

## Appendix 3-E (Risk Chapter)

### Supplemental Occupational Exposure Assessment Methodology

#### Scenario I

The mass balance calculations for Scenario I were conducted as follows for each chemical with a vapor pressure less than 35 mmHg at 25°C (using the open surface model and the Fehrenbacher and Hummel vapor generation rate)<sup>1</sup>:

- All concentrations were converted from weight percent to mole percent.
- The diffusivity of each chemical in the formulation was calculated using the following equation:

$$D_{ab} = (4.09 \times 10^{-5} T^{1.9} (1/29 + 1/M)^{0.5} M^{-0.33}) / P_t$$

where:

$D_{ab}$	=	Diffusivity, cm <sup>2</sup> /sec
$T$	=	Temperature, K
$M$	=	Molecular weight, g/g-mole
$P_t$	=	Total pressure, atm

- The vapor generation rate of each chemical in the formulation was calculated using the following equation (Fehrenbacher and Hummel vapor generation rate):

$$G_i = (0.02 M X_i P_i^* (D_{ab} v_z / (P_i z))^{0.5}) / (RT)$$

where:

$G_i$	=	Vapor generation rate of substance i, g/m <sup>2</sup> -sec
$M$	=	Molecular weight, g/g-mole
$X_i$	=	Mole fraction of substance i in solution, dimensionless
$P_i^*$	=	Vapor pressure of pure substance i, mmHg at 25°C
$D_{ab}$	=	Diffusivity, cm <sup>2</sup> /sec
$v_z$	=	Air velocity above can, m/sec
$P_i$	=	The constant pi, 3.14159
$z$	=	Pool length in direction of air flow, m
$R$	=	Gas constant, 0.0624 mmHg-m <sup>3</sup> /mol-K
$T$	=	Temperature, K

- Using the assumptions presented in Section 3.5, the potential inhalation dose rate of each chemical in the formulation was estimated using the following equation:

$$I = 0.21G_iAt$$

where:

I	=	Total amount of substance inhaled, mg/day
G <sub>i</sub>	=	Vapor generation rate of substance i, g/m <sup>2</sup> -sec
A	=	Surface area of liquid/air interface, m <sup>2</sup>
t	=	Duration of exposure, sec/day

The mass balance calculations for Scenario I were conducted for each chemical with a vapor pressure greater than or equal to 35 mmHg at 25°C (using the open surface model and the Engel and Reilly vapor generation rate)<sup>2</sup>:

- All concentrations were converted from weight percent to mole percent.
- The “generalized” Schmidt number was calculated using the following equation:

$$Sc = (2.94T^{-0.9} + 0.0329T^{0.1})M^{0.33} / (1/28.9 + 1/M)^{0.5}$$

where:

Sc	=	Schmidt number, dimensionless
T	=	Temperature, K
M	=	Molecular weight, g/g-mole

- The vapor generation rate of each chemical in the formulation was calculated using the following equation (Engel and Reilly vapor generation rate):

$$G_i' = (2.1 \times 10^{-7}MX_iP_i^*Av_z^{0.78}) / (z^{0.11}Sc^{0.67}T)$$

where:

G <sub>i</sub> '	=	Vapor generation rate of substance i, g/sec (Note: the units of the Fehrenbacher and Hummel vapor generation rate, G <sub>i</sub> , are g/m <sup>2</sup> -sec, the units of the Engel and Reilly vapor generation rate, G <sub>i</sub> ', are g/sec)
M	=	Molecular weight, g/g-mole
X <sub>i</sub>	=	Mole fraction of substance i in solution, dimensionless
P <sub>i</sub> *	=	Vapor pressure of pure substance i, mmHg at 25°C
A	=	Surface area of liquid/air interface, cm <sup>2</sup>
v <sub>z</sub>	=	Air velocity above can, ft/min
z	=	Pool length in direction of air flow, cm
Sc	=	Schmidt number, dimensionless
T	=	Temperature, K

- Using the assumptions presented in Section 3.5, the potential inhalation dose rate of each chemical in the formulation was estimated using the following equation:

$$I = 0.21G_i't$$

where:

I	=	Total amount of substance inhaled, mg/day
$G_i'$	=	Vapor generation rate of substance i, g/sec
t	=	Duration of exposure, sec/day

## Scenario II

The mass balance calculations for Scenario II were conducted for each formulation (printing room mass balance model):

- The concentration of each chemical in the printing room was calculated using the following equation:

$$C_v = (1.7 \times 10^5 T G_i A) / (M Q k)$$

where:

$C_v$	=	Airborne concentration, ppm
T	=	Ambient temperature, K
$G_i$	=	Vapor generation rate of substance i, g/m <sup>2</sup> -sec
A	=	Surface area of liquid/air interface, m <sup>2</sup>
M	=	Molecular weight, g/g-mole
Q	=	Ventilation rate, ft <sup>3</sup> /min
k	=	Mixing factor, dimensionless

It was assumed that  $G_i A$  equals the fugitive emission rate.

- The volume-based concentrations calculated above were converted to mass-based concentrations using the equation:

$$C_m = C_v M / V$$

where:

$C_m$	=	Airborne concentration, mg/m <sup>3</sup>
$C_v$	=	Airborne concentration, ppm
M	=	Molecular weight, g/g-mole
V	=	Molar volume of ideal gas at 25°C and 760 mmHg, L/mole

- Calculate the potential inhalation dose rate of each chemical in the formulation using the following equation:

$$I = bC_m t$$

where:

I	=	Total amount of substance inhaled, mg/day
b	=	Worker inhalation rate, m <sup>3</sup> /hour
C <sub>m</sub>	=	Airborne concentration, mg/m <sup>3</sup>
t	=	Duration of exposure, hour/day

### Assumptions — Occupational Exposure Assessment Methodology

Additional assumptions associated with the Fehrenbacher and Hummel vapor generation rate are listed below:

- The surface temperature of the liquid and the evaporation rate are constant.
- The heat of evaporation is provided by the surroundings.
- Diffusion at the edge of the pool and in the direction of the air stream is negligible.
- The air velocity is constant and flowing in only one direction.
- There is no mixing in the area above the pool of liquid.
- There is no local exhaust present.
- There are no physical barriers present at the edges of the pool.
- There are no effects from heat transfer.
- The incoming air flowing over the pool of liquid is free of the contaminant of concern.

### Sample Calculation of Occupational Exposures

Following the method outlined above, occupational exposures for each chemical in the ink formulations were calculated. Applying this methodology to the example data presented in Table [3.10] results in the data presented in Table 3-E, below.

