ALTSHULER BERZON LLP
ATTORNEYS AT LAW
177 POST STREET, SUITE 300
SAN FRANCISCO, CALIFORNIA 94108
(415) 421-7151
FAX (415) 362-8064
www.altshulerberzon.com

STEPHEN P. BERZON
ERIC P. BROWN
HAMILTON CANDEE
EVE H. CERVANTEZ
CONNIE K. CHAN
BARBARA J. CHISHOLM
JEFFREY B. DEMAIN
JAMES M. FINBERG
KRISTIN M. GARCÍA
EILEEN B. GOLDSMITH
SCOTT A. KRONLAND
DANIELLE E. LEONARD
STACEY M. LEYTON
MATTHEW J. MURRAY
PETER D. NUSSBAUM
ZOE PALITZ
P. CASEY PITTS
DANIEL T. PURTELL
MICHAEL RUBIN
PEDER J. THOREEN
JONATHAN WEISSGLASS

FRED H. ALTSHULER
FOUNDING PARTNER EMERITUS

TONY LOPRESTI
FELLOW

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AUG 26 2015

OCCUPATIONAL SAFETY AND HEALTH
STANDARDS BOARD

August 24, 2015

Via Overnight Delivery

Occupational Safety and Health Standards Board
2520 Venture Oaks Way, Suite 350
Sacramento, California 95833

Re: *Petition for Promulgation of a Health and Safety Standard for Preparation and Coating for Corrosion Prevention*

Dear Honorable Board Members:

This petition is submitted on behalf of the International Union of Painters and Allied Trades (IUPAT) to request that the Occupational Safety and Health Standards Board adopt a safety and health standard for the performance of corrosion prevention work on industrial and infrastructure projects in California.

The IUPAT is a labor organization that represents more than 160,000 active and retired workers in the United States and Canada. Through its affiliated local unions, IUPAT represents approximately 20,000 painters, glaziers, and other workers in California, including journey-level workers and apprentices. Part of IUPAT's mission is to protect the health and safety of all workers in its industries.

Corrosion is the natural deterioration of a substance (usually a metal) because of a reaction with its environment. A 2002 study released by the Federal Highway Administration revealed that metallic corrosion costs the country $276 billion per year. The primary defense against corrosion involves the application of protective coatings to surfaces, which is done by IUPAT members and other painters throughout the country. The performance of corrosion prevention on industrial and infrastructure projects presents significant safety and health risks for the workers that should be addressed by a standard applicable to the work at issue.

In 2004, the two leading corrosion industry groups, the Society for Protective Coatings and NACE, International, collaborated to develop a general industry standard for the safe performance of corrosion prevention work. With input from industry experts and career industrial painters, they developed the NACE 13/ACS 1 standard for certification as an Industrial Coating and Lining Application Specialist. The NACE 13/ACS 1 standard represents the consensus of the industrial painting community as to the body of knowledge necessary to safely and effectively perform surface preparation and coating application for steel and concrete surfaces for complex industrial and infrastructure projects.

IUPAT's proposed health and safety standard would require employers performing corrosion prevention work on such projects to use only trained personnel that have been certified as meeting the NACE 13/ACS 1 standard. The proposed standard includes a phase-in and a provision for uncertified workers to perform the work under direct supervision. The proposed standard is attached as Exhibit A to this letter.

The letters and studies accompanying this petition describe in detail the serious risks to worker health and safety associated with corrosion prevention work. (*See* Exhibits B-E.) Adverse health outcomes for industrial painters include increased incidence of cancer, respiratory disease, lead poisoning, and brain degeneration (known in the medical community as "chronic painter's syndrome"). The use of untrained personnel to perform this work also leads to accidents and acute injuries that can put workers' lives at risk. The NACE 13/ACS 1 standard requires training regarding these health hazards, the observance of proper safety protocols, and the use of protective equipment to keep workers safe and healthy.

The two industrial painter apprenticeship programs approved by the California Division of Apprenticeship Standards have already incorporated the NACE 13/ACS 1 standard into their training curricula. (*See* Exhibit C (Letter from Jesus Fernandez).) As described in the attached letters, the incorporation of the NACE 13/ACS 1 standard into the apprenticeship curricula has resulted in an increase in the observance of proper safety protocols and a decrease in work-related health incidents and accidents. The proposed Standard for Preparation and Coating for Corrosion Prevention would ensure that all painters who perform corrosion prevention work obtain this critical safety training, not just those who participate in a state-approved apprenticeship program.

IUPAT is not alone in urging the adoption of this new health and safety standard. Many contractors and contractor associations across California, who collectively employ hundreds of painters performing corrosion prevention work, have signed letters of support for this petition, as have the California Labor Federation and the State Building and Construction Trades Council. (*See* Exhibit F.) Moreover, several government agencies throughout California — including Caltrans, Bay Area Rapid Transit, the California Department of Water Resources, and several major cities (e.g. Los Angeles, San Francisco, San Jose) — already require compliance with the NACE 13/ACS 1 standard on their industrial and infrastructure projects. (*See* Exhibit D (Letter from Robert Williams III), Exhibit 2.) Leading national companies and federal agencies do as well. (*See* Exhibit B (Letter from Robert Chalker).)

For the reasons outlined in the attached letters, IUPAT urges the Standards Board to adopt the proposed Standard for Preparation and Coating for Corrosion Prevention to protect the health and safety of industrial painters in California. IUPAT and its California district councils would be glad to provide further information to assist the Board in processing the proposed petition. Please do not hesitate to contact me if you or your staff has any questions about this petition.

Sincerely,

Zoe Palitz

Scott A. Kronland
Zoe Palitz
ALTSHULER BERZON LLP
177 Post Street, Suite 300
San Francisco, CA 94108
Telephone: (415) 421-7151
Facsimile: (415) 362-8064
E-mail: skronland@altber.com
zpalitz@altber.com

Attorneys for the International Union of Painters and Allied Trades

Cc: Marley Hart, Executive Officer, Occupational Safety and Health Standards Board

Attachments:

Exhibit A: Proposed Standard for Preparation and Coating for Corrosion Prevention
Exhibit B: Letter from Robert Chalker, CEO of NACE, International (with attachments)
Exhibit C: Letter from Jesus Fernandez, Training Director, Finishing Trades Institute of District Council 36 JATC (with attachment)
Exhibit D: Letter from Robert Williams III, Business Representative, District Council 16 (with attachments)
Exhibit E: Letter from Chad Smith, Assistant to the General President, Western Region Government Affairs, IUPAT
Exhibit F: Letters of Support

EXHIBIT A

International Union of Painters and Allied Trades

Petition for Promulgation of a Health and Safety Standard for Preparation and Coating for Corrosion Prevention

Proposed Cal/OSHA Standard

Preparation and Coating for Corrosion Prevention

SEC 1. Scope and Application.

All employers performing surface preparation and application of protective coatings and linings to steel and concrete surfaces for the purpose of corrosion prevention on industrial or infrastructure projects shall comply with the standards adopted pursuant to this Article.

SEC 2. Definitions.

(a) "Corrosion prevention work" means surface preparation and application of protective coatings and linings to steel and concrete surfaces for the purpose of corrosion prevention.

(b) "Corrosion prevention work" does not include corrosion prevention work on sheet metal and ventilation systems or on plumbing and piping systems or precast concrete work that is performed offsite.

(c) "Industrial" means a structure that is used primarily for industrial activity, which is generally not open to the public including, but not limited to, refineries, factories, warehouses, and storage facilities.

(d) "Infrastructure" means the fundamental structures serving the public including, but not limited to, bridges, tunnels, pipelines, and railways.

(e) "NACE 13/ACS 1 standard" means the standard for an industrial coating and lining application specialist determined by the Society for Protective Coatings or the National Association of Corrosion Engineers International.

(f) "Trained and certified" means either of the following: (1) workers who have a valid certificate issued by an organization generally accepted in the industry as meeting the NACE 13/ACS 1 standard; or (2) workers registered in an industrial apprenticeship program approved by the Division of Apprenticeship Standards that provides training to meet the NACE 13/ACS 1 standard and who are receiving the supervision required by the program.

SEC 3. Training and Certification Requirements.

(a) The employer shall permit only trained and certified personnel to perform corrosion prevention work on industrial or infrastructure projects.

(b) Notwithstanding the requirements of subsection (a), an employee who is not trained and certified is permitted to perform corrosion prevention work only where all of the following requirements are met:

(1) The employee has valid certificates issued by an organization generally accepted in the industry as meeting the C3, C7, and C12 standards of the Society for Protective Coatings;

(2) The employee performs corrosion prevention work only under the direct supervision of a trained and certified individual within the meaning of paragraph (1) of subsection (f) of section 2. Direct supervision means the supervisor is in the immediate area of the employee, within visual sighting distance, and is able to effectively communicate with the employee; and

(3) The employer shall ensure that at all times on the job site, there are three trained and certified individuals performing corrosion prevention work for every one employee who is not trained and certified performing such work.

SEC 4. Recordkeeping and transparency.

The employer shall maintain records showing its compliance with the requirements of this Article. Copies of such records shall be made available to any employee or the authorized collective bargaining representative of the employer's employees within ten days upon request.

SEC 5. Effective dates and phase-in.

For purpose of meeting the requirements of section 3:

(a) On or before January 1, 2016, the employer shall ensure that at least twenty-five percent of all corrosion prevention work hours on a project are performed by trained and certified personnel.

(b) On or before January 1, 2018, the employer shall ensure that at least fifty percent of all corrosion prevention work hours on a project are performed by trained and certified personnel.

(c) On or before January 1, 2020, the employer shall ensure that all corrosion prevention work hours on a project are performed by trained and certified personnel, except as permitted by subsection (b) of section 3.

EXHIBIT B

International Union of Painters and Allied Trades

Petition for Promulgation of a Health and Safety Standard for Preparation and Coating for Corrosion Prevention

August 11, 2015

California Occupational Safety and Health Standards Board
2520 Venture Oaks Way, Suite 350
Sacramento, California 98533

Re: Standard for Preparation and Coating for Corrosion Prevention

Dear Honorable Board Members:

I write to urge you to adopt the health and safety standard for Preparation and Coating for Corrosion Prevention proposed by the International Union of Painters and Allied Trades (IUPAT), which relies on the standard for an Industrial Coating and Lining Application Specialist, also known as the NACE 13/ACS 1 standard. (*See* Exhibit 1 for a copy of the NACE 13/ACS 1 standard.) Corrosion prevention today is a highly technical and skilled operation. Proper training of workers is necessary to mitigate significant risks to health and safety.

NACE International is recognized globally as the premier authority on corrosion control. Founded in 1943 by eleven engineers in the pipeline industry as the "National Association of Corrosion Engineers," the organization has since grown to reach all industries impacted by corrosion, and currently serves more than 36,000 members in 130 countries. Our members include corrosion engineers, contractors, workers, inspectors, experts, and others involved in the field of corrosion prevention. NACE currently offers the most specified technical training and certification programs, conferences, reports, and publications dedicated to the prevention and mitigation of corrosion. In addition to these programs, NACE has developed a set of industry standards used worldwide in the performance of corrosion prevention work.

The NACE 13/ACS 1 standard for an Industrial Coating and Lining Application Specialist was first developed in 2004 at the impetus of the U.S. Navy, which spends over $2.4 billion per year on corrosion control efforts. NACE, together with the Navy and the Society for Protective Coatings (SSPC), worked to develop a single industry standard for industrial coating and lining application specialists.

NACE develops all of its industry standards, including the NACE 13/ACS 1 standard, in accordance with the democratic procedures recommended by the American National Standards Institute (ANSI). (*See* Exhibit 2 for a graphic of the standards development cycle.) After a draft of the NACE 13/ACS 1 standard was prepared by a committee, it was circulated to the entire NACE membership for comment and review. As mentioned, NACE's membership includes tens of thousands of corrosion engineers and experts in the field. These experts had an opportunity to suggest changes to the standard based on their technical knowledge, and those changes were incorporated into the final standard, which was voted on and approved by NACE's membership. NACE requires ninety percent approval from its membership before a standard may be issued. Through this democratic process, we ensure that the standards we issue reflect the true consensus of experts and practitioners in the corrosion industry as to the skills and knowledge necessary to perform a particular corrosion prevention task safely and effectively.

A primary emphasis of the NACE 13/ACS 1 is on worker safety and hazards containment. The Body of Knowledge includes dozens of elements that are designed to ensure that any worker certified as meeting the NACE 13/ACS 1 knows how to protect him or herself, his or her colleagues, and the public from the many environmental, safety, and health hazards associated with corrosion control work. (*See* Exhibit 1 at p. 5–14 (Appendix A).)

In the eleven years since its adoption, the NACE 13/ACS 1 standard has proven so successful at improving the quality and safety of corrosion prevention work that many government agencies and major companies require adherence to the standard on their projects, including the U.S. Army Corps of Engineers, the Federal Highway Administration, the U.S. Coast Guard, Amtrak, Lockheed Martin, Chevron, and CSX Transportation.

We encourage California to join these agencies and companies in protecting corrosion prevention workers by adopting IUPAT's proposed occupational health and safety standard.

Sincerely,

Robert Chalker
Chief Executive Officer
NACE International

EXHIBIT 1

International Union of Painters and Allied Trades

Petition for Promulgation of a Health and Safety Standard for Preparation and Coating for Corrosion Prevention

SSPC-ACS-1

ANSI/NACE No. 13
Item No. 21122

ANSI/NACE/SSPC Standard Practice

Industrial Coating and Lining Application Specialist Qualification and Certification

Approved 2008-01-01

ISBN 1-57590-215-X

An American National Standard
Approved December 10, 2008

NACE International
1440 South Creek Dr.
Houston, TX 77084-4906
(telephone +1 281/228-6200)

SSPC: The Society for Protective Coatings
40 24th Street, Sixth Floor
Pittsburgh, PA 15222
(telephone +1 412/281-2331)

Printed by NACE International

Foreword

This standard sets forth the requirements for qualification and certification of an industrial coating and lining application specialist, referred to hereafter as an *Application Specialist*. The qualification and certification process is a stepwise achievement process that includes all aspects of surface preparation and coating application for steel and concrete surfaces of complex industrial structures. The intended audience includes persons involved in developing education and certification programs for the training and assessment of the skills and knowledge of an Application Specialist or assessing the training and certification programs available either on the open market or from an in-house source.

The body of the standard provides the requirements for qualification and certification of an Application Specialist.

Appendix A (mandatory) defines the competency requirements or the minimum "Body of Knowledge" for each qualification level that provides a basis to allow applicants to achieve qualification in a Certified Application Specialist Program. Appendix A provides requirements for Section 5.

Appendix B (mandatory) describes the level of cognition required for each qualification level. Appendix B provides required information for use with Appendix A for development of a learning skills program associated with the Body of Knowledge in Appendix A.

Appendix C (nonmandatory) provides information on desirable workplace skills (reading text, document use, and numeracy) that should be considered by those attempting to both nurture and assess a candidate's overall skills level.

This standard could be used to validate or assess a candidate's (e.g., an employee or potential employee) knowledge and skills level based on qualification in a certification program operated under this standard. One of the goals of this standard is to recognize and record in an outline format the minimum overarching elements in the Body of Knowledge as these elements relate to a candidate's cognitive levels of learning and skills.

Government and industry are striving for long-term reliability of equipment and operations. Corrosion mitigation of steel and concrete structures by coatings and linings is germane to achieving that goal. Coating application also combines corrosion mitigation with aesthetic appeal in both the public and private sectors. The success of coatings and linings is heavily dependent on the qualifications of the Application Specialist. The study "Corrosion Costs and Preventive Strategies in the United States"[1] identified an annual expenditure of $108.6 billion US on protective coatings and linings. As much as 71% of that annual expenditure may be affected by work performed by an Application Specialist.

This standard is designed to qualify the Application Specialist through a broad range of classroom instruction and associated work experiences.

This standard was developed by the joint Task Group (TG) 320 on Coating and Lining Applicator Qualification. TG 320 is administered by Specific Technology Group (STG) 04 on Coatings and Linings, Protective: Surface Preparation, and is composed of representatives from NACE International, The Society for Protective Coatings (SSPC), and the International Union of Paint and Allied Trades (IUPAT).[1] This standard is published under the auspices of NACE STG 04 and SSPC Coating Applicator Qualification Committee.

In NACE/SSPC standards, the terms *shall, must, should,* and *may* are used in accordance with Paragraph 2.2.1.8 of the Agreement Between NACE International and SSPC: The Society for Protective Coatings. The terms *shall* and *must* are used to state mandatory requirements. The term *should* is used to state something considered good and is recommended but is not mandatory. The term *may* is used to state something considered optional.

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[1] International Union of Painters and Allied Trades (IUPAT), 1750 New York Avenue NW, Washington, DC 20006.

NACE/SSPC

Joint Standard Practice

Industrial Coating and Lining Application Specialist Qualification and Certification

Contents

Section 1: General

1.1 Scope

1.1.1 This standard provides criteria for the education, training, experience, knowledge, and skills required by an Application Specialist to prepare and apply protective coatings to steel and concrete surfaces of complex industrial structures. This standard may be used for certification of Application Specialists for other substrates or conditions, as considered appropriate by facility owners, contractors, or certifying agencies.

1.1.2 This standard applies to qualification of an Application Specialist for work on new construction and maintenance of complex industrial structures.

Section 2: Definitions

Application Specialist: An individual who engages in surface preparation and application of protective coatings and linings to steel and concrete surfaces of complex industrial structures.

Section 3: Body of Knowledge

3.1 The basis for the qualification of an Application Specialist shall consist of:

3.1.1 Body of Knowledge; and

3.1.2 Test requirements.

3.2 The Body of Knowledge shall consist of:

3.2.1 A list of required areas of knowledge and skills; and

3.2.2 Required level of cognition for each area of knowledge and skill.

3.3 The core areas of the Body of Knowledge include:

3.3.1 Environmental, safety, and health;

3.3.2 Process control: specifications, codes and standards, quality assurance, and quality control;

3.3.3 Materials: consumables; surface preparation materials; coating materials; material properties, characteristics, and use; material safety data sheets (MSDSs);

3.3.4 Surface preparation: the purpose of surface preparation, chemical cleaning, hand and power tools, waterjetting (WJ), abrasive blasting, surface preparation standards, environmental controls, substrate repairs, and surface contaminants; and

3.3.5 Application: storage, mixing, environmental conditions and controls, conventional spray, airless spray, thermal spray, trowel, brush, roller, tapes, heat-shrinkable coatings, powder coatings, plural component spray, curing, recoat and overcoat, defects and repairs.

3.4 The specialty areas of the Body of Knowledge include:

3.4.1 Installation of polymer coatings and linings on concrete floors and secondary containment;

3.4.2 High-pressure water cleaning (HPWC) and ultrahigh-pressure waterjetting (UHPWJ);

3.4.3 Electrostatic spray;

3.4.4 Plural component spray;

3.4.5 Powder coatings;

3.4.6 Specialty pipeline coatings; and

3.4.7 Thermal spray coatings.

Section 4: Qualification Levels for Application Specialist

4.1 This standard sets forth requirements for three basic qualification levels—Level I, Level II, and Level III—for an Application Specialist. In addition, requirements are set forth to attain specialty qualifications for Level II. These qualification levels are summarized in Table 1.

Table 1: Qualification Levels for Application Specialist

Qualification Level	Requirements
Level I	Basic knowledge of industrial coatings and linings
Level II	Detailed knowledge and skills of industrial coatings and linings
Specialty	Level II plus detailed knowledge and skills of specialty areas as identified herein
Level III	Level II plus: • Basic supervisory knowledge and skills • Basic training knowledge and skills • Basic communication knowledge and skills

4.2 The requirements associated with each qualification level include prerequisites, experience, and an appropriate degree of knowledge and skills as they relate to the Body of Knowledge elements in Appendix A. Table A1 in Appendix A provides the Body of Knowledge that is used to establish each qualification level based on appropriate competency requirements for each knowledge and skill element.

4.3 Level I qualification is intended for entry-level Application Specialists. Level I Application Specialists customarily work with and under the supervision of Level II and Level III Application Specialists.

4.4 Level II qualification is intended for experienced Application Specialists able to work independently.

4.5 Level III qualification is intended for Application Specialists responsible for planning, oversight, evaluation, and supervision of industrial coating and lining of complex industrial structures.

Section 5: Requirements for Each Qualification Level

5.1 Application Specialist Qualification Requirements—Level I

5.1.1 Successful completion of a skills assessment program measuring essential employability skills: text reading, document use, and numeracy (see Appendix C);

5.1.2 Successful completion of examinations and skills test on the Body of Knowledge (see Appendix A); and

5.1.3 Successful demonstration of the ability to read, write, and communicate in the language of the workplace location (e.g., English in the United States, United Kingdom, and Canada; French in Quebec; Spanish in Mexico).

5.2 Application Specialist Qualification Requirements—Level II

5.2.1 Successful completion of all Level I requirements;

5.2.2 Qualify to take Level II examinations by one of the following methods:

5.2.2.1 Successful completion of a three-year apprenticeship program that includes a minimum of 3,000 hours of verifiable work experience and a minimum of 450 hours of coating-related technical training (training to be dispersed evenly throughout the experience phase);

or

5.2.2.2 Five years (minimum) of related work experience that includes a minimum of 5,000 hours of verifiable work experience and a minimum of 450 hours of coating-related technical training (training to be dispersed evenly throughout the experience phase);

or

5.2.2.3 Eight years (minimum) of related work experience that includes a minimum of 8,000 hours of verifiable work experience;
and

5.2.3 Successful completion of Level II examinations (refer to Section 6 for details of Level II core and specialty qualifications).

5.3 Application Specialist Qualification Requirements—Level III

5.3.1 Qualify to take Level III examinations by one of the following methods:

5.3.1.1 Five years (minimum) of related work experience after achieving qualification to Level II;

or

5.3.1.2 Five years (minimum) of verifiable work experience in inspection or supervision of coating-related work for complex industrial structures after completion of the requirements included in Paragraph 5.2.2;

and

5.3.2 Successful completion of Level III examination.

Section 6: Examination Requirements for Level II Core and Specialty Qualifications

6.1 Level II core and specialty qualification requirements shall consist of a combination of written examinations to assess knowledge and practical examinations to assess knowledge and skills. Table 2 shows the various examination requirements for Level II core and specialty (add-on) qualifications.

Table 2: Level II Core and Specialty Qualification Examination Requirements

	Level II Core Qualification [A]			Specialty (Add-on) Qualification (optional)	
	Written Examination	Practical Examination: Surface Preparation	Practical Examination: Application	Written Examination	Practical Examination
Core area of Body of Knowledge	✓	✓	✓		
Coating of concrete floors and secondary containment	✓			✓	✓
HPWC & UHPWJ	✓			✓	✓
Electrostatic spray	✓			✓	✓
Plural component spray	✓			✓	✓
Powder coatings	✓			✓	✓
Specialty pipeline coatings	✓			✓	✓
Thermal spray coatings	✓			✓	✓

[A] Level II core qualification assesses knowledge and skills in the core areas of the Body of Knowledge, and general knowledge of the specialty areas of the Body of Knowledge.

Section 7: Certification Program Requirements

7.1 Certification programs operated under this standard shall be developed and operated in accordance with ISO[(2)] 17024.[2]

7.2 Certification examinations shall be based on the competency requirements in the Body of Knowledge for the qualification level that the candidate is striving to achieve.

7.3 Practical examinations for Level II shall require the candidate to prepare and coat a test panel or test apparatus that mimics the efforts required to prepare and coat complex industrial structures. The examination and test panel or test apparatus shall test the candidate on his/her ability to:

7.3.1 Plan steps and procedures;

7.3.2 Set up and start abrasive blasting equipment;

7.3.3 Abrasive blast the test panel or test apparatus to a specific level of cleanliness and surface profile;

7.3.4 Inspect, assess, measure, and document the specified surface preparation;

7.3.5 Mix and thin liquid coating materials;

7.3.6 Set up and start coating application equipment;

7.3.7 Set up and start spray, brush, or roller application, as appropriate;

7.3.8 Brush, roll, and/or spray coat the test panel or test apparatus;

7.3.9 Inspect, assess, measure, and document the coating application (each coat and total coating system); and

7.3.10 Clean up and dispose of waste.

7.4 The test panel shall be in accordance with ASTM[(3)] D 4228[3] or appropriate equivalent.

7.5 The coating systems shall be specified at the time of testing. A variety of coating materials, surface preparation methods, and means of application shall be used to test the candidate's ability to handle various types of coatings and their surface preparation and application issues.

7.6 Inspection and documentation of surface preparation and coating application shall be in accordance with ASTM D 5161.[4]

Section 8: Requirements for Maintaining Qualification

8.1 Qualifications shall be valid for no more than three years. Qualifications shall be maintained by one of the following methods:

8.1.1 Successful completion of a minimum of 40 hours per year of training; or

8.1.2 Successful completion of the qualification examination(s) for the qualification level (core or specialty) being maintained.

References

1. "Corrosion Costs and Preventive Strategies in the United States," Report FHWA-RD-01-156 (Springfield, VA: National Technical Information Service[(4)]).

2. ISO 17024 – ISO/IEC 17024 (latest revision), "Conformity assessment – General requirements for bodies operating certification of persons" (Geneva, Switzerland: ISO).

3. ASTM D 4228 (latest revision), "Standard Practice for Qualification of Coating Applicators for Application of Coatings to Steel Surfaces" (West Conshohocken, PA: ASTM).

(2) International Organization for Standardization (ISO), 1 rue de Varembé, Case Postale 56, CH-1211 Geneva 20, Switzerland.
(3) ASTM International (ASTM), 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959.
(4) National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.

4. ASTM D 5161 (latest revision), "Standard Guide for Specifying Inspection Requirements for Coating and Lining Work (Metal Substrates)" (West Conshohocken, PA: ASTM).

5. B.S. Bloom, B.B. Mesia, D.R. Krathwohl, "Levels of Cognition," in Taxonomy of Educational Objectives, Vol. 1: The Affective Domain, and Vol. 2: The Cognitive Domain (New York, NY: David McKay, 1964).

6. R.H. Dave, in R.J. Armstrong et al., Developing and Writing Behavioral Objectives (Tucson, AZ: Educational Innovators Press, 1970).

7. Test of Workplace Essential Skills (TOWES). Bow Valley College, 332 - 6th Avenue SE, Calgary, AB T2G 4S6 Canada.

Appendix A
Body of Knowledge for Application Specialist Qualification
(Mandatory)

NOTE: The N1 through N6 designations for the competency requirements indicate levels of cognition and psychomotor skills in accordance with Appendix B. The N designation in each block applies to the entire associated section, not just the line item with which it is aligned.

