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WASHINGTON, D.C. 20460

OFFICE OF CHEMICAL SAFETY
AND POLLUTION PREVENTION

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MEMORANDUM

Subject: Respirator Requirements for the AEATF Airless Sprayer Exposure Study

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Introduction

The purpose of this memo is to determine what respiratory protection is needed for study subjects participating in the airless sprayer exposure study (AEA10) that will be conducted by the Antimicrobial Exposure Assessment Task Force (AEATF).

Hazard Characterization of the Paint to be used in the study

The Safety Data Sheet (SDS) for the paint to be used in the airless sprayer study (Sherwin Williams SUPERPAINT Interior Flat Latex Wall Paint) indicates in Section 3 that there are six ingredients that are hazardous to human health (Sherwin Williams, 2017a). These ingredients include titanium dioxide (14.91%), calcium carbonate (10.89%), amorphous silica (1.97%), cristobalite (1.85%), aluminum hydroxide (1.41%) and crystalline silica (0.26%). All six of these ingredients are particulates. In the supplement label element section, the SDS has a statement that "Abrading or sanding of the dry film may release crystalline silica which has been shown to cause lung damage and cancer under long term exposure".

The Environmental Data Sheet (EDS) for SUPERPAINT indicates that the percent non-volatile content is 60.2% by weight (Sherwin Williams, 2017b). The sum total of the six ingredients listed on the SDS is 31.3% by weight and is it assumed that the remaining 29% consists of the acrylic latex binders and resins that are non-hazardous. The organic volatiles content is listed on

the EDS as 0.9% by weight according to EPA criteria and 1.3% by weight according to California criteria. The California criteria includes 2-amino-2-methy-1-propanol (0.4% by weight) which is excluded from the EPA criteria.

Based on the low VOC content in the paint, VOC exposures are anticipated to be low and respirators are only needed for protection to particulates.

Of the six ingredients listed in the SDS, five have substance specific exposure limits. Titanium dioxide has an OSHA PEL of 15 mg/m³ and a NIOSH REL of 2.4 mg/m³. The OSHA PEL is based on the total mass collected on a 37 mm cassette filter and the NIOSH REL is based on the respirable fraction. Amorphous Silica has an OSHA PEL of 80 mg/m³ divided by the silica content and a NIOSH REL of 6 mg/m³. Both are based on the total mass. Cristobalite, which is a crystalline form of silica, and crystalline silica both have an OSHA PEL of 0.05 mg/m³ which is measured as a respirable aerosol. Aluminum hydroxide has a NIOSH REL of 2.0 mg/m³. The remaining ingredient, calcium carbonate does not a substance specific exposure limit.

Although the paint contains approximately 2.0 percent crystalline silica, which has low exposure limit of 0.05 mg/m³, this limit is for the respirable aerosols which are not likely to occur because the silica powder is encapsulated within the paint spray droplets. Because of this the painter exposure will be evaluated using OELs for nuisance particulates. These OELs include the OSHA PEL of 15 mg/m³ for nuisance dust, total and the American Conference of Governmental Industrial Hygienist (ACGIH) Threshold Limit Value (TLV) of 10 mg/m³ for the inhalable fraction of Particulates (insoluble or poorly soluble) Not Otherwise Specified (PNOS).

Calculation of Paint Particulate Air Concentrations

The unit inhalation exposure value of 0.56 mg ai/lb ai handled as listed in US EPA (2012) is based upon 15 monitoring events (MEs) from the Pesticide Handler Exposure Database Study 467 (PHED 467) and 36 MEs from Formella (1995) which is listed as MRID 43600102. In the PHED 467 study, the air concentrations were measured using polyurethane foam (PUF) filters and in the Formella (1995) study, the air concentrations were measured using 37 mm glass fiber filters. The PUF filters and the glass fiber filters were analyzed for the active ingredient (ai) in the paint being sprayed. To determine if respirators are needed for the paint particulates, the existing air concentration data for the ais was converted to total particulate (i.e. solids) air concentrations using the amount of ai in the paint and the percent solids in the paint. These particulate air concentrations were then converted to unit exposures for total particulate by normalizing by the amount of paint sprayed. These unit exposures were then used to calculate 8 hour TWA for persons spraying 30 gallons of paint per day. As shown in Attachment A, the mean 8 hour TWAs are 4.5, 4.8, 25 and 3.1 mg/m³ for spraying 30 gallons of exterior oil based stain, exterior latex paint, interior latex paint and exterior alkyd paint, respectively. The overall average 8 hour TWA, which corresponds to the unit exposure of 0.56 mg/lb ai that OPP currently uses to assess paint ai exposures, is 9.1 mg/m³.

