAL AT DISTANCE INDICATED	AMBIENT LEVEL	WITH HELMET AND WITH BREATHING AIR	WITH HELMET WITHOUT BREATHING AIR	RANGE DURING BLASTING	AVERAGE DURING BLASTING	NOTES
Blasters	In room 74(A)	92/96(A)	98/106(A)	98/106(A)	102(A)	Diver's type helmet
	*Outside of room	92/100(20)	98/108(20)	98/108(20)	103(20)	
	70/87(A)					
	82/99(20)					
Ceiling of blasting room					120(A)	Steady

GENERAL NOTES AND COMMENTS:  
 \*Due to chipper at 50 ft. distance.



SCHEMATIC OF INSTALLATION R-7  
 ABRASIVE BLAST CLEANING ROOM  
 CROSSFLOW VENTILATION

APPENDIX B  
Test Equipment and Procedure



1. DUST EXPOSURE

a. Equipment Descriptiop

As GCA's manual states: "The Model RDM-101 Respirable Dust Monitor (Figure B-1) is an advanced instrument designed for on-the-spot measurements of mass concentrations of the respirable fraction or the total mass loading of dust particles. It is a portable and fully self-contained monitor with automatic and direct digital readout of the mass concentration of airborne dust."

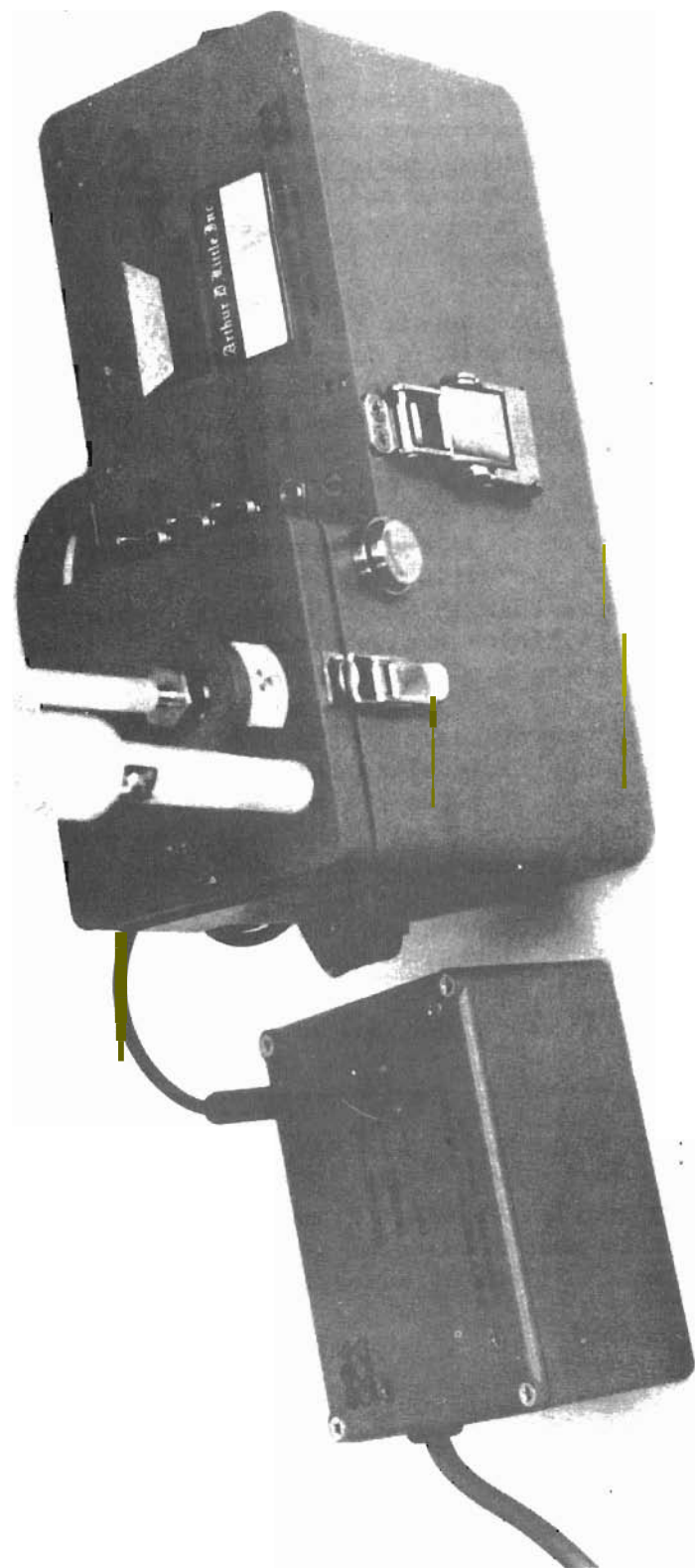
Dust is collected by sampling air at 2 liters per minute (a rate that is factory set but adjustable; a test rotameter is available for periodic confirmation of this flow rate) through a two-stage collection system. Total airborne dust is accumulated without the first stage of the collection system by impaction directly on a "vaseline" coated, circular plastic (polyester) disc. Collected particles are approximately 50  $\mu\text{m}$  (spheres of unit density) in diameter and smaller. Respirable airborne dust is collected using both a cyclone precollector first stage and the coated disc second stage. The cyclone's function is to remove all non-respirable particles larger than 10  $\mu\text{m}$  in diameter (spheres of unit density), to allow passage of all particles smaller than 2  $\mu\text{m}$  in diameter, and to allow passage of selected percentages of particle sizes between these two limits.

