EXECUTIVE SUMMARY

ENVIRON has developed a series of calibration factors that can be used in conjunction with a portable, real-time aerosol monitor to measure levels of theatrical smoke and haze. Calibrated aerosol monitors can be used to determine whether actors are potentially exposed to concentrations above the Peak Guidance levels recommended in the report *Health Effects Evaluation of Theatrical Smoke, Haze, and Pyrotechnics* (Mt. Sinai and ENVIRON 2000).

TABLE ES-1
Summary of Calibration Factors

Manufacturer	Machine	Fluid	Fluid type	Calibration factor	Ref
CITC	Fog Max	Natural Fogging Fluid	glycol	0.663	(4)
	Haze Max	Water Vapor Haze Fluid	glycerol	0.108	(4)
	Starhazer	High Performance Fluid	oil	0.867	(4)
High End Systems	F-100	Atmosphere HQ Fluid	glycol	1.38	(1)
	F-100	Atmosphere Stage Formula	glycol	0.253	(1)
	F-100	Atmosphere Cold Flow Formula	glycol	2.41	(1)
Le Maitre Special Effects	G100	Extra Quick Dissipating	glycol	3.17	(1)
	G100	Quick Dissipating	glycol	3.45	(1)
	G100	Regular Fog Fluid	glycol	4.17	(1)
	G150	Extra Quick Dissipating	glycol	3.17	(1)
	G150	Molecular Fog Fluid	glycol	2.58	(1)
	G150	Pro Beam (Long Lasting)	glycol	1.42	(4)
	G150	Quick Dissipating	glycol	3.45	(1)
	G150	Regular Fog Fluid	glycol	4.17	(1)
	G300	Molecular Fog Fluid	glycol	0.533	(4)
	G300	Pro Beam (Long Lasting)	glycol	0.667	(4)
	G300	Quick Dissipating	glycol	2.65	(4)
	G300	Regular Fog Fluid	glycol	0.304	(4)
	Neutron XS	Neutron Haze Fluid	glycerol	0.12	(2)
	Opti Mist Ranger	Mini Mist Canister	glycol	3.01	(1)
	Show Fogger Pro	Pro Beam (Long Lasting)	glycol	0.436	(4)
	Show Fogger Pro	Quick Dissipating	glycol	2.56	(4)
	Show Fogger Pro	Regular Fog Fluid	glycol	0.444	(4)
	Stage Fogger Pro	Molecular Fog Fluid	glycol	2.77	(4)
	Stage Fogger Pro	Pro Beam (Long Lasting)	glycol	1.36	(4)
	Stage Fogger Pro	Quick Dissipating	glycol	1.37	(4)
	Stage Fogger Pro	Regular Fog Fluid	glycol	0.995	(4)
Look Solutions / Theatre Effects	Tiny Fogger	Tiny Fogger Fluid	glycol	0.761	(4)
	Unique Hazer	Unique Fluid	glycol	0.299	(4)
	Viper II (NT)	Viper Fluid	glycol	1.46	(4)

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Summary of Calibration Factors

Manufacturer	Machine	Fluid	Fluid type	Calibration factor	Ref
Martin Professional	Jem Glaciator	Jem B2 Heavy Fog Fluid	glycol	3.41	(4)
	Jem ZR12-DMX	Jem Pro-Smoke Super Fluid	glycol	1.12	(4)
MDG Fog Generators	Mini-Max	MDG Dense Fluid	glycol	3.21	(1)
	MAX 300 Atmosphere	MDG Neutral Fluid	oil	0.784	(1)
Reel EFX, Inc.	DF-50	Diffusion Fluid	oil	0.784	(1)
Rosco Laboratories	1600	Rosco Clear Fog Fluid	glycol	1.82	(1)
	1600	Rosco Fog Fluid	glycol	1.27	(1)
	1600	Rosco Light Fog Fluid	glycol	1.375	(1)
	1600	Rosco Stage & Studio Fluid	glycol	1.56	(1)
	Alpha 900	Rosco Clear Fog Fluid	glycol	1.82	(1)
	Alpha 900	Rosco Fog Fluid	glycol	1.27	(1)
	Alpha 900	Rosco Light Fog Fluid	glycol	1.375	(1)
	Alpha 900	Rosco Stage & Studio Fluid	glycol	1.56	(1)
	Delta 3000	Rosco Clear Fog Fluid	glycol	1.43	(4)
	Delta 3000	Rosco Fog Fluid	glycol	1.00	(4)
	Delta 3000	Rosco Light Fog Fluid	glycol	1.35	(4)
	Delta 3000	Rosco Stage & Studio Fluid	glycol	1.97	(4)
	PF-1000	Rosco Clear Fog Fluid	glycol	1.82	(1)
	PF-1000	Rosco Fog Fluid	glycol	1.27	(1)
	PF-1000	Rosco Light Fog Fluid	glycol	1.375	(1)
	PF-1000	Rosco Stage & Studio Fluid	glycol	1.56	(1)
SFX	Fog Master FM-1	Aquafog Fluid	glycol	0.19	(3)
Smoke Factory	Tour Hazer	Tour Hazer Fog Fluid	glycol	0.299	(4)

References:
(1) *Equipment-Based Guidelines for the Use of Theatrical Smoke and Haze* (ENVIRON 2001a)
(2) *Theatrical Haze and Fog Testing for Mamma Mia!, Winter Garden Theatre* (ENVIRON 2001b)
(3) *Theatrical Smoke and Haze Testing for The Phantom of the Opera, Majestic Theatre* (ENVIRON 2002)
(4) This study

The real-time aerosol monitor readings can be converted to glycol, mineral oil, or glycerol concentrations using the appropriate calibration factor for the fluid, as follows:

$$CONC = C \times PDR$$

where:

$CONC$ = air concentration of total glycols, mineral oil, or glycerin mist, mg/m^3
C = aerosol monitor calibration factor (from Table ES-1), $(mg/m^3)/(mg/m^3$ aerosol$)$
PDR = aerosol monitor reading, mg/m^3

These calculated concentrations can then be compared with the Peak Guidance levels:

- Glycols – 40 mg/m^3
- Mineral oil – 25 mg/m^3
- Glycerol – 50 mg/m^3