**Table 3-E Example Data for a Flexographic Printing Solvent-Based Formulation <sup>a</sup>**

Chemical component	Weight percent	Vapor pressure (mmHg at 25°C)	Scenario I (mg/day, typical)	Scenario II (mg/day, typical)
Ethanol	19.8%	59.03	6.2	530
Pigment	14.6%	<10 <sup>-6</sup>	0	0
Propyl acetate	10.0%	33.7	2.8	270
Propanol	43.3%	21	8.4	1,200
Nitrocellulose	2.7%	<10 <sup>-6</sup>	0	0
Resin	2.2%	2x10 <sup>-4</sup>	0	0
Glycol ether	1.3%	10.2	0.11	35
Extender	6.1%	0.001	4.3x10 <sup>-5</sup>	160

<sup>a</sup>The solvent-based formulation presented above is a fictional formulation.

Stepping through the calculations for ethanol:

**Scenario I:**

Ethanol has a vapor pressure greater than 35 mmHg at 25°C, so the open surface model and the Engel and Reilly vapor generation rate were used to estimate the worker exposure in Scenario I.

$$\bullet \quad Sc = (2.94T^{-0.9} + 0.0329T^{0.1})M^{0.33} / (1/28.9 + 1/M)^{0.5}$$

where:

$$T = 298 \text{ K (Table [3.11])}$$

$$M = 50 \text{ g/g-mole (Table [3.10])}$$

Therefore:

$$Sc = (2.94(298)^{-0.9} + 0.0329(298)^{0.1})50^{0.33} / (1/28.9 + 1/50)^{0.5}$$

$$Sc = 1.18$$

$$\bullet \quad G_i' = (2.1 \times 10^{-7} M P_i v_z^{0.78}) / (z^{0.11} Sc^{0.67} T)$$

where:

$$M = 50 \text{ g/g-mole (Table [3.10])}$$

$$X_i = 0.305 \text{ (Table [3.10])}$$

$$P_i^* = 59.03 \text{ mmHg at } 25^\circ\text{C (Table [3.10])}$$

$$A = [P_i (z/2)^2] = [3.14159(30.48/2)^2] \text{ cm}^2 = 729.659 \text{ cm}^2$$

(calculated from the diameter given below ( $z=0.3048\text{m}$ ))

$$v_z = 100 \text{ ft/min (Table [3.11])}$$

$$z = 1 \text{ ft} = 30.48 \text{ cm (Table [3.11])}$$

$$Sc = 1.18 \text{ (calculated above)}$$

$$T = 298 \text{ K (Table [3.11])}$$

Therefore:

$$G_i' = [2.1 \times 10^{-7} (50)(0.305)(59.03)(729.659)(100^{0.78})] / [(30.48^{0.11})(1.18^{0.67})(298)]$$

$$G_i' = 0.0103 \text{ g/sec}$$

$$\bullet \quad I = 0.21 G_i' t$$

where:

$$G_i' = 0.0103 \text{ g/sec (calculated above)}$$

$$t = 48 \text{ min/day} = 2,880 \text{ sec/day (Table [3.11])}$$

Therefore:

$$I = 0.21 (0.0103)(2,880)$$

$$I = 6.23 \text{ mg/day}$$

***Scenario II:***

- $C_v = (1.7 \times 10^5 T G_i A) / (MQk)$

where:

$$T = 298 \text{ K (Table [3.11])}$$

$$G_i A = \text{fugitive emission rate} = 0.096 \text{ g/sec (Table [D.1])}$$

$$M = 50 \text{ g/g-mole (Table [3.10])}$$

$$Q = 7,000 \text{ ft}^3/\text{min (Table [3.11])}$$

$$k = 0.5 \text{ (Table [3.11])}$$

Therefore:

$$C_v = [1.7 \times 10^5 (298)(0.096)] / [(50)(7,000)(0.5)]$$

$$C_v = 27.7 \text{ ppm}$$

- $C_m = C_v M / V$

where:

$$C_v = 27.7 \text{ ppm (calculated above)}$$

$$M = 50 \text{ g/g-mole (Table [3.10])}$$

$$V = 24.45 \text{ L/mole (molar volume of an ideal gas)}$$

Therefore:

$$C_m = [(27.7)(50)] / (24.45)$$

$$C_m = 56.7 \text{ mg/m}^3$$

- $I = b C_m t$

where:

$$b = 1.25 \text{ m}^3/\text{hour (medium work inhalation rate [3])}$$

$$C_m = 56.7 \text{ mg/m}^3 \text{ (calculated above)}$$

$$t = 7.5 \text{ hours/day (Table [4.1])}$$

Therefore:

$$I = (1.25)(56.7)(7.5)$$

$$I = 531 \text{ mg/day}$$

Ethanol has a vapor pressure greater than 35 mmHg at 25°C; therefore, the Engel and Reilly vapor generation rate was used for Scenario I. Propyl alcohol has a vapor pressure less than 35 mmHg at 25°C; therefore, the Fehrenbacher and Hummel vapor generation rate was used for Scenario I. These calculations are shown below:

**Scenario I:**

- $D_{ab} = (4.09 \times 10^{-5} T^{1.9} (1/29 + 1/M)^{0.5} M^{-0.33}) / P_i$

where:

$$T = 298 \text{ K (Table [3.11])}$$

$$M = 60 \text{ g/g-mole (Table [3.10])}$$

$$P_i = 1 \text{ atm (standard pressure)}$$

Therefore:

$$D_{ab} = (4.09 \times 10^{-5} (298)^{1.9} (1/29 + 1/60)^{0.5} 60^{-0.33}) / 1$$

$$D_{ab} = 0.120 \text{ cm}^2/\text{sec}$$

- $G_i = \{0.02 M X_i P_i^* [D_{ab} v_z / ((P_i) z)]^{0.5}\} / RT$

where:

$$M = 60 \text{ g/g-mole (Table [3.10])}$$

$$X_i = 0.555 \text{ (Table [3.10])}$$

$$P_i^* = 21 \text{ mmHg at } 25^\circ\text{C (Table [3.10])}$$

$$D_{ab} = 0.120 \text{ cm}^2/\text{sec (calculated above)}$$

$$v_z = 100 \text{ ft/min} = 0.508 \text{ m/sec (Table [3.11])}$$

$$P_i = \text{The constant } P_i, 3.14159$$

$$z = 1 \text{ ft} = 0.3048 \text{ m (Table [3.11])}$$

$$R = 0.0624 \text{ mmHg}\cdot\text{m}^3/\text{mol}\cdot\text{K (gas constant)}$$

$$T = 298 \text{ K (Table [3.11])}$$

Therefore:

$$G_i = \{0.02(60)(0.555)(21)[(0.120)(0.508)/((3.14159)(0.3048))]^{0.5}\} / [(0.0624)(298)]$$

$$G_i = 0.190 \text{ g/m}^2\text{-sec}$$

- $I = 0.21 G_i A t$

where:

$$G_i = 0.190 \text{ g/m}^2\text{-sec (calculated above)}$$

$$A = 0.0730 \text{ m}^2 \text{ (calculated from the diameter given above (} z=0.3048\text{m))}$$

$$t = 48 \text{ min/day} = 2,880 \text{ sec/day (Table [3.11])}$$

Therefore:

$$I = 0.21 (0.190)(0.0730)(2,880)$$

$$I = 8.39 \text{ mg/day}$$



**REFERENCES**

1. Fehrenbacher, M.C. and A.A. Hummel. "Evaluation of the Mass Balance Model Used by EPA for Estimating Inhalation Exposure to New Chemical Substances," American Industrial Hygiene Association, submitted for publication.
2. Engel, A.J. and B. Reilly. *Evaporation of Pure Liquids from Open Surfaces*. U.S. Environmental Protection Agency, Pre-Publication Draft.
3. Chemical Engineering Branch (CEB). *Manual for the Preparation of Engineering Assessments*, U.S. Environmental Protection Agency, February, 1991.

**Appendix 3-F (Risk Chapter)  
Occupational Exposure Data**

Table 3-F.1 Occupational Exposure Results, Scenario II (Press Room)<sup>a</sup>

Chemical category ( <i>additives in italics</i> )	Blue			Green			White			Cyan			Magenta		
	Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)	
		min.	max.		min.	max.		min.	max.		min.	max.		min.	max.
<b>Solvent-based Ink #S1 – Site 9B</b>															
Alcohols	204	62	186	146	35	106	547	21	63	71	21	63	92	26	79
Polyol derivatives	0	83	248	0	71	212	0	11	32	0	53	158	0	49	148
Resins	0	72	217	0	26	79	0	74	221	0	95	285	0	61	182
Water	0	4	12	0	4	13	0	2	6	0	2	6	0	2	6
Alcohols	1,293	392	1,177	1,096	265	794	7,116	273	820				490	141	424
Alkyl acetates	687	208	625	785	189	568	1,457	56	168				420	121	363
Resins	0	7	22	0	9	26				0	8	25	0	5	14
Pigments - organometallic	0	83	248	0	35	106				0	169	506			
Alcohols				2,190	529	1,586				2,561	766	2,297	2,349	678	2,033
Alkyl acetates				146	35	106				282	84	253	70	20	61
Propylene glycol ethers				146	35	106				176	53	158	140	40	121
Resins	0	72	217				0	116	347						
Organotitanium compounds	0	10	31				0	6	19						
Alkyl acetates	24	7	22				547	21	63						
Organic acids or salts	0	1	3				0	2	6						
Pigments - organometallic	0	52	155												
Aromatic esters	0	31	93												
Organic acids or salts	0	1	3												
Inorganics				0	4	13									
Pigments - organic				0	62	185									
Pigments - inorganic							0	452	1,357						
Hydrocarbons - low molecular weight							6,295	242	726						
Hydrocarbons - high molecular weight							0	11	32						
Inorganics													0	20	61
Pigments - organometallic													0	61	182
Pigments - organometallic													0	7	20
<i>Additive: Propanol</i>	706	214	642				353	14	41						

Table 3-F.1 Occupational Exposure Results, Scenario II (Press Room) <sup>a</sup> (continued)

Chemical category ( <i>additives in italics</i> )	Blue			Green			White			Cyan			Magenta		
	Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)	
		min.	max.		min.	max.		min.	max.		min.	max.		min.	max.
<i>Additive: Propyl acetate</i>										164	49	147			
<i>Additive: Propylene glycol propyl ether</i>													119	34	103
<i>Additive: Trade secret</i>													ND <sup>b</sup>	ND	ND
<b>Solvent-based Ink #S2 – Site 5</b>															
Alcohols	3,825	486	1,457	3,664	413	1,239	7,410	309	928	5,113	444	1,333	3,459	387	1,160
Alkyl acetates	877	111	334	777	88	263	351	15	44	1,442	125	376	892	100	299
Hydrocarbons - low molecular weight	790	100	301	1,172	132	396	3,889	162	487	1,016	88	265	1,771	198	594
Alcohols	475	60	181	540	61	183	800	33	100	707	61	184	975	109	327
Resins	0	267	801	0	279	838	0	266	798	0	286	858	0	193	580
Hydrocarbons - low molecular weight	40	5	15	31	3	10	166	7	21	64	6	17	63	7	21
Siloxanes	0	10	31	0	11	34	0	12	35	0	11	34	0	12	35
Amides or nitrogeneous compounds	0	10	31	0	11	34	0	12	35	0	11	34	0	12	35
Organic acids or salts	0	10	31	0	11	34	0	12	35	0	11	34	0	12	35
Alcohols	484	61	184	561	63	190				643	56	168	576	64	193
Polyol derivatives	0	38	114	0	22	66				0	38	114	0	30	91
Amides or nitrogeneous compounds	0	10	31	0	11	34				0	11	34	0	12	35
Organophosphorous compounds	0	10	31	0	11	34				0	11	34	0	12	35
Pigments - organometallic	0	77	230	0	21	62				0	140	419			
Pigments - inorganic				0	94	283	0	472	1,417						
Pigments - organometallic	0	43	129												
Pigments - organic				0	46	138									
Pigments - organometallic				0	20	60									
Pigments - inorganic													0	152	457

Table 3-F.1 Occupational Exposure Results, Scenario II (Press Room) <sup>a</sup> (continued)

