# Health and Safety

## Taking the Lead in Lead Exposure Prevention: Mitigating Hazards in Stained Glass Conservation

***By Ariana Makau, President & Principal Conservator of Nzilani Glass Conservation, Inc.***

Stained glass conservators often have to remove and install windows in their architectural settings, meaning they also have to adhere to regulations set for the construction industry. When I founded Nzilani Glass Conservation over fifteen years ago, I felt overwhelmed by the myriad of Health and Safety (H&S) issues inherent to practicing stained glass conservation in private practice. Having previously worked in an institutional setting, I was accustomed to having a protocol-based support system and personal protective equipment on hand in the conservation lab. But where could I begin as an independent conservator working on site and in the studio? Even knowing which safety measures to implement, how they could be presented to clients to convey why H&S considerations were necessary, and figuring out how clients could accept H&S as a billable line item were challenging.

Part of growing Nzilani has involved forging that desire for safety into tangible practices and weaving these into our company culture. Our company's three philosophical pillars are: "Be Safe. Have Fun. Do Excellent Work." When we are safe, we are freer to enjoy our work, and the quality of our output reflects the synergy of these practices.

### Be safe – know your (true) enemies

The independent conservator may feel that they are at cross-purposes with regulators and regulations. Previous articles in AIC newsletters address these various agencies and how they can help you. In California, we worked with the Division of Occupational Safety and Health (DOSH), better known as CAL/OSHA, or simply OSHA. We have found that working with representatives from regulatory organizations makes the workplace safer and serve as a conservator's resource center — use them! That said, our experience has involved a steep learning curve from both sides.

The first step toward compliance is to find a specialist who is not only well-versed in specific regulations in your field, but is also willing to partner with the conservator to improve the workspace within both conservation and regulatory (federal and state) parameters. The search for a good fit can be discouraging: when the conservator is motivated to be safe and in compliance, yet the regulator's understanding of a studio's workflow and processes are impaired, it may take a few tries before the perfect ally is found within the regulatory landscape.

"Lead is real!" is a playful platitude often repeated at Nzilani. Its naissance is derived from an early company lead safety class that was not adequately calibrated to our team's level of awareness and failed to address the specifics of our industry. The first uttered sentences in class were: "Lead is real; it is dangerous. You may not be aware that it can be found in many things you interact with every day." The consultant had not researched that lead is one of the key materials we interact with daily, so this opening fell flat. Even years later, when attending a mandatory OSHA-approved Lead Worker class, it was primarily structured for trades people exposed to lead paint, despite the instructor's attempts to customize the syllabus for our audience. We ultimately had to translate much of the literature and regulations ourselves.

The first step in mitigating a hazard is to identify it. The main hazard in stained glass conservation is 100% pure lead, a heavy metal with toxic properties. The conservation process involves numerous points of exposure: lead dust in came (a came is a divider bar used between small pieces of glass to make a larger glazing panel), oxidized lead came, or newly extruded sheets. Lead can also be found in conjunction with other hazardous materials, such as calcium carbonate (a.k.a. whiting), "red" lead, and asbestos found in glazing putty, metal, or wooden frames, glass, or glass paint.

### Testing

Air quality and surface testing for lead has given us quantifiable data for changing such long-established studio practices such as glazing (building) windows with bare hands; using drinking cups in the work area; and wearing the same clothes at work and at home, elevating exposure risks to self and others. Testing has resulted in implementation of mitigation practices such as wearing disposable gloves, separating work and eating areas, changing clothes and footwear, and washing hands often.

Monitoring our blood lead levels provides another data set about the effectiveness of workplace practices and personal hygiene. As an independent conservator, I systematically test my blood lead levels and am able to see the correlation between safe practices, lead levels, and various treatment types. When Nzilani added employees, it was logical to track everyone's levels biannually, beginning with a baseline test for each new employee before beginning work at the studio. Similarly, we give an "exit" test when an employee leaves Nzilani. This data provides markers of time worked at the company and feedback on the effectiveness of our H&S strategies. Although there is no "safe" level of lead, the Center for Disease Control (CDC) recommends blood lead levels (BLLs) of 5 micrograms per deciliter (ug/dl) or lower for the general population. OSHA BLL compliance standards require worker BLLs to be below 40 ug/dl. At Nzilani, the average employee BLL was 3.6 ug/dl in our most recent company-wide test. Our test results show that one can interact with lead safely on a daily basis in our industry when using appropriate risk mitigation protocols and PPE.

To consult on customizing solutions to meet regulations for stained glass practice, Nzilani engaged an industrial hygienist (IH) who learned about our procedural treatment tasks before making any recommendations for improvement. Together, we identified our exposures in various tasks both on site and in the studio, after which we paired the proper PPE to each job, in compliance with the OSHA lead standard for the construction industry (1926.62) and its Permissible Exposure Limit (PEL). In order to learn what our "trigger tasks" (OSHA specified tasks requiring PPE) were, we took lead particulate samples from both the ambient air, as well as "inhaled air." Based on these results, and in consultation with the site IH, we created customized H&S protocols and determined which PPE we should use in the studio and on site to be in compliance with OSHA regulations.

## Testing for lead exposure

To determine employee exposures to lead in the workplace, OSHA requires the performance of air sampling. The results of the air sampling are used to determine the requirements for additional monitoring, implementation of exposure controls (i.e., ventilation, PPE, etc.), and medical monitoring, to include blood lead level (BLL) testing.

