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Introduction

In 2013 I created the *Bay Area Green Jewelry Studio Project* to help jewelry educators in the greater San Francisco area make their jewelry classrooms more eco-friendly. The information I presented was compiled from years of research, teaching and lecturing in the US and abroad. That information has been expanded beyond the scope of the original project to address issues for any jewelry classroom, art center, jewelry studio or jewelry store. The dual goals are to provide a safe place to work and at the same time, to minimize harmful effects on our environment.

This book deals with chemicals, processes and ecological impact —all serious topics that span thousands of pages and occupy professions in each field for long careers. Clearly, this is a summary, and just as clearly, there are risks in simplifying complex material. While every attempt has been made to ensure that the information on the following pages is current and accurate, it is the responsibility of the reader to update and apply this information as appropriate for his or her situation.

The guidelines presented here are intended for small scale jewelry studios and schools. Industrial applications are different so companies should seek guidance from their local Occupational Safety and Health Agency (OSHA). The best tools for safety and good health are commonsense and personal awareness. If something causes a rash, or hurts your breathing, stop doing that thing and find an alternative. It's your body and your responsibility to take care of it.

What is Eco Jewelry?

“Eco” is a term (along with “Green”) that is used loosely in current American culture, particularly when it comes to the marketing and sales of products. For our purposes, we will assume that you are not reading this handbook because you are motivated by marketing hype, but because you have a genuine desire to do the right thing. Therefore, we will define “Eco Jewelry” as jewelry and other forms of metalwork made from responsibly sourced materials in a studio that uses safe, healthy, and environmentally friendly practices.

Jewelry making is an ancient craft, and many of the techniques we use have been performed in much the same way for hundreds, even thousands of years. Despite its long history, the jewelry industry is just beginning to see the importance of protecting the health of people and the planet as we mine precious materials and manufacture jewelry. Awareness of these issues is relatively new, so there are not always perfect solutions to every problem or “best” answers to every question. This handbook endeavors to provide pertinent information in a compact form that will allow readers to make responsible, informed decisions about studio practices and materials sourcing.

Some readers might encounter unfamiliar terms and for this reason there is a glossary at the end of the book. Please turn to it if needed.

Ecology, n.

1873, Branch of science dealing with the relationship of living things to their environments, coined by German zoologist Ernst Haeckel (1834-1919) as *Ökologie*, from Greek *oikos* "house, dwelling place, habitation" + -logia "study of"

We generally think of ecology in terms of how we damage or protect the air, water and plants around us. We might forget that we are one of the "living things" in our environment, which is why it is appropriate—in fact necessary—to include health and studio safety in this book.

PART 1

Health & Safety

Creating and using working methods that ensure health and safety are cornerstones for building a long career as a working jeweler. Reduce risk by minimizing exposure to harmful substances, by substituting less harmful alternatives, by using personal protective equipment, by installing adequate ventilation, and limiting the time and frequency of exposure. This section highlights some points on health and safety that I believe pertain to most working jewelers and deserve particular attention including ergonomics and stretches for injury prevention. Books, articles and websites with additional information on health and safety are listed in the Resources section.

Hygiene

Our hands are our most valuable and most used tool in the shop, which means they can be exposed to chemicals, metals and dust. Develop a hand washing habit to reduce the ingestion of contaminants. Regular, thorough hand washing with a mild, biodegradable soap, including when leaving the shop, can help significantly reduce your exposure.

Chemicals

Less Toxic Alternatives

Identifying hazardous chemicals and practices in the studio is the first step to creating a safer working environment. Once a hazard has been identified, eliminate the product