Calculation of Respirator Protection Factors

In Table 1, the Paint Solids 8 Hour TWAs are compared to two occupational exposure limits (OELs) to determine what respirator protection factor is needed. This comparison indicates that the maximum PF required is 2.5 which is less than the Assigned Protection Factor (APF) of 10 that OSHA specifies for filtering facepiece respirators in OSHA (2009). This means that the filtering facepiece respirators will provide adequate protection for the study subjects applying 30 gallons of paint.

Table 1 – Respirator Protection Factors Needed for the AEATF Airless Sprayer Study

Data Considered	Paint Solids Air Concentration ^A (mg/m ³)	Paint Solids 8 Hour TWA Unit Exposure ^B (mg/m ³ /gallons sprayed)	Paint Solids 8 Hour TWA ^C (mg/m ³)	OEL (mg/m ³)	Respirator PF Needed for OEL ^F
Formella (1995) Interior Latex MEs only (n=12)	59.5	0.83	25	15 ^D	1.7
				10 ^E	2.5
PHED 467 and Formella (1995) All MEs including Exterior Stain, Exterior Alkyd, Exterior Latex and Interior Latex (n=51)	23.9	0.30	9.1	15 ^D	None ^G
				10 ^E	None ^G

A. Based on the ai air concentration measured in the studies and the percent solids in the paints.
 B. Based on the mean 8 hour TWA air concentration normalized by the number of gallons sprayed.
 C. Based on the unit exposure (mg/m³/gallons sprayed) and 30 gallons sprayed.
 D. The Occupational Exposure Limit (OEL) of 15 mg/m³ is the OSHA PEL for nuisance dust, total.
 E. The OEL of 10 mg/m³ is ACGIH TLV for inhalable particulates.
 F. Respirator Protection Factor Needed for OEL = Paint Solids 8 Hour TWA (mg/m³) / OEL (mg/m³)
 G. Respirators are not needed because the Paint Solids 8 Hour TWA is less than the OEL.

Comparison to Airless Spray Air Concentrations Measured in Fortmann, 1999

In Fortmann (1999) paint particles were measured during the airless spray application of two coats of latex paint to a room in the test house. During the application of the first coat, which lasted 20 minutes, the total suspended particulate (TSP) concentration was 49.7 mg/m³ near the painter and 40.9 mg/m³ in the center of the room while the PM₁₀ and PM_{2.5} air concentrations in the center of the room were 21.9 and 4.62 mg/m³, respectively. During the application of the second coat, which lasted 15 minutes, the TSP was 38.7 mg/m³ near the painter and 37.2 mg/m³ in the center of the room while the PM₁₀ and PM_{2.5} in the center of room were 19.9 and 0.83 mg/m³, respectively. The TSP concentrations are shown to ground-truth the unit exposure approach in Table 1 and are comparable to the mean paint solids air concentration of 59.5 mg/m³ that was estimated from the interior latex MEs of Formella (1995).

Conclusion

A hazard characterization of the paint ingredients indicates that exposures will be limited to aerosols, and an exposure analysis of the aerosols indicates that the required respiratory protection factor ranges from less than one to 2.5 which is less than the OSHA APF of 10 for a filtering facepiece respirator. Given this information, a filtering facepiece respirator will provide adequate protection for the study subjects if it is fit tested in accordance with 29 CFR 1910.134.

References

Formella (1995) Potential Exposure of Workers to Chlorothalonil when Handling and Applying Paint Containing Chlorothalonil: Lab Project Number: 94-0204: ISKB-1894-002-02: 5227-94-0204-CR-001. Unpublished study prepared by Ricerca, Inc. 272 p. MRID 43600102.

Fortmann (1999) Measurements of Volatile Organic Compounds and Particles During Application of Latex Paint with an Airless Sprayer, EPA Report 600/A-00/057, R. Fortmann, N. Roache and A. Ng (Arcadis) and J. Chang (EPA).