BLL testing of employees for lead exposure is mandated when air sampling of the workplace shows lead particulates exceeding the specified threshold. An employer is required to provide BLL testing at no cost to the employee "for all employees who are or may be exposed at or above the action level for more than 30 days per year." See OSHA 29 CFR 1910.1025 Lead (general industry) and 1926.62 (construction industry), and their Appendices A, B, C, D, and your state or province's occupational agency for specific limits and detailed information.

Monitoring lead exposure by testing employee BLLs can also be a voluntary precaution, one that may help evaluate the effectiveness of in-place H&S controls, especially in operations where lead-containing surface contamination poses an increased risk of exposure by ingestion.

***—Members of the AIC H&S Committee***

### Personal protective equipment (PPE)

We have found that our understanding of lead exposure and containment is often similar to that of the instructors of the certification classes for builders and contractors, yet we have had to customize H&S practices to our particular needs and practices.

All tasks except paperwork, which is done in separate offices, require the use of disposable gloves. Hands are washed often throughout the day, and when transitioning from work to breaks. Depending on the task and location, we use a variety of PPE including aprons, coveralls, disposable "Tyvek" coveralls with hoods and booties, half-mask and full-face respirators with rated cartridges, and eye and ear protection. We also implement annual respirator medical qualification, training, and fit testing, which is scheduled closely with one of the biannual blood level tests.

### Have fun – necessity breeds invention

Drawing on the creative backgrounds of the Nzilani team, we are constantly conceiving risk-reducing improvements for the studio and on site. Since stained glass conservation is a hybrid between object conservation and construction, many of our in-house systems are custom made. The following are a few examples of how we have mitigated key trigger tasks.

### Soak tank

In the studio, H&S measures are implemented as soon as a leaded glass panel arrives, as historical panels usually have some amount of oxidized lead. This type of exposure requires at least a half-mask respirator with P100 filters, worn while both sides of the panel are HEPA-vacuumed. After a rubbing is taken of the original

window design, the panel is placed into the soak tank to loosen the old putty for dismantling. Unless the glass paint is unstable, all the dismantling happens under water, reducing our exposure and ensuring the old lead is contained in all its forms. Our soak tanks were designed by team members to our specifications and fabricated locally in collaboration with a vendor who specializes in water filtration. Effluent water is strained through multiple filters to meet discharge requirements before entering city drainage systems.

### Lead recycling & sludge disposal

The old lead generated during dismantling is placed in appropriately labeled containers to be taken for recycling. We keep these buckets closed, and periodically moisten the contents to prevent lead dust from escaping when additional old lead is added. We also recycle any unusable pieces of lead came, which are collected in their own separate containers to reduce the spread of lead dust. Both go to a qualified lead intake facility.

The dismantling process also results in containers full of old glazing putty, a sludge-like waste material containing lead that requires proper disposal. One of the challenges of being a niche industry is that we have had difficulty conveying the specifics of our work to various local municipality representatives, so they can recommend which hazardous waste protocols we should follow.

### Glass paint

Often, glass paint is a medium that is overlooked as hazardous, as people perhaps assume that it is like acrylic or tempera paints. However, as a vitreous paint, this medium is a combination of ground glass and pigment oxides, often with a lead flux. This paint requires prudent handling, and we use P100 filters in our half-mask respirators while glass painting.

### Soldering & articulated fume hoods

Nzilani created a customized system of mounted vent hoods which feed to an industrial air scrubber for use during soldering, another OSHA trigger task. After various prototypes, we settled on a final workbench hood system designed by a crew member and fabricated by a local metal worker. The mobile anchoring system integrates existing laptop arm technology with customized aluminum vent-hood holsters to provide close and steady placement during work tasks. Team members also use half-mask respirators with combination organic vapor and P100 cartridge filters during soldering.

### Particulates created during treatment

In addition to lead dust, the team encounters other particulates during the treatment of panels. During the puttying phase, both sawdust and calcium carbonate (whiting) are used. Puttying is restricted to a small room with a dedicated air scrubber. The small cubic square footage ensures the air is scrubbed at a fast rate, and during high volume work, the filters are checked once every two weeks. P100 respirator filters used for lead particulates are also effective in providing protection against sawdust and whiting.

### Do excellent work

Nzilani employees come from a wide range of cultural and experiential backgrounds. Very few have a conservation background, yet all are integral to Nzilani's success in creating an environment where safe innovation in practice is cultivated.

Our company's procedures have been refined over time, and we often update them with new ideas and improvements to old systems. Simple daily actions, such as changing between street and work shoes at the beginning and end of each work day and frequent hand washing, have become routine. The entire team participates in a weekly deep cleaning of the studio in addition to daily cleaning of individual stations. More detailed safety procedures are conveyed via posted treatment protocol sheets, periodic lead awareness classes, weekly meetings that follow our three-pillar structure, and quarterly H&S meetings. Mitigating hazards within our workplace not only benefits us, but it also informs others in similar industries. For example, all our protocols can be applicable, even where stained glass is practiced as a hobby on a smaller scale.

Learning to combine the realities of everyday stained-glass treatment with regulatory expectations is an ongoing process. Effective teamwork between regulatory agencies, conservators and conservation organizations will help alleviate misconceptions and misinformation; producing more accessible, practical recommendations, and a safer environment for everyone.

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## Contact the H&S Committee

Have a question about health and safety in your workplace? Contact the Health & Safety Committee at health-safety@conservation-us.org.