Table A1

Body of Knowledge—Application Specialist Qualification				
	Competency Requirements			
Knowledge and Skills Elements	Level I	Level II	Level III	Specialty
A1 Environmental, Safety, and Health				
A1.1 Local and Other Applicable Safety Codes, Practices, Standards, and Regulations A1.1.1 Rigging and hoisting A1.1.2 Scaffolding and ladders A1.1.3 Fall protection A1.1.4 Confined space A1.1.5 Lock out/tag out A1.1.6 Aerial lifts A1.1.7 Hazard communication (Hazcom) A1.1.8 First aid/cardiopulmonary resuscitation (CPR) A1.1.9 Legal and regulatory requirements and compliance A1.1.10 Health A1.1.11 Electrical grounding requirements A1.1.12 Hand and power tool cleaning A1.1.13 Fire protection programs A1.1.14 Personal protective equipment (PPE) A1.1.15 Respiratory protection A1.2 Safety Related Directly to Specific Materials/Equipment A1.2.1 Abrasive cleaning (both wet and dry methods) A1.2.2 WJ A1.2.3 Ventilation A1.2.4 Toxic metal abatement A1.2.5 Hydrocarbon solvent exposure, use, and disposal A1.3 Ventilation A1.3.1 Lower explosive limit (LEL)/upper explosive limit (UEL) A1.3.2 Threshold limit value (TLV)/permissible exposure limit (PEL) A1.3.3 Dilution	N1	N3	N6	

Body of Knowledge—Application Specialist Qualification				
	Competency Requirements			
Knowledge and Skills Elements	Level I	Level II	Level III	Specialty
A1.3.4 Air flow A1.3.5 Protection factors—internal and external A1.4 Environmental A1.4.1 Waste minimization A1.4.2 Handling and disposal of hazardous materials A1.5 Health A1.5.1 Hearing conservation A1.5.2 Asbestos A1.5.3 Personal protection—eyes, hearing, shoes A1.5.4 Benzene A1.5.5 Heat stress A1.5.6 Silica A1.5.7 Hydrogen sulfide				
A2 Process Control (including quality assurance and quality control)				
A2.1 Specifications, Codes, and Standards A2.2 Relevance and Importance of Specifications, Codes, and Standards A2.3 Definitions A2.4 Roles and Responsibilities A2.5 Legal and Ethics Issues A2.6 Using Lessons-Learned for Continual Improvement A2.7 Quality Assurance and Quality Control Programs	N1	N3	N5	
A2.8 General Science Knowledge A2.8.1 Fluid and gas dynamics A2.8.2 Basic electricity—direct and alternating current A2.8.3 Basic chemistry A2.8.4 Physical properties related to paint and protective coatings A2.8.5 Basic physics	N1	N2	N4	
A2.9 Work Planning A2.9.1 Process control A2.9.2 Procedures and work instructions A2.9.3 Work planning and sequencing	N1	N3	N5	
A2.10 Develop and Follow Application Procedures A2.10.1 Receipt and storage procedure A2.10.2 Product data sheets and MSDS A2.10.3 Mixing procedure—boxing, hand, power A2.10.4 Thinning procedure A2.10.5 Application procedures—brush, roller, spray, other A2.10.6 In-process measuring and monitoring (inspection) A2.10.7 Test panels	N1	N3	N6	

Body of Knowledge—Application Specialist Qualification				
	Competency Requirements			
Knowledge and Skills Elements	Level I	Level II	Level III	Specialty
A2.11 In-Process Quality Control A2.11.1 Document ambient conditions A2.11.2 Document materials A2.11.3 Document equipment—cleaning, application A2.11.4 Document work progress A2.11.5 Identify discrepancies A2.11.6 Document discrepancies A2.11.7 Appropriate equipment—cleaning, application A2.11.8 Operate equipment A2.11.9 Maintain equipment	N1	N3	N5	
A2.12 Test Equipment A2.12.1 Accuracy level (+/- tolerances) A2.12.2 Verifying accuracy (e.g., equipment calibration) A2.12.3 Basic gauges A2.12.4 Test methods (destructive and nondestructive)	N1	N3	N5	
A2.13 Ambient Conditions (temperature, relative humidity, wind, moisture, etc.) A2.13.1 Measure and record conditions A2.13.2 Have knowledge of measuring equipment—uses and limitations A2.13.3 Anticipate localized conditions based on site—cooling towers, steam traps, etc.	N1	N3	N6	
A2.14 Surface Conditions—Acceptability for Coating Application A2.14.1 Cleanliness—importance/recognition/remediation A2.14.2 Conformity to visual standards—importance/recognition/remediation A2.14.3 Impact on coating performance A2.14.4 Surface profile A2.14.5 Chemical contaminants	N1	N3	N6	
A2.15 Verification Inspection (recognize out-of-specification conditions) A2.15.1 Why A2.15.2 How to A2.15.3 How to document	N1	N3	N6	
A2.16 Testing and Evaluation Methods for Failure Analysis and Troubleshooting of Coatings (existing and new) A2.16.1 Laboratory methods A2.16.2 Field methods A2.16.3 Batch retention A2.16.4 Dry film thickness (DFT)/wet film thickness (WFT) A2.16.5 Hardness/cure A2.16.6 Microscopic analyses	N1	N2	N2	
A3 Materials				
A3.1 Reasons for Coating A3.1.1 Aesthetics A3.1.2 Corrosion prevention A3.1.3 Safety A3.1.4 Process aids	N1	N3	N4	

Body of Knowledge—Application Specialist Qualification

Knowledge and Skills Elements	Competency Requirements: Level I	Level II	Level III	Specialty
A3.1.5 Environmental protection				
A3.2 Abrasives (new and recycled) A3.2.1 Types A3.2.2 Properties A3.2.3 Testing A3.2.3.1 Qualification testing (abrasive on qualified products list?) A3.2.3.2 Batch testing A3.2.3.3 In-service testing A3.2.4 Receipt A3.2.5 Storage A3.2.6 Protection	N1	N3	N5	
A3.3 Coating Material Properties A3.3.1 Chemical resistance A3.3.2 Ultraviolet (UV) light resistance A3.3.3 Gloss and color retention A3.3.4 Corrosion resistance A3.3.5 Water resistance A3.3.6 Reflectivity A3.3.7 Hydrocarbon resistance A3.3.8 Heat resistance A3.3.9 Permeability	N1	N3	N5	
A3.4 Coating Materials A3.4.1 Convertible coatings A3.4.2 Nonconvertible coatings A3.4.3 Pigments (describe types of pigment and their various uses) A3.4.4 Thinners A3.4.5 Other additives A3.4.6 Suitability for various service conditions A3.4.7 Film formation/curing mechanisms A3.4.8 Film properties A3.4.9 Material stewardship A3.4.10 Identification of defective material A3.4.11 Disposal	N1	N3	N5	
A3.5 Coating Materials—Specialty A3.5.1 Types A3.5.2 Characteristics	N1	N1	N1	
A4 Surface Preparation				
A4.1 Basics of Surface Preparation A4.1.1 Effects of mass, velocity, air volume and pressure, nozzle and hose size, etc., on abrasive blasting A4.1.2 Substrates	N1	N4	N5	

Body of Knowledge—Application Specialist Qualification				
	Competency Requirements			
Knowledge and Skills Elements	Level I	Level II	Level III	Specialty
A4.2 Surface Preparation Standards (steel) A4.2.1 Identifying and documenting initial condition of the steel A4.2.2 Identification of surface irregularities requiring preparation (including weld condition) A4.2.3 Identification of steel condition prior to application A4.2.4 Identification of preparation requirements A4.2.5 Solvent cleaning A4.2.6 Dry abrasive blasting standards A4.2.7 Power and hand tool cleaning standards A4.2.8 Wet abrasive blasting standards A4.2.9 Water cleaning (WC) and WJ standards	N1	N3	N5	
A4.3 Equipment Setup and Operation—Abrasive Blasting A4.3.1 Equipment setup—compressor, blast pot, separators, etc. A4.3.2 Equipment operation—all control valves A4.3.3 Hose and couplings layout A4.3.4 Nozzle management A4.3.5 Compressor sizing A4.3.6 Dust and debris control A4.3.7 Safety equipment	N1	N3	N5	
A4.4 Identification of Specified Surface Cleanliness A4.4.1 Visual A4.4.2 Nonvisual A4.4.3 Flash rusting	N1	N3	N5	
A4.5 Identification of Acceptable Surface Profile and Variables Affecting Surface Profile A4.5.1 Measuring A4.5.2 Assessing	N1	N3	N5	
A4.6 Identification of Acceptable Abrasive Blasting Conditions A4.6.1 Dew point A4.6.2 Temperature A4.6.3 Relative humidity A4.6.4 Dehumidification A4.6.5 Wind A4.6.6 Projecting conditions through initial cure A4.6.7 Surface temperature	N1	N3	N5	
A4.7 Comparison of Standards and Requirements to Varying Substrate Conditions A4.7.1 New steel A4.7.2 Coated steel A4.7.3 Corroding steel A4.7.4 Weathering steel A4.7.5 New concrete A4.7.6 Existing concrete	N1	N3	N5	
A4.8 Hand Tool Cleaning A4.8.1 Safety and PPE	N1	N3	N5	

Body of Knowledge—Application Specialist Qualification	Competency Requirements			
Knowledge and Skills Elements	Level I	Level II	Level III	Specialty
A4.8.2 Methods and equipment A4.8.3 Standards and inspection				
A4.9 Power Tool Cleaning A4.9.1 Safety and PPE A4.9.2 Methods and equipment A4.9.3 Standards and inspection	N1	N3	N5	
A4.10 WC and WJ A4.10.1 Safety and PPE A4.10.2 WC methods and equipment A4.10.3 WJ methods and equipment A4.10.4 Standards and inspection	N1	N3	N5	
A4.11 Chemical Stripping A4.11.1 Safety and PPE A4.11.2 Methods and materials A4.11.3 Standards and inspection	N1	N3	N5	
A4.12 Concrete Surface Preparation A4.12.1 Surface contamination and defects A4.12.2 Surface cleaning and repair A4.12.3 Surface preparation methods and equipment A4.12.4 Standards and inspection	N1	N3	N5	
A5 Coating Application—Liquid Coatings				
A5.1 Ensure Existence of Appropriate Procedures and Work Instructions	N1	N3	N5	
A5.2 Mixing A5.2.1 Mixing requirements A5.2.2 Premix requirements A5.2.3 Equipment/mixing blade A5.2.4 Time A5.2.5 Results A5.2.6 Thinning A5.2.7 Induction time A5.2.8 Pot life A5.2.9 Filtering/straining	N1	N4	N5	
A5.3 Application Equipment—Limits, Strengths, and Weaknesses of Each A5.3.1 Safety A5.3.2 Types of equipment A5.3.2.1 Spray A5.3.2.1.1 Conventional A5.3.2.1.2 Airless A5.3.2.1.3 High-volume low-pressure A5.3.2.1.4 Air-assisted airless A5.3.2.2 Brush and roller application A5.3.2.3 Squeegee A5.3.2.4 Mitt	N1	N3	N5	

Body of Knowledge—Application Specialist Qualification	Competency Requirements			
Knowledge and Skills Elements	Level I	Level II	Level III	Specialty
A5.3.2.5 Trowel A5.3.3 Acceptable environmental conditions A5.3.3.1 Surface temperature/relative humidity/air temperature/dew point A5.3.3.2 Condensation A5.3.3.3 Wind				
A5.4 Equipment Selection A5.5 Equipment Setup and Adjustment A5.6 Equipment Operation and Maintenance A5.7 Overspray Control A5.8 Safety	N1	N3	N5	
A5.9 Drying and Curing Conditions A5.9.1 Ambient conditions A5.9.2 Heating (force curing) A5.9.3 Ventilation	N1	N4	N5	
A5.10 In-Process Measurement and Monitoring A5.10.1 WFT A5.10.2 Film deficiencies A5.10.3 Other contaminants	N1	N3	N5	
A5.11 After Initial Cure (and/or between coats)—Measurement and Monitoring A5.11.1 DFT A5.11.2 Amine blush A5.11.3 Film deficiencies—identification and rework procedures A5.11.3.1 Fisheyes A5.11.3.2 Craters A5.11.3.3 Misses A5.11.3.4 Blistering A5.11.3.5 Sagging A5.11.3.6 Wrinkling	N1	N3	N5	
A5.12 Requirements for Maintenance Coating (Overcoating) A5.12.1 Coating compatibility/compatibility tests A5.12.2 Feathering-in A5.12.3 Identify chalking and other contamination A5.12.4 Matching material and requirements to equipment A5.12.5 General knowledge of various application methods A5.12.6 Control of overspray A5.12.7 Containment A5.12.8 Outside factors A.5.12.9 Coating life cycle—touch-up, overcoat, recoat	N1	N3	N5	
A5.13 Application Hazards	N1	N3	N5	
A6 Polymer Coating of Concrete				
A6.1 Properties of Concrete A6.2 Concrete Surfaces—Gunite, Poured Concrete, Cinder Block, Concrete Block A6.3 Surface Preparation	N1	N1	N1	N4

Body of Knowledge—Application Specialist Qualification				
	Competency Requirements			
Knowledge and Skills Elements	Level I	Level II	Level III	Specialty
A6.3.1 Mechanical methods—hand, power tools, grinding A6.3.2 Dry and wet abrasive blasting A6.3.3 WC and WJ A6.3.4 Acid etching A6.4 Surface Preparation Standards A6.4.1 Preparation standards A6.4.2 Identification of surface irregularities A6.4.3 Identification of surface condition prior to preparation A6.4.4 Identification of prepreparation requirements A6.4.5 Problem areas—porosity, contamination, laitance, cracks, waxes A6.5 Coating Application A6.5.1 Materials—fillers, surfacers, coatings/linings, reinforcements A6.5.2. Squeegee A6.5.3 Trowels A6.5.4 Spray A6.5.5 Screed A6.5.6 Hand lay-up A6.5.7 Surface finishing—sacking, stoning, troweling, synthetic surfacers, broadcast, etc. A6.6 Inspection and Testing A6.6.1 Moisture and moisture vapor testing A6.6.2 Visual A6.6.3 Ultrasonic testing A6.6.4 Roughness A6.7 Documentation				
A7 HPWC and UHPWJ				
A7.1 Equipment Safety Devices A7.2 PPE A7.3 Equipment Setup A7.3.1 Hoses A7.3.2 Pumps A7.3.3 Lances A7.3.4 Robots A7.4 Equipment Operation and Maintenance A7.4.1 Hoses A7.4.2 Pumps A7.4.3 Lances A7.4.4 Robots A7.5 Surface Preparation Standards A7.6 Troubleshooting A7.7 Inspection and Testing A7.8 Documentation	N1	N1	N1	N4
A8 Electrostatic Spray Equipment				
A8.1 Safety A8.2 PPE A8.3 Equipment A8.3.1 Setup A8.3.2 Operation	N1	N1	N1	N4

Body of Knowledge—Application Specialist Qualification				
	Competency Requirements			
Knowledge and Skills Elements	Level I	Level II	Level III	Specialty
A8.3.3 Maintenance A8.3.4 Safety A8.4 Application A8.5 Troubleshooting A8.6 Inspection and Testing A8.7 Documentation				
A9 Plural-Component Spray Equipment				
A9.1 Safety A9.2 PPE A9.3 Equipment A9.3.1 Setup A9.3.2 Operation A9.3.3 Maintenance A9.3.4 Safety A9.4 Application of Coating Materials A9.5 Troubleshooting A9.6 Inspection and Testing A9.6.1 Visual A9.6.2 Measuring A9.10 Documentation	N1	N1	N1	N4
A10 Powder Coatings				
A10.1 Safety A10.2 PPE A10.3 Materials A10.3.1 Thermosetting A10.3.2 Thermoplastic A10.4 Types of Setup (process) A10.4.1 Surface preparation A10.4.2 Powder application methods A10.4.3 Heating/curing methods A10.5 Inspection and Testing A10.5.1 Visual A10.5.2 Measuring A10.6 Documentation	N1	N1	N1	N4
A11 Thermal Spray Coatings and Equipment				
A11.1 Safety A11.2 PPE A11.3 Types A11.4 Materials A11.4.1 Zinc A11.4.2 Aluminum A11.4.3 Al-Zn A11.4.4 Other A11.5 Sealers A11.6 Substrates A11.6.1 Steel A11.6.2 Concrete	N1	N1	N1	N4

Body of Knowledge—Application Specialist Qualification	Competency Requirements			
Knowledge and Skills Elements	Level I	Level II	Level III	Specialty
A11.6.3 Other A11.7 Surface Preparation A11.8 Application Methods A11.8.1 Arc spray A11.8.2 Flame spray A11.8.3 Plasma spray A11.8.4 Application of sealer A11.9 Equipment Selection/Setup/Operation A11.10 Material Selection A11.11 Equipment Selection A11.12 Process and Work Instructions A11.13 Inspection and Testing A11.13.1 Visual A11.13.2 Destructive testing A11.13.2.1 DFT A11.13.2.2 Bend test A11.13.2.3 Adhesion test A11.13.3 Measuring A11.13.4 Documentation				
A12 Specialty Pipeline Coatings (tapes, heat-shrink sleeves, hot applications, powder coatings, cold-applied mastics)				
A12.1 Safety A12.2 PPE A12.3 Types A12.4 Materials A12.4.1 Tape wraps A12.4.2 Heat-shrink sleeves A12.4.3 Hot applications A12.4.4 Powder coatings A12.4.5 Cold-applied mastics A12.4.6 Other A12.5 Application Methods A12.6 Equipment Selection/Setup/Operation A12.7 Material Selection A12.8 Rockshielding A12.9 Overview of Cathodic Protection (CP) Systems A12.10 Equipment Selection A12.11 Process and Work Instructions A12.12 Inspection and Testing A12.12.1 Visual A12.12.2 Destructive testing A12.12.3 Measuring A12.13 Documentation	N1	N1	N1	N4
13 Basics of Corrosion	N1	N3	N5	

Appendix B
Cognition
(Knowledge and Skills Requirements)
(Mandatory)

This system of identifying competency requirements is based on the six "Levels of Cognition" in Bloom's Taxonomy of Cognition[5] and Dave's definition of the Psychomotor Taxonomy[6] required to perform satisfactorily on written and practical examinations.

Six levels of competency, designated N1 through N6, shall be used to develop the minimum requirements for written and practical assessment examinations. Associated with each level of competency shown here is a brief description of the specific descriptor from Bloom for the cognitive domain and from Dave for the psychomotor domain. However, for convenient and accurate interpretation of the descriptors the cited references, or the amplifying information in the appendixes, shall be consulted.

Six Levels of Competency

N1

- **Cognitive domain**—Knowledge
- **Psychomotor domain**—Imitation—Manipulation

N2

- **Cognitive domain**—Comprehension
- **Psychomotor domain**—Naturalization

N3

- **Cognitive domain**—Application
- **Psychomotor domain**—Naturalization

N4

- **Cognitive domain**—Analysis
- **Psychomotor domain**—Naturalization

N5

- **Cognitive domain**—Synthesis
- **Psychomotor domain**—Naturalization

N6

- **Cognitive domain**—Evaluation
- **Psychomotor domain**—Naturalization

Six Levels Of Cognition Based on Bloom's Taxonomy (Revised)

The six levels of cognition are presented below in rank order from least complex to most complex (original terminology is provided in parentheses).

Knowledge. (Also commonly referred to as recognition, recall, or rote knowledge.) Able to remember or recognize terminology, definitions, facts, ideas, materials, patterns, sequences, methodologies, principles, etc. Example verbs: arrange, define, duplicate, label, list, memorize, name, order, recognize, relate, recall, repeat, reproduce, state.

Comprehension. Able to read and understand descriptions, communications, reports, tables, diagrams, directions, regulations, etc. Example verbs: classify, describe, discuss, explain, express, identify, indicate, locate, recognize, report, restate, review, select, translate.

Application. Able to apply ideas, procedures, methods, formulas, principles, theories, etc., in job-related situations. Example verbs: apply, choose, demonstrate, dramatize, employ, illustrate, interpret, operate, practice, schedule, sketch, solve, use, write.

Analysis. Able to break down information into its constituent parts and recognize the parts' relationship to one another and how they are organized; identify sublevel factors or salient data from a complex scenario. Example verbs: analyze, appraise, calculate, categorize, compare, contrast, criticize, differentiate, discriminate, distinguish, examine, experiment, question, test.

Synthesis. Able to make judgments regarding the value of proposed ideas, solutions, methodologies, etc., by using appropriate criteria or standards to estimate accuracy, effectiveness, economic benefits, etc. Example verbs: arrange, assemble, collect, compose, construct, create, design, develop, formulate, manage, organize, plan, prepare, propose, set up, write.

Evaluation. Able to put parts or elements together in such a way as to show a pattern or structure not clearly there before; able to identify which data or information from a complex set is appropriate to examine further or from which supported conclusions can be drawn. Example verbs: appraise, argue, assess, attach, choose, compare, defend, estimate, judge, predict, rate, core, select, support, value, evaluate.

Five Categories of Psychomotor Skills as Described by Dave[6]

The psychomotor domain includes physical movement, coordination, and use of the motor-skill areas. Development of these skills requires practice and is measured in terms of speed, precision, distance, procedures, or techniques in execution. The five major categories of psychomotor skills listed in order of increasing difficulty are:

Imitation. Observing and patterning behavior after someone else. Performance may be of low quality. Example: Copying a work of art.

Manipulation. Being able to perform certain actions by following instructions and practicing. Example: Creating work on one's own, after taking lessons, or reading about it.

Precision. Refining, becoming more exact. Few errors are apparent. Example: Working and reworking something, so it will be "just right."

Articulation. Coordinating a series of actions, achieving harmony and internal consistency. Example: Producing a video that involves music, drama, color, sound, etc.

Naturalization. Having high-level performance become natural, without needing to think much about it. Examples: Michael Jordan playing basketball, Nancy Lopez hitting golf ball, etc.

Definitions of Associated Terms

Cognition: The act or process of knowing; perception. Also, the product of such a process; something thus known, perceived, etc.

Cognitive: Of or pertaining to the mental processes of perception, memory, judgment, and reasoning, as contrasted with emotional and volitional processes.

Psychomotor: Of or pertaining to movement produced by action of the mind or will.

Taxonomy: The science, laws, or principles of classification or systematics, resulting in division into ordered groups.

Appendix C
Skills Assessment Program
(Nonmandatory)

Test of Workplace Essential Skills (TOWES)[7] has been used successfully to measure a candidate's abilities in three essential domains—*"Reading Text, Document Use, and Numeracy."* Other skills assessment programs to measure these abilities may be available. Essential skills are enabling skills required for all types of work. Skills such as reading text or numeracy help people perform the tasks required by their occupation and other daily activities. They provide a foundation for learning other skills and enhance people's ability to adapt to workplace change. Essential skills are not technical skills but rather the skills people use to carry out a wide variety of occupational tasks and activities.

A listing of essential skills defined by Human Resources and Social Development Canada (HRSDC) are:

Reading Text
    Thinking Skills

Document Use
    Problem Solving

Numeracy
    Decision Making

Writing
    Job Task Planning & Organizing

Oral Communicating
    Finding Information

Computer Use
    Significant Use of Memory

Working with Others
    Continuous Learning

Definitions of Associated Terms

Numeracy: Able to use or understand numerical techniques of mathematics.

[5] Human Resources and Social Development Canada (HRSDC), 300 Laurier Ave. West, Ottawa, ON K1A 0J6 Canada.

EXHIBIT 2

International Union of Painters and Allied Trades

Petition for Promulgation of a Health and Safety Standard for Preparation and Coating for Corrosion Prevention

STANDARDS DEVELOPMENT CYCLE

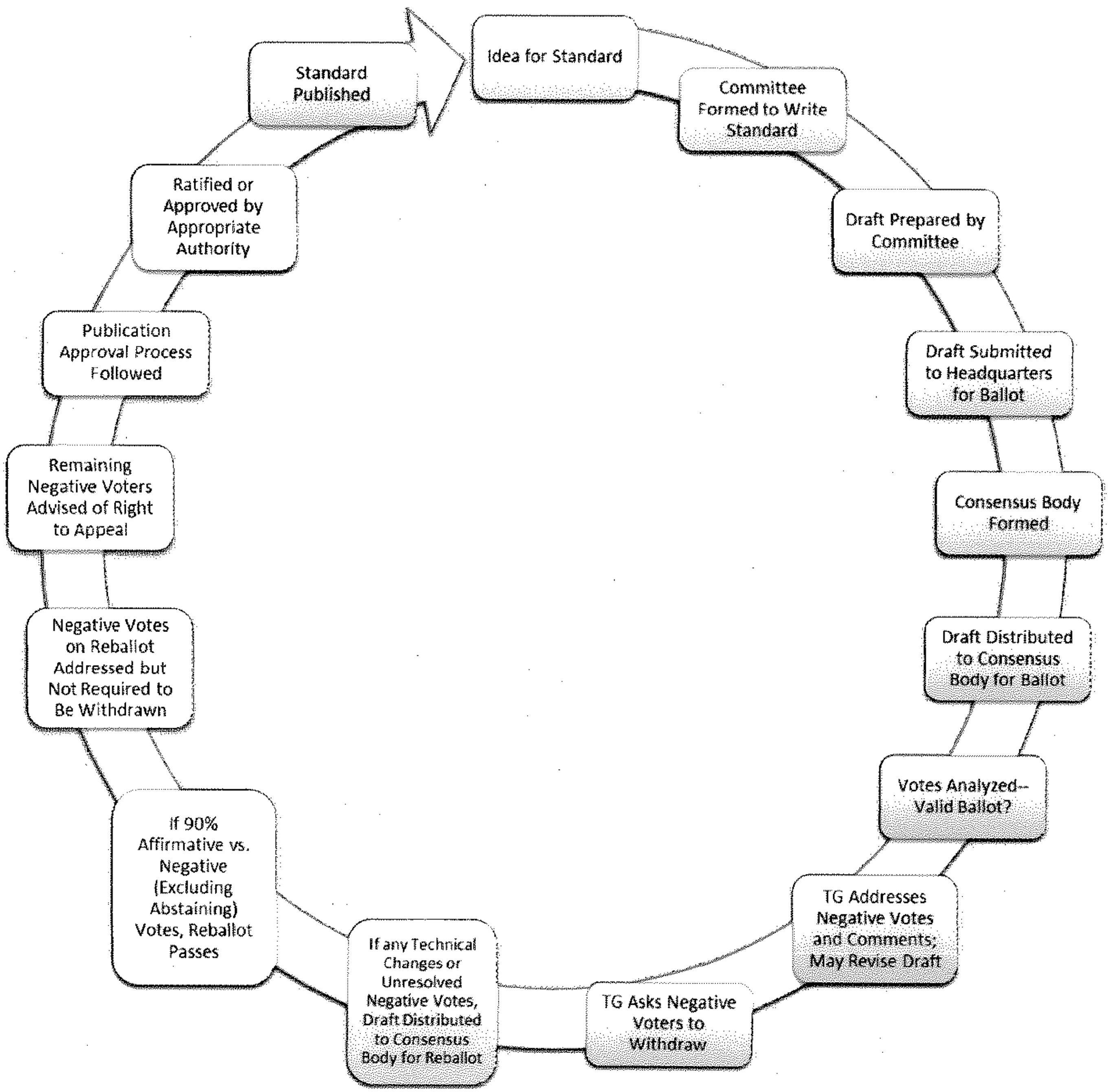

EXHIBIT C

International Union of Painters and Allied Trades

Petition for Promulgation of a Health and Safety Standard for Preparation and Coating for Corrosion Prevention

Painters & Allied Trades District Council 36
Finishing Trades Institute of District Council 36 JATC

August 6, 2015

Marley Hart
Executive Officer
California Occupational Safety and Health Standards Board
2520 Venture Oaks Way, Suite 350
Sacramento, California 95833

Re: Corrosion Prevention Standard

Dear Ms. Hart:

I write to urge the California Occupational Safety and Health Standards Board to adopt the health and safety standard for Preparation and Coating for Corrosion Prevention proposed by the International Union of Painters and Allied Trades (IUPAT). As Training Director for the IUPAT District Council 36 Industrial Painter Joint Apprenticeship Training Program, I have seen firsthand that the proposed standard is critical to protecting the safety and health of industrial painters engaged in corrosion prevention work throughout California.