Chemical category ( <i>additives in italics</i> )	Blue			Green			White			Cyan			Magenta		
	Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)	
		min.	max.		min.	max.		min.	max.		min.	max.		min.	max.
<b>Solvent-based Ink #S2 – Site 7</b>															
Alcohols	1,619	191	573	1,591	191	574	3,073	149	447	1,373	195	586	1,677	188	563
Alkyl acetates	1,449	171	513	1,350	162	487	1,749	85	255	1,273	181	543	1,485	166	498
Hydrocarbons - low molecular weight	610	72	216	663	80	239	2,519	122	366	416	59	177	1,103	123	370
Alcohols	367	43	130	305	37	110	518	25	75	289	41	124	607	68	204
Resins	0	192	575	0	169	506	0	200	600	0	192	575	0	120	361
Hydrocarbons - low molecular weight	31	4	11	17	2	6	107	5	16	26	4	11	39	4	13
Siloxanes	0	7	22	0	7	21	0	9	26	0	7	22	0	7	22
Amides or nitrogeous compounds	0	7	22	0	7	21	0	9	26	0	7	22	0	7	22
Organic acids or salts	0	7	22	0	7	21	0	9	26	0	7	22	0	7	22
Alcohols	4,053	478	1,434	4,173	502	1,506				3,312	471	1,414	4,290	480	1,439
Polyol derivatives	0	27	81	0	13	40				0	25	76	0	19	57
Amides or nitrogeous compounds	0	7	22	0	7	21				0	7	22	0	7	22
Organophosphorous compounds	0	7	22	0	7	21				0	7	22	0	7	22
Pigments - organometallic	0	55	165	0	12	37				0	94	281			
Pigments - inorganic				0	57	171	0	355	1,066						
Pigments - organometallic	0	31	93												
Pigments - organic				0	28	83									
Pigments - organometallic				0	12	36									
Pigments - inorganic													0	95	285
<i>Additive: Propanol</i>							6,855	332	997						

Table 3-F.1 Occupational Exposure Results, Scenario II (Press Room) <sup>a</sup> (continued)

Chemical category ( <i>additives in italics</i> )	Blue			Green			White			Cyan			Magenta		
	Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)	
		min.	max.		min.	max.		min.	max.		min.	max.		min.	max.
<b>Solvent-based Ink #S2 – Site 10</b>															
Alcohols	1,310	183	548	1,624	199	597	2,712	140	421	1,324	175	524	1,386	164	492
Alkyl acetates	838	117	350	835	102	307	945	49	147	1,028	135	406	415	49	147
Hydrocarbons - low molecular weight	494	69	206	677	83	249	2,223	115	345	401	53	159	911	108	323
Alcohols	297	41	124	312	38	115	457	24	71	279	37	110	502	59	178
Resins	0	183	550	0	175	525	0	188	565	0	171	514	0	105	316
Hydrocarbons - low molecular weight	25	4	11	18	2	6	95	5	15	25	3	10	32	4	11
Siloxanes	0	7	21	0	7	22	0	8	24	0	7	20	0	6	19
Amides or nitrogeneous compounds	0	7	21	0	7	22	0	8	24	0	7	20	0	6	19
Organic acids or salts	0	7	21	0	7	22	0	8	24	0	7	20	0	6	19
Alcohols	4,019	560	1,681	4,387	537	1,612				2,301	303	910	5,274	624	1,871
Polyol derivatives	0	26	78	0	14	41				0	23	68	0	17	50
Amides or nitrogeneous compounds	0	7	21	0	7	22				0	7	20	0	6	19
Organophosphorous compounds	0	7	21	0	7	22				0	7	20	0	6	19
Pigments - organometallic	0	53	158	0	13	39				0	84	251			
Pigments - inorganic				0	59	177	0	334	1,003						
Pigments - organometallic	0	29	88												
Pigments - organic				0	29	86									
Pigments - organometallic				0	13	38									
Pigments - inorganic													0	83	249
<i>Additive: Propanol</i>							8,128	420	1,261						
<i>Additive: Propylene glycol methyl ether</i>										2,099	277	830	463	55	164
<i>Additive: 2-Methoxy-1-propanol</i>										43	6	17	9	1	3

Table 3-F.1 Occupational Exposure Results, Scenario II (Press Room) <sup>a</sup> (continued)

Chemical category ( <i>additives in italics</i> )	Blue			Green			White			Cyan			Magenta		
	Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)	
		min.	max.		min.	max.		min.	max.		min.	max.		min.	max.
<b>Water-based Ink #W1 – Site 4</b>															
Water	0	342	1,025	0	438	1,314	0	265	795	0	567	1,700	0	603	1,809
Amides or nitrogenous compounds	86	19	56	73	19	57	545	27	82	22	10	29	24	10	31
Alcohols	668	146	437	383	99	298	1,089	55	164	81	36	107			
Acrylic acid polymers	0	522	1,566	0	371	1,113				0	39	118	0	39	118
Acrylic acid polymers	0	21	64	0	39	116				0	36	107	0	38	115
Ethylene glycol ethers	212	46	139	127	33	99				149	66	197	154	66	199
Resins	0	35	105	0	35	106	0	105	314						
Acrylic acid polymers							0	311	933	0	267	801	0	269	806
Organic acids or salts							0	37	112	0	49	147	0	36	107
Alcohols	34	8	23	20	5	15									
Hydrocarbons - high molecular weight	126	28	83	68	18	53									
Pigments - organometallic	0	108	325							0	223	670			
Pigments - organic	0	26	77												
Pigments - organometallic				0	195	585									
Pigments - organic				0	47	142									
Pigments - inorganic							0	467	1,400						
Ethylene glycol ethers										0	8	25			
Pigments - organic													0	239	716
<i>Additive: Ethoxylated tetramethyldecyldiol</i>							0	33	100						

Table 3-F.1 Occupational Exposure Results, Scenario II (Press Room) <sup>a</sup> (continued)

Chemical category ( <i>additives in italics</i> )	Blue			Green			White			Cyan			Magenta		
	Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)	
		min.	max.		min.	max.		min.	max.		min.	max.		min.	max.
<b>Water-based Ink #W2 – Site 1</b>															
Water	0	687	2,062	0	731	2,192	0	463	1,390	0	686	2,057	0	523	1,569
Acrylic acid polymers	0	64	192	0	101	302	0	355	1,066				0	188	564
Amides or nitrogenous compounds	11	3	8	21	7	21	616	34	102				16	20	60
Hydrocarbons - high molecular weight	10	3	8	13	4	13	102	6	17				4	5	15
Ethylene glycol ethers	0	25	75	0	45	134				0	36	108	0	50	150
Resins	0	98	294	0	60	181				0	180	541			
Ethylene glycol ethers	0	4	12	0	6	18							0	11	34
Resins	0	125	376	0	223	670							0	251	752
Hydrocarbons - low molecular weight	5	1	4	7	2	7							2	2	7
Pigments - organometallic	0	147	441							0	361	1,082			
Pigments - organic	0	28	85										0	226	679
Hydrocarbons - high molecular weight	2	1	2												
Inorganics	0	5	16												
Pigments - organic	0	37	111												
Pigments - organic				0	121	362									
Pigments-inorganic							0	410	1,231						
Alcohols							256	14	42						
Ethylene glycol ethers							256	14	42						
<i>Additive: Isobutanol</i>	4	1	3							9	11	33	9	11	34
<i>Additive: Ethyl carbitol</i>	4	1	3							9	11	33	9	11	34
<i>Additive: Propanol</i>	284	70	209				63	3	10						
<i>Additive: Ammonia</i>										13	15	45			