The first stage cyclone precollector is designed to separate in accordance with estimated particle sizes that actually pass into smaller portions of the human respiratory tract (to small bronchioles and alveolar sacs). Separation is in accordance with the following profile as determined by the AEC and recommended by the U. S. Bureau of Mines.

<u>AERODYNAMIC DIAMETER (<math>\mu\text{m}</math>)</u> <u>(UNIT DENSITY SPHERE)</u>	<u>% PASSING</u> <u>SELECTOR</u>
2	100
2.5	75
3.5	50
5.0	25
10.0	a

This commercially available, 10-mm diameter, nylon cyclone is accepted as a standard in most industrial hygiene uses (U.S. Bureau of Mines and U.S. Department of Health, Education, and Welfare, per GCA).

<sup>1</sup> "Sampling and Evaluating Respirable Coal Mine Dust: A Training Manual," Bureau of Mines Information Circular, February 1971.



Arthur D. Little, Inc.

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F GUR B GCA CORPORATION RESPIRABLE DUST MONITOR

Automatic operation of the Respirable Dust Monitor provides for a one-minute total sample period (40 seconds effective sample collection, 10 seconds each for initial [no sample] and final [collected sample] mass determinations by B-energy mass absorption). Air samples with low respirable dust concentrations often are below significant sensitivity ( $\ll 10 \text{ mg/M}^3$ ) of the instrument in its automatic sampling time; therefore a manual override for increased sampling time is provided. This, however, requires a correction factor to give the true respirable dust concentration. This factor is determined by the following formula and correction factors are presented in Table B-1.

$$\text{DIGITAL READOUT} \times \text{CORRECTION FACTOR} = \text{CORRECT RESPIRABLE DUST CONCENTRATION}$$

TABLE B-1  
CORRECTION FACTORS

TOTAL SAMPLING TIME	EFFECTIVE SAMPLING TIME (Total less 20 sec. required for mass Measurements)	CORRECTION FACTOR	CONCENTRATION RANGE ( $\text{mg/M}^3$ )
1 minute	40 sec.	1.0	1-50
1 min., 40 sec.	80	0.5	0.5-30
2 min.	100	0.4	0.4-25
3 min.	160	0.25	0.25-20
3 min., 40 sec.	200	0.20	0.20-12
4 min.	220	0.182	0.18-10
5 min.	280	0.143	0.14-8
6 min.	340	0.118	0.12-8
7 min.	400	0.100	0.10-6
8 min.	460	0.087	0.09-6
10 min.	580	0.069	0.07-5
13 min., 40 sec.	800	0.050	0.05-3

Measureable concentration ranges of airborne dust are also given <sup>3</sup> in the above table. The maximum limitation of the instrument is 50 mg/M which is significantly higher than the recommended maximum concentration of nonsilica respirable dust of 5 mg/M<sup>3</sup>.<sup>2</sup> The GCA monitor therefore adequately covers the spectrum of dust levels required in collection of NIOSH data.

b. Equipment Calibration

The ROM-101 is calibrated at the manufacturer's facilities against a gravimetric reference filter sample from a test flow tunnel with continuous dust feeding.