My entire career has been devoted to industrial painting, including corrosion prevention work. I started as an IUPAT painting apprentice in 1989, and I worked as an industrial painter for fifteen years. For the past decade, I have trained new apprentices to become industrial painters. In 2005, I became Training Director for the District Council 36 Industrial Painter Joint Apprenticeship Training Program, one of the two industrial painter apprenticeship programs approved by the Division of Apprenticeship Standards. As Training Director, I oversee training programs at five facilities and four Job Corps centers located in Southern California. I also authored the curriculum used in both state-approved industrial painter apprenticeship programs. That curriculum includes extensive information regarding the proper performance of corrosion prevention work.

The District Council 36 Industrial Painter Joint Apprenticeship Training Program prepares apprentices to become certified as meeting the NACE 13/ACS 1 standard. Jointly created by the Society for Protective Coatings and NACE International (the two leading groups in the corrosion prevention field), the NACE 13/ACS 1 standard represents a rare example of a comprehensive industry standard for certification in a trade. We have incorporated the standard into our apprenticeship program curriculum for eight years. To meet the NACE 13/ACS 1 standard, apprentices must learn the essentials for the safe performance of corrosion prevention work —

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everything from blasting and coating technique to proper use of personal protective equipment to how to mix chemicals to create the coatings that we apply. Due to the heightened health and safety risks associated with corrosion prevention, which I discuss below, safety is the number one theme of our training program, and the NACE 13/ACS 1 standard incorporates the necessary information to protect worker safety.

If not done properly, corrosion prevention work can be hazardous to worker health and safety. It is important to note at the outset that industrial corrosion prevention work often takes place under challenging conditions. A painter might be working inside a confined space such as in fuel holding tanks, thousands of feet underground in tunnels or penstocks, suspended hundreds of feet in the air on a bridge or elevated water holding tank, or inside an oil refinery, among other locations. These difficult conditions — particularly confined spaces — exacerbate the health risks outlined below and make the observance of proper safety protocols a matter of life and death.

Corrosion prevention work is generally a two-step process. First, industrial painters prepare the surface (known as the substrate) by removing the existing paint, coating, or lining material. This step often involves abrasive blasting, a process by which painters direct a high velocity stream of abrasive material at a speed of up to 450 miles per hour at 120 pounds per square inch of air pressure at the substrate through a 1½ inch inner diameter blast hose. The second step involves the application of protective coatings to the prepared substrate, generally using high pressure, specialized pumps to spray the coating onto the substrate.

When workers engage in abrasive blasting, it pulverizes whatever paint or coating was on the substrate and sends that material into the air (as well as the used abrasive blast material), creating a high level of hazardous dust. The most common materials our painters encounter during surface preparation are lead paint, silica, asbestos, cresol (which is found in coal tar epoxy), chromium, and cadmium. All of these can contain toxins, and many are well-known for causing serious lung damage, including cancer and silicosis, along with a host of other respiratory problems. Likewise, when cresol contacts skin, it seeps into the pores. The pores close and, upon reacting with sunlight, the cresol in the skin will cause an intensely painful sensation, like being burned from the inside out. These are everyday risks for painters involved in corrosion prevention.

There are also health risks associated with the protective coatings. The solvent-based coatings involved in corrosion prevention contain toxins which can cause neurotoxicity and brain atrophy, as well as reproductive hazards if untrained people fail to follow proper safety protocols.

There are several other steps in the process that pose health and safety risks if carried out by untrained persons. For example, industrial painters mix their own materials on the job, and the formulas can require mixing up to four or five different components that, once mixed, can create a new hazard. These hazardous materials will be in the air, on surfaces, and potentially on clothing and equipment on the jobsite. Familiarity with their unique qualities is essential for painters to be able to recognize the specific health and safety risks associated with certain materials and to respond to any problems that arise quickly and correctly.

Serious acute physical injuries can occur from inadvertent injection of blasting or coating media into human tissue. Industrial painters use airless spray equipment to transfer coating from the spray gun to the substrate at high pressure. This means that the toxic materials used in blasting and coating can be easily injected into workers' skin and bloodstreams. When that happens, it works like a snakebite, with the toxic material spreading through the painter's body from the site of the injection like venom. Immediate medical attention is necessary to stop the spread of the material and to attempt to save the body part that was injected. For example, I have attached a photograph showing the finger of an apprentice who inadvertently injected himself while applying a protective coating. (*See* Exhibit 1.) This injury occurred with only low-pressure, water-based paint. But one can easily see how the consequences could have been much worse if the material had been more toxic, higher pressure had been used, and the site of the injection were an eye, rather than a finger. Painters have lost fingers, hands, and other body parts through accidents like this.

Serious injury or death can result from lack of training on the proper use of respiratory equipment. Industrial painters rely on a steady supply of oxygen into their protective hoods to breathe while working. Plugging into the wrong air source can have tragic consequences by exposing workers to carbon monoxide poisoning or asphyxiation. An industrial painter who is certified as meeting the NACE 13/ACS 1 standard would know how to properly set-up his or her respiratory gear at different types of workplaces.

Workplace safety in this area depends upon *all* workers remaining aware of their surroundings and working in unison. Abrasive blast nozzles typically weigh about five pounds. If one is dropped with the pressure on, it will immediately thrash about, potentially causing injury to nearby workers through contact with either the nozzle itself or with the material it is spraying. Training prepares painters to quickly shut off pressure to eliminate this danger. Similarly, a corrosion prevention job may require blasting on or near biological hazards or flammable materials, as in the case of waste water treatment plants and refinery work. Use of improper methods in such scenarios can cause leaks or explosions, leading to deadly results for both the untrained worker and his or her coworkers.

Workplace hazards can become community hazards if workers fail to observe proper safety protocols including jobsite hazards containment. For example, workers who wear their equipment home may bring hazardous materials like lead into their homes and cars, or into public spaces. Proper training required by the NACE 13/ACS 1 standard helps prevent this risk. In our program, apprentices learn how to properly remove and clean their personal protective

EXHIBIT 1

International Union of Painters and Allied Trades

Petition for Promulgation of a Health and Safety Standard for Preparation and Coating for Corrosion Prevention

EXHIBIT D

International Union of Painters and Allied Trades

Petition for Promulgation of a Health and Safety Standard for Preparation and Coating for Corrosion Prevention

District Council 16
International Union of Painters and Allied Trades

2705 Constitution Drive • Livermore, CA 94551
Telephone (925) 245-1080 • Fax (925) 245-1084

Chris Christophersen
Business Manager/Secretary-Treasurer

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Sign, Pictorial & Display Painters

August 11, 2015

California Occupational Safety and Health Standards Board
2520 Venture Oaks Way, Suite 350
Sacramento, California 98533

Re: Standard for Preparation and Coating for Corrosion Prevention

Dear Board Members:

I write to urge you to adopt the health and safety standard for Preparation and Coating for Corrosion Prevention proposed by the International Union of Painters and Allied Trades (IUPAT). As a Business Representative for IUPAT District Council 16, and a third generation industrial painter, I have seen firsthand the dangers that can arise from a lack of training in my industry. I have also seen how necessary this standard is to ensure that corrosion prevention work is done safely and well.

I followed in my father's and grandfather's footsteps by entering the painting industry at the age of 18. For fourteen years, I worked for one of the largest painting contractors in Northern California, Jerry Thompson & Sons. While there, I supervised and worked alongside crews of five to seventy painters on a variety of projects, including hospitals, museums, water treatment plants, and pipelines. A significant portion of my work involved corrosion prevention. Since 2012, I have served as a business representative of District Council 16. In that role, I interact daily with the journeypersons and apprentices who perform corrosion prevention and other industrial paint work in Northern California.

In this letter, I will describe the nature of corrosion prevention work. I then will identify some of the many health risks associated with that work. Finally, I will describe the training involved in meeting the NACE

13/ACS 1 standard and the ways in which I have seen workers benefit from that training.

The proposed standard would apply to only industrial and infrastructure corrosion prevention projects. Industrial projects generally involve structures unfit for human habitation, such as chemical plants, warehouses, and manufacturing facilities. Infrastructure projects include bridges, roadways, overpasses, power plants, refineries, waste water pipelines, water storage facilities, and water treatment plants. These projects are longer, more complicated, and involve greater risks to worker health and safety than commercial painting projects.

The first thing that happens on most industrial corrosion prevention projects is the workers set up a containment area. That usually is scaffolding with shrink-wrap plastic on the outside. The containment protects the public and other workers outside the containment area from the hazardous materials released during corrosion prevention, but it magnifies the risk to the painters who must perform their work inside the containment area. Approximately sixty percent of all industrial corrosion prevention projects involve a containment area or other confined space.

Corrosion prevention has two steps: (1) surface preparation and (2) application of protective coatings. Surface preparation involves roughing up the surface you are working with (known as the substrate) to create a profile upon which the paint or coating can adhere, and removing unwanted material on the substrate (such as old coatings, grease, and oils). Surface preparation is usually done by abrasive blasting, which involves projecting sand or a harder material from a large hose toward the substrate at high pressure. The second, application step involves spraying a liquid protective coating at high pressure to cover the substrate.

This two-step process presents many health hazards. First, the abrasive blasting process releases into the air substances -- heavy metals, silica, lead, among others -- that float around the containment area and can cause both acute and chronic health problems for workers who fail to use proper respiratory and personal protective equipment (PPE). Lung cancer, asthma, and pneumonia are common among painters who perform corrosion prevention work. A former colleague of mine developed emphysema, which his doctor attributed to our work. Lead poisoning is also a very common health hazard associated with our work. Because of the blood testing required by the Lead Standard, we are more aware than ever of how much lead is sent into the air during the abrasive blasting process. Lead poisoning is a leading cause of work-related medical leave in the painting industry.

The protective coatings themselves also contain chemicals that are known carcinogens, reproductive mutagens, and neurotoxins. Although there has been a move to safer, water-based paints for commercial projects (like the kind of paint you would buy at Home Depot for your house), industrial and infrastructure corrosion prevention projects continue to use primarily solvent-based coatings because of their improved abrasion and chemical resistance qualities. As an example of the acute health effects, after a 3 day job involving spray application of a chemical stripper, I found myself coughing up blood for a week. Longer term health effects include something known as "chronic painter's syndrome" (chronic toxic encephalopathy) in which the brain degrades over time and causes cognitive defects.

The bad health outcomes for professional painters are well known. A report published by the World Health Organization in 2007 found that "there is consistent evidence in humans that occupational exposure as a painter causes lung and urinary bladder cancer." (I have attached relevant excerpts of this report to this letter. *See* Exhibit 1 at p. 390-394.) Five out of seven studies also showed "significant excesses" of childhood leukemia among children whose parents are exposed to paints, particularly among mothers. (*Id.* at 391-392.)

When I first started painting in 1998, I was told during my apprenticeship that the average IUPAT painter lived long enough to receive thirteen pension checks after retirement (one per month). IUPAT members at the time retired on average at 54 or 55 years old. So our life expectancy, as reported by the Union, was approximately 56. For a point of comparison, in 2010 the life expectancy of a male in the United States was 76. (*See* http://data.worldbank.org/indicator/SP.DYN.LE00.MA.IN.)

There are many other hazards that occur during the blasting and spraying processes, which require proper training to avoid. It is easy to inject yourself or a member of your crew with abrasive blast material or a coating. The abrasive blaster and the spray applicator both use enough pressure to tear through human skin or other tissue. Similarly, when a painter is using a hose, the pressure is pushing against him pretty hard, and if someone were to turn off the hose without alerting the painter, he could fall forward, potentially off of a scaffold. There are also shortcuts that an untrained painter may take, which increase the safety risks for himself and his crew. For example, to operate the abrasive blaster, the painter has to hold down a trigger on the nozzle the whole time. Untrained painters often wrap cloth or tape around the trigger, so that they don't have to hold it down. But if the trigger is taped in an "on" position, it will continue blasting even if the hose is dropped. When dropped, the pressure causes the hose to whip around, and I know of instances in which painters have suffered broken noses and other injuries from being hit with the hose. Proper training helps painters understand why these shortcuts are dangerous and not worth the risk.

For the past eight years, the two industrial painter apprenticeship programs approved by the State of California have trained apprentices to become certified as meeting the NACE 13/ACS 1 standard for corrosion prevention work. The NACE 13/ACS 1 standard involves not just a technical component (how to do good corrosion prevention work), but also a safety component (how to identify the risks associated with a particular job and what steps to take to keep yourself safe). For example, the standard includes knowledge regarding use of respiratory protection, PPE, proper ventilation, hearing conservation, handling and disposal of hazardous materials, as well as information regarding the specific materials with which we come into contact: lead, benzene, asbestos, silica, among others. At the District Council 16 Apprenticeship Program, we spend approximately sixty to seventy percent of the training time on health and safety.

Based on my seventeen years of experience, I believe the NACE 13/ACS 1 standard is the minimum necessary for painters to do corrosion prevention work safely and well. Indeed, the standard is so successful that dozens of California government agencies -- including Caltrans, Bay Area Rapid Transit, the California Department of Water Resources, and several major cities (e.g. Los Angeles, San Francisco, San Jose) -- already require painters working on their corrosion prevention projects to meet the NACE 13/ACS 1 standard. (*See* Exhibit 2 for a national list of public and private entities that require contractors on their projects to have the Society for Protective Coatings' QP certification, which incorporates the NACE 13/ACS 1 standard.)

In my own work, I have seen the NACE 13/ACS 1 standard create a safer environment for painters performing corrosion prevention work. The biggest impact has been on worker attitudes and awareness around health and safety. When I was starting out (before the NACE 13/ACS 1 standard was used), some District Council 16 painters took a lot of risks with their health. Now, our apprenticeship graduates have a much better understanding of how dangerous the work is and how to protect themselves. For example, the PPE is very hot; it usually involves full body coverings with thick plastic material. In the past, workers would reject the PPE, instead wearing a long-sleeved t-shirt and jeans. Now, because of the training, our painters are aware that the coatings we use contain life-threatening chemicals, and I have seen a noticeable increase in the proper use of PPE and respirators. Overall, I have seen a shift in the philosophy of our members toward taking better care of themselves as a result of the adoption of this standard. Meanwhile, in my role as business representative, I spend time around some non-union worksites where I see untrained employees "acting like cowboys" (that's what we call it) with rags tied around their faces instead of using PPE or a respirator.

It is generally acknowledged that mandatory trainings are far more successful than voluntary ones at improving worker health and safety. A study by the Center to Protect Workers' Rights, for example, compared the effects of Alaska's mandatory hazardous paint course with voluntary courses offered in Oregon and Washington. The study had three notable conclusions that I believe are relevant here. It found that the mandatory training system was more effective in reaching three groups: (1) untrained painters and people new to the industry; (2) non-union painters; and (3) painters working for small contractors (those who have fewer than four employees). (*See* Exhibit 3 at p. 4-5.) These findings were particularly significant because the study also found that non-union painters and painters working for small contractors "were more likely to have higher risks of toxic exposures." (*Id.* at p. 5.) Of course the study's findings make sense. Voluntary trainings are more likely to attract painters with prior training (because they already know and care about keeping themselves safe) and union painters, who often have access to courses offered through the Union. But the adoption of the proposed standard would ensure that all of California's industrial painters receive the training necessary to protect their health and safety.

For all of these reasons, I strongly encourage the Standards Board to adopt IUPAT's proposed standard for corrosion prevention work. The work of an industrial painter is dangerous, but the proper training and education can help to ensure that measures are taken to do the job safely.

Sincerely,

Robert Williams III
Business Representative
IUPAT District Council 16

EXHIBIT 1

International Union of Painters and Allied Trades

Petition for Promulgation of a Health and Safety Standard for Preparation and Coating for Corrosion Prevention

WORLD HEALTH ORGANIZATION
INTERNATIONAL AGENCY FOR RESEARCH ON CANCER

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans

VOLUME 98

Painting, Firefighting, and Shiftwork

This publication represents the views and expert opinions of an IARC Monographs Working Group on the Evaluation of Carcinogenic Risks to Humans, which met in Lyon,

2–9 October 2007

2010

IARC MONOGRAPHS

In 1969, the International Agency for Research on Cancer (IARC) initiated a programme on the evaluation of the carcinogenic risk of chemicals to humans involving the production of critically evaluated monographs on individual chemicals. The programme was subsequently expanded to include evaluations of carcinogenic risks associated with exposures to complex mixtures, lifestyle factors and biological and physical agents, as well as those in specific occupations. The objective of the programme is to elaborate and publish in the form of monographs critical reviews of data on carcinogenicity for agents to which humans are known to be exposed and on specific exposure situations; to evaluate these data in terms of human risk with the help of international working groups of experts in chemical carcinogenesis and related fields; and to indicate where additional research efforts are needed. The lists of IARC evaluations are regularly updated and are available on the Internet at http://monographs.iarc.fr/.

This programme has been supported since 1982 by Cooperative Agreement U01 CA33193 with the United States National Cancer Institute, Department of Health and Human Services. Additional support has been provided since 1986 by the Health, Safety and Hygiene at Work Unit of the European Commission Directorate-General for Employment, Social Affairs and Equal Opportunities, and since 1992 by the United States National Institute of Environmental Health Sciences, Department of Health and Human Services. The contents of this volume are solely the responsibility of the Working Group and do not necessarily represent the official views of the U.S. National Cancer Institute, the U.S. National Institute of Environmental Health Sciences, the U.S. Department of Health and Human Services, or the European Commission Directorate-General for Employment, Social Affairs and Equal Opportunities.

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The IARC Monographs Working Group alone is responsible for the views expressed in this publication.

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CONTENTS

5. Summary of Data Reported

5.1 Exposure data

Thousands of chemical compounds are used in paint products as pigments, extenders, binders, solvents, and additives. The main organic solvents used are toluene, xylene, aliphatic compounds, ketones, alcohols, esters, and glycol ethers. Azo pigments that contain 3,3′-dichlorobenzidine are common, although free aromatic amines are not present in significant quantities. Asbestos was used as a filler in paints and decorative coatings until the early 1990s. Several hazardous chemicals including benzene, some other solvents, phthalates (plasticizers), chromium and lead oxides have been reduced or replaced in paint, although they are still used in some countries. The increasing use of water-based paints and powder coatings has promoted this trend. New formulations contain lower-toxicity solvents, neutralizing agents, such as amines, and biocides.

Workers in the painting industry are potentially exposed to the chemicals found in paint products during their application and removal. Exposure to dichloromethane occurs during paint stripping from wood and metal surfaces. Diisocyanate is present in some binders and is released during painting. Silica is used in the preparation of surfaces. Painters may also be exposed to asbestos or crystalline silica as bystanders during construction activities. During the application of paint, workers are exposed primarily to solvents whereas the mechanical removal of paint leads mainly to exposure to pigments and fillers. In the past, exposure to hazardous substances frequently exceeded current occupational exposure limits, but exposure levels have generally decreased over time.

Inhalation is the predominant route of exposure, followed by dermal absorption to a much lesser extent; higher inhalation exposures are frequently accompanied by higher dermal exposures. Appropriate selection and use of personal protective equipment can substantially reduce uptake, although painters do not generally wear respirators or gloves. Biomonitoring of exposure to paint products reveals elevated levels of paint compounds or their metabolites in blood and urine.

5.2 Human carcinogenicity data

Seventeen cohort and linkage studies of painters have shown consistent and significant, although moderate (36%), excesses of mortality from lung cancer. Three of these studies provided information on tobacco smoking which is strongly associated with this neoplasm. These excesses are consistent with case–control studies which largely controlled for smoking. Twenty-nine case–control studies of lung cancer in painters were evaluated. Although the results were heterogeneous, partially due to small numbers in some studies, overall, a consistent excess risk of lung cancer was observed over time. Of the 29 studies, three had an odds ratio < 1 with large confidence intervals that included the null value, and the others had odds ratios > 1, 14 of which showed a statistically significant or borderline significant increase. When all independent studies that appropriately adjusted for potential confounders were used in a meta-analysis, a statistically significant excess risk of 35% was obtained. When the analysis and results from the above and from population-based studies were restricted to smoking-adjusted estimates, the statistically significant excess risks were 34% and 41%, respectively.

A borderline significant excess of mortality from mesothelioma was observed in cohort studies and positive results were obtained in two case–control studies of this tumour, which is consistent with the presence of asbestos at some sites where painters work.

The 11 cohort and linkage studies of painters showed consistent, although moderate (21%), excesses of mortality from urinary bladder cancer. Two of these studies provided information on tobacco smoking which is strongly associated with this neoplasm. These excesses are consistent with case–control studies of painters that controlled for smoking in which an excess risk for urinary bladder cancer was seen. Most of the studies that were evaluated had odds ratios > 1. When all independent studies that appropriately adjusted for confounding were used in a meta-analysis, a statistically significant excess risk of 28% was obtained. When the analysis and results from the above and from population-based studies were restricted to smoking-adjusted estimates, the statistically significant excess risks were 26% and 27%, respectively.

Other statistically significant excesses of mortality were observed in the cohort studies for cancers of the pharynx, oesophagus, and liver. Cancers at these sites are associated with tobacco smoking (pharynx and oesophagus) and alcoholic beverage consumption (pharynx, oesophagus, and liver), both of which have been shown to be increased among painters compared with the national populations typically used as referent groups; hence, these might act as positive confounders. However, there are inadequate supportive data from case–control studies of these cancers that control for these potential confounders to conclude that confounding can be excluded as a cause of these excesses. The data were insufficient for evaluation, but the Working Group noted some consistency between case–control and cohort studies for cancers of the pharynx and oesophagus.

More case–control studies evaluated the risk for lymphatic and haematopoietic cancers among painters than that for cancers at other sites. Although some excesses were observed, the data are inadequate to draw a conclusion because of inconsistency among results from these studies, and the lack of any excess mortality from these cancers in the cohort studies. A few case–control studies of cancers of the nose, nasopharynx, larynx, oesophagus, stomach, pancreas, small bowel, kidney, brain, prostate, ovary and breast, mesothelioma, melanoma, and soft–tissue sarcoma were conducted among painters.

Several case–control studies evaluated the risk for childhood cancer and parental occupation as a painter or parental exposure to paints. Seven studies focused on leukaemia. Five showed significant excesses associated with occupational or non-occupational exposure to paints, primarly among mothers. Despite this relatively small amount of data, the Working Group considered that there was some evidence that maternal occupational or other exposure to paints is associated with childhood leukaemia. The risks tended to be greater when mothers were exposed before or during pregnancy rather than after birth of the child, and two studies showed some evidence of an exposure–response relationship with duration of exposure.

Overall, a weakness of both the cohort and case–control studies is the lack of information on exposure–response trends, and few studies included analyses by duration of work as a painter.

There is also little information on specific work settings. One cohort, one case–control and one proportionate mortality study of artistic painters all showed excess mortality from urinary bladder cancer. Insufficient information is available to judge whether trends for risk for cancer have decreased over time with the changes in components of paints; for example, the levels of solvents, such as benzene, and pigments, such as lead chromates in paints, have decreased over past years. Data from studies carried out since the previous evaluations of painters still involve primarily painters who were exposed in the 1960s and the 1970s before many changes in paint components had taken effect.

Nevertheless, when the cohort and case–control studies were taken together, the Working Group concluded that there is consistent evidence in humans that occupational exposure as a painter causes lung and urinary bladder cancer. It does not appear that the excess mortality from these cancers is caused by the principal potential confounder, which is tobacco smoking.

No particular agent can be identified from epidemiological studies as the cause of excess of lung and urinary bladder cancer. It is improbable that the presence of asbestos would completely explain the excess of lung cancer; if this had been the case, a more pronounced excess of mesothelioma would have been observed. There is little information from epidemiological studies on the risk associated with the use of paint pigments that are known lung carcinogens, such as chromium or cadmium.

5.3 Animal carcinogenicity data

No data were available to the Working Group.

5.4 Other relevant data

Painters and paint industry workers are exposed to solvents (such as benzene, toluene and dichloromethane), paint pigments (such as lead, cadmium and chromium compounds) and many other compounds. Solvents are absorbed by inhalation and through the skin, and are generally rapidly metabolized and excreted as conjugated metabolites. Metal compounds that are used as paint pigments are predominantly absorbed in the lung. Dermal absorption is generally low and depends on the chemical properties of the compound, the vehicle, and the integrity of the skin. Absorbed metals are distributed to the organs and, in the case of lead, are concentrated in the bone. Elimination of metals varies from several days to several years.

Overall, six of the eight studies on chromosomal aberrations among painters showed consistent and significant elevated frequencies. Of these six positive studies, three reported an association with years of employment while the other studies did not report analyses on duration of employment. Five of six studies reported significant increases in the frequencies of micronucleus formation among painters. Two of these five studies reported a dose gradient with years or weeks worked and levels of micronuclei. Chromosomal aberrations and micronucleus formation were found in both cultured lymphocytes and buccal cells. Four of seven studies on sister chromatid exchange among painters reported significantly increased frequencies. Exposure–response relationships with duration of employment were reported in three of these four studies. Three of the four studies on DNA single-strand breaks reported increased levels among painters.

Haematological changes were observed in several studies of painters. These included decreased levels of total white blood cells, T-cells and natural killer cells. Furthermore, an increased prevalence of leucopenia, anaemia and granulocytopenia was observed among painters. Immunological changes were also observed among painters in several studies. These effects included specific immunoglobulin (G and E) responses to hexamethylene diisocyanate and increased proliferation of lymphocytes after in-vitro stimulation with hexamethylene diisocyanate.