Table 3-F.1 Occupational Exposure Results, Scenario II (Press Room) <sup>a</sup> (continued)

Chemical category ( <i>additives in italics</i> )	Blue			Green			White			Cyan			Magenta		
	Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)	
		min.	max.		min.	max.		min.	max.		min.	max.		min.	max.
<b>Water-based Ink #W3 – Site 2</b>															
Water	0	952	2,855	0	831	2,492	0	618	1,853	0	750	2,251	0	884	2,653
Acrylic acid polymers	0	131	393	0	183	548	0	187	561	0	299	896	0	202	606
Amides or nitrogenous compounds	140	21	63	187	28	85	307	19	56	108	38	113	115	26	78
Acrylic acid polymers	0	45	135	0	85	255	0	64	193	0	65	195	0	75	224
Olefin polymers	0	6	17	0	8	24	0	10	31	0	16	48	0	11	32
Siloxanes	0	6	19	0	5	16	0	8	25	0	11	34	0	9	27
Organic acids or salts	0	1	3	0	2	5	0	2	6	0	2	7	0	2	5
Ethylene glycol ethers	0	9	26				0	13	40	0	14	41	0	11	32
Propylene glycol ethers										16	6	17	18	4	12
Alcohols										0	5	14	0	1	2
Pigments - organic	0	98	294												
Alcohols				86	13	39									
Ethylene glycol ethers				42	6	19									
Pigments - organic				0	28	84									
Pigments - organometallic				0	99	298									
Pigments - inorganic							0	357	1,072						
Alcohols							85	5	15						
Pigments - organometallic										0	90	270			
Pigments - organometallic													0	71	214
<i>Additive: Ammonia</i>	10	2	5	6	1	3	11	1	2	13	5	14	13	3	9
<i>Additive: Propanol</i>	129	19	58	68	10	31	258	16	47				3	1	2
<i>Additive: Isopropanol</i>	2	0	1	ND	ND	ND	3	0	1				2	0	1
<i>Additive: Polyfunctional aziridine</i>	0	5	16												
<i>Additive: Other components</i>	ND	ND	ND												

Table 3-F.1 Occupational Exposure Results, Scenario II (Press Room) <sup>a</sup> (continued)

Chemical category ( <i>additives in italics</i> )	Blue			Green			White			Cyan			Magenta		
	Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)	
		min.	max.		min.	max.		min.	max.		min.	max.		min.	max.
<b>Water-based Ink #W3 – Site 3</b>															
Water	0	782	2,345	0	644	1,932	0	503	1,508	0	715	2,145	0	720	2,161
Acrylic acid polymers	0	178	535	0	262	785	0	197	592	0	315	944	0	274	822
Amides or nitrogenous compounds	99	28	85	185	40	121	435	19	58	52	40	119	33	35	105
Acrylic acid polymers	0	61	184	0	122	365	0	68	204	0	68	205	0	102	305
Olefin polymers	0	8	23	0	12	35	0	11	32	0	17	50	0	15	44
Siloxanes	0	9	26	0	8	23	0	9	26	0	12	36	0	12	37
Organic acids or salts	0	1	4	0	3	8	0	2	6	0	2	7	0	2	7
Ethylene glycol ethers	0	12	35				0	14	42	0	14	43	0	15	44
Propylene glycol ethers										8	6	18	5	6	17
Alcohols										0	5	14	0	1	3
Pigments - organic	0	134	401												
Alcohols				83	18	54									
Ethylene glycol ethers				42	9	27									
Pigments - organic				0	40	121									
Pigments - organometallic				0	143	428									
Pigments-inorganic							0	377	1,132						
Alcohols							121	5	16						
Pigments - organometallic										0	95	285			
Pigments - organometallic													0	97	291
<i>Additive: Ammonia</i>	83	24	71	2	0	1	135	6	18	14	11	33	14	15	45
<i>Additive: Propanol</i>	221	63	190				977	44	131						
<i>Additive: Extenders</i>							ND	ND	ND						
<i>Additive: 2-Butoxyethanol</i>													6	6	19

Table 3-F.1 Occupational Exposure Results, Scenario II (Press Room) <sup>a</sup> (continued)

Chemical category ( <i>additives in italics</i> )	Blue			Green			White			Cyan			Magenta		
	Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)	
		min.	max.		min.	max.		min.	max.		min.	max.		min.	max.
<b>Water-based Ink #W4 – Site 9A</b>															
Water	0	678	2,035	0	527	1,582	0	395	1,185	0	659	1,978	0	728	2,185
Alcohols	73	42	125	34	20	61	335	24	73	117	58	174	48	36	107
Amides or nitrogenous compounds	9	5	16	9	5	15	84	6	18	14	7	21	16	12	36
Hydrocarbons - high molecular weight	9	5	16	9	5	15	84	6	18	8	4	13	8	6	18
Siloxanes	0	5	16	0	5	15	0	6	18	0	4	13	0	6	18
Alcohols	0	5	16	0	5	15	0	6	18	0	4	13	0	6	18
Acrylic acid polymers	0	130	390	0	127	381	0	152	456	0	105	314			
Amides or nitrogenous compounds	10	6	18	34	20	61				8	4	13	48	36	107
Resins	0	78	234	0	76	229				0	63	189			
Pigments - organometallic	0	182	545	0	20	61				0	147	440			
Alcohols				111	66	199	335	24	73				70	51	154
Propylene glycol ethers	73	42	125							0	60	180			
Propylene glycol ethers	73	42	125							110	55	164			
Pigments - inorganic				0	356	1,068	0	632	1,895						
Amides or nitrogenous compounds				9	5	15	84	6	18						
Pigments - organometallic	0	42	125												
Pigments - organic				0	36	107									
Pigments - organometallic				0	20	61									
Inorganics							0	43	128						
Alcohols										34	17	50			
Pigments - organometallic													0	208	624

Table 3-F.1 Occupational Exposure Results, Scenario II (Press Room) <sup>a</sup> (continued)