OSHA (2009) Assigned Protection Factors for the Revised Respiratory Protection Standard, OSHA 3352-02.

Sherwin Williams (2017a) Safety Data Sheet for SUPERPAINT Interior Flat Latex Wall Paint, Extra White, Product Code A86W1151, The Sherwin-Williams Company, September 9, 2017.

Sherwin Williams (2017b) Environmental Data Sheet for SUPERPAINT Interior Flat Latex Wall Paint, Extra White, Product Number A86W151, The Sherwin-Williams Company, August 16, 2017.

US EPA (2012) Standard Operating Procedures for Residential Pesticide Exposure Assessment, Health Effects Division, Office of Pesticide Programs, Office of Chemical Safety and Pollution Prevention, U.S. Environmental Protection Agency, October, 2012.

Attachments

A. Airless Sprayer Paint Solids Air Concentrations and Unit Exposures from PHED Study 467 and Formella, 1995 (MRID 43600102)

Attachment A - Airless Sprayer Paint Solids Air Concentrations and Unit Exposures from PHED 467 and Formella 1995 (MRID 43600102)

Data Source	Worker ID	Amount Sprayed (Gallons)	Amount AI in Paint (ug/gm)	Air Time (minutes)	AI Air Concentration (mg/m ³)	Paint Solids Content (Percent)	Paint Solids Air Concentration (mg/m ³)	Paint Solids 8 Hour TWA (mg/m ³)	Paint Solids 8 Hour TWA Unit Exposure (mg/m ³ /gallons sprayed)	Paint Solids 8 Hour TWA Assuming 30 Gallons Sprayed (mg/m ³)
PHED 0467	A	5.0	4825	27	0.163	33	11.1	0.63	0.13	3.8
PHED 0467	B	5.0	4825	13	0.773	33	52.9	1.43	0.29	8.6
PHED 0467	C	5.0	4825	17	0.126	33	8.6	0.31	0.06	1.8
PHED 0467	D	5.0	4825	21	0.400	33	27.4	1.20	0.24	7.2
PHED 0467	E	5.0	4825	25	0.272	33	18.6	0.97	0.19	5.8
PHED 0467	F	5.0	4825	17	0.159	33	10.9	0.38	0.08	2.3
PHED 0467	G	5.0	4825	20	0.250	33	17.1	0.71	0.14	4.3
PHED 0467	H	5.0	4825	11	0.250	33	17.1	0.39	0.08	2.4
PHED 0467	I	5.0	4825	16	0.450	33	30.8	1.03	0.21	6.2
PHED 0467	J	5.0	4825	11	0.582	33	39.8	0.91	0.18	5.5
PHED 0467	K	5.0	4825	18	0.381	33	26.0	0.98	0.20	5.9
PHED 0467	L	5.0	4825	12	0.300	33	20.5	0.51	0.10	3.1
PHED 0467	M	5.0	4825	16	0.138	33	9.4	0.31	0.06	1.9
PHED 0467	N	5.0	4825	13	0.335	33	22.9	0.62	0.12	3.7
PHED 0467	O	5.0	4825	13	0.527	33	36.0	0.98	0.20	5.9

Mean of PHED (Exterior Oilbased Stain)

0.34

23.3

0.76

0.15

4.5

MRID 43600102	EL-01	4.9	10451	46	0.232	50	11.1	1.06	0.22	6.5
MRID 43600102	EL-02	4.6	10148	58	0.147	50	7.2	0.87	0.19	5.7
MRID 43600102	EL-03	4.8	10331	38	0.160	50	7.7	0.61	0.13	3.8
MRID 43600102	EL-04	4.8	10282	65	0.073	50	3.5	0.48	0.10	3.0
MRID 43600102	EL-05	4.7	10423	60	0.089	50	4.3	0.54	0.11	3.4
MRID 43600102	EL-06	4.9	10043	53	0.145	50	7.2	0.80	0.16	4.9
MRID 43600102	EL-07	4.9	10163	49	0.076	50	3.7	0.38	0.08	2.3
MRID 43600102	EL-08	4.8	9965	49	0.135	50	6.8	0.69	0.14	4.3
MRID 43600102	EL-09	4.2	9549	48	0.300	50	15.7	1.57	0.38	11.3
MRID 43600102	EL-10	4.7	9863	35	0.105	50	5.3	0.39	0.08	2.5
MRID 43600102	EL-11	4.7	10181	81	0.064	50	3.2	0.53	0.11	3.4
MRID 43600102	EL-12	4.9	10288	40	0.242	50	11.7	0.98	0.20	6.0