Most cytogenetic studies among painters that measured a variety of cytogenetic end-points and markers of genotoxicity reported elevated levels of genetic damage. Several of these studies showed a dose-gradient with years or weeks worked and the cytogenetic end-point. Stratified analyses by tobacco smoking status generally showed consistent results among smokers and nonsmokers. These data strongly suggest that occupational exposures in painting lead to increased levels of DNA damage. Furthermore, mechanistic data reviewed by the Agency for Toxic Substances and Disease Registry and in previous evaluations by the IARC Monographs on selected specific chemicals that had been or still are prevalent in exposures encountered by painters indicate strong support for the induction of haematopoietic (benzene, trichloroethylene, 1,3-butadiene), liver (trichloroethylene), and lung (asbestos, cadmium, chromium) cancers.

6. Evaluation and Rationale

6.1 Cancer in humans

There is *sufficient evidence* in humans for the carcinogenicity of occupational exposure as a painter. Occupational exposure as a painter causes cancers of the lung, and of the urinary bladder.

There is *limited evidence* in humans, based primarily on studies of maternal exposure, that painting is associated with childhood leukaemia.

6.2 Cancer in experimental animals

There is *inadequate evidence* in experimental animals for the carcinogenicity of occupational exposure as a painter, since no data were available to the Working Group.

6.3 Overall evaluation

Occupational exposure as a painter is *carcinogenic to humans (Group 1)*.

EXHIBIT 2

International Union of Painters and Allied Trades

Petition for Promulgation of a Health and Safety Standard for Preparation and Coating for Corrosion Prevention

QP for Contractors

SSPC certified contractors need to demonstrate that they strive to be the best in the industry. To become certified, the contractor or shop must:

- Complete a detailed application form describing the company and its work history
- Submit documentation on quality control, safety, and environmental compliance programs and procedures
- Obtain acceptance of the submittal
- Undergo an on-site audit by an SSPC auditor of both the contractor's primary place of business and an active job site to demonstrate the company's capabilities
- For coating contractor certifications, comply with a rigorously enforced Disciplinary Action Code

All industrial coating contractors and shops, regardless of size, volume of work, markets served, or affiliations, are eligible for SSPC certification, provided that they can demonstrate a six-month production history of compliance with certification requirements prior to their initial evaluation.

SSPC QP1 Certification
(Field Application to Complex Industrial and Marine Structures)

SSPC QP1SM certification is a nationally recognized program that evaluates the practices of industrial painting contractors in key areas of business. These standards are considered to be the MINIMUM level of service and quality for today's coatings industry. The complex nature of coating systems and the specific surface preparations required for these systems, have made the QP 1 guidelines vital to the longevity of applied protective coatings. The program is designed to provide facility owners and specification writers a means to determine whether the painting contractor has the capability to perform surface preparations and coating application in the field on complex industrial and marine structures, such as:

- Bridges
- Food and beverage facilities
- Off-shore drilling
- Power generation facilities
- Petro/chemical plants
- Storage tanks
- Ships maintenance

Information excerpted from the SSPC website. The chart attached identifies facility owners that require SSPC QP certification on their projects. More information is available at http://www.sspc.org/qp-programs/qp-programs-home/.

- Waste water treatment facilities

To be certified by SSPC, industrial contractors must demonstrate competence in several key areas:

- Management procedures
- Quality control
- Safety, health and environmental compliance

CAS for QP 1 Contractors

SSPC established the Coating Application Specialist (CAS) Certification Program for industrial painters in 2008 in order to strengthen the qualifications of the current workforce and lay the groundwork for development of a strong industrial painter work force for the decades to follow.

The CAS program is based on the requirements of SSPC ACS-1/NACE 13, a standard published jointly in 2008 by SSPC and NACE International. ACS-1 defines training and experience requirements that a tradesperson must have in order to qualify to be assessed for certification.

Information excerpted from the SSPC website. The chart attached identifies facility owners that require SSPC QP certification on their projects. More information is available at http://www.sspc.org/qp-programs/qp-programs-home/.

Facility Owners Requiring SSPC QP Certification

State	Organization	Industry	Public or Private	Certification Required								
				QP 1	QP 2	QP 3	QP 5	QP 6	QP 8	QP9	QS1	QN1
Alaska	Alaska DOT	Bridge / Hwy	Public		Yes							
Arkansas	AHTD(Arkansas State Hwy & Trans Dept)	Bridge / Hwy	Public	Yes	Yes							
California	Aera Energy	Petro / Chem	Private	Yes								
California	Morton Salt	Structure	Private	Yes	Yes							
California	Pacific Gas & Electric	Power	Private	Yes								
California	Southern California Edison	Power	Private	Yes								
California	Alameda County Dept of Public Works	Bridge / Hwy	Public	Yes	Yes							
California	Bay Area Rapid Transit	Structure	Public	Yes								
California	CA DOT (CALTRANS)	Bridge / Hwy	Public	Yes	Yes	Yes						
California	California Dept of Water Resources	Water	Public	Yes								
California	California State Parks	Multiple	Public	Yes	Yes							
California	Casitas Municipal Water District	Water	Public	Yes								
California	CCC Sanitary District	Water	Public	Yes								
California	City of Anaheim	Bridge / Hwy	Public	Yes	Yes							
California	City of Brisbane	Bridge / Hwy	Public	Yes								
California	City of Burlingame	Water	Public	Yes	Yes							
California	City of Colfax	Water	Public	Yes								
California	City of Fort Bragg	Water	Public	Yes								
California	City of Fremont	Water	Public	Yes								
California	City of Fresno	Water	Public	Yes								
California	City of Hayward	Water	Public	Yes								
California	City of Madera	Water	Public	Yes	Yes							
California	City of Long Beach	Bridge / Hwy	Public	Yes	Yes							
California	City of Napa	Water	Public	Yes								
California	City of Oakland	Bridge / Hwy	Public	Yes								
California	City of Palo Alto	Water	Public	Yes								
California	City of Petaluma	Bridge / Hwy	Public	Yes								
California	City of Pinole	Water	Public	Yes								
California	City of Pittsburg	Water	Public	Yes								
California	City of Pleasanton	Bridge / Hwy	Public	Yes								
California	City and County of San Francisco	Water	Public	Yes								
California	City of San Jose	Bridge / Hwy	Public	Yes	Yes	Yes						
California	City of San Leandro	Water	Public	Yes								
California	City of Stockton	Bridge / Hwy	Public	Yes								

Facility Owners Requiring SSPC QP Certification

State	Organization	Industry	Public or Private	Certification Required								
				QP 1	QP 2	QP 3	QP 5	QP 6	QP 8	QP9	QS1	QN1
California	City of San Diego	Bridge / Hwy	Public	Yes	Yes							
California	City of Sunnyvale	Water	Public	Yes	Yes							
California	City of Vacaville	Water	Public	Yes								
California	City of Vallejo	Structure	Public	Yes								
California	City of Yuba City	Water	Public	Yes								
California	Coastside County Water District	Water	Public	Yes								
California	County of Butte	Bridge / Hwy	Public	Yes	Yes							
California	County of Los Angeles	Bridge / Hwy	Public		Yes							
California	County of Madera	Bridge / Hwy	Public	Yes		Yes						
California	County of Orange	Bridge / Hwy	Public	Yes								
California	County of Sacramento Public Works	Bridge / Hwy	Public	Yes	Yes							
California	County of Santa Cruz	Bridge / Hwy	Public	Yes								
California	County of Sonoma	Bridge / Hwy	Public	Yes	Yes							
California	Daly City	Water	Public	Yes								
California	Delta Diablo Sanitation District	Water	Public	Yes								
California	East Bay Municipal Utility District	Water	Public	Yes	Yes							
California	Fairfield Suisun sewer District	Water	Public	Yes								
California	Graton Community Service District	Water	Public	Yes								
California	Groveland Community Services District	Water	Public	Yes								
California	Kern County Water Agency	Water	Public	Yes								
California	Las Virgenes Municipal Water District	Water	Public	Yes	Yes							
California	Marin Municipal Water District	Water	Public	Yes	Yes							
California	Mt. View Sanitary District	Water	Public	Yes								
California	Monterey Regional Water Pollution Authority	Water	Public	Yes								
California	North Marin Water District	Water	Public	Yes								
California	Orange County Sanitation District	Water	Public	Yes								
California	Otay Water District	Water	Public	Yes								
California	Pajaro Valley Water Management Agency	Water	Public	Yes								
California	Placer County Water Agency	Water	Public	Yes								
California	Port of Oakland	Marine	Public	Yes								
California	Port of Richmond	Marine	Public	Yes								
California	Purissima Hills Water District	Water	Public	Yes								
California	Sacramento Area Sewer District	Water	Public	Yes								
California	San Francisco Public Utilities Programs	Power	Public	Yes								

				Certification Required								
State	**Organization**	**Industry**	**Public or Private**	**QP 1**	**QP 2**	**QP 3**	**QP 5**	**QP 6**	**QP 8**	**QP9**	**QS1**	**QN1**
California	San Jose WWTP	Water	Public	Yes	Yes							
California	San Rafael Sanitation District	Water	Public	Yes								
California	Sanitary District #5, Tiberon	Water	Public	Yes								
California	Santa Clara Valley Water District	Water	Public	Yes								
California	South Bayside System Authority	Water	Public	Yes								
California	Turlock Irrigation District	Water	Public	Yes								
California	Union Sanitary District	Water	Public	Yes								
California	Vallejo Sanitation & Flood Control District	Water	Public	Yes								
California	Westborough Water District	Water	Public	Yes								
California	Zone #7 Water Authority	Water	Public	Yes								
California	Contra Costa Water District	Water		Yes								
Canada	Seaway International Bridge Corp.	Bridge / Hwy	Pub / Priv	Yes	Yes							
Canada	Alberta, Ministry of Transportation	Bridge / Hwy	Public	Yes								
Canada	BC Ministry of Transportation (Canada)	Bridge / Hwy	Public	Yes								
Canada	Fisheries and Oceans, Canada	Water	Public	Yes								
Colorado	City of Aurora	Bridge / Hwy	Public		Yes							
Colorado	Denver City and County Water	Water	Public	Yes								
Colorado	El Paso County	Bridge / Hwy	Public	Yes	Yes							
Connecticut	Connecticut DOT	Bridge / Hwy	Public	Yes	Yes	Yes						
Connecticut	Connecticut Resources Recovery Authority	Petro / Chem	Public	Yes								
Connecticut	Town of Killingworth	Bridge / Hwy	Public	Yes	Yes							
Connecticut	Town of Roxbury	Bridge / Hwy	Public	Yes	Yes							
D.C.	D.C. Public Works	Bridge / Hwy	Public	Yes	Yes							
Delaware	Delaware DOT	Bridge / Hwy	Public	Yes	Yes							
Florida	Florida Power & Light	Power	Private	Yes	Yes							
Florida	Broward County	Bridge / Hwy	Public		Yes							
Florida	City of Fort Lauderdale	Bridge / Hwy	Public	Yes	Yes							
Florida	City of Lakeland	Power	Public	Yes								
Florida	City of Orlando	Bridge / Hwy	Public	Yes	Yes	Yes						
Florida	City of Winterhaven	Water	Public		Yes							
Florida	Emerald Coast Utilities Authority	Water	Public	Yes								
Florida	Florida DOT	Bridge / Hwy	Public	Yes	Yes	Yes						
Florida	Hillsborough County, Aviation Department	Bridge / Hwy	Public	Yes								
Florida	Hillsborough County, Covanta Energy	Power	Public	Yes								

Facility Owners Requiring SSPC QP Certification

State	Organization	Industry	Public or Private	Certification Required QP 1	QP 2	QP 3	QP 5	QP 6	QP 8	QP9	QS1	QN1
Florida	Jacksonville Transportation Authority	Bridge / Hwy	Public	Yes								
Florida	Lee County	Bridge / Hwy	Public	Yes								
Florida	Miami-Dade Water and Sewer	Water	Public	Yes								
Florida	Miami-Dade County Expressway Authority	Bridge / Hwy	Public		Yes							
Florida	Florida Turnpike Enterprises	Bridge / Hwy	Public	Yes								
Florida	Orange County	Bridge / Hwy	Public	Yes								
Florida	Orlando Orange County Expressway Auth	Bridge / Hwy	Public	Yes								
Florida	Pinellas County	Bridge / Hwy	Public	Yes								
Florida	Polk County Transportation Engineering Divis	Bridge / Hwy	Public	Yes								
Florida	South Florida Water Management District	Water	Public			Yes						
Florida	Tolomato Community Development District	Bridge / Hwy	Public	Yes								
Georgia	City of Sandy Springs	Bridge / Hwy	Public	Yes								
Georgia	City of Savannah	Water	Public		Yes							
Georgia	City of Social Circle	Bridge / Hwy	Public	Yes	Yes							
Georgia	Cobb County DOT	Bridge / Hwy	Public	Yes	Yes							
Georgia	Georgia DOT	Bridge / Hwy	Public	Yes	Yes							
Georgia	Newton County	Bridge / Hwy	Public		Yes							
Hawaii	Hawaii DOT	Bridge / Hwy	Public	Yes	Yes							
Idaho	PacifiCorp	Power	Private		Yes							
Idaho	Idaho DOT	Bridge / Hwy	Public	Yes	Yes							
Illinois	Honeywell International, Inc.	Structure	Private	Yes	Yes							
Illinois	Illinois DOT	Bridge / Hwy	Public	Yes	Yes	Yes						
Illinois	City of Chicago DOT	Bridge / Hwy	Public		Yes							
Illinois	City of Naperville	Water	Public		Yes							
Illinois	Lake County	Bridge / Hwy	Public			Yes						
Indiana	Allen County	Structure	Public	Yes								
Indiana	Carroll County	Bridge / Hwy	Public	Yes								
Indiana	Indiana Port Commission	Bridge / Hwy	Public	Yes	Yes							
Indiana	City of Indianapolis	Water	Public	Yes	Yes							
Indiana	Indiana DOT	Bridge / Hwy	Public	Yes	Yes							
Louisiana	Citco Refinery, Lake Charles	Petro / Chem	Private	Yes								
Louisiana	Enbridge Offshore Transmission	Petro / Chem	Private	Yes								
Louisiana	Consolidated Waterworks District #1	Water	Public	Yes								
Louisiana	Jefferson Parish	Bridge / Hwy	Public	Yes	Yes							

State	Organization	Industry	Public or Private	Certification Required								
				QP 1	QP 2	QP 3	QP 5	QP 6	QP 8	QP9	QS1	QN1
Louisiana	Louisiana DOT	Water	Public	Yes	Yes							
Louisiana	St. John the Baptist Parish	Water	Public	Yes								
Maine	Maine Turnpike Authority	Bridge / Hwy	Public	Yes	Yes							
Maine	Maine DOT	Bridge / Hwy	Public	Yes	Yes							
Maryland	Carroll County	Bridge / Hwy	Public	Yes								
Maryland	Cecil County	Bridge / Hwy	Public	Yes	Yes							
Maryland	Charles County	Bridge / Hwy	Public	Yes								
Maryland	Frederick County	Bridge / Hwy	Public	Yes	Yes							
Maryland	City of Baltimore	Bridge / Hwy	Public	Yes	Yes							
Maryland	Maryland Stadium Authority	Structure	Public	Yes								
Maryland	Maryland State Highway Administration	Bridge / Hwy	Public	Yes	Yes							
Maryland	Montgomery County	Bridge / Hwy	Public	Yes	Yes							
Massachusett	Fitchburg State College	Power	Public	Yes								
Massachusett	MA DOT / MHD	Bridge / Hwy	Public	Yes	Yes							
Massachusett	MA Dept of Conservation and Recreation	Bridge / Hwy	Public	Yes	Yes							
Massachusett	Mass Bay Trans Authority	Bridge / Hwy	Public	Yes	Yes							
Massachusett	Town of Yarmouth	Water	Public	Yes	Yes							
Michigan	City of Battle Creek	Water	Public	Yes								
Michigan	Huron Clinton Metropolitan Authority	Bridge / Hwy	Public	Yes	Yes							
Michigan	Michigan DOT	Bridge / Hwy	Public	Yes	Yes							
Michigan	City of Ann Arbor	Bridge / Hwy	Public		Yes							
Minnesota	Monticello Nuclear Power	Power	Private	Yes								
Minnesota	University of Minnesota	Structure	Public			Yes						
Missouri	Associated Electric Cooperative Inc.	Power	Private		Yes							
Missouri	Bi-State Development Agency	Bridge / Hwy	Public	Yes	Yes							
National	Anheuser -Busch	Mfg / Maint	Private	Yes								
National	Bayer	Mfg / Maint	Private	Yes								
National	Burlington Northern Santa Fe Railway	Bridge / Hwy	Private	Yes	Yes							
National	Chevron	Petro / Chem	Private	Yes								
National	CSX Transportation	Bridge / Hwy	Private	Yes	Yes							
National	Dominion	Power	Private	Yes								
National	Dupont (construction)	Mfg / Maint	Private	Yes	Yes							
National	Voridian	Petro / Chem	Private	Yes	Yes							
National	Lockheed Martin	Mfg / Maint	Private	Yes								

State	Organization	Industry	Public or Private	Certification Required								
				QP 1	QP 2	QP 3	QP 5	QP 6	QP 8	QP9	QS1	QN1
National	Longview Fiber Paper Mill	Pulp / Paper	Private	Yes	Yes							
National	Permatec	Mfg / Maint	Private	Yes	Yes							
National	Procter & Gamble	Mfg / Maint	Private	Yes								
National	Progress Energy	Power	Private	Yes	Yes							
National	Amtrak	Bridge / Hwy	Pub / Priv	Yes	Yes							
National	US Army Corps of Engineers	Water	Public	Yes	Yes			Yes				
National	US Bureau of Land Management	Water	Public	Yes	Yes							
National	US Bureau of Reclamation	Water	Public	Yes	Yes							
National	US Coast Guard	Marine	Public	Yes								
National	US Department of Agriculture	Structure	Public	Yes								
National	US Department of Commerce	Multiple	Public	Yes	Yes							
National	US Department of Veterans Affairs	Water	Public	Yes								
National	US Forest Service	Bridge / Hwy	Public	Yes	Yes							
National	Tri-Services Facilities Guide Spec (DOD)	Marine	Public	Yes	Yes	Yes	Yes					
National	US Navy (NAVSEA)	Marine	Public	Yes								
National	Federal Highway Administration	Bridge / Hwy	Public									
National	Federal Lands Department	Water	Public	Yes	Yes							
National	BC Ministry of Transportation (Canada)	Bridge / Hwy	Public	Yes								
National	National Oceanic and Atmospheric Administr	Marine	Public	Yes								
National	Western Federal Lands Highway Division	Bridge / Hwy	Public	Yes	Yes							
Nevada	City of North Las Vegas	Water	Public	Yes	Yes							
Nevada	Nevada DOT	Bridge / Hwy	Public	Yes	Yes							
New Hampshi	NH DOT	Bridge / Hwy	Public	Yes	Yes	Yes		Yes				
New Hampshi	Town of Henniker	Bridge / Hwy	Public	Yes	Yes							
New Hampshi	Town of Wentworth	Bridge / Hwy	Public	Yes	Yes							
New Jersey	Paulus Hook Pier	Marine	Private	Yes								
New Jersey	South Jersey Port Corporation	Structure	Private									
New Jersey	Cape May County	Bridge / Hwy	Public	Yes								
New Jersey	NJ Highway Authority	Bridge / Hwy	Public	Yes	Yes							
New Jersey	Nj / NY Port Authority	Bridge / Hwy	Public	Yes	Yes							
New Jersey	Morris County WWTP	Water	Public	Yes	Yes							
New Jersey	South Jersey Transportation Authority	Bridge / Hwy	Public	Yes								
New Jersey	Township of Sparta	Water	Public	Yes	Yes							
New York	Brooklyn Bridge Park Development Corp	Marine	Private	Yes								

				Certification Required								
State	Organization	Industry	Public or Private	QP 1	QP 2	QP 3	QP 5	QP 6	QP 8	QP9	QS1	QN1
New York	Buffalo and Port Erie Public Bridge Authority	Bridge / Hwy	Public	Yes	Yes							
New York	Cattaraugus County Dept of Public Works	Bridge / Hwy	Public	Yes	Yes							
New York	Chautauqua County dept of Facilities	Bridge / Hwy	Public		Yes							
New York	City of Rochester	Bridge / Hwy	Public	Yes	Yes							
New York	Nassau Dept of Public Works	Bridge / Hwy	Public	Yes	Yes							
New York	Niagara Falls Bridge Commission	Bridge / Hwy	Public	Yes	Yes							
New York	NY City DOT	Bridge / Hwy	Public	Yes	Yes							
New York	NY City Transit Authority	Bridge / Hwy	Public	Yes	Yes							
New York	NY DOT	Bridge / Hwy	Public	Yes	Yes							
New York	NY Power Authority	Power	Public	Yes	Yes							
New York	NY Thruway Authority	Bridge / Hwy	Public	Yes	Yes							
New York	NY Tri-Boro Bridge / Tunnel Authority	Bridge / Hwy	Public	Yes	Yes	Yes						
New York	Riverhead Water District	Water	Public		Yes							
New York	Sullivan County	Bridge / Hwy	Public	Yes	Yes							
New York	Town of North Bellmore	Structure	Public						Yes			
New York	Town of Brookhaven	Structure	Public						Yes			
New York	Town of Oyster Bay	Structure	Public						Yes			
New York	New York State Department of Parks	Structure	Public						Yes			
New York	Suffolk County DPW	Food Services	Public						Yes			
New York	Hofstra University Health Care System	Structure	Private						Yes			
New York	Tioga County DPW	Bridge / Hwy	Public	Yes	Yes							
New York	Tompkins County	Bridge / Hwy	Public	Yes	Yes							
New York	Village of Lake George	Water	Public	Yes	Yes							
North Carolina	City of Asheville	Bridge / Hwy	Public	Yes								
North Carolina	City of Winston-Salem	Water	Public	Yes	Yes							
North Carolina	NC DOT	Bridge / Hwy	Public	Yes	Yes	Yes						
North Carolina	Town of Maysville	Water	Public		Yes							
North Dakota	North Dakota DOT	Bridge / Hwy	Public	Yes	Yes							
Ohio	City of Dayton	Bridge / Hwy	Public	Yes								
Ohio	Ohio DOT	Bridge / Hwy	Public			Yes	Yes					
Ohio	Allen County	Bridge / Hwy	Public		Yes							
Ohio	Montgomery County	Water	Public		Yes							
Oregon	Oregon Dept of Parks and Recreation	Marine	Public	Yes	Yes							
Oregon	Eugene Water and Electric Board	Water / Power	Public		Yes							

Facility Owners Requiring SSPC QP Certification

				Certification Required								
State	**Organization**	**Industry**	**Public or Private**	**QP 1**	**QP 2**	**QP 3**	**QP 5**	**QP 6**	**QP 8**	**QP9**	**QS1**	**QN1**
Oregon	Multoma County	Bridge / Hwy	Public	Yes	Yes							
Oregon	Oregon Bureau of Land Management	Water	Public	Yes	Yes							
Panama	Panama Canal Authority	Water	Public	Yes				yes				
Pennsylvania	North Coventry Municipal Authority	Water	Public	Yes	Yes							
Pennsylvania	Penn DOT	Bridge / Hwy	Public			Yes						
Pennsylvania	PA Turnpike Commission	Transporation	Public		yes							
Pennsylvania	Philadelphia Water Department	Water	Public	Yes	Yes							
Pennsylvania	Delaware River Port Authority	Bridge / Hwy	Public	Yes								
Rhode Island	National Grid, USA	Power	Private	Yes	Yes							
Rhode Island	Harrisville Fire District	Water	Public		Yes							
Rhode Island	RI DOT	Bridge / Hwy	Public	Yes	Yes	Yes						
Rhode Island	Rhode Island Turnpike & Bridge Authority	Bridge / Hwy	Public	Yes	Yes							
South Carolin	Alcoa	Mfg / Maint	Private	Yes								
South Carolin	BP Amoco Chemical Company	Petro / Chem	Private		Yes							
South Carolin	SC DOT	Bridge / Hwy	Public	Yes	Yes							
South Carolin	City of Charleston	Structure	Public	Yes								
Tennessee	City of Oakridge	Water	Public	Yes								
Tennessee	Metro Nashville Public Works	Bridge / Hwy	Public	Yes	Yes							
Tennessee	TN DOT	Bridge / Hwy	Public	Yes	Yes							
Texas	Rowan Companies	Petro / Chem	Private	Yes								
Texas	Brazos River Authority	Water	Public	Yes								
Texas	City of Fort Worth	Water	Public	Yes								
Texas	City of Austin	Water	Public	Yes	Yes							
Texas	City of Frisco	Water	Public	Yes								
Texas	City of Garland	Water	Public	Yes								
Texas	City of San Antonio	Bridge / Hwy	Public		Yes							
Texas	City of San Marcos	Water	Public	Yes								
Texas	Galveston County	Bridge / Hwy	Public	Yes								
Texas	Houston Port Authority	Bridge / Hwy	Public	Yes								
Texas	Texas DOT	Bridge / Hwy	Public	Yes	Yes							
Utah	Intermountain Power Service Corp	Power	Private	Yes								
Utah	Utah DOT	Bridge / Hwy	Public	Yes	Yes	Yes						
Utah	Utah Transit Association	Bridge / Hwy	Public	Yes								
Virginia	Honeywell Inc.	Bridge / Hwy	Private	Yes								

Facility Owners Requiring SSPC QP Certification

State	Organization	Industry	Public or Private	Certification Required								
				QP 1	QP 2	QP 3	QP 5	QP 6	QP 8	QP9	QS1	QN1
Virginia	Capitol Region Airport Commission	Bridge / Hwy	Public	Yes								
Virginia	Carol County	Bridge / Hwy	Public	Yes								
Virginia	City of Alexandria	Bridge / Hwy	Public	Yes	Yes							
Virginia	City of Lynchburg	Water	Public	*	*							
Virginia	City of Virginia Beach	Water	Public	Yes	Yes	Yes	Yes					
Virginia	Town of Christiansburg	Bridge / Hwy	Public	Yes								
Virginia	Richmond Metropolitan Authority	Bridge / Hwy	Public	Yes	Yes							
Virginia	Virginia DOT	Bridge / Hwy	Public	Yes	Yes							
Washington	Puget Sound Energy	Power	Private		Yes							
Washington	Chelan County Public Utility Dist. #1	Water	Public		Yes							
Washington	City of Seattle	Bridge / Hwy	Public	Yes	Yes							
Washington	City of Tacoma	Bridge / Hwy	Public	Yes	Yes							
Washington	Grant County Public Utility District #2	Water	Public		Yes							
Washington	Lake Whatcom Water and Sewer District	Water	Public	Yes								
Washington	Port of Grays Harbor	Marine	Public	Yes		Yes						
Washington	Washington DOT	Bridge / Hwy	Public	Yes	Yes							
California	DWR California	Water	Public		yes							
California	Calaveras County Water District	Water	Public	yes								
California	Coachella Valley Water District	Water	Public	yes								
California	City of Chico	Water	Public	yes	yes							
California	City of Reedley	Water	Public	yes								
California	Monterey County	Transporation	Public	yes								
California	City of Morro Bay	Transporation	Public	yes								
California	Moulton Niguel Water Dist.	Water	Public	yes								
California	City of Rohnert Park	Water	Public	yes	yes							
California	Port of San Francisco	Marine	Public	yes								
California	Nevada Irrigation District	Water	Public	yes								
California	Tahoe-Tucker Sanitation Agency	Water	Public	Yes	Yes							
California	Donner Summit Public Utility District	Water	Public	yes								
California	City of Turlock-Municipal Svcs/Engrg Div.	Water	Public	yes								
California	Nevada County Sanitation District No. 1	Water	Public	yes								
California	MacPherson Oil	Oil	Private	yes								
California	BP Pipeline and Logistics	Oil	Private	yes								
California	City of Modesto	Water	Public	yes								