Chemical category ( <i>additives in italics</i> )	Blue			Green			White			Cyan			Magenta		
	Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)	
		min.	max.		min.	max.		min.	max.		min.	max.		min.	max.
Resins													0	208	624
<i>Additive: Ammonia</i>	10	6	18	8	5	14				12	6	18	4	3	8
<i>Additive: Propanol</i>	59	34	101							70	35	104			
<i>Additive: Solids</i>										0	71	214			
<i>Additive: Ethyl carbitol</i>										ND	ND	ND			
<i>Additive: Petroleum distillate</i>										ND	ND	ND			
<b>UV-cured Ink #U1 – Site 11</b>															
Acrylated polymers	0	209	626	0	204	612	0	125	375	0	209	626	0	209	626
Amides or nitrogenous compounds	22	10	31	24	10	31	137	9	26	8	10	31	8	10	31
Aromatic esters	105	49	146	113	48	143	638	40	119	39	49	146	38	49	146
Aromatic ketones	0	28	83	0	27	82	0	9	26	0	28	83	0	28	83
Olefin polymers	0	10	31	0	10	31	0	9	26	0	10	31	0	10	31
Siloxanes	0	10	31	0	10	31	0	9	26	0	10	31	0	10	31
Acrylated polymers	0	765	2,294	0	748	2,245				0	765	2,294	0	765	2,294
Aromatic ketones	0	10	31	0	10	31				0	10	31	0	10	31
Pigments - organic	0	209	626												
Pigments - organometallic				0	204	612									
Pigments - inorganic							0	454	1,362						
Acrylated polymers							0	284	852						
Acrylated polymers							0	170	511						
Pigments - inorganic							0	170	511						
Organophosphorous compounds							0	23	68						
Pigments - organometallic										0	209	626			
Pigments - organometallic													0	209	626
<i>Additive: 1,6-Hexanediol diacrylate</i>				66	28	83									

Table 3-F.1 Occupational Exposure Results, Scenario II (Press Room) <sup>a</sup> (continued)

Chemical category ( <i>additives in italics</i> )	Blue			Green			White			Cyan			Magenta		
	Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)	
		min.	max.		min.	max.		min.	max.		min.	max.		min.	max.
<b>UV-cured Ink #U2 – Site 6</b>															
Acrylated polymers	0	347	1,041	0	280	839	0	91	274	0	369	1,108	0	225	675
Acrylated polyols	392	163	490	327	259	778	2,910	321	963	124	125	375	205	132	396
Acrylated polyols	281	117	351	92	73	218	1,181	130	391	141	142	425	161	104	312
Acrylated polyols	0	19	56	0	50	151	0	80	241	0	3	8	0	36	107
Alcohols	0	13	39	0	13	39	0	13	39	0	13	39	0	13	39
Aromatic ketones	0	39	117	0	39	117	0	39	117	0	39	116	0	39	117
Aromatic ketones	94	39	117	49	39	117	325	36	108	38	39	116	60	39	117
Aromatic ketones	0	39	117	0	39	117	0	20	59	0	39	116	0	39	117
Aromatic ketones	0	13	39	0	13	39	0	3	8	0	13	39	0	13	39
Olefin polymers	0	13	39	0	13	39	0	13	39	0	13	39	0	13	39
Acrylated polymers	0	147	441	0	160	479				0	141	424	0	191	573
Polyol derivatives	0	100	299	0	92	275				0	104	311	0	142	425
Acrylated polymers	0	60	179	0	55	165				0	62	187	0	104	312
Pigments - organometallic	0	136	408							0	200	599			
Pigments - organic	0	55	166												
Pigments - organometallic				0	136	407									
Pigments - organic				0	40	120									
Pigments - inorganic							0	521	1,564						
Organophosphorous compounds							0	33	98						
Pigments - organometallic													0	211	632

Table 3-F.1 Occupational Exposure Results, Scenario II (Press Room) <sup>a</sup> (continued)

Chemical category ( <i>additives in italics</i> )	Blue			Green			White			Cyan			Magenta		
	Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)	
		min.	max.		min.	max.		min.	max.		min.	max.		min.	max.
<b>UV-cured Ink #U3 – Site 8</b>															
Acrylated polymers	0	765	2,294	0	765	2,294	0	419	1,258	0	765	2,294	0	765	2,294
Aromatic esters	44	49	146	41	49	146	380	42	126	32	49	146	26	49	146
Amides or nitrogeous compounds	9	10	31	9	10	31	81	9	27	7	10	31	6	10	31
Siloxanes	0	10	31	0	10	31	0	9	27	0	10	31	0	10	31
Olefin polymers	0	10	31	0	10	31	0	9	27	0	10	31	0	10	31
Aromatic ketones	0	10	31	0	10	31	0	9	27	0	10	31	0	10	31
Acrylated polyols	187	209	626	177	209	626				136	209	626	111	209	626
Aromatic ketones	0	28	83	0	28	83				0	28	83	0	28	83
Pigments - organic	0	209	626												
Pigments - organometallic				0	209	626									
Pigments - inorganic							0	509	1,528						
Acrylated polymers							0	180	539						
Acrylated polymers							0	90	270						
Organophosphorous compounds							0	24	72						
Pigments - organic										0	209	626			
Pigments - organometallic													0	209	626

<sup>a</sup> Shaded areas indicate where data are not applicable (i.e., the chemical category was not found in the particular color and formulation).

<sup>b</sup> No data or information available.

Table 3-F.2 Occupational Exposure Results, Scenario I (Ink Preparation Room)<sup>a</sup>

Chemical category	Blue			Green			White			Cyan			Magenta		
	Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)	
		min.	max.		min.	max.		min.	max.		min.	max.		min.	max.
<b>Solvent-based Ink #S1</b>															
Alcohols	2	78	234	1	52	156	0	21	64	1	26	78	1	39	117
Polyol derivatives	0	104	312	0	104	312	0	11	32	0	65	195	0	65	195
Resins	0	91	273	0	39	117	0	75	224	0	117	351	0	117	351
Water	0	5	16	0	7	20	0	2	6	0	3	8	0	4	12
Alcohols	13	494	1,482	9	390	1,170	7	277	831				7	273	819
Alkyl acetates	4	195	585	3	156	468	1	53	160				2	104	312
Resins	0	9	27	0	13	39				0	10	31	0	9	27
Pigments-organometallic	0	104	312	0	52	156				0	208	624			
Alcohols				4	286	858				12	702	2,106	6	403	1,209
Alkyl acetates				0	52	156				1	104	312	0	39	117
Propylene glycol ethers				0	52	156				0	65	195	0	78	234
Resins	0	91	273				0	117	352						
Organotitanium compounds	0	13	39				0	6	19						
Alkyl acetates	0	9	27				1	21	64						
Organic acids or salts	0	1	4				0	2	6						
Pigments-organometallic	0	65	195												
Aromatic esters	0	39	117												
Organic acids or salts	0	1	4												
Inorganics				0	7	20									
Pigments-organic				0	91	273									
Pigments-inorganic															
Hydrocarbons - low molecular weight							30	245	735						
Hydrocarbons - high molecular weight							0	11	32						
Inorganics													0	39	117
Pigments-organometallic													0	117	351
Pigments-organometallic													0	13	39