Arizona road dust is fed into an 8-inch diameter test tunnel and sampled isokinetically 20 diameters from the inlet.

Three samplers were used concurrently:

1. A filter sampler using a Gelman Metrical (0.45 μm pore size) Filter @1 CFM.
2. A Bausch and Lomb Light-Scattering Particle Counter Model 40-1 (used only to keep watch on uniformity of particle size).
3. A GCA Respirable Dust Monitor RDM-101.

The GCA dust monitor is calibrated to agree with the gravimetric sample. This primary calibration was done at the outset of our program and again half way through our sampling efforts.

Test Arizona road dust is of the following specifications:

<u>PARTICLE SIZE</u>	<u>WT. %</u>
0-5 μ	39 + 2
5-10	18 + 3
10-20	16 + 3
20-40	18 + 3
40-80	9 + 3

<sup>2</sup> Federal Register, Vol. 36, No. 157, 13, August 1971.

Also GCA literature depicts a rather good agreement between RDM-101 and gravimetric techniques in sampling air streams laden with coal dust.

A secondary mylar calibration disc is provided to check adherence of the instrument to the original calibration. This provides an indication of deviation from the originally set point under field use conditions and adjustment of a potentiometer will reset the instrument if necessary.

2. AIR FLOW VELOCITY

a. Equipment Description

A Datametrics' Series 800-VTP Airflow Multimeter (Figure B-2) was used to directly record air velocities at abrasive blast cleaning installations. This device is a hot wire anemometer requiring direct probe insertion into the airflow path. Direct velocity readout was available to 5000 LFM.

b. Equipment Calibration

This device was factory calibrated at the outset of the program.

3. SOUND LEVEL EXPOSURE

a. Equipment List

The following sound level monitoring equipment (Figure B-3) was used to measure the acoustic levels:

Sound Level Meter	General Radio 1551-C
Octave Analyzer	H. H. Scott 420-A
Preamplifier	General Radio 1560-P40
Power Supply	General Radio 1560-9575'
Calibrator	General Radio 1552-B
Oscillator	General Radio 1307-A'
Windscreen	General Radio 1560-9521

b. Equipment Calibration

The assembled equipment was calibrated before and after measurements were made at each facility. For all of the measurements, a 5-mil polyethylene sleeve was placed over the microphone to prevent the intrusion of grit particles. A laboratory check was made of the effect of such a shield on the acoustic response of the equipment. It was determined that the acoustic calibration could not be made with the sleeve due to dimensioned interference with the calibrator and high level effects, but measurements could be made satisfactorily with an acceptable one to two dB error in the two highest octave bands (2400-4800 and 4800-9600 Hz).