Facility Owners Requiring SSPC QP Certification

State	Organization	Industry	Public or Private	Certification Required								
				QP 1	QP 2	QP 3	QP 5	QP 6	QP 8	QP9	QS1	QN1
Connecticut	Devon Power	Power	Private	yes	yes							
Connecticut	Town of Naugatuck	Transporation	Public	yes	yes							
Connecticut	Town of Westbrook	Transporation	Public	yes								
D.C.	DDOT	Transporation	Public		yes							
Florida	Florida East Coast Railway	Transporation	Public		yes							
Florida	Seminole County Board of County Commissi	Transporation	Public	yes								
Florida	Board of County Commissioners Santa Rosa	Transporation	Public	yes								
Hawaii	K-Sea (Smith Maritime)	Marine	Private	yes								
Hawaii	Healy Tibbitts Builders, Inc	Marine	Private	yes								
Idaho	Bureau of Reclamation	Power	Public	yes								
Louisiana	PPG Industries	Manufacturing	Private	yes								
Louisiana	Boussard	Marine	Private	yes								
Louisiana	Toledo Bend Project Joint Operation	Marine	Public	yes								
Maryland	St Mary's County Metropolitan Commision	Water	Public	yes	yes							
Maryland	Maryland Transportation Authority	Transportation	Public	yes	yes							
Massachusetts	Berkley Investments, Inc.	Commercial	Private	yes	yes							
Mississippi	South MS. Electric Power Association	Power	Private	yes								
Missouri	METRO	Transporation	Public	yes	yes							
National	US Coast Guard	Marine	Public	yes	yes	yes	yes	yes				
National	American Water Military Service	Water	Public	yes								
National	USACE	Water	Public								yes	
Nevada	Truckee Meadow Water Authority	Water	Public	yes								
New Hampshi	Burgess Biopower	Power	Private		yes							
New Jersey	New Jersey DOT	Transportation	Public	yes	yes							
New Jersey	Hunterdon County	Transporation	Public	yes								
New York	Long Island Rail Road	Transportation	Public	yes	yes							
New York	Port Authority of NY-NJ	Transportation	Public	yes	yes							
New York	New York State Bridge Authority	Transporation	Public	yes	yes							
New York	Westchester County	Transporation	Public	yes	yes							
New York	Metro North	Transporation	Public	yes	yes							
New York	Onondaga County DPW	Transporation	Public	yes	yes							
New York	Town of Vestal	Transporation	Public	yes	yes							
Oregon	Oregon DOT	Transportation	Public	yes								
Pennsylvania	Township of Lower Merion	Water	Public	yes								

				Certification Required								
State	**Organization**	**Industry**	**Public or Private**	**QP 1**	**QP 2**	**QP 3**	**QP 5**	**QP 6**	**QP 8**	**QP9**	**QS1**	**QN1**
Pennsylvania	PennDOT	Transporation	Public	Yes	yes	Yes						
Rhode Island	EPCO	Utility	Private	yes	yes							
Texas	Jackrabbit MUD	Water	Public	yes								
Texas	Northwest Harris County MUD	Water	Public	yes								
Texas	Harris County Freshwater Supply District No	Water	Public	yes								
Texas	Harris County MUD	Water	Public	yes								
Texas	City of Malakoff	Transportatior	Public	yes								
Texas	Spansion, Inc.	Water	Private	yes								
Texas	City of Fairfield	Water	Public	yes								
Texas	City of Pleasanton	Water	Public	yes								
Texas	City of Smithville	Water	Public	yes								
Texas	Town of Flower Mound	Water	Public	yes								
Texas	City of Conroe Public Works	Water	Public	yes								
Texas	City of Texas City	Transporation	Public	yes								
Texas	Bridgestone MUD	Water	Public	yes								
Texas	Cinco Municipal Utility District No.1	Water	Public	yes								
Texas	Fort Bend County MUD	Water	Public	yes								
Vermont	Vermont DOT/AOT	Transporation	Public	yes	yes							
Virginia	HEPACO	Water	Private	yes								
Washington	Pend Oreille County	Transportatior	Public	yes								
Washington	Cascade Natural Gas	Utility	Private	yes	yes							

EXHIBIT 3

International Union of Painters and Allied Trades

Petition for Promulgation of a Health and Safety Standard for Preparation and Coating for Corrosion Prevention

THE CENTER TO PROTECT WORKERS' RIGHTS

CPWR

A Comparison of Safety-and-Health Training of Painters In Alaska, Oregon, and Washington

Rod Wolford and **Marilyn Larson**
FOF Communications, Washington, D.C.
Dooley Merrick
Paint-Safe, Seattle, Washington
Sandra Tillett
Occupational Health Foundation, Washington, D.C.

with contributions from

Sharon Morris and **Matt Keiffer**
Northwest Center for Occupational Health & Safety, University of Washington, Seattle

January 1997

The Center to Protect Workers' Rights
Suite 1000 • 8484 Georgia Ave. • Silver Spring, MD 20910
301-578-8500 • Fax: 301-578-8572 • www.cpwr.com • www.elcosh.org

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CPWR — the research and development arm of the Building and Construction Trades Department, — is uniquely situated to serve workers, contractors, and the scientific community. A major CPWR activity is to improve worker safety and health in the construction industry in the United States. This report is part of that effort.

Copies of this report may be obtained from Publications, The Center to Protect Workers' Rights, 8484 Georgia Avenue, Suite 1000, Silver Spring, Maryland 301-578-8500. (Report no. P1-97)

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Contents

This three-year study examined differences in training and self-protective practices between painters in Alaska subject to mandatory safety-and-health training and painters in Oregon and Washington state, where such training is voluntary. The study also examined the effects of type of work, paint application method, union status, employer size, and other employer characteristics on training and protective practices among these painters.

The Need for the Study

Construction and maintenance painters face increased rates of lung, throat, and larynx cancers, and leukemia; impaired nervous system function; kidney and liver disease; diseases of the blood or blood-forming organs; and birth defects among offspring — all of these outcomes associated with exposure to dozens of chemicals in oil-based paints and coatings (International Agency for Research on Cancer 1989). Solvents are particularly hazardous and inhalation is the primary means of painter exposures to them (Selikoff 1975 or see, for instance, Englund, Ringen, and Mehlman 1983) Thus, there is a particular need for training in the selection and use of respirators and fans.[1] Providing training for painters has been difficult, however, because of the transient, mobile nature of the work and the prevalence of small contracting companies that do not have full-time safety professionals or access to training resources.

The Alaska Model

The Alaska Hazardous Painting Certification Standard, implemented in 1988, was designed, in part, to overcome some of the difficulties associated with delivering training to the construction or maintenance painter. The Alaska law requires all painters who use organic, solvent-borne coatings to obtain an initial 16 hours of training and eight hours of refresher training every two years (painters pay a certification fee that covers course tuition and a fee paid to the state). A painter must earn a passing score of 70 on a state-approved examination at the end of each course. Employers are required to screen employees for certification for jobs using solvent-borne coatings.

The Study

Painter recruitment

Recruitment of painters for training involved three mailings in each state to targeted painters; multiple contacts by phone, mail, and personal meeting with more than 1,400 licensed contractors; mailings to more than 1,300 vendors, asking them to post notices in their paint stores; local newspaper advertisements; and, in the final phase of the training effort, mailings by unions to their members. In Alaska, Paint-Safe, a nonprofit organization in the Pacific Northwest, sent the three mailings to more than 800 painters, using the Alaska Certified Painter Registry, which is public record, to identify recipients. In Oregon and Washington, the state labor departments each sent three mailings to painters, identifying recipients from state employment records and using state envelopes; the mailings were each

[1]The importance of respirator use for painters is supported by a case-referent study of lung cancer among painters, which showed a fivefold excess risk of lung cancer for painters who did not wear a respirator. See Stockwell and Matanoski 1985.

sent to more than 1,100 painters in Oregon and more than 2,400 in Washington. The two state agencies handled the mailings to assure confidentiality of records. (The states billed Paint-Safe for postage.)

Painters who received announcements could call a toll-free number to enroll in scheduled classes. Class times and locations were flexible to accommodate recruits. Training was offered at reduced cost in Alaska and at no cost in Oregon and Washington.

Participant groups

Study participants were categorized in four groups, three for painters and one for employers. One group comprised non-union and union painters participating in mandatory certification training in Alaska between August 1994 and March 1995. This mandatory training group consisted of 128 painters applying for initial certification, eligible for renewal, or returning for renewal, plus nine painters in Oregon and Washington who were Alaska-certified and who worked sometimes in Alaska.

A second group, the voluntary training group, consisted of non-union and union painters who participated in a voluntary training program offered between August 1994 and March 1995 as part of the study in Oregon and Washington. The 231 volunteers were recruited from among workers who were employed at the time by a licensed painting contractor, had applied for state unemployment compensation in the previous three years and listed "painter" as their occupation, were self-employed as painters, or were active members of a painters' union.

Painters in the first two groups completed a pre-training baseline questionnaire, a post-training questionnaire, and a follow-up telephone interview two-to-six months 44 to 340 days after training. The Alaska state-approved painter training course was given to both training groups. In Alaska, the trainers were three apprenticeship instructors from two state-approved labor-management programs. In Oregon and Washington, one WashCOSH instructor and eight instructors from labor-management training programs served as instructors. (WashCOSH is the Washington Committee on Occupational Safety and Health, a nonprofit organization in Seattle.) All 11 instructors attended a one-week train-the-trainer orientation course to assure uniform training delivery.

The third group of painters consisted of a representative sample in each of the states who responded to a cross-sectional mail survey of all identifiable painters in 1993 and who reported working with oil-based paint in the preceding week. These 1,134 painters provided baseline comparisons with the trainees in each state (in the first two groups). In other statistical analyses, painters in this third group were combined with the trainees to increase the statistical power of the findings (thus reducing the possibility of a key type of statistical error).

Statistical analyses found the painters in all three states to be comparable in key demographic features, such as age, years in the trade, education level, and so on.

Last, 206 painting contractors in Alaska, Oregon, and Washington were surveyed in 1993. The contractors were interviewed by telephone concerning company size, type of work, paint application methods, workplace policies, and safety-and-health expenditures. The contractors had been named as employers by painters in the third group responding to the 1993 cross-sectional survey and were linked with their then-current employees for some statistical analyses.

The training

The program approved by the state of Alaska was used to train 368 painters in the three states: 128 in Alaska, 102 in Oregon, and 138 in Washington. The program focused on using respirators and fans to reduce exposures while painting. Topics included the selection and use of personal protective equipment, such as respirators and gloves; the health hazards of painting, with an emphasis on recognizing and avoiding neurotoxic signs and symptoms of exposure; how to obtain and use a material safety data sheet (MSDS); and selection and use of fans for temporary ventilation. A 7-minute video produced for the training demonstrated correct ventilation using one or two portable fans; numbers on the screen showed exposure levels and how they changed during the demonstration. Training time was split between classroom and hands-on sessions.

Surveys used

Six survey instruments were used in this study, all during the study's second and third years. (Copies of the year 3 questionnaires are in annex A.)

Survey instrument	**Description**
Year 2	
Painter questionnaire	Cross-sectional survey in Alaska, Oregon, and Washington; questions include type of work, application methods, contractor size, types of training (if any), years in the trade, union status, protective practices (respirators, fans, gloves, long-sleeve shirts, and so on).
Contractor questionnaire	Used with 206 contractors in Alaska, Oregon, and Washington; questions include company size, type of work, application methods, state worked in the most, training and protective-practice policies, spending for safety-and-health and production equipment, and attitudes, beliefs, and knowledge.
Year 3	
Painter demographic/behavioral questionnaire	Pre-training; selection of questions from the year 2 painter survey questionnaire.
Painter reading-level test	Pre-training; SelectABLE, standardized reading test (Harcourt Brace Jovanovich), which groups trainees into three levels.
Knowledge test	Pre- and post-training; questions from the Alaska certi- fication exam on health hazards of painting, reading and understanding material safety data sheets, and respirator and fan use.
Painter follow-up telephone survey	Given 44 to 340 days after training (an average of 180 days after); selected questions from the demographic/behavioral questionnaire (see above, this chart), used as baseline for nontrainees and as follow-up for trainees.

In year 2 of the study, researchers at the University of Washington compared surreptitious observations of painter work practices with self-reporting by the same painters on mailed questionnaires two to three weeks later. The comparison showed that the observations and the self-reports were in substantial agreement, beyond what would be expected by chance. The results indicated that painters' self-reports could be relied upon in the study. Questions from the validated questionnaire continued to be used in all subsequent painter questionnaires for years 2 and 3 (Keiffer and others 1996).

Painters were grouped for statistical comparisons, based on information obtained from the demographic, knowledge-test, and contractor surveys. Self-reported protective practices related to respirator and fan use — reported by painters on the questionnaire — were the primary dependent variables used in the analysis to determine training effectiveness.

Results

The findings presented here cover the effectiveness of training on self-protective behaviors, the effectiveness of mandatory training in reaching painters most in need of training, and the cost-effectiveness of a mandatory system (Selected data are presented in tables in annex B).[2]

First, when data from the three painter groups were pooled, painters with previous Alaska state certification training were 2.7 times more likely to wear respirators than were painters who had not had training (Odds ratios 95% CI=1.95 to 3.81; p=.00000). Fan use was 1.65 times greater among painters who had Alaska state certification training than among painters who had not had training (Odds ratios 95% CI=1.22 to 2.23; p=.00120). Analysis of survey responses also showed that most other types of training — not provided in this study — from hazard communication to lead abatement, also increased the odds of painters wearing respirators or using fans.

Second, compared with voluntary training programs, Alaska's mandatory system tends to reach untrained painters, particularly those at higher risk of exposures to oil-based paints.

- Mandatory training increased the likelihood that a painter had been trained. Statistically, it was much more likely that painters in Alaska would have been trained previously, compared with painters in Oregon and Washington. For instance, painters in Alaska were 6.9 times more likely to have completed a combination of courses in respirator wear, ventilation, and health hazard recognition than were painters in Oregon and Washington (Odds ratios 95% CI=5.13 to 9.28; p=.00000). Painters in Alaska were five times more likely to have had *any* given safety-and-health training than were painters in Oregon and Washington, states where safety-and-health training is voluntary.

- Mandatory training reached untrained painters, while voluntary training largely attracted those who had already been trained. For instance, 82% of those in the voluntary training group in Oregon and 78% in Washington reported previous respirator training compared with only 39 and 31%, respectively, of the baseline survey groups in those states (Group T-tests p=.000). Further, 69% of the voluntary training group in Oregon and 67% in Washington reported previous ventilation training compared with only 24 and 19%, respectively, in the baseline survey groups in those states (Group T-tests p=.000). Painters with the least previous training tended not to attend training under the voluntary system.

The results just described for Oregon and Washington contrast with findings for the Alaska mandatory training group whose responses did not differ significantly from those of the Alaska baseline survey group in that state. For instance, 78% of those in the mandatory training group in Alaska had previous respirator training compared with 83% in the baseline group in that state

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[2]Other results of the study not presented here include pre- and post-training comparisons of knowledge and protective practices among the study trainees and evaluations of training features, the validity and reliability of the Alaska Certification Examination, and the relationship between a contractor's size and policy and painters' protective practices.

(Group T-tests p=.264). Further, 65% of the mandatory training group had had previous ventilation training compared with 75% of the baseline group in Alaska (Group T-tests p=.064).

• Mandatory training was more effective than voluntary training in attracting non-union painters. Non-union painters were less likely to have had previous training, but were more likely to have higher risks of toxic exposures. Non-union painters in all three states were only about one-third (0.360 times) as likely as union painters to have received prior training (Odds ratio 95% CI=0.28 to 0.46, p=.00000). In the mandatory training group, the odds that a trained painter was not a union member were about 2.79 (Odds ratio 95% CI=1.78 to 4.36, p=.00000), roughly comparable to the 78% non-union prevalence in Alaska. But, in the voluntary training group, the odds that a trained painter was not a union member were 0.39 in Oregon and 0.12 in Washington compared with the baseline groups for those states (Odds ratio 95% CI=.22 to .72, p=.00000; odds ratio 95% CI=.07 to 0.20, p=.00000). Yet non-union painters may have the greater exposure risk. For instance, non-union painters were 1.73 times more likely than union painters to spray oil-based paint (Odds ratio 95% CI=1.34 to 2.22, p=.00002).

• Mandatory training was also more effective than voluntary training in reaching painters working for small contracting companies, those having fewer than four employees. Painters working for small companies were only half as likely to have had previous safety-and-health training (Odds ratio 95% CI=0.34 to 0.69, p=.0004). Yet they are at greater risk of exposure than other painters, being 1.46 times more likely to spray oil-based paints than painters working for medium and large companies (Odds ratio 95% CI=1.01 to 2.11; p=.04511). With mandatory training in Alaska, painters working for small companies are 1.8 times *more* likely to participate in training than other painters (Odds ratio 95% CI=1.10 to 3.09; p=.02056), whereas painters working for small companies are only three-fifths (0.6 times) as likely to participate in training in Oregon (Odds ratio 95% CI=0.28 to 1.26; p=.17381) and one-fourth (0.25) as likely in Washington (Odds ratio 95% CI=0.13 to 0.44; p=.00000).

Third, lower recruitment costs suggest that mandatory training is more cost-effective than voluntary training. Recruitment costs were 10 times lower and participation rates were 10 times higher for the mandatory training in Alaska than for the voluntary training in Oregon and Washington. Under the mandatory training program, the cost of recruiting trainees during the study period was about $8 per trainee with a participation rate exceeding 80% of the eligible painters.[3] Under the voluntary training program in Oregon and Washington, the costs for recruiting trainees ranged from $79 to $109 per trainee with participation rates of 6 to 8%.

Last, the research found that Alaska's mandatory training requirement did not elevate employers' safety-and-health expenditures, compared with expenditures in Oregon and Washington. The survey of 206 contracting companies in the three states found that average annual expenditures in Alaska were $532 per painter compared with $1,108 in Oregon and $880 in Washington (Anova p=.0001). (In Alaska, some of the training costs are borne by workers, who pay $100 every two years for certification, which includes training.) So, while painters in Alaska were better protected, being more likely to wear

[3]The State of Alaska notified painters and contractors of the requirements of the certification regulation in 1989. Notification and other administrative aspects of the regulation were funded entirely through fees collected from painters, with fees reimbursing expenses retroactively in the first three years. Since 1989, training providers have taken over notification as part of marketing. The state uses its share of the certification fees to help support its general safety-and-health program, which enforces the regulation through means such as state OSHA inspectors.

respirators and use fans, contractors in Alaska spent less per painter on safety-and-health equipment and training than did contractors in Oregon and Washington.

Conclusions

This study has demonstrated the following:

- Safety-and-health training improves painters' self-protective behaviors, such as respirator and fan use. Trained workers appear to better protect themselves from exposures to toxic substances, thus reducing the risks to themselves and their offspring of serious and costly long-term work-related health effects.
- Mandatory training is more effective than voluntary training in improving self-protective behaviors overall and in reaching a wide range of painters, regardless of previous training, union status, or company size. Voluntary training tends to draw mainly "true believers" — workers with previous training, better protective practices, and lower exposure risks.
- A mandatory system costs less for recruitment and produces much higher participation rates.
- Under Alaska's mandatory training system, employers appear to spend less per worker on safety-and-health supplies and training. This issue warrants further investigation.

Although this study covers only a six-year period, the authors believe the findings about worker self-protective practices will continue to apply for the longer term.

The findings have clear implications for efforts to provide training or improve safety and health for painters and other construction workers. The key lesson is that the construction industry, employees, and society can benefit substantially — in terms of costs and worker quality of life — from a well-designed government-mandated safety-and-health certification training program.

* * *

This report is the first of a planned series based on the three-year study.

References

Englund, Anders, Knut Ringen, and Myron A. Mehlman, eds. 1983. *Occupational Health Hazards of Solvents.* Princeton, N.J.: Princeton Scientific Publishers, p. 157.

International Agency for Research on Cancer, World Health Organization. 1989. *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans: Some Organic Solvents, Resin Monomers, and Related Compounds, Pigments and Occupational Exposures in Paint, Manufacturing, and Painting.* Lyon, France: IARC, 47: 329-442.

Keiffer, Matthew, and others. 1996. "Validation of a self-administered questionnaire for assessing health and safety behavior among construction painters." Northwest Center for Occupational Health and Safety, University of Washington. Mimeo.

Selikoff, Irving J. 1975. *Investigations of Health Hazards in the Painting Trades.* National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services.

Stockwell, H.G., and G.M. Matanoski. 1985. A case-controlled study of lung cancer in painters. *Journal of Occupational Medicine,* 27:125-26.

Annex B. Selected Tables

B-1. PRE-TRAINING RESPIRATOR USE FOR WORK WITH OIL-BASED PAINTS AND COATINGS BY PREVIOUS TRAINING - CROSSTABS YR03 TRAINEES [PRE-TRNG] AND YR03 NON-TRAINED AND YR02 SURVEY RESPONDENTS

PREVIOUS TRAINING (YES/NO)	PRE-TRAINING RESPIRATOR USE (YES/NO) ODDS RATIO	95% CONFIDENCE INTERVAL	CHI-SQUARE PEAR / LR	N= YES/NO
AK CERT TRNG(1) AK CERT=YES NO TRNG=NO	2.72683	1.95028- 3.81257	.00000*/.00000*	323/ 415
OTHER TRNG(2) OTHR TR=YES NO TRNG=NO				
RESPIR SELECT	1.37085	1.02612- 1.83139	.03259*/.03240*	385/ 412
VENTILATION TR	1.51026	1.09239- 2.08798	.01239*/.01196*	272/ 412
HEALTH HZD PTG	1.39091	1.01873- 1.89906	.03754*/.03698*	300/ 412
ASBESTOS ABATE	1.47612	0.92975- 2.34356	.09749 /.09400	102/ 412
LEAD ABATEMENT	1.47417	1.03528- 2.09912	.03096*/.02987*	207/ 412
HAZ COM TRNG	1.50461	1.07355- 2.10876	.01740*/.01674*	239/ 412
MSDS TRAINING	1.32800	0.99198- 1.77784	.05642 /.05614	371/ 412
EMP INITIAL TR	1.59287	1.14397- 2.21792	.00571*/.00564*	307/ 307
ANY H&S TRG	1.39074	1.06080- 1.82330	.01683*/.01690*	496/ 415
RSP+VNT+HZDS	1.33138	1.01258- 1.75057	.04020*/.03994*	421/ 477
VOC TRG Y/N (3)	0.94849	0.68481- 1.31371	.75034 /.75033	314/ 298
APPR TRG Y/N(3)	1.45285	1.03449- 2.04041	.03079*/.03020*	249/ 352

EMP INITIAL TRG, VOC TRG, and APPR TRG include year 03 non-trained follow up group.

(1) Compares respirator wear between all AK-certified painters and all painters with no previous training in the three states.

(2) Compares respirator wear between all painters with each type of other training and all painters with no previous training in the three states.

(3) Compares respirator wear between all painters with apprentice or vocational training and all painters without in the three states.

B-2. PRE-TRAINING FAN USE FOR WORK WITH OIL-BASED PAINTS AND COATINGS BY PREVIOUS TRAINING - CROSSTABS YR03 TRAINEES [PRE-TRNG] AND YR03 NON-TRAINED AND YR02 SURVEY RESPONDENTS

PREVIOUS TRAINING (YES/NO)	PRE-TRAINING FAN USE (YES/NO)			
	ODDS RATIO	95% CONFIDENCE INTERVAL	CHI-SQUARE PEAR / LR	N= YES/NO
AK CERT TRG(1) AK CERT=YES NO TRNG=NO	1.64784	1.21664- 2.23186	.00120*/.00123*	328/ 427
OTHER TRNG(2) OTHR TR=YES NO P TR=NO				
RESPIR SELECT	1.67174	1.25084- 2.23428	.00049*/.00049*	394/ 424
VENTILATION TR	1.84476	1.34616- 2.52802	.00013*/.00014*	282/ 424
HEALTH HZD PTG	1.80077	1.32326- 2.45059	.00017*/.00018*	307/ 424
ASBESTOS ABATE	2.46588	1.59440- 3.81369	.00004*/.00005*	105/ 424
LEAD ABATEMENT	1.83951	1.30608- 2.59081	.00045*/.00050*	213/ 424
HAZ COM TRNG	1.91094	1.37808- 2.64983	.00009*/.00010*	247/ 424
MSDS TRAINING	1.64132	1.22488- 2.29936	.00087*/.00087*	381/ 424
EMP INITIAL TR	1.72727	1.24155- 2.40302	.00113*/.00110*	320/ 312
ANY H&S TRG	1.49380	1.13559- 1.96501	.00403*/.00392*	513/ 427
RSP+VNT+HZDS	1.66826	1.26804- 2.19480	.00024*/.00025*	417/ 507
VOC TRG Y/N (3)	1.57227	1.12450- 2.19835	.00796*/.00784*	320/ 309
APPR TRG Y/N(3)	1.84343	1.35534- 2.50730	.00009*/.00009*	344/ 385

EMP INITIAL TRG, VOC TRG, and APPR TRG include year 03 non-trained follow up group.
(1) Compares respirator wear between all AK-certified painters and all painters with no previous training in the three states.
(2) Compares respirator wear between all painters with each type of other training and all painters with no previous training in the three states.
(3) Compares respirator wear between all painters with apprentice or vocational training and all painters without in the three states.