Table 3-F.2 Occupational Exposure Results, Scenario I (Ink Preparation Room) <sup>a</sup> (continued)

Chemical category	Blue			Green			White			Cyan			Magenta		
	Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)	
		min.	max.		min.	max.		min.	max.		min.	max.		min.	max.
<b>Solvent-based Ink #S2</b>															
Alcohols	11	328	983	10	345	1,036	6	219	657	11	335	1,006	10	325	975
Alkyl acetates	3	107	321	2	84	252	0	3	8	3	125	374	2	97	292
Hydrocarbons - low molecular weight	2	123	370	3	144	432	3	180	539	2	101	304	4	214	641
Alcohols	2	74	223	2	66	199	1	37	111	2	71	212	3	118	353
Resins	0	329	986	0	304	913	0	294	882	0	329	987	0	209	626
Hydrocarbons - low molecular weight	1	6	19	1	4	11	1	8	23	1	6	19	1	8	23
Siloxanes	0	13	38	0	13	38	0	13	38	0	13	39	0	13	38
Amides or nitrogeous compounds	0	13	38	0	13	38	0	13	38	0	13	39	0	13	38
Organic acids or salts	0	13	38	0	13	38	0	13	38	0	13	39	0	13	38
Alcohols	1	76	227	1	69	207				1	64	193	1	70	209
Polyol derivatives	0	47	140	0	24	71				0	44	131	0	33	99
Amides or nitrogeous compounds	0	13	38	0	13	38				0	13	39	0	13	38
Organophosphorous compounds	0	13	38	0	13	38				0	13	39	0	13	38
Pigments-organometallic	0	94	283	0	23	68				0	161	482			
Pigments-inorganic				0	103	308	0	522	1,566						
Pigments-organometallic	0	53	159												
Pigments-organic				0	50	150									
Pigments-organometallic				0	22	66									
Pigments-inorganic													0	164	493



Table 3-F.2 Occupational Exposure Results, Scenario I (Ink Preparation Room) <sup>a</sup> (continued)

Chemical category	Blue			Green			White			Cyan			Magenta		
	Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)	
		min.	max.		min.	max.		min.	max.		min.	max.		min.	max.
<b>Water-based Ink #W1</b>															
Water	0	326	979	0	424	1,273	0	254	761	0	551	1,652	0	588	1,765
Amides or nitrogenous compounds	15	20	59	12	19	58	22	29	86	5	10	29	5	10	31
Alcohols	1	130	390	1	94	281	1	57	172	0	37	110			
Acrylic acid polymers	0	542	1,626	0	381	1,142				0	40	121	0	40	121
Acrylic acid polymers	0	22	66	0	40	119				0	37	110	0	39	117
Ethylene glycol ethers	0	48	144	0	34	101				0	67	201	0	68	203
Resins	0	36	109	0	36	109	0	109	328						
Acrylic acid polymers							0	325	975	0	273	818	0	274	823
Organic acids or salts							0	39	117	0	50	150	0	36	109
Alcohols	0	8	23	0	5	16									
Hydrocarbons-high molecular weight	0	29	86	0	18	55									
Pigments-organometallic	0	112	337							0	228	685			
Pigments-organic	0	27	80												
Pigments-organometallic				0	200	600									
Pigments-organic				0	49	146									
Pigments-inorganic							0	488	1,463						
Ethylene glycol ethers										0	9	26			
Pigments-organic													0	244	731

Table 3-F.2 Occupational Exposure Results, Scenario I (Ink Preparation Room) <sup>a</sup> (continued)

Chemical category	Blue			Green			White			Cyan			Magenta		
	Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)	
		min.	max.		min.	max.		min.	max.		min.	max.		min.	max.
<b>Water-based Ink #W2</b>															
Water	0	721	2,162	0	666	1,999	0	455	1,365	0	706	2,117	0	539	1,617
Acrylic acid polymers	0	48	144	0	112	337	0	371	1,113				0	194	581
Amides or nitrogenous compounds	1	3	8	3	5	14	7	10	31				3	5	14
Hydrocarbons-high molecular weight	0	3	8	0	5	15	0	6	18				0	5	15
Ethylene glycol ethers	0	26	79	0	50	150				0	37	111	0	52	155
Resins	0	113	339	0	67	202				0	186	557			
Ethylene glycol ethers	0	3	9	0	7	20							0	12	35
Resins	0	131	393	0	250	750							0	258	775
Hydrocarbons-low molecular weight	0	1	4	0	2	7							0	3	8
Pigments-organometallic	0	170	509							0	371	1,114			
Pigments-organic	0	33	98										0	233	700
Hydrocarbons-high molecular weight	0	1	2												
Inorganics	0	6	19												
Pigments-organic	0	43	128												
Pigments-organic				0	135	405									
Pigments-inorganic							0	428	1,285						
Alcohols							0	15	44						
Ethylene glycol ethers							0	15	44						

Table 3-F.2 Occupational Exposure Results, Scenario I (Ink Preparation Room) <sup>a</sup> (continued)

Chemical category	Blue			Green			White			Cyan			Magenta		
	Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)	
		min.	max.		min.	max.		min.	max.		min.	max.		min.	max.
<b>Water-based Ink #W3</b>															
Water	0	725	2,174	0	642	1,927	0	452	1,357	0	667	2,002	0	657	1,970
Acrylic acid polymers	0	238	714	0	263	788	0	238	714	0	347	1,041	0	316	948
Amides or nitrogenous compounds	15	38	113	18	40	121	12	23	70	19	44	131	18	40	121
Acrylic acid polymers	0	82	246	0	122	367	0	82	246	0	75	226	0	117	351
Olefin polymers	0	10	31	0	12	35	0	13	39	0	19	56	0	17	51
Siloxanes	0	12	35	0	8	23	0	10	31	0	13	40	0	14	43
Organic acids or salts	0	2	6	0	3	8	0	3	8	0	3	8	0	3	8
Ethylene glycol ethers	0	16	47				0	17	51	0	16	48	0	17	51
Propylene glycol ethers										0	7	20	0	7	20
Alcohols										0	5	16	0	1	4
Pigments-organic	0	178	534												
Alcohols				0	18	55									
Ethylene glycol ethers				0	9	27									
Pigments-organic				0	40	121									
Pigments-organometallic				0	143	429									
Pigments-inorganic							0	455	1,365						
Alcohols							0	7	20						
Pigments-organometallic										0	105	314			
Pigments-organometallic													0	112	335

Table 3-F.2 Occupational Exposure Results, Scenario I (Ink Preparation Room) <sup>a</sup> (continued)