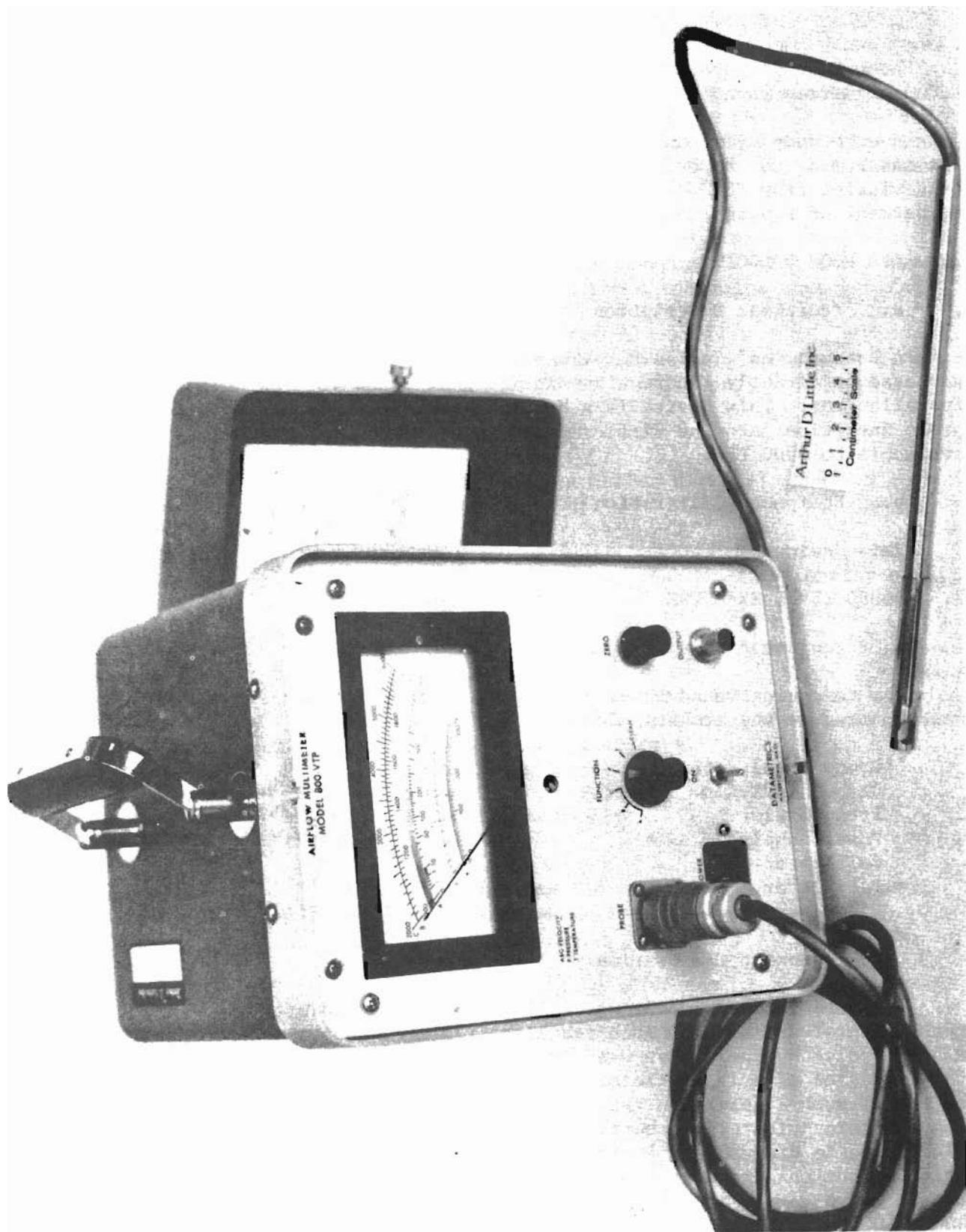


FIGURE B-2 DATAMETRICS SERIES 800-VTP AIRFLOW MULTIMETER

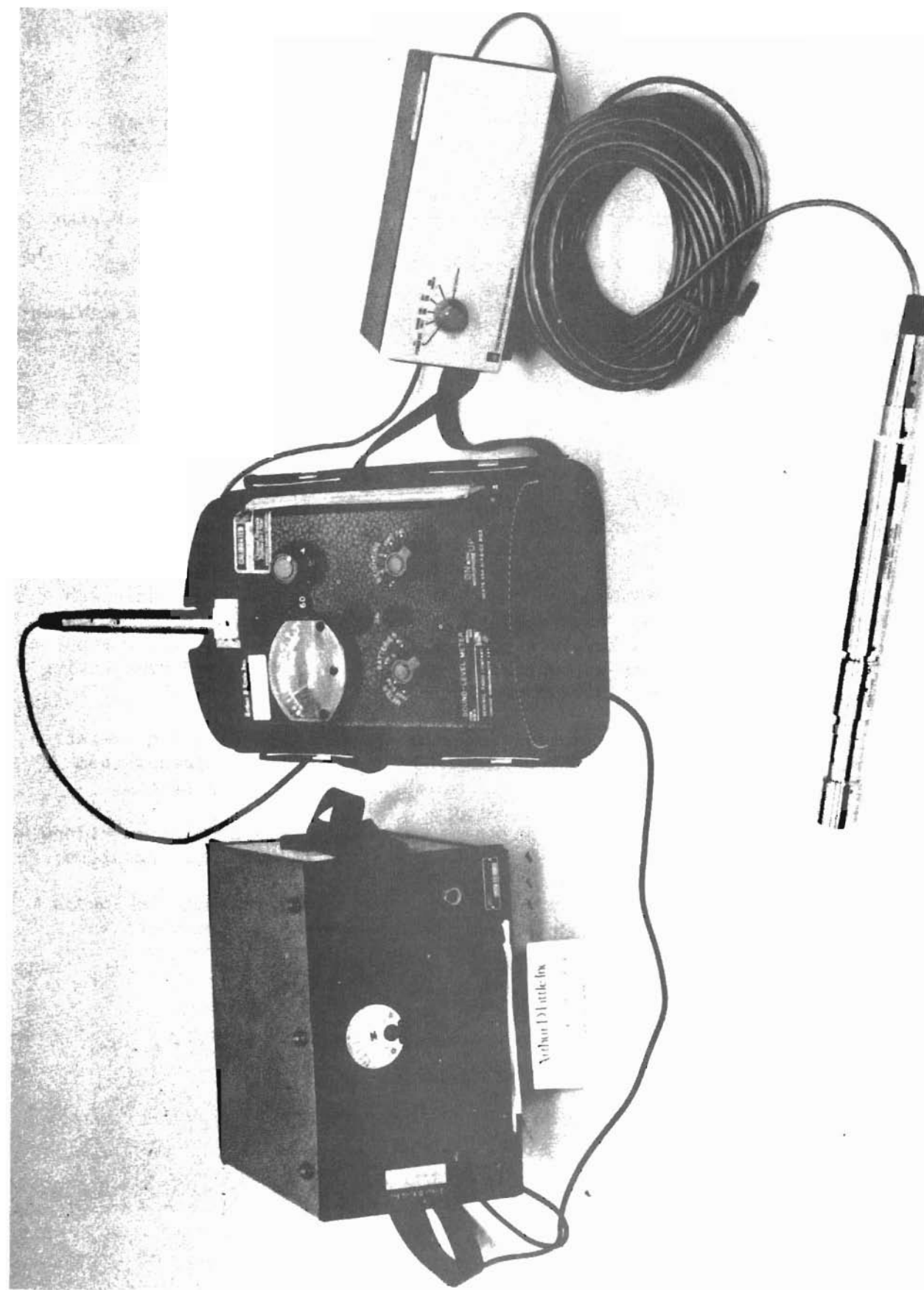


FIGURE B-3 SOUND LEVEL MONITORING INSTRUMENTATION



The microphone (one-inch ceramic) and preamplifier were hung as an assembly around the neck of a helmeted worker so that the microphone opening was placed just below the lobe of the right ear (Figure B-4). This allowed the preamplifier to nestle in the hollow area of the neck below the worker's jaw and ear. Thus, there was no physical contact with the hard surfaces of the helmet and no interference with the worker's physical movements. A 100-foot cable was led from the worker to the remaining equipment. A preliminary set of measurements was made at ADL using rented abrasive blasting equipment in order to work out and establish this procedure.

It was observed that breathing air to the helmet could cause subjectively high level noise. A measurement of this noise was made (in one instance) first, with the microphone positioned as described above and second, with the foam polyurethane windscreen in position over the microphone. Readings taken with the A, B, or C-weighting scales or the meter in the flat (20 c) response mode indicate no difference in sound level between the two cases. Thus, the noise generated by supplying breathing air to the helmet is caused by jet turbulence at the air exit holes in the helmet and not by the wind-generated noise at the microphone surface. Because of this, measurements were made without the windscreen under the worker's helmet thus easing the equipment set up. Reported in the data are those sound levels with breathing air only; that is, without on-going blasting. Where appropriate, the windscreen was used when taking measurements at outdoor blasting facilities.

In the case of a nonhelmeted worker or cabinet type blasting operation, the microphone and preamplifier were hand held three to six inches from the operator's ear or just at the operator's station if appropriate.

In appropriate instances, sound level readings were made at locations of other nearby workers, helpers, or observers to the blasting operation.

Background ambient readings also were made to insure that the levels measured were due only to the blasting or to identify the source of the high noise level if the blasting was not the primary source.



**FIGURE B-4 MICROPHONE POSITION RELATIVE TO BLAST OPERATOR'S EAR FOR INSIDE HELMET MEASUREMENT**