B-3. PREVIOUS TRAINING BY STATE - CROSSTABS YR03 TRAINEES [PRE-TRAINING] AND YR02 SURVEY RESPONDENTS

	PARTICIPANT STATE (ALASKA VS WASHINGTON-OREGON)			
PREVIOUS TRG (YES/NO)	ODDS RATIO	95% CONFIDENCE INTERVAL	CHI-SQUARE PEAR / LR	N= AK/WA-OR
RESP SELECT TR	6.17889	4.68627- 8.14691	.00000*/.00000*	420/958
VENTILATION TR	6.48003	5.01414- 8.37448	.00000*/.00000*	420/958
HLTH HZDS PTG	6.66549	5.13098- 8.65891	.00000*/.00000*	420/958
HAZ COM TRG	3.47119	2.72720- 4.41815	.00000*/.00000*	420/958
MSDS TRAINING	5.14313	3.94991- 6.69681	.00000*/.00000*	420/958
EMP INITIAL TR	1.37142	1.07902- 1.74305	.00972*/.01001*	392/933
ASBESTOS AB TR	1.94785	1.41011- 2.69063	.00004*/.00007*	420/958
LEAD ABTMNT TR	1.04897	0.79736- 1.37999	.73528 /.73302	420/958
ANY H&S TRG	5.34615	3.94481- 7.24529	.00000*/.00000*	421/992
RSP+VNT+HZDS	6.89969	5.12917- 9.28137	.00000*/.00000*	420/958
VOC TRG Y/N	0.85189	0.66814- 1.08617	.19575 /.19410	425/996
APPR TRG Y/N	1.13605	0.88015- 1.46634	.32714 /.32903	425/996

EMP INITIAL TR, VOC TRG, APPR TRG include year 03 non-trained follow up group.

B-4. PREVIOUS TRAINING BY PARTICIPANT GROUP STATUS - GROUP T-TESTS YR03 TRAINEES [PRE-TRAINING] VERSUS YR02 SURVEY RESPONDENTS

PREVIOUS TRAINING BY STATE	PARTICIPANT GROUP (YR03 TRNS/YR02 SRVY)		SIG.	N= TRN/SUR
	YR03 TRNS	YR02 SRVY		
AK ALASKA CERT TRG Y/N (Mean)	.39	.94	.000*	104/ 284
WA ALASKA CERT TRG Y/N (Mean)	.02	.02	.845	99/ 383
OR ALASKA CERT TRG Y/N (Mean)	.04	.03	.521	72/ 294
AK RESP SELECT TRG Y/N (Mean)	.78	.83	.264	104/ 284
WA RESP SELECT TRG Y/N (Mean)	.78	.31	.000*	99/ 383
OR RESP SELECT TRG Y/N (Mean)	.82	.39	.000*	72/ 294
AK VENTILATION TRNG Y/N (Mean)	.65	.75	.064	104/ 284
WA VENTILATION TRNG Y/N (Mean)	.67	.19	.000*	99/ 383
OR VENTILATION TRNG Y/N (Mean)	.69	.24	.000*	72/ 294

B-5. PREVIOUS TRAINING BY UNION STATUS - CROSSTABS FOR WORK WITH OIL-BASED PAINTS AND COATINGS YR03 TRAINEES [PRE-TRAINING] AND YR02 SURVEY RESPONDENTS

PREVIOUS TRAINING (YES/NO)	UNION STATUS (NO/YES)			
	ODDS RATIO	95% CONFIDENCE INTERVAL	CHI-SQUARE PEAR / LR	N= YES/NO
ANY H&S TRG	0.35974	0.28239- 0.45827	.00000*/.00000*	590/646

B-6. RELATIVE RISKS - PAINT APPLICATION BY UNION STATUS FOR WORK WITH OIL-BASED PAINTS AND COATINGS YR03 TRAINEES [PRE-TRAINING] AND YR02 SURVEY RESPONDENTS

	UNION STATUS (NO/YES)			
	ODDS RATIO	95% CONFIDENCE INTERVAL	CHI-SQUARE PEAR / LR	N= YES/NO
APPLICATION:				
SPRAY	1.72604	1.34021- 2.22291	.00002*/.00002*	590/646
ROLL	1.09615	0.85513- 1.40510	.46857 /.46841	590/645
BRUSH	1.07290	0.74519- 1.37678	.93473 /.93472	589/646

B-7: RELATIVE RISKS - UNION STATUS BY PARTICIPANT GROUP STATUS YR03 TRAINEES [PRE-TRAINING] AND YR02 SURVEY RESPONDENTS

NON-UNION STATUS BY STATE	PARTICIPANT GROUP STATUS (YR03 TRNG PARTICIPANTS/YR02 SURVEY RSPNDS)			
	ODDS RATIO	95% CONFIDENCE INTERVAL	CHI-SQUARE PEAR / LR	N= TRN/SUR
AK UNION STAT	2.78629	1.78202- 4.35653	.00000*/.00000*	137/311
WA UNION STAT	0.12146	0.07434- 0.19846	.00000*/.00000*	132/427
OR UNION STAT	0.39695	0.21803- 0.72272	.00197*/.00124*	97/317

B-8. RELATIVE RISKS - COMPANY SIZE BY ANY H&S TRAINING FOR WORK WITH OIL-BASED PAINTS AND COATINGS YR03 TRAINING PRTCPNTS [PRE-TRAINING] AND YR02 SURVEY RESPONDENTS

	ANY PREVIOUS H&S TRAINING (YES/NO)			
	ODDS RATIO	95% CONFIDENCE INTERVAL	CHI-SQUARE PEAR / LR	N= YES/NO
COMPANY SIZE:				
SM 1-4 PTRS	0.48255	0.33901- 0.68687	.00004*/.00006*	477/199
MD 5-9 PTRS	1.36606	0.91284- 2.04428	.12847 /.12393	477/199
LG 10+ PTRS	1.50633	1.07707- 2.10667	.01638*/.01608*	477/199

B-9. RELATIVE RISKS - COMPANY SIZE BY SPRAY OIL FOR WORK WITH OIL-BASED PAINTS AND COATINGS YR03 TRAINEES [PRE-TRAINING] AND YR02 SURVEY RESPONDENTS

	SPRAY OIL-BASED PAINT (YES/NO)			
	ODDS RATIO	95% CONFIDENCE INTERVAL	CHI-SQUARE PEAR / LR	N= YES/NO
COMPANY SIZE:				
SM 1-4 PTRS	1.45945	1.00716- 2.11486	.04511*/.04281*	460/216
MD 5-9 PTRS	1.29621	0.87787- 1.91390	.19125 /.18739	460/216
LG 10+ PTRS	0.61538	0.44437- 0.85221	.00336*/.00336*	460/216

B-10. RELATIVE RISKS - COMPANY SIZE BY PARTICIPANT GROUP STATUS YR03 TRAINEES [PRE-TRAINING] AND YR02 SURVEY RESPONDENTS

	PARTICIPANT GROUP STATUS (YR03 TRNG PARTICIPANTS/YR02 SURVEY RSPNDS)			
COMPANY SIZE SM=1-4 PTRS MD=5-9 PTRS LG=10+ PTRS	ODDS RATIO	95% CONFIDENCE INTERVAL	CHI-SQUARE PEAR / LR	N= TRN/SUR
AK SMALL CNTR	1.84149	1.09591- 3.09432	.02056*/.02021*	126/118
WA SMALL CNTR	0.23843	0.12946- 0.43912	.00000*/.00000*	124/167
OR SMALL CNTR	0.59919	0.28488- 1.26026	.17381 /.16577	93/164
AK MEDIUM CNTR	0.75392	0.44335- 1.28203	.29652 /.29650	126/118
WA MEDIUM CNTR	1.31960	0.76683- 2.27083	.31595 /.31733	124/167
OR MEDIUM CNTR	0.95623	0.44968- 2.03339	.90743 /.90729	93/164
AK LARGE CNTR	0.64675	0.36189- 1.15584	.13991 /.13970	126/118
WA LARGE CNTR	2.28450	1.42108- 3.67250	.00059*/.00056*	124/167
OR LARGE CNTR	1.41304	0.79551- 2.50995	.23714 /.23358	93/164

B-11. COST COMPARISONS THREE-STATE PAINTERS STUDY

COMPARISON OF RECRUITMENT COSTS AND RESPONSE RATES BY STATE
ALASKA, WASHINGTON, OREGON

STATE	MAIL TTL	CERT ELIG	ATTENDED TRNG PREV CERT	ATTENDED TRNG OTHER	COST PER TRAINEE*	RESPONSE PERCENT	MEAN RANK TEST P=
AK	891	55	40	88	$8 ($42)	80% + 88 new	.0000
WA	2485	2485	-	138	$109	6%	
OR	1355	1355	-	102	$79	8%	

* $6/ELIGIBLE PAINTER

B-12. CONTRACTOR EXPENDITURES PER PAINTER FOR HEALTH & SAFETY* BY STATE ANOVA YR02 CONTRACTOR SURVEY

STATE	MEANS	95% CONFIDENCE INTERVAL	Prob.	N=
MEAN EXPENDITURES				
ALASKA	$532	$420 - $644	.0001*	110
WASHINGTON	$880	$711 - $1,048		296
OREGON	$1,108	$894 - $1,323		164

*HEALTH & SAFETY = COSTS PER PAINTER FOR EQUIPMENT -- SUCH AS RESPIRATORS, GLOVES, HARD HATS -- AND FOR H&S TRAINING EACH YEAR.

The Paint-Safe Consortium

Northwest Conference of Painters
International Brotherhood of Painters & Allied Trades
Seattle

Northwest Center for Occupational Health & Safety
University of Washington
Seattle

Paint-Safe
Seattle

Occupational Health Foundation
Washington, D.C.

FOF Communications
Washington, D.C.

EXHIBIT E

International Union of Painters and Allied Trades

Petition for Promulgation of a Health and Safety Standard for Preparation and Coating for Corrosion Prevention

PAINTERS AND ALLIED TRADES
ONE UNION
AFL-CIO
INTERNATIONAL UNION

Representing
Protective and Decorative Coatings Applicators • Wallcoverers • Drywall Finishers • Painters • Decorators • Scenic Artists • Designers • Civil Service Workers • Shipyard Workers • Maintenance Workers • Building Cleaners • Metal Polishers • Metalizers • Public Employees • Clerical Workers • Professional Employees • Security Guards • Safety Engineers • Bridge Painters • Riggers • Tank Painters, Marine Painters • Containment Workers • Waterblasters • Vacuum Cleaners • Sign Painters • Sign and Display Workers • Bill Posters • Convention and Show Decorators and Builders • Paint Makers • Glaziers • Architectural Metal and Glass Workers • Sandblasters • Lead Abatement Workers • Floorlaying and Decorative Coverings Workers • Journeyman and Apprentice Commercial, Industrial, Highway, Residential Construction Workers

7234 Parkway Drive
Hanover, MD
21076

Organizing Since 1887

August 24, 2015

California Occupational Safety and Health Standards Board
2520 Venture Oaks Way, Suite 350
Sacramento, California 98533

Re: *Standard for Preparation and Coating for Corrosion Prevention*

Dear Board Members:

I write to provide information in support of the health and safety standard for Preparation and Coating for Corrosion Prevention proposed by the International Union of Painters and Allied Trades (IUPAT). In carrying out our mission to protect the health and safety of our members and other workers, IUPAT collects reports regarding work-related hazards for industrial painters and recommendations of experts and industry professionals of ways to improve workplace health and safety. Attached to this letter, please find two relevant public health studies.

First, attached as Exhibit 1, is a study from the National Institutes of Health entitled *Personal Exposure, Behavior, and Work Site Conditions as Determinants of Blood Lead Among Bridge Painters*. The study discusses the lead exposure among bridge painters, and also how specific, simple safety measures that painters do or do not take (such as wearing a respirator, washing hands before taking a break, and showering before leaving the jobsite) can lead to decreased blood lead levels.

Second, attached as Exhibit 2, is a study of *Work-Related Deaths in Construction Painting*. The study revealed that the construction painting industry has three to five times more work-related fatalities than the general working population. The death rate for painters is higher than even that of other construction workers. Of the 129 deaths investigated by the study, the largest category was falls, followed by electrocution, and asphyxiation from solvents or oxygen deficiency. The study reported that some painters fail to take safety precautions (such as using fall protection), even where safety equipment was available at the jobsite. The study recommended improved safety training for workers as a way of decreasing these preventable workplace fatalities.

Sincerely,

Chad Smith

Chad Smith
Assistant to the General President
Western Region Government Affairs

EXHIBIT 1

International Union of Painters and Allied Trades

Petition for Promulgation of a Health and Safety Standard for Preparation and Coating for Corrosion Prevention

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Personal Exposure, Behavior, and Work Site Conditions as Determinants of Blood Lead Among Bridge Painters

Ema G. Rodrigues[1,2], **M. Abbas Virji**[3], **Michael D. McClean**[2], **Janice Weinberg**[4], **Susan Woskie**[3], and **Lewis D. Pepper**[2]

[1] Department of Environmental Health, Harvard School of Public Health, Boston, Massachusetts

[2] Department of Environmental Health, Boston University School of Public Health, Boston, Massachusetts

[3] Department of Work Environment, University of Massachusetts Lowell, Lowell, Massachusetts

[4] Department of Biostatistics, Boston University School of Public Health, Boston, Massachusetts

Abstract

Bridge painters are exposed to lead during several job tasks performed during the workday, such as sanding, scraping, and blasting. After the Occupational Safety and Health Administration standard was passed in 1993 to control lead exposures among construction workers including bridge painters, this study was conducted among 84 bridge painters in the New England area to determine the significant predictors of blood lead levels. Lead was measured in personal air and hand wipe samples that were collected during the 2-week study period and in blood samples that were collected at the beginning and at the end of the study period. The personal air and hand wipe data as well as personal behaviors (i.e., smoking, washing, wearing a respirator) and work site conditions were analyzed as potential determinants of blood lead levels using linear mixed effects models. Our results show that the mean air lead levels over the 2-week period were the most predictive exposure measure of blood lead levels. Other individual-level significant predictors of blood lead levels included months worked on bridge painting crews, education, and personal hygiene index. Of the site-level variables investigated, having a containment facility on site was a significant predictor of blood lead levels. Our results also indicate that hand wipe lead levels were significantly associated with higher blood lead levels at the end of the study period compared with the beginning of the study period. Similarly, smoking on site and respirator fit testing were significantly associated with higher blood lead levels at the end of the study period. This study shows that several individual-level and site-level factors are associated with blood lead levels among bridge painters, including lead exposure through inhalation and possible hand-to-mouth contact, personal behaviors such as smoking on site, respirator fit testing, and work site conditions such as the use of better containment facilities. Accordingly, reduction in blood lead levels among bridge painters can be achieved by improving these workplace practices.

Keywords

air lead levels; blood lead levels; bridge painters; hand wipes; lead; work site conditions

Address correspondence to: Ema G. Rodrigues, Harvard School of Public Health, Environmental Health, 665 Huntington Avenue Building, Room 1406, Boston, MA 02115; emarod@hsph.harvard.edu.

INTRODUCTION

Approximately one million U.S. construction workers are exposed to lead each year, and approximately 50,000 (~5%) of those workers paint and rehabilitate highway and railroad bridges.(1) The Occupational Safety and Health Administration (OSHA) published a final rule for occupational lead exposure in 1978, but the standard did not apply to the construction trades including structural steel painters. Finally, in 1993, OSHA passed a standard for controlling lead exposures in construction that reduced the permissible exposure limit (PEL) from an 8-hr time-weighted average (TWA) of 200 $\mu g/m^3$ to 50 $\mu g/m^3$ and incorporated additional requirements designed to minimize worker exposures and transport of lead from work sites.

The primary route of occupational exposure to lead is inhalation. Even relatively insoluble forms of lead can be absorbed through the alveoli.(2) Several studies have investigated the relationship between air lead and blood lead levels (BLLs) among workers in different industries. A study conducted among workers in the crystal industry found a statistically significant relationship between personal air lead levels and BLLs.(3) Lai et al.(4) also found that air lead levels, in addition to other determinants such as age, gender, alcohol consumption, and personal hygiene, were significant predictors of BLL among lead battery workers. The association between air lead and BLL may be influenced by a number of factors, including particle size, solubility, lead stores in bone that may be mobilized, and other routes of exposure.(5–7)

Incidental ingestion of lead is another significant potential route of lead exposure that can result from hand-to-mouth activities, such as eating and smoking, and often goes unrecognized in occupational settings.(8–10) Wearing personal protective equipment (PPE) such as gloves has been associated with lower BLL, while the frequency of hand-to-mouth contact on the work site has been associated with increased BLLs among lead-exposed workers even after adjusting for air lead levels.(11) Other studies have investigated the effects of smoking, eating, and personal hygiene on BLL among workers in lead battery plants. For instance, after providing health education to workers of a battery recycling plant in Japan, one study found a mean decrease of 10 μg/dL (from 46 to 36 μg/dL) in BLL over a 3-year period (2000–2003). The greatest decrease in BLL during this period occurred in workers who were nonsmokers and had excellent hygiene (e.g., wearing PPE and washing), although no personal air lead levels were available.(12) Similarly, Chuang et al.(13) found that eating and smoking at the work site regularly (>3 days per week) were significantly associated with higher BLL among lead battery workers who participated in a health promotion program in Taiwan from 1991 to 1997. In addition, workers who smoked and ate at work regularly had a significant increased risk of having an elevated BLL (>40 μg/dL in males and >30 μg/dL in females).(13) Accordingly, personal hygiene and behavioral factors can also influence individuals' personal exposure to lead.

Most previous studies investigating determinants of BLL have relied on exposure measures, such as job titles, ambient air lead levels, or a single personal air lead measurement. While these exposure measures are more readily available, they may introduce exposure misclassification and may not adequately represent the temporal variability in personal exposures. Following the implementation of the OSHA standard for construction workers in 1993, a study was conducted among bridge painters working for eight different contractors in Massachusetts to assess their daily lead exposure during a 2-week period.(14) Bridge painters are exposed to lead through the dust generated during bridge surface preparation tasks, such as abrasive blasting, sanding, grinding, and scraping. Based on their tasks and work site conditions, some workers may be exposed to chronic low levels of lead, and others may be exposed to high levels for short periods. Exposure information collected by task over time for each worker, in conjunction with daily diaries of tasks performed and their duration, can result in less misclassification in estimating daily exposure than is associated with summary exposure metrics, such as job group daily averages that are often used in occupational epidemiology. (15,16) The task-based method of estimating daily exposure is particularly relevant to jobs in the construction industry where tasks and their duration may change from day to day, requiring an approach that accounts for these changes.

Using the exposure assessment data previously described by Virji et al.,(14) the primary objectives of this paper are to: (1) identify the inhalation measure that best predicts absorbed lead measured as BLL at two time points over a 2-week period, (2) evaluate personal air and hand wipe levels as potential determinants of BLL while controlling for potential confounders, and (3) determine whether other individual-level factors (e.g., eating and smoking on site) and site-level factors (e.g., presence of containment facility) also contribute to BLL.

METHODS

Study Population

Eighty-four bridge painters (83 male, 1 female) participated in this study during a2-week work period in 1994 or 1995. The painters worked for eight different contractors on 13 different work sites across New England and performed various job tasks during the study period, including abrasive blasting, scraping, sanding, painting, cleaning, and pressure washing. The number of workers per site ranged from 2 to 12. Each participant provided written informed consent prior to participation in the study. The Human Subjects Committees at Boston University School of Public Health and University of Massachusetts Lowell reviewed and approved all protocols.

Air Monitoring

A total of 268 task-based air samples were collected throughout the study as described previously.(14) Briefly, each participant wore a Gillian GilAir-5 air sampling pump (Sensidyne, Clearwater, Fla.) set at a flow rate of 2.0 L/min attached to an Institute of Occupational Medicine (IOM) sampler with a 25 mm diameter, 0.8 μm pore size, mixed cellulose ester filter to collect the inhalable fraction of lead particulate matter. Samples were collected while performing selected job tasks during at least 1 day over the 2-week study period. The samples were acid digested and analyzed for lead using flame atomic absorption spectroscopy according to NIOSH Method 7082.

Task-specific air lead concentrations were calculated and used to estimate personal daily exposures. The minimum variance unbiased estimator (MVUE) of the task means were used in the time-weighting equations, as this summary measure is the preferred estimator of the true arithmetic mean when the data have a lognormal distribution.(17) In addition, participants completed a diary during each workday of the 2-week period to document the type and duration of each task performed and the type of PPE used. The TWA daily personal lead exposure levels were calculated by combining mean task lead levels with task duration and summing over all the tasks performed in a day and dividing by the total time worked. Daily TWA exposures were estimated for all participants from all the occupations included in the study.

The TWA daily personal lead levels were corrected for respirator use to approximate dose by estimating the lead concentration available for lung deposition. This metric may be more closely associated with BLL. To obtain estimates of task lead exposures corrected for respirator use, the mean task lead levels were divided by the NIOSH assigned protection factor associated with the worker-reported respirator from the daily diary. All air lead measures used throughout this paper were corrected for respirator use.

Additional summary metrics were calculated based on the daily full-shift TWAs described above. For any day that a participant did not work, it was assumed they had zero exposure to lead. Two-week respirator-corrected average concentrations ($\mu g/m^3$) were calculated for each participant by taking the arithmetic mean of the daily respirator-corrected air lead levels on all days during the monitoring period. The maximum daily concentration ($\mu g/m^3$) was chosen as the day with the highest daily respirator-corrected lead exposure, and the 2-week cumulative exposure ($\mu g/m^3$-days) was calculated by summing each daily respirator-corrected concentration.

Hand Wipes

Two hand-wipe samples were collected from individual participants on the day they wore the air sampling pumps. Details of the sample collection and analysis are reported elsewhere.(18) Briefly, each worker was given two Wash 'n Dri towelettes to wipe each hand for 30 sec. Hand wipes were collected during the midshift break and at the end of the work shift after workers had reportedly cleaned up. Although some workers cleaned up before breaks, the midday break hand wipe samples are considered a measure of exposure during the workday (i.e., lead on hands during the work shift), whereas the hand wipe collected at the end of the day is a measure of residual exposure following cleanup activities (i.e., lead on hands as they prepare to leave work). The hand wipe samples were digested using a modified method of Millson et al.(19) and were analyzed by flame atomic absorption spectrometry using NIOSH Method 7082.

Interviews and Observation Logs

Each participant completed a semi-structured interview to obtain information on demographics and behavioral factors, such as respirator use, smoking, and personal hygiene. The interviewer also collected information on potential confounders and other significant predictors of BLL, such as education, training, and hobbies involving lead. All responses were coded and entered into spreadsheets prior to analysis. Additional interviews were conducted with workers to collect qualitative information on individual personal hygiene practices at the end of the work shift on days that they wore the air monitor and/or provided hand wipe samples. A personal hygiene index (PHI) was calculated based on personal responses to six factors. Briefly, workers were asked if they (1) removed their coveralls at break time; (2) washed their hands before their break activity (eating, drinking, and smoking); (3) smoked cigarettes during the work shift; (4) washed their hands at the end of the day; (5) showered at the end of the day, and (6) cleaned their respirator at the end of the day. Each response was assigned a zero (undesirable) or a one (desirable), and the responses were summed and divided by the total number of responses and multiplied by 100 to obtain a percent score for desirable personal hygiene. The PHI scores were then categorized into high (good personal hygiene) and low (poor personal hygiene) by dichotomizing at $\geq$50%.

Observation logs were also collected by project industrial hygienists on air monitoring days to characterize the work site conditions and health and safety environment. The presence or absence of a respirator program, decontamination and hand washing facilities, types of cleanup practices, and containment structures were noted. Composite scores were also created for these work site variables in a similar manner as mentioned above (Table IV). For example, a composite score was calculated to describe the containment structures on site using a structured form to gather information on 10 variables, including containment facility material, air permeability, support structures, treatment of joints, entryways, air makeup points, input airflow, air pressure and movement inside containment, and exit airflow/dust collection. Each variable was assigned a score from 1 to 10 (10 is best), and a composite score was calculated by summing all variable scores and converting the total into a percent "good" score. The composite score was dichotomized at ≥50% to compare those with good containment facilities to those with poor facilities. Details of other composite scores are given elsewhere.(14,18)

Blood Lead Levels

Blood samples were collected at the beginning of the work shift from each participant on the first day of the monitoring period (Time 1) and again at the beginning of the work shift 2 weeks later (Time 2). Each participant's arm was cleaned with an alcohol wipe prior to blood collection to avoid any external lead contamination of the sample. The blood samples were analyzed for lead at the Massachusetts Division of Occupational Safety Lab (West Newton, Mass.) using graphite furnace atomic absorption spectroscopy method.

Statistical Analysis

All statistical analyses were conducted using SAS version 9.1. Geometric mean concentrations were calculated for air lead levels, hand wipes, and BLL due to the lognormal distribution of the measures.(20) BLLs were modeled (both at Time 1 and Time 2) rather than "change in BLL" because there were four participants who did not have a blood sample drawn at Time 2. Air lead and hand wipe lead levels were also log-transformed because the log transformed exposure variables were better predictors of BLL. This approach is consistent with a recommendation that the log-log model should be used to establish environmental policies for lead in relation to BLL.(21) Mixed models were used to examine the effect of the air lead summary measures and hand wipe levels on BLL to determine which air measure and hand wipe (midshift or post-shift) was the best predictor of BLL. Additional mixed model analyses included other potential predictors of BLL, such as those listed in Appendix 1 (demographics, hobbies, and smoking) and the group-level variables describing the work site and health and safety programs (e.g., presence of a hand-washing facility, cleaning practices, presence of a containment facility). Statistical models were run with and without the addition of hand wipe levels because hand wipes were available only for a subset of participants. Interactions with each of the covariates and time of blood collection (start or end of 2 weeks) were also examined to test whether there was a difference in BLL over time. The significant ($p \leq 0.05$) interactions and main effects were included in the final models. The mixed models accounted for correlation between repeated measurements on the same individual assuming compound symmetry. To account for the potential residual correlation between individuals working at the same site, a random intercept for site was also included.

RESULTS

Study Population

The demographic characteristics of the 84 participants are presented in Table I. The mean age of the participants was 33.2 years (range: 19–55 years), and their mean duration of employment as a bridge painter was 5.9 years (range: <1–33 years). The majority (76%) of the participants were laborers, while 16% were supervisors and 8% were the contractors/business owners who are responsible for setting up the contract with the customers. On average, the participants worked 8 days during the study period (range: 3–11 days). At the time of the study period, 42% of the participants were current smokers, 26% were former smokers, and 31% were never smokers; smoking status was missing for one participant.

Summary of Exposure Data

Table II presents the geometric means (GM) and standard deviations (GSD) for the air lead metrics, hand wipes, and BLLs for all participants. The GMs of the daily average concentrations, the maximum daily average, and cumulative air lead exposures over the 2-week work period were 59μg/m^3, 212μg/m^3, and 767μg/m^3 days respectively for all workers.

There was no statistically significant difference in exposure among the occupational titles, though the sample size was small for supervisors and contractors (data not shown). Of the 84 participants in the study, 58 provided a hand wipe sample of both hands at the time of their midshift break, and 64 participants provided a hand wipe sample at the end of their shift following cleanup (Table II). For those who provided both a midshift and end of day hand sample (n=48), the GM lead levels from the midshift hand wipes were 2.9 times greater than the post-shift hand wipes (925 vs. 321μg lead).