Chemical category	Blue			Green			White			Cyan			Magenta		
	Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)	
		min.	max.		min.	max.		min.	max.		min.	max.		min.	max.
<b>Water-based Ink #W4</b>															
Water	0	613	1,840	0	460	1,381	0	423	1,268	0	591	1,773	0	694	2,083
Alcohols	0	49	147	0	23	69	0	26	78	0	53	158	0	44	133
Amides or nitrogenous compounds	0	6	18	0	6	17	0	7	20	0	7	20	0	13	38
Hydrocarbons-high molecular weight	0	6	18	0	6	17	0	7	20	0	7	20	0	6	19
Siloxanes	0	6	18	0	6	17	0	7	20	0	7	20	0	6	19
Alcohols	0	6	18	0	6	17	0	7	20	0	7	20	0	6	19
Acrylic acid polymers	0	153	460	0	144	431	0	163	488	0	164	492			
Amides or nitrogenous compounds	0	6	18	0	23	69				0	7	20	0	44	133
Resins	0	92	276	0	86	259				0	98	295			
Pigments-organometallic	0	215	644	0	23	69				0	230	689			
Alcohols				0	46	138	0	26	78				0	44	133
Propylene glycol ethers	0	49	147							0	53	158			
Propylene glycol ethers	0	49	147							0	53	158			
Pigments-inorganic				0	403	1,208	0	585	1,755						
Amides or nitrogenous compounds				3	6	17	3	7	20						
Pigments-organometallic	0	49	147												
Pigments-organic				0	40	121									
Pigments-organometallic				0	23	69									
Inorganics							0	46	137						
Alcohols										0	26	79			
Pigments-organometallic													0	221	663
Resins													0	221	663

Table 3-F.2 Occupational Exposure Results, Scenario I (Ink Preparation Room) <sup>a</sup> (continued)

Chemical category	Blue			Green			White			Cyan			Magenta		
	Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)	
		min.	max.		min.	max.		min.	max.		min.	max.		min.	max.
<b>UV-cured Ink #U1</b>															
Acrylated polymers	0	209	626	0	209	626	0	125	375	0	209	626	0	209	626
Amides or nitrogenous compounds	0	10	31	0	10	31	0	9	26	0	10	31	0	10	31
Aromatic esters	0	49	146	0	49	146	0	40	119	0	49	146	0	49	146
Aromatic ketones	0	28	83	0	28	83	0	9	26	0	28	83	0	28	83
Olefin polymers	0	10	31	0	10	31	0	9	26	0	10	31	0	10	31
Siloxanes	0	10	31	0	10	31	0	9	26	0	10	31	0	10	31
Acrylated polymers	0	765	2,294	0	765	2,294				0	765	2,294	0	765	2,294
Aromatic ketones	0	10	31	0	10	31				0	10	31	0	10	31
Pigments-organic	0	209	626												
Pigments-organometallic				0	209	626									
Pigments-inorganic							0	454	1,362						
Acrylated polymers							0	284	852						
Acrylated polymers							0	170	511						
Pigments-inorganic							0	170	511						
Organophosphorous compounds							0	23	68						
Pigments-organometallic										0	209	626			
Pigments-organometallic													0	209	626

Table 3-F.2 Occupational Exposure Results, Scenario I (Ink Preparation Room) <sup>a</sup> (continued)

Chemical category	Blue			Green			White			Cyan			Magenta		
	Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)	
		min.	max.		min.	max.		min.	max.		min.	max.		min.	max.
<b>UV-cured Ink #U2</b>															
Acrylated polymers	0	347	1,041	0	280	839	0	91	274	0	369	1,108	0	225	675
Acrylated polyols	0	163	490	0	259	778	0	321	963	0	125	375	0	132	396
Acrylated polyols	0	117	351	0	73	218	0	130	391	0	142	425	0	104	312
Acrylated polyols	0	19	56	0	50	151	0	80	241	0	3	8	0	36	107
Alcohols	0	13	39	0	13	39	0	13	39	0	13	39	0	13	39
Aromatic ketones	0	39	117	0	39	117	0	39	117	0	39	116	0	39	117
Aromatic ketones	0	39	117	0	39	117	0	36	108	0	39	116	0	39	117
Aromatic ketones	0	39	117	0	39	117	0	20	59	0	39	116	0	39	117
Aromatic ketones	0	13	39	0	13	39	0	3	8	0	13	39	0	13	39
Olefin polymers	0	13	39	0	13	39	0	13	39	0	13	39	0	13	39
Acrylated polymers	0	147	441	0	160	479				0	141	424	0	191	573
Polyol derivatives	0	100	299	0	92	275				0	104	311	0	142	425
Acrylated polymers	0	60	179	0	55	165				0	62	187	0	104	312
Pigments-organometallic	0	136	408							0	200	599			
Pigments-organic	0	55	166												
Pigments-organometallic				0	136	407									
Pigments-organic				0	40	120									
Pigments-inorganic							0	521	1,564						
Organophosphorous compounds							0	33	98						
Pigments-organometallic													0	211	632

Table 3-F.2 Occupational Exposure Results, Scenario I (Ink Preparation Room) <sup>a</sup> (continued)

Chemical category	Blue			Green			White			Cyan			Magenta		
	Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)		Inhalation exposure (mg/day)	Dermal exposure (mg/day)	
		min.	max.		min.	max.		min.	max.		min.	max.		min.	max.
<b>UV-cured Ink #U3</b>															
Acrylated polymers	0	765	2,294	0	765	2,294	0	419	1,258	0	765	2,294	0	765	2,294
Aromatic esters	0	49	146	0	49	146	0	42	126	0	49	146	0	49	146
Amides or nitrogenous compounds	0	10	31	0	10	31	0	9	27	0	10	31	0	10	31
Siloxanes	0	10	31	0	10	31	0	9	27	0	10	31	0	10	31
Olefin polymers	0	10	31	0	10	31	0	9	27	0	10	31	0	10	31
Aromatic ketones	0	10	31	0	10	31	0	9	27	0	10	31	0	10	31
Acrylated polyols	0	209	626	0	209	626				0	209	626	0	209	626
Aromatic ketones	0	28	83	0	28	83				0	28	83	0	28	83
Pigments-organic	0	209	626												
Pigments-organometallic				0	209	626									
Pigments-inorganic							0	509	1,528						
Acrylated polymers							0	180	539						
Acrylated polymers							0	90	270						
Organophosphorous compounds							0	24	72						
Pigments-organic										0	209	626			
Pigments-organometallic													0	209	626

<sup>a</sup> Shaded areas indicate where data are not applicable (i.e., the chemical category was not found in the particular color and formulation).