Mean of Exterior Latex (EL)

4.7

10141

52

0.147

7.3

0.74

0.16

4.8

Data Source	Worker ID	Amount Sprayed (Gallons)	Amount AI in Paint (ug/gm)	Air Time (minutes)	AI Air Concentration (mg/m ³)	Paint Solids Content (Percent)	Paint Solids Air Concentration (mg/m ³)	Paint Solids 8 Hour TWA (mg/m ³)	Paint Solids 8 Hour TWA Unit Exposure (mg/m ³ /gallons sprayed)	Paint Solids 8 Hour TWA Assuming 30 Gallons Sprayed (mg/m ³)
MRID 43600102	IL-01	4.5	3917	35	0.260	50	33.2	2.42	0.54	16.2
MRID 43600102	IL-02	4.8	3753	26	0.549	50	73.1	3.96	0.82	24.7
MRID 43600102	IL-03	4.4	3798	44	0.242	50	31.9	2.93	0.67	20.0
MRID 43600102	IL-04	4.4	3670	37	0.386	50	52.5	4.05	0.92	27.5
MRID 43600102	IL-05	4.6	3349	34	0.245	50	36.6	2.59	0.56	16.9
MRID 43600102	IL-06	4.8	3506	33	0.436	50	62.2	4.27	0.90	27.0
MRID 43600102	IL-07	4.3	3664	22	0.685	50	93.5	4.28	1.01	30.2
MRID 43600102	IL-08	4.8	3585	28	0.374	50	52.1	3.04	0.64	19.1
MRID 43600102	IL-09	4.7	3710	26	0.567	50	76.4	4.14	0.87	26.2
MRID 43600102	IL-10	4.5	3607	36	0.465	50	64.4	4.83	1.08	32.4
MRID 43600102	IL-11	4.7	3745	37	0.470	50	62.7	4.83	1.03	30.9
MRID 43600102	IL-12	4.3	3360	27	0.505	50	75.1	4.23	0.98	29.3
Mean of Interior Latex (IL)		4.6	3639	32	0.432		59.5	3.80	0.83	25.0
MRID 43600102	EA-01	4.8	6139	43	0.101	50	8.2	0.74	0.15	4.6
MRID 43600102	EA-02	4.8	6237	38	0.037	50	2.9	0.23	0.05	1.5
MRID 43600102	EA-03	4.8	6291	49	0.052	50	4.1	0.42	0.09	2.6
MRID 43600102	EA-04	4.5	6056	35	0.050	50	4.2	0.30	0.07	2.0
MRID 43600102	EA-05	4.6	6010	35	0.106	50	8.8	0.64	0.14	4.2
MRID 43600102	EA-06	4.4	6228	39	0.075	50	6.1	0.49	0.11	3.4
MRID 43600102	EA-07	4.8	6609	44	0.099	50	7.5	0.69	0.14	4.3
MRID 43600102	EA-08	4.6	6355	38	0.068	50	5.3	0.42	0.09	2.7
MRID 43600102	EA-09	4.6	6195	35	0.051	50	4.1	0.30	0.07	2.0
MRID 43600102	EA-10	4.6	6231	53	0.044	50	3.5	0.39	0.08	2.5
MRID 43600102	EA-11	4.8	6105	35	0.120	50	9.8	0.72	0.15	4.5
MRID 43600102	EA-12	4.6	6225	39	0.067	50	5.4	0.44	0.10	2.9
Mean of Exterior Alkyd (EA)		4.7	6223	40	0.073		5.8	0.48	0.10	3.1
Overall Count					51		51		51	51
Overall Mean					0.25		23.9		0.30	9.1
Overall Standard Deviation					0.19		24.0		0.32	9.5
Overall Maximum					0.77		93.5		1.1	32.4