Overall, the GM of BLL was 16.1μg/dL at the beginning of the study period and 18.2μg/dL at the end of the study period. None of the measured BLLs were greater than 50 μg/dL, the OSHA action level leading to the worker's temporary removal from lead exposure. However, 4 of the 84 participants (~5%) had a BLL ≥ 40 μg/dL, which requires that the employer provide blood lead analyses for these workers every 2 months until the levels decrease. Of the remaining participants, 22 (26%) had at least one BLL ≥ 25 μg/dL, 47 (56%) had at least one BLL ≥ 10 μg/dL, and 11 (13%) participants had both BLL < 10 μg/dL.

Air and Hand Wipes Associated with Blood Lead Levels

The daily mean, maximum daily, and cumulative air lead exposures were examined to determine which measure best predicted BLL (Table III). Of the air lead metrics tested, the mean and cumulative measures were statistically significant predictors of BLL and yielded similar results. The interaction between time and the air lead measurements was not statistically significant, indicating that the air lead levels measured during this study had similar effects on BLL collected at the beginning and at the end of the monitoring period. However, there was a significant interaction between the hand wipes collected at midshift and time of BLL collection.

Predictors of Blood Lead Levels

Although occupational title and union membership were not significant predictors of BLL, the laborers had the highest change in BLL compared to supervisors/foremen and contractors (2.1, 0.65, and −0.21 μg/dL respectively) over the two-week monitoring period. While the majority of the study population was white (88%), non-white participants (n=9) had a significantly greater increase in BLL during the study period (4.9 vs. 1.4, p=0.002).

The final models including air, hand wipe lead levels, and the additional significant predictors for BLL are presented in Table V. When considering the model including only air lead levels (no hand wipes), the BLL at Time 2 was significantly higher than at Time 1, and there was a significant main effect for 2-week mean respirator-corrected air lead levels associated with BLL. More specifically, for each additional 10% increase in air lead levels, there was a 1% increase in BLL. A majority of the participants (83%) in this study had been working for at least 1 month since the beginning of the year when they were monitored, indicating that it is possible that the inhalation exposures during this period were not very different from the 2 weeks prior to the study period. Other significant main effects included education, total number of months having worked on bridge painting crews, and personal hygiene. Those who had a high school diploma or less had higher BLL than those with at least some college education, and there was a significant increase in BLL per each month worked as a bridge painter. The personal hygiene index (PHI) was dichotomized into high (good) and low (poor) categories and was negatively associated with BLL such that workers with a low PHI had BLLs that were 31% higher than workers with a high PHI (p=0.02). Of the site-level variables, the containment facility index was positively associated with BLL, indicating that those who worked on sites with good containment facilities actually had BLLs that were 80% higher than those who did not work on sites with good containment structures (p=0.001).

Of the other covariates tested, a significant interaction was found between time and both smoking on site and having respirators fit tested. On average, those who reported that they did smoke on site or did not have their respirator fit tested had greater increases in BLL between Time 1 and Time 2 compared with those who did not smoke on site or had their respirator fit tested.

The second model in Table V includes hand wipe levels in addition to air lead levels. Unlike air lead levels, there was a significant interaction between hand wipe lead levels and time. Hand wipe levels were significantly associated with higher BLL at Time 2 compared with Time 1. While most effect estimates did not change substantially after adjusting for hand wipe lead levels, the beta estimates for the log-log relationship between air lead levels and BLL decreased from 0.11 to 0.05 (i.e., the percent increase in BLL associated with each percent increase in mean air lead levels decreased from 0.1% to 0.05%). This difference must be interpreted with caution because the hand wipe model includes only the subset of the air exposure study participants who also provided hand wipe samples (n= 54). The original air model was run with the same 54 individuals who provided hand wipes (data not shown) and the effect of air lead levels was similar, when not adjusting for hand wipes, ($\beta = 0.06$, SE = 0.07, p-value = 0.33) to that seen in the air and hand wipe model in Table V. This indicates that the change in the effect estimate for air was due to the loss of subjects and not due to the addition of the hand wipes levels. Accordingly, it appears that the subset of individuals who provided a hand wipe sample differs from those who did not provide a hand wipe sample with respect to the effect of air lead levels on BLL. The results from the hand wipe models may not be generalizeable to the remaining participants, but the effect estimates of smoking on site, respirator fit testing, PHI, and containment facility remained similar when including hand wipes.

DISCUSSION

Air lead levels and hand wipe levels were evaluated as potential determinants of BLL, and while mean air lead levels were associated with higher BLL at both times of blood collection (pre and post study period), midshift hand wipe lead levels were significantly associated with higher BLL at the end of the monitoring period compared with BLLs at the beginning of the study period. When comparing the use of the 2-week average air lead levels with other summary measures, very similar results were noted when using the cumulative air lead measure. However, the maximum daily exposure did not predict BLL as well. Although blood is reflective of recent exposure, the half-life of lead in blood is approximately 30 days, so BLLs are a better indicator of chronic exposure to lead rather than very high exposures on a single day.(22)

Particle size may affect the time course for absorption of lead. Specifically, only the respirable fraction ($\leq$10 μm) is generally deposited in the alveolar region of the lung.(23) The absorption of the respirable fraction into the blood is more immediate due to the smaller particle size and explains greater variability in BLL.(5) In fact, some have shown that the relationship between air lead levels and BLL is substantially decreased after adjusting for the respirable fraction of particulate matter.(24) Since the exposure metrics in the present study are based on the inhalable fraction of particulate matter (<100 μm), a large fraction of the lead content was in the nonrespirable particle size range and possibly contributed to some exposure misclassification that resulted in less significant air-blood lead relationships. Limited data on the respirable fraction in our study varied by job task ranging from 11.8% for taking down tarps to 36.3% for job activities taking place <6 meters from a containment structure.(14)

In addition to personal air and hand wipe lead exposure, this study evaluated demographics, work site characteristics, and personal behaviors that may contribute to higher BLL among workers. After adjusting for the air and hand wipe lead levels, education level, smoking on site, and respirator fit testing were significant predictors of BLL. While controlling for air lead levels that were respirator adjusted for the time that a respirator was worn, fit testing appears to be an important determinant of BLLs suggesting that fit testing is essential to fully benefit from respirator use. In addition, behaviors involving hand-to-mouth contact such as smoking may lead to additional exposure via ingestion. Similarly, our results suggest that personal hygiene practices such as washing before eating and smoking, changing clothes, showering, and cleaning respirators should be implemented to minimize additional exposure to lead. The ability of a worker to perform these individual practices is dependent on work site facilities and conditions. Although not statistically significant in the final models, those who worked on sites with good hand washing facilities and cleaning practices had smaller changes in BLL compared with those with poor hand washing facilities and cleaning routines (data not shown).

A higher score for the containment structure was significantly associated with higher BLL. Containment structures are designed to prevent fugitive emissions from entering the environment by containing lead exposures generated during job tasks, such as abrasive blasting or scraping within the enclosure. Although containment may reduce the environmental impact of lead exposures, such facilities may actually lead to higher personal exposures to the workers inside the containment when engineering controls such as general exhaust ventilation are not incorporated into the containment. Though few individuals spend their work shift working inside the containment area, increased BLLs among other workers may have resulted from setting up and taking down tarps for containment, and cleaning tasks associated with containment. Although not exposed to lead dusts during activities inside containment, workers may have been exposed while performing these other tasks associated with maintenance of the containment facility.

Prior to 1993, the construction trades were not protected under OSHA's lead standard for general industry.(25) Documented cases of acute lead poisonings among ironworkers who were disassembling and deconstructing a bridge in New York in 1987 demonstrated a need for the inclusion of a lead standard for workers in the construction industry.(26) The overall aim of this study was to evaluate the effectiveness of the 1993 OSHA Lead in Construction Standard in reducing personal exposures to lead among bridge painters. Lower BLLs were observed among ironworkers within the first year of the implementation of the OSHA Lead in Construction Standard in 1993, although it is unclear which of the mandated controls were most effective in lowering BLLs.(26) Unlike the study conducted by Levin et al.,(27) it was not possible for us to compare BLLs among workers prior to and after the implementation of the OSHA Lead in Construction Standard; instead, the differences in BLLs were investigated among bridge painters on work sites with different degrees of compliance with the OSHA standard. Although none of the participants in this study had a BLL greater than 50 μg/dL, requiring removal from lead exposure, roughly 5% had a BLL greater than 40 μg/dL, which requires blood monitoring every 2 months. In addition, work site facilities were not always updated according to the new OSHA standard. For example, 8% of the participants (from three different work sites) reported having no drinking water available, 7% (from two work sites) reported not having water for washing, 12% (from two work sites) reported having no showers available. In addition, 45% of the participants reported that they did not have a designated eating area. Our findings regarding the impact of hand wipe samples on BLLs suggest that the implementation of these work site facilities as required by OSHA could lead to additional reductions in workers' BLLs.

CONCLUSIONS

Personal exposure to airborne lead, hand wipe lead levels, personal behaviors, and work site conditions were evaluated as potential predictors of BLL among bridge painters after the implementation of the 1993 OSHA Lead in Construction Standard. There was a significant positive association between mean respirator-adjusted air lead levels and BLL. In addition, hand wipe lead levels were associated with higher BLL at the end of the 2-week study period compared with the beginning of the study period. Other significant predictors of BLL among these bridge painters included smoking on site, respirator fit testing, personal hygiene practices, and the use of containment facilities on site. While it was not possible to compare the BLL with those prior to the 1993 OSHA standard, the findings indicate that greater compliance with the OSHA standard results in lower BLLs among bridge painters.

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References

1. Lead Exposure in Construction; Interim Final Rule. Federal Register May 4;1993 58:84.
2. Cantarow, A.; Trumper, M. Lead Poisoning. Baltimore, Md: Williams & Wilkins Company; 1944. p. xx-xx.
3. Pierre F, Vallayer C, Baruthio F, et al. Specific relationship between blood lead and air lead in the crystal industry. Int Arch Occup Environ Health 2002;75(4):217–223. [PubMed: 11981654]
4. Lai JS, Wu TN, Liou SH, et al. A study of the relationship between ambient lead and blood lead among lead battery workers. Int Arch Occup Environ Health 1997;69(4):295–300. [PubMed: 9138005]
5. Hodgkins DG, Robins TG, Hinkamp DL, Schork MA, Levine SP, Krebs WH. The effect of airborne lead particle size on worker blood-lead levels: an empirical study of battery workers. J Occup Med 1991;33(12):1265–1273. [PubMed: 1800687]
6. Froines JR, Baron S, Wegman DH, O'Rourke S. Characterization of the airborne concentrations of lead in U.S. industry. Am J Ind Med 1990;18(1):1–17. [PubMed: 2378366]
7. Froines JR, Liu WC, Hinds WC, Wegman DH. Effect of aerosol size on the blood lead distribution of industrial workers. Am J Ind Med 1986;9(3):227–237. [PubMed: 3963005]
8. Askin DP, Volkmann M. Effect of personal hygiene on blood lead levels of workers at a lead processing facility. Am Ind Hyg Assoc J 1997;58(10):752–753. [PubMed: 9342837]
9. Karita K, Shinozaki T, Tomita K, Yano E. Possible oral lead intake via contaminated facial skin. Sci Total Environ 1997;199(1–2):125–131. [PubMed: 9200855]
10. Far HS, Pin NT, Kong CY, Fong KS, Kian CW, Yan CK. An evaluation of the significance of mouth and hand contamination for lead absorption in lead-acid battery workers. Int Arch Occup Environ Health 1993;64(6):439–443. [PubMed: 8458660]
11. Ulenbelt P, Lumens ME, Geron HM, Herber RF, Broersen S, Zielhuis RL. Work hygienic behaviour as modifier of the lead air-lead blood relation. Int Arch Occup Environ Health 1990;62(3):203–207. [PubMed: 2347642]
12. Karita K, Nakao M, Ohwaki K, et al. Blood lead and erythrocyte protoporphyrin levels in association with smoking and personal hygienic behaviour among lead exposed workers. Occup Environ Med 2005;62(5):300–303. [PubMed: 15837850]
13. Chuang HY, Lee ML, Chao KY, Wang JD, Hu H. Relationship of blood lead levels to personal hygiene habits in lead battery workers: Taiwan, 1991–1997. Am J Ind Med 1999;35(6):595–603. [PubMed: 10332513]
14. Virji MA, Woskie SR, Pepper LD. Task-based lead exposures and work site characteristics of bridge surface preparation and painting contractors. J Occup Environ Hyg 2009;6:99–112. [PubMed: 19065390]
15. Nicas M, Spear RC. A task-based statistical model of a worker's exposure distribution: Part I Description of the model. Am Ind Hyg Assoc J 1993;54:211–220. [PubMed: 8498356]

16. Nicas M, Spear RC. A task-based statistical model of a worker's exposure distribution: Part II Application to sampling strategy. Am Ind Hyg Assoc J 1993;54:221–227. [PubMed: 8498357]
17. Muhausen, JR.; Damiano, J. A Strategy for Assessing and Managing Occupational Exposures. Vol. 2. Fairfax, Va: American Industrial Hygiene Association; 1998. p. 251-264.
18. Virji MA, Woskie SR, Pepper LD. Skin and surface lead contamination, hygiene programs, and work practices of bridge surface preparation and painting contractors. J Occup Environ Hyg 2009;6:131–142. [PubMed: 19107672]
19. Millson M, Eller PM, Ashley K. Evaluation of wipe sampling materials for lead in surface dust. Am Ind Hyg Assoc J 1994;55:339–342. [PubMed: 8209839]
20. Seixas NS, Robins TG, Moulton LH. The use of geometric and arithmetic mean exposures in occupational epidemiology. Am J Ind Med 1988;14(4):465–477. [PubMed: 3189359]
21. Jiang Q, Succop PA. A study of the specification of the log-log and log-additive models for the relationship between blood lead and environmental lead. J Agric Biol Environ Stat 1996;1(4):426–434.
22. Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for Lead. Atlanta, Ga: U.S. Department of Health and Human Services, Public Health Service; 2007.
23. Hinds, WC. Aerosol Technology. John Wiley & Sons, Inc; 1999. p. xx-xx.
24. Park DU, Paik NW. Effect on blood lead of airborne lead particles characterized by size. Ann Occup Hyg 2002;46(2):237–243. [PubMed: 12074033]
25. Occupational Exposure to Lead. Federal Register November 14;1978 43:52952–53014.
26. Marino PE, Franzblau A, Lilis R, Landrigan PJ. Acute lead poisoning in construction workers: the failure of current protective standards. Arch Environ Health 1989;44(3):140–145. [PubMed: 2751349]
27. Levin SM, Goldberg M, Doucette JT. The effect of the OSHA lead exposure in construction standard on blood lead levels among iron workers employed in bridge rehabilitation. Am J Ind Med 1997;31(3):303–309. [PubMed: 9055953]

EXHIBIT 2

International Union of Painters and Allied Trades

Petition for Promulgation of a Health and Safety Standard for Preparation and Coating for Corrosion Prevention

Scand J Work Environ Health 1992;18:30—3

Work-related deaths in construction painting

by Anthony J Suruda, MD[1]

SURUDA AJ. Work-related deaths in construction painting. *Scand J Work Environ Health* 1992;18: 30—3. Analysis of investigation records of the United States Occupational Safety and Health Administration (OSHA) concerning work-related deaths in Standard Industrial Classification (SIC) 1721, construction painting, showed a higher risk of fatal injury than expected from cohort studies including injuries on and off the job. Work-related death rates were $2.3 \cdot 10^{-4}$/year (ie, three to five times that of general industry). Of the 129 deaths investigated, the largest category was falls (N = 65), followed by electrocution (N = 40) and asphyxiation from solvents or oxygen deficiency (N = 6). Eighteen deaths had other causes. The average OSHA fine for the employer was USD 607.00/fatality. Only 31% of the deaths occurred at firms covered by a union contract. Risk of fatal injury was the highest for small firms with fewer than 10 employees. Cohort mortality studies based on records from unions or large employers probably exclude many small firms and so underestimate the risk of fatal injury to painters.

Key terms: injuries, labor unions, occupational diseases, solvents.

Mortality studies of painters have reported varied risks for deaths from unintentional injuries. Both the study made on the basis of union records by Matanoski et al (1) on painters in the United States (US) (1) and the study of Morgan et al (2) using industrial data reported lower than expected standardized mortality ratios (SMR) for accidents (table 1). In a population-based study of painters in Geneva, Guberán et al (3) found increased deaths from motor vehicle accidents but lower than expected mortality from other types of unintentional injury. For a cohort of 416 Swedish painters Lundberg (4) reported nine deaths from external causes, with eight expected. As deaths from work-related injuries account for only 20% of all US deaths from injuries among persons of working age (5), an analysis of deaths in broad categories such as "all accidents" (International Classification of Diseases, ninth revision, E800—949), which includes both work- and nonwork-related injuries, might not detect excesses in deaths related to work.

Gersh reported that in 1934 US painters had a death rate from falls of $5.7 \cdot 10^{-4}$/year compared with 1.9/10^{-4}/year for all workers (6). Such a high risk for fatal falls has not been reported in recent studies. The California Occupational Mortality Study (7) found an increase in falls and machinery accidents (SMR 131) among painters in 1979—1981; this value was not statistically significant. In proportionate mortality ratio (PMR) studies which included painters Milham (8) reported an excess of deaths from falls in Washington State (89 observed, 54 expected, PMR 164, $P < 0.05$), and the Pennsylvania Department of Health (9) found a significant increase in deaths from falls (17 observed, 6.7 expected, PMR 254, $P < 0.05$).

Because of an unexpected finding in the US Occupational Safety and Health Administration (OSHA) investigations that painters in the construction industry had high rates of electrocution (10), this study was done to examine further OSHA data concerning the types and circumstances of fatal injury among painters.

Material and methods

OSHA is the regulatory agency within the US Department of Labor which issues and enforces occupational safety and health regulations and which conducts investigations of work-related deaths. OSHA maintains the Integrated Management Information Systems (IMIS) data base containing the results of investigations of approximately 1600 work-related deaths each year, or some 20% (11) to 30% (12) of US work-related deaths. Only 47 US states are included in the data base; California, Michigan, and Washington State maintain data files in a format incompatible with the federal system. The IMIS data base therefore covers only 83% of the US work force. It contains information about the employer, the injured employee, and the nature and cause of injury.

Because of jurisdictional issues and selective reporting, OSHA fatality investigations are concentrated in construction and manufacturing (13). For 1982—1986, the IMIS data base reported an average of 660 fatalities per year in the construction industry; this number was a substantial amount (73%) of the 900 annual deaths from injury in construction which the National Institute for Occupational Safety and Health (NIOSH) identified from death certificates for a comparable period in the same 47 states (14). Almost all of the

[1] Division of Occupational Medicine, Department of Environmental Health Sciences, Johns Hopkins University School of Hygiene and Public Health, Baltimore, Maryland, United States.

Reprint requests to: Dr A Suruda, 944 Chestnut Ridge Road, Morgantown, WV 26505, USA.

Table 1. Mortality studies reporting injury mortality of painters. (SMR = standard mortality ratio)

Author	Study period	Subjects (N)	All external causes (E800—978)[a]			All accidents (E800—950)[a]			Motor vehicle accidents (E810—827)[a]		
			Observed (N)	Expected (N)	SMR	Observed (N)	Expected (N)	SMR	Observed (N)	Expected (N)	SMR
Guberán et al, 1989 (3)	1970—1984	1 916	26	22.7	115	16	12.2	131	12	5.9	203*
Lundberg, 1986 (4)	1961—1981	416	9	8	112	.	.	.	.	.	.
Matonoski et al, 1986 (1)	1975—1979	57 175	.	.	.	157	203	78*	55	72.3	76*
Morgan et al, 1981 (2)	1946—1976	16 243	151	318.2	52*	.	.	.	.	.	.

[a] International Classification of Diseases (ninth revision).
* $P<0.05$.

deaths investigated are due to trauma, and fewer than 1% are from occupational illness. OSHA does not investigate the two leading causes of US work-related deaths, motor vehicle accidents and homicide (15). Deaths in firms of all sizes are investigated, except for agriculture, for which farms with fewer than 11 employees are exempt.

OSHA fatality investigations are classified by the Standard Industrial Classification (SIC) (16). Of the approximately 500 000 painters in the United States, the Bureau of the Census estimated that, in 1980, 340 000 persons were employed as construction or maintenance painters (17) and that, in 1982, 136 000 were employed by firms in SIC 1721, "painting, paperhanging, and decorating" (18). Painters in other construction trades such as general contracting (SIC 1522) cannot be separately identified due to lack of occupational coding in the OSHA data base.

A printout was obtained of all deaths investigated by OSHA in SIC 1721 for the years 1982—1986. Additional detailed descriptions in the form of abstracts of the accident investigation were available for events in 1984—1986. The data base contained little information on postevent factors such as first aid, emergency medical care, or time from injury until death.

Results

For 1982—1986 the IMIS data base reported 129 deaths in SIC 1721. All 129 were from injury and all occurred at work. All of the deaths occurred among men. The average age was 34.2 (SD 10.8) years. Sixty-five (50%) of the deaths were from falls, 40 (31%) were electrocutions, and 6 (5%) were asphyxiations from solvents, toxic gases, or oxygen deficient atmospheres. Eighteen deaths (14%) were from other causes. The rates of death for SIC 1721 are shown in table 2.

Table 2. Work-related deaths in construction painting[a] in 1982—1986 as investigated by the US Occupational Safety and Health Administration.

Cause of death	Deaths (N)	Fatality rate[b] per 10 000/year
All causes	129	2.3
Falls	65	1.2
Electrocution	40	0.7

[a] Standard Industrial Classification 1721, "painting and paperhanging, and decorating," which included 136 128 workers in 1982.
[b] Fatality rates adjusted for employment in 47 states.

Falls

The 65 deaths were all from falls from heights. The average height of the fatal falls was 46 feet (14 m). Detailed information was available for 45 of the 46 deaths in 1984—1986. Twenty-four (52%) of the falls involved scaffolds. In 21 the painter fell from a scaffold, and in three the scaffold collapsed because of improper bracing, allowing the worker to fall. Fourteen deaths involved suspended scaffolds which fell due to rope or attachment point failure and in which the painter was not attached to a separate lifeline. In six deaths (13%), the painter fell from a ladder, in five from a work platform, and in four from a roof. There were seven falls from other or unknown locations.

The painters killed in falls had a mean age of 35.1 (SD 9.9) years and were significantly older than those who died of all other causes, who had a mean age of 30.9 (SD 12.3) years ($P<0.05$).

Electrocutions

Of the 40 deaths from electrocution, detailed information was obtained for 27 of 28 deaths in 1984—1986. There was one death from lightning, two from low voltage (110 volts, alternating current), and 24 from power lines (high voltage alternating current). In 14 (50%) cases, the painter moved a metal ladder into contact with a power line, and in three a mobile scaffold was rolled over into a power line. The other power line electrocutions also involved inadvertent contact with equipment held or operated by the painter.

Asphyxiation

Six painters died from asphyxiation in confined spaces in five separate incidents. There were three deaths from nitrogen atmospheres, and one each from methylene chloride, chlorine, and nitropropane. In no case, were confined space procedures and air supply respirators in use.

In addition, one of the 65 deaths from falls was of a painter who fell from a suspended scaffold while spray painting the inside of a tank. The OSHA investigator felt that improper air supply for the painter combined with high air levels of xylene in the tank were important contributing factors.

Firm size

The number of employees of the firm was known for all 129 deaths. Eighty-two (64%) were in firms with fewer than 11 employees. Denominator data on firm size for SIC 1721 is available from the 1982 census of construction industries (18). When the expected number of deaths was calculated on the basis of employment in each size class, the risk of death was significantly increased for small firms (table 3).

Forty (31%) of the 129 deaths occurred in establishments covered by collective bargaining agreements with a union. Small firms were less likely to be covered by union contracts (table 4). The union workers had an average age of 39.4 years, compared to 32.4 years for nonunion workers.

OSHA issued citations for safety violations in 74% of the cases. The average fine paid per fatality was USD 607.00. There was no significant difference in the OSHA citation rate or type of citation for union and nonunion firms. However, union firms paid larger fines, USD 1003.00, on the average, versus USD 393.00 for the nonunion companies.

Table 3. Firm size and risk of fatal injury in construction painting (Standard Industrial Classification 1721) in 1982—1986.

Employees in firm (N)	Employment in size class	Observed deaths (N)	Expected deaths (N)	Rate ratio
1—4	34 474	52	32.7	1.59*
5—9	26 103	26	24.7	1.05
10—19	24 317	18	23.0	0.78
20—49	26 691	18	25.3	0.71
50—99	11 266	8	10.7	0.75
100—249	8 811	6	8.4	0.71
≥250	4 467	1	4.2	0.42
Total	136 129	129	129.0	1.00

* $P<0.05$.

Table 4. Union contracts and fatal work-related injuries to construction painters according to firm size.

Employees in the firm (N)	Deaths (N)	Deaths in firms with union contracts	
		N	%
1—4	52	9	17
5—9	26	6	23
10—19	18	7	38
20—49	18	11	61
50—99	8	4	50
≥100	7	3	43
Total	89	40	31

Discussion

This study looked at work-related deaths of construction painters in SIC 1721 investigated by a regulatory agency (OSHA) that places special emphasis on the construction industry (13) and which investigates the majority of deaths that occur at construction worksites. However, the actual number of deaths in SIC 1721 could be greater as neither OSHA nor death certificates identify all US work-related deaths (12).

The work-related death rate for SIC 1721 of $2.3 \cdot 10^{-4}$/year in 1982—1986 was higher than that for the construction industry as a whole ($1.9 \cdot 10^{-4}$/year, OSHA data) and several times the work-related death rate of $0.5 \cdot 10^{-1}$/year for general industry for the same period as reported by the US Bureau of Labor Statistics (15) or that of NIOSH of $0.7 \cdot 10^{-4}$/year (14). Because of limited coverage, OSHA investigation data cannot be used to generate rates for all industry.

The work-related death rate from falls, $1.2 \cdot 10^{-4}$/year, is 20 times the rate of $0.06 \cdot 10^{-4}$/year for general industry reported by the Bureau of Labor Statistics or NIOSH (14, 15). The rate for electrocution, $0.8 \cdot 10^{-4}$ painters/year, is also several times that for general industry of $0.05 \cdot 10^{-4}$/year (14, 15).

Some of the difference in rates between SIC 1721 and general industry may reflect the relatively hazardous nature of construction painting, which employs about 25% of US painters. The high rates of fatal injury may not be the same for other painters, who might have less exposure to work at high elevations or in confined spaces.

Fatal falls among painters remain as much an occupational health problem today as they did 50 years ago in the time of Gersh (6). Lack of adequate fall protection in the form of scaffold guardrails, nets, lifelines, and safety belts caused the majority of severe injuries then as it did in the present study. Failure of a painter to connect his safety belt to a lifeline when painting from a suspended scaffold was the single most common cause of deaths associated with scaffolds in SIC 1721 and is a cause which is clearly preventable.

Failure to use fall protection while working at heights has been studied for nonfatal injuries. The Bureau of Labor Statistics studied 778 workers identified from 1982 compensation reports for workers who were injured in falls from heights of three or more feet (≥3.3 m) (19). Five hundred sixty-seven (78%) reported working regularly at heights of 10 feet (3 m) or more and only one-half of these persons indicated that guardrails or personal fall protection was required by their company for such work, even though such equipment was available at the job site. Improved safety training and enforcement should be targeted towards increasing the use of fall protective measures.

Acute toxicity from solvent exposure was known to be involved in one of the 65 fatal falls. None of the other reports mentioned whether solvent-based paint was in use on the day of the fatal fall. Hunting (20) reported that, in a prospective study of union painters using oil-based paints, exposure to solvents was associated with slips and falls. Boat builders are another occupational group exposed to solvents, and they are known to be at increased risk of fall injury (21). The role of solvent exposure in severe occupational falls is an area needing further study.

Fatal electrocutions in SIC 1721 were mainly due to painters moving equipment in the vicinity of overhead power lines. OSHA already prohibits the use of metal ladders by those engaged in electrical work, and NIOSH estimates that metal ladders account for 4% of the approximately 400 electrocutions at work in the United States each year (22). The use of nonconductive fiberglass extension ladders would have prevented at least 14 deaths in the present study, as would have maintaining the recommended 10 foot (3 m) clearance between equipment and overhead power lines.

Union officials estimate that 50% of construction painters were covered by union contracts at the time of this study (Rodney Woolford, personal communication, 1988). However the proportion so covered in SIC 1721 is unknown. Therefore it is not possible to assess the fatality risk of union versus nonunion companies.

This analysis of OSHA investigation data shows that construction painters are at high risk of fatal injury, particularly from falls and electrocution. Specialized data sets like OSHA's that focus solely on work-related deaths can identify groups at risk that are not identified by cohort mortality studies which analyze deaths from all injury causes. Cohort studies of painters which use union or industry records are likely to exclude the small firms whose workers have the greatest risk of fatal injury, and therefore they probably underestimate the risk of death from unintentional injury.

Acknowledgments

The author wishes to thank Mr R Woolford of the International Brotherhood of Painters and Allied Trades, Mr T Tyburski, Mr J Katalinas, and Mr B Beveridge of OSHA, Ms J Russell of the NIOSH Division of Safety Research, and Dr W Marine.

References

1. Matanoski GM, Stockwell HG, Diamond EL, Haring-Sweeney M, Joffe RD, Mele LM, et al. A cohort mortality study of painters and allied tradesmen. Scand J Work Environ Health 1986;12:16—21.
2. Morgan RW, Kaplan SD, Gaffey WR. A general mortality study of production workers in the paint and coatings manufacturing industry. J Occup Med 1981; 23:13—21.
3. Guberan E, Usel M, Raymond L, Tissot R, Sweetman PM. Disability, mortality, and incidence of cancer among Geneva painters and electricians: a historical prospective study. Br J Ind Med 1989;46:16—23.
4. Lundberg I. Mortality and cancer incidence among Swedish paint industry workers with long-term exposure to organic solvents. Scand J Work Environ Health 1986; 12:108—113.
5. National Safety Council. Accident facts 1986. Chicago, IL: National Safety Council, 1987.
6. Gersh, A. Occupational hazards and the painter. New York, NY: Brotherhood of Painters, Decorators, and Paperhangers of America, 1937.
7. California Department of Health. California occupational mortality 1979—1981. Sacramento, CA: Department of Health Services, 1987.
8. Milham S. Occupational mortality in Washington State 1950— 1979. Cincinnati, OH: National Institute for Occupational Safety and Health, 1983. (DHHS (NIOSH) publication 83—116.)
9. Pennsylvania Department of Health. Mortality experience of Pennsylvania workers 1983—1985. Harrisburg, PA: State Health Data Center, 1987.
10. Suruda A. Electrocution at work. Prof Saf 1988;33: 27—32.
11. Suruda A, Emmett EA. Counting recognized occupational deaths in the United States. J Occup Med 1988; 30:868—72.
12. Stout N, Bell C. Effectiveness of source documents for identifying fatal occupational injuries: a synthesis of studies. Am J Public Health 1991;81:725—8.
13. Mendeloff JM, Kagey BT. Using Occupational Safety and Health Administration accident investigations to study patterns in work fatalities. J Occup Med 1990; 32:1117—23.
14. National Institute for Occupational Safety and Health (NIOSH). National traumatic occupational fatalities 1980—1985. Cincinnati, OH: NIOSH, 1989. (DHHS (NIOSH) publication 89—116.)
15. Bureau of Labor Statistics. Annual survey of occupational illnesses and injuries 1984. Washington, DC: Department of Labor, 1986. (Publication 2259.)
16. Office of Management and Budget. Standard industrial classification manual. Springfield, VA: National Technical Information Service, 1987. (National Technical Information Service PB 87—1000012.)
17. US Department of Commerce Bureau of the Census. 1980 census of population, detailed population characteristics. Washington, DC: US Government Printing Office, 1984. (Volume PC8O-1-DI-A.)
18. US Department of Commerce Bureau of the Census. 1982 census of construction industries, industry 1721. Washington, DC: US Government Printing Office, 1984. (Publication CC82-I-II.)
19. Bureau of Labor Statistics. Injuries resulting from falls from elevations. Washington, DC: US Department of Labor, 1984. (BLS bulletin 2195.)
20. Hunting KL, Matanoski GM, Larson M, Woolford R. Solvent exposure and the risk of slips, trips, and falls among painters. Am J Ind Med 1991;20:353—70.
21. Brigham CR, Landrigan PJ. Safety and health in boatbuilding and repair. Am J Ind Med 1985;8:169—82.
22. National Institute for Occupational Safety and Health (NIOSH). Preventing electrocutions of workers using portable metal ladders near overhead power lines. Cincinnati, OH: NIOSH, 1989. (DHHS (NIOSH) publication 89—110.)

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EXHIBIT F

International Union of Painters and Allied Trades

Petition for Promulgation of a Health and Safety Standard for Preparation and Coating for Corrosion Prevention

Los Angeles Painting & Finishing Contractors Association
1106 Colorado Boulevard, Los Angeles, California 90041-2504
(323) 258-8136 · FAX (323) 258-2279

Grant Mitchell
Painters and Allied Trades, District Council #36
1155 Corporate Center Drive
Monterey Park, CA 91754

July 22, 2015

grant.mitchell@dc36.org

Re: Cal/OSHA Standard for Corrosion Prevention

Dear Mr. Mitchell:

The Los Angeles Painting and Finishing Contractors Association (LAP&FCA) supports the adoption of the Preparation and Coating for Corrosion Prevention Standard being proposed by the International Union of Painters and Allied Trades to the California Occupational Safety & Health Standards Board.

The NACE 13/ACS 1 Standard is generally accepted in our industry. The failure to use a trained and certified workforce to perform corrosion prevention work presents serious concerns for worker health and safety.

The LAP&FCA is an organization of commercial and industrial painting contractors that has been in existence for more than 100 years. During our lengthy existence the LAP&FCA has always promoted quality workmanship along with the highest safety and environmental concerns. We also strongly support qualified applicators to ensure long lasting projects that are performed within manufacturers strict specifications, thus providing maximum value to awarding agencies and the public trust.

You may advise the Standards Board of our support for this proposed standard.

Sincerely,

Don Vulich, Executive Director

RANDALL/McANANY COMPANY
Painting and Wallcovering Contractors

4935 McConnell Avenue, Suite 20
Los Angeles, California 90066-6756
Tel: 310/822-3344 • FAX 310/301-4924
State Lic. # 362689

July 24, 2015

Grant Mitchell
Painters and Allied Trades District Council 36
1155 Corporate Center Drive,
Monterey Park, CA 91754
grant.mitchell@dc36.org

Re: Cal/OSHA Standard for Corrosion Prevention

Dear Mr. Mitchell:

Randall McAnany Company supports the adoption of the Preparation and Coating for Corrosion Prevention Standard being proposed by the International Union of Painters and Allied Trades to the California Occupational Safety & Health Standards Board.

The NACE 13/ACS 1 Standard is generally accepted in our industry. The failure to use a trained and certified workforce to perform corrosion prevention work presents serious concerns for worker health and safety.

Randall McAnany Company is a painting and wallcovering contractor based in Los Angeles, California. Our crew size varies with the workload; however, we consistently employ a crew of 50 to 75. Because of our coastal location, we encounter situations that require corrosion prevention on the exterior painting projects that we complete.

You may advise the Standards Board of our support for this proposed standard.

Sincerely,

Stefan Politz
President

AMERICAN COATINGS

a D.F.K. CONST. CORPORATION

PAINTING AND DECORATING CONTRACTORS OF AMERICA

PAINTERS TO INDUSTRY & DEFENSE

FINISHING CONTRACTORS ASSOCIATION

August 5, 2015

Serial No. 2015-093

Grant Mitchell
Painters and Allied Trades District Council 36
1155 Corporate Center Drive,
Monterey Park, CA 91754
Email: grant.mitchell@dc36.org

Reference: Cal/OSHA Standard for Corrosion Prevention

Dear Mr. Mitchell,

AMERICAN COATINGS a D.F.K. Const., Corp., supports the adoption of the Preparation and Coating for Corrosion Prevention Standard being proposed by the International Union of Painters and Allied Trades to the California Occupational Safety & Health Standards Board.

The NACE 13/ACS 1 Standard is generally accepted in our industry. The failure to use a trained and certified workforce to perform corrosion prevention work presents serious concerns for worker health and safety.

AMERICAN COATINGS a D.F.K. Const., Corp., primarily contracts for Corrosion Control on Industrial Facilities, we employ approximately 20 Industrial Painters. We also are a member of the National Finishing Contractors Association Affiliate, Ventura, Santa Barbara, San Luis Obispo, Master Painting Contractors Association, Inc. who also supports this measure.

You may advise the Standards Board of our support for this proposed standard.

Please call if you have any questions.

Very truly yours,

AMERICAN COATINGS

David F. Kappos, President

D.F.K. Const., Inc.

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Grant Mitchell
Painters and Allied Trades District Council 36

1155 Corporate Center Drive,
Monterey Park, CA 91754
grant.mitchell@dc36.org

August 18, 2015

Re: Cal/OSHA Standard for Corrosion Prevention

Dear Mr. Mitchell:

Cor-Ray Painting Co. supports the adoption of the Preparation and Coating for Corrosion Prevention Standard being proposed by the International Union of Painters and Allied Trades to the California Occupational Safety & Health Standards Board.

The NACE 13/ACS 1 Standard is generally accepted in our industry. The failure to use a trained and certified workforce to perform corrosion prevention work presents serious concerns for worker health and safety.

Cor-Ray Painting Co. performs industrial painting and coating work across the United States and has over 65 employees.

You may advise the Standards Board of our support for this proposed standard.

Sincerely,

Philippe Goutagny

WILSON & HAMPTON
Painting Contractors

B/C-33 144226

August 14, 2015
"Since 1923"

Grant Mitchell
Painters and Allied Trades District Council 36
1155 Corporate Center Drive,
Monterey Park, CA 91754

Re: Cal/OSHA Standard for Corrosion Prevention

Dear Mr. Mitchell:

Wilson & Hampton Painting Contractors supports the adoption of the Preparation and Coating for Corrosion Prevention Standard being proposed by the International Union of Painters and Allied Trades to the California Occupational Safety & Health Standards Board.

The NACE 13/ACS 1 Standard is generally accepted in our industry. The failure to use a trained and certified workforce to perform corrosion prevention work presents serious concerns for worker health and safety.

Wilson & Hampton has been the painting industry in Southern California since 1923. With extensive experience in the field of corrosion prevention and remediation

You may advise the Standards Board of our support for this proposed standard.

Sincerely,

DJ Hampton
Douglas J. Hampton
President

Email DougH@WilsonHampton.com

U.S. Green Building Council

1524 W. Mable Street
PO Box 9949
Anaheim, CA 92812

800-398-2468
Cell 714-863-9330
Fax 714-284-4900

California Labor Federation | AFL-CIO www.workingcalifornia.org

Headquarters: 600 Grand Ave
Suite 410
Oakland, CA 94610-3561

510.663.4000 tel
510.663.4099 fax

1127 11th Street
Suite 425
Sacramento, CA 95814-3809

916.444.3676 tel
916.444.7693 fax

3303 Wilshire Boulevard
Suite 415
Los Angeles, CA 90010-1798

213.736.1770 tel
213.736.1777 fax

August 10, 2015

Mr. Chris Christophersen
Painters and Allied Trades District Council 16
2705 Constitution Drive
Livermore, CA 94551

RE: **Cal/OSHA Standard for Corrosion Prevention**

Dear Mr. Christophersen:

The California Labor Federation supports the adoption of the Preparation and Coating for Corrosion Prevention Standard being proposed by the International Union of Painters and Allied Trades to the California Occupational Safety & Health Standards Board.

The NACE 13/ACS 1 Standard is generally accepted in the construction industry. The failure to use a trained and certified workforce to perform corrosion prevention work presents serious concerns for worker health and safety.

Anti-corrosion applications are a crucial maintenance component for bridges, roads, industrial structures, and water infrastructure. Corrosion prevention work is necessary for long-term environmental protection and is an ongoing, but important component of maintenance that leads to cost savings and increases the life of a project.

It is for these reasons that we support this proposed standard. Please let me know if I can be of any assistance in the future.

Sincerely,

Caitlin Vega

Caitlin Vega
Legislative Director
CV: sm
OPEIU 3 AFL CIO (31)

District Council 16
International Union of Painters and Allied Trades

2705 Constitution Drive • Livermore, CA 94551
Telephone (925) 245-1080 • Fax (925) 245-1084

Chris Christophersen
Business Manager/Secretary-Treasurer

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August 13, 2015

California Occupational Safety and Health Standards Board
2520 Venture Oaks Way, Suite 350
Sacramento, CA 98533

Re: Standard for Preparation and Coating for Corrosion Prevention

Dear Board Members:

I am the Director of Communications for International Union of Painters and Allied Trades (IUPAT) District Council 16 in Northern California. The following list of contractors and contractor associations has authorized me to advise you of their support for the health and safety standard for Preparation and Coating for Corrosion Prevention proposed by IUPAT. These are employers and industry partners with hundreds of painters across Northern California who perform corrosion prevention work.

Mason Painting
George Maskers Painting
C&J Painting
A&B Painting
Fresno Area Painting and Decorators Association
Nelson Painting & Decorating
WM. B. Saleh Company
Brand Energy
J&R Painting
KBI Painting
Gugel/Today Painting

Sincerely,

Mike West

Mike West
Director of Communications
District Council 16 IUPAT

District Council 16

Northern California
Journeyman and Apprentice Training Trust Fund

Mark Watchers
Executive Director

2020 Williams Street • Suite A • San Leandro, CA 94577
Telephone (510) 785-8467 • Fax (866) 884-4856

Chris Christophersen
Painters and Allied Trades District Council 16
2705 Constitution Drive
Livermore, CA 94551
cjcsr@dc16iupat.org

July 24, 2015

Re: Cal/OSHA Standard for Corrosion Prevention

Dear Mr. Christophersen:

District Council 16 Joint Apprenticeship Training Trust Fund supports the adoption of the Preparation and Coating for Corrosion Prevention Standard being proposed by the International Union of Painters and Allied Trades to the California Occupational Safety & Health Standards Board.

The NACE 13/ACS 1 Standard is generally accepted in our industry. The failure to use a trained and certified workforce to perform corrosion prevention work presents serious concerns for worker health and safety.

District Council 16 Joint Apprenticeship Training Trust Fund is actively involved in the health & safety and technical training that is necessary for Journeypersons and Apprentices to achieve Coatings Application Specialist certification.

The health and safety aspects involved in the Industrial Applicators industry are real and not to be ignored as proven by the higher accident rates in this career path. As the Society of Steel Protective Coatings vets the Industrial Contractors that hold a QP1 standard and employ CAS certified employees, this standard and the health and safety training required to receive this certification would help to protect employees in this profession.

You may advise the Standards Board of our support for this proposed standard.

Sincerely,

Mark J. Watchers
Executive Director

Chris Christophersen
Painters and Allied Trades District Council 16
2705 Constitution Drive
Livermore, CA 94551
cjcsr@dc16iupat.org

July 29, 2015

Re: Cal/OSHA Standard for Corrosion Prevention

Dear Mr. Christophersen:

The Northern California Painting and Finishing Contractors association (NCPFC) supports the adoption of the Preparation and Coating for Corrosion Prevention Standard being proposed by the International Union of Painters and Allied Trades to the California Occupational Safety & Health Standards Board.

The NACE 13/ACS 1 Standard is generally accepted in our industry. The failure to use a trained and certified workforce to perform corrosion prevention work presents serious concerns for worker health and safety.

NCPFC is a California based association who represents union painting contractors. We currently represent over one-hundred contractors, several of whom are industrial painters and will be directly impacted by this change.

You may advise the Standards Board of our support for this proposed standard.

Sincerely,

Ryan Sarna

Director of Labor Relations

Northern California Painting and Finishing Contractors

State Building and Construction Trades Council

of California

ROBBIE HUNTER
PRESIDENT

J. TOM BACA
SECRETARY-TREASURER

Established 1901
Chartered by
BUILDING AND CONSTRUCTION TRADES
DEPARTMENT
AFL-CIO

July 31, 2015

Mr. Chris Christophersen
Painters and Allied Trades District Council 16
2705 Constitution Drive
Livermore, CA 94551

RE: Cal/OSHA Standard for Corrosion Prevention

Dear Mr. Christophersen:

I write on behalf of the State Building and Construction Trades Council, AFL-CIO, in support of the adoption of the Preparation and Coating for Corrosion Prevention Standard being proposed by the International Union of Painters and Allied Trades to the California Occupational Safety & Health Standards Board.

The NACE 13/ACS 1 Standard is generally accepted in the construction industry. The failure to use a trained and certified workforce to perform corrosion prevention work presents serious concerns for worker health and safety.

Anti-corrosion applications are a crucial maintenance component for bridges, roads, industrial structures, and water infrastructure. Corrosion prevention work is necessary for long-term environmental protection and is an ongoing, but important component of maintenance that leads to cost savings and increases the life of a project.

It is for these reasons that we support this proposed standard. Please let me know if I can be of any assistance in the future.

Sincerely,

CÉSAR DIAZ
Legislative Director

CD:bb
opeiu#29/afl-cio

1231 I Street, Suite 302 · Sacramento, CA 95814-2933 · (916) 443-3302 · FAX (916) 443-8204

Painting & Decorating

Contractors' Association of Sacramento, Inc.

Chris Christophersen
Painters and Allied Trades District Council 16
2705 Constitution Drive
Livermore, CA 94551
cjcsr@dc16iupat.org

July 24, 2015

Re: Cal/OSHA Standard for Corrosion Prevention

Dear Mr. Christophersen:

The PDCA of Sacramento, Inc. supports the adoption of the Preparation and Coating for Corrosion Prevention Standard being proposed by the International Union of Painters and Allied Trades to the California Occupational Safety & Health Standards Board.

The NACE 13/ACS 1 Standard is generally accepted in our industry. The failure to use a trained and certified workforce to perform corrosion prevention work presents serious concerns for worker health and safety.

The PDCA of Sacramento is an association with approximately 10 contractors employing over 150 painters. This would be a valuable health and safety standard as many of our painters work on water tanks, waste water stations, pump stations, sewer lift stations.

You may advise the Standards Board of our support for this proposed standard.

Sincerely,

Christopher Harris
President
PDCA of Sacramento, Inc.

P.O. Box 89 • Roseville, CA 95678 • phone (916)451-7511 • fax (916)780-6807

DISTRICT COUNCIL 16 NORTHERN CALIFORNIA JOURNEYMAN AND APPRENTICE TRAINING TRUST FUND

2020 Williams, Suite A San Leandro, CA 94577

Painters – Glaziers – Drywall Finishers – Floor Coverers

Phone-510-785-8467; Fax-866-884-4856

Chris Christophersen
Painters and Allied Trades District Council 16
2705 Constitution Drive
Livermore, CA 94551
cjcsr@dc16iupat.org

July 24, 2015

Re: Cal/OSHA Standard for Corrosion Prevention

Dear Mr. Christophersen:

District Council 16 Joint Apprenticeship Training Trust Fund supports the adoption of the Preparation and Coating for Corrosion Prevention Standard being proposed by the International Union of Painters and Allied Trades to the California Occupational Safety & Health Standards Board.

The NACE 13/ACS 1 Standard is generally accepted in our industry. The failure to use a trained and certified workforce to perform corrosion prevention work presents serious concerns for worker health and safety.

District Council 16 Joint Apprenticeship Training Trust Fund is actively involved in training our members in NACE/SSPC to comply with NACE No. 13/SSPC-ACS-1 as well as covering the Body of Knowledge in health & safety under section 3 of its Standards. This provides for our Journeypersons and Apprentices to acquire the technical training necessary to achieve Coatings Application Specialist certification with concerns to safety.

The health and safety aspects involved in the Industrial Applicators industry are real and not to be ignored as proven by the higher accident rates in this career path. As the Society of Steel Protective Coatings vets the Industrial Contractors that hold a QP1 standard and employ CAS certified employees, this standard and the health and safety training required to receive this certification would help to protect employees in this profession. You may advise the Standards Board of our support for this proposed standard.

Sincerely,

Alex Beltran
Director of Training

Chris Christophersen
Painters and Allied Trades District Council 16
2705 Constitution Drive
Livermore, CA 94551
cjcsr@dc16iupat.org

July 29, 2015

Re: Cal/OSHA Standard for Corrosion Prevention

Dear Mr. Christophersen:

The Northern California Allied Trades supports the adoption of the Preparation and Coating for Corrosion Prevention Standard being proposed by the International Union of Painters and Allied Trades to the California Occupational Safety & Health Standards Board.

The NACE 13/ACS 1 Standard is generally accepted in our industry. The failure to use a trained and certified workforce to perform corrosion prevention work presents serious concerns for worker health and safety.

NCAT (Northern California Allied Trades) is an umbrella organization for union contractors in the finishing trades, including painters.

You may advise the Standards Board of our support for this proposed standard.

Sincerely,

Ryan Sarna

Director of Labor Relations

Northern California Allied Trades

F.D. THOMAS, INC.

Chris Christophersen
Painters and Allied Trades District Council 16
2705 Constitution Drive
Livermore, CA 94551
cjcsr@dc16iupat.org

July 28, 2015

Re: Cal/OSHA Standard for Corrosion Prevention

Dear Mr. Christophersen:

F.D. Thomas, Inc. supports the adoption of the Preparation and Coating for Corrosion Prevention Standard being proposed by the International Union of Painters and Allied Trades to the California Occupational Safety & Health Standards Board.

The NACE 13/ACS 1 Standard is generally accepted in our industry. The failure to use a trained and certified workforce to perform corrosion prevention work presents serious concerns for worker health and safety.

F.D. Thomas, Inc. is a California Contractor in the industrial painting market and this division is chiefly involved in performing industrial painting and coatings work on bridges, waste/water treatment plants, pipelines and hydroelectric projects. Much of this work entails technical applications which require an involved training program for competency and safety. F.D. Thomas, Inc. currently employs approximately 100 workers in California.

You may advise the Standards Board of our support for this proposed standard.

Sincerely,

Grover Lee
Vice President/Division Manager
F.D. Thomas, Inc.
541-864-1602 – Direct
541-840-6276 – Cell
541-664-1105 – Fax
grover@fdthomas.com

Redwood Painting Co., Inc.

License No. 302617
Industrial Coatings • Sandblasting

620 West 10th Street
P.O. Box 1269
Pittsburg, CA 94565
(925) 432-4500 ph.
(925) 432-6129 fax

July 30, 2015

Chris Christopherson
Painters and Allied Trades District Council 16
2705 Constitution Drive
Livermore, CA 94551
cjcsr@dc16iupat.org

Re: Cal/OSHA Standard for Corrosion Prevention

Dear Mr. Christophersen:

Redwood Painting Co., Inc. supports the adoption of the Preparation and Coating for Corrosion Prevention Standard being proposed by the International Union of Painters and Allied Trades to the California Occupational Safety & Health Standards Board.

The NACE 13/ACS 1 Standard is generally accepted in our industry. The failure to use a trained and certified workforce to perform corrosion prevention work presents serious concerns for worker health and safety.

Redwood Painting Co., Inc. is an Industrial Painting Contractor employing approximately 100 craft people serving the Energy, Petrochemical and Water/Wastewater Industries through out California.

You may advise the Standards Board of our support for this proposed standard.

Sincerely,
Redwood Painting Co., Inc

Charles Del Monte
President

cc: NCPFC

JERRY THOMPSON & SONS, INC.

Chris Christophersen
Painters and Allied Trades District Council 16
2705 Constitution Drive
Livermore, CA 94551
cjcsr@dc16iupat.org

July 27, 2015

Re: Cal/OSHA Standard for Corrosion Prevention

Dear Mr. Christophersen:

Jerry Thompson & Sons Painting supports the adoption of the Preparation and Coating for Corrosion Prevention Standard being proposed by the International Union of Painters and Allied Trades to the California Occupational Safety & Health Standards Board.

The NACE 13/ACS 1 Standard is generally accepted in our industry. The failure to use a trained and certified workforce to perform corrosion prevention work presents serious concerns for worker health and safety.

Jerry Thompson & Sons is a commercial/industrial painting contractor who employ some 150 painters. JTS recently painted the new 49er Levi stadium and have painted several CALTRANS projects.

You may advise the Standards Board of our support for this proposed standard.

Sincerely,

Stephen G Thompson

3 Simms Street, San Rafael, California 94901-5414 Phone 415-454-1500 Fax 415-454-9170

PAINTING & DECORATING

PYRAMID PAINTING, INC.

July 27, 2015

Chris Christophersen
Painters and Allied Trades District Council 16
2705 Constitution Drive
Livermore, CA 94551
cjcsr@dc16iupat.org

Re: Cal/OSHA Standard for Corrosion Prevention

Dear Mr. Christophersen:

Pyramid Painting, Inc. supports the adoption of the Preparation and Coating for Corrosion Prevention Standard being proposed by the International Union of Painters and Allied Trades to the California Occupational Safety & Health Standards Board.

The NACE 13/ACS 1 Standard is generally accepted in our industry. The failure to use a trained and certified workforce to perform corrosion prevention work presents serious concerns for worker health and safety.

Pyramid Painting, Inc was established as a California Corporation in 1956 and has been an active member of the California State License Board since that inception date. We are a union painting contractor that specializes in all commercial, light industrial and high density residential projects. We currently employ between 50-80 union painters and wallcovering installers. Our light industrial scope of work that we perform consists of the proper preparation and application of corrosion preventative coatings to many types of steel structures and components.

You may advise the Standards Board of our support for this proposed standard.

Sincerely,

Craig Ruybalid

President

155 EAST DANA STREET • MOUNTAIN VIEW, CA 94041 • (650) 903-9791 • Fax (650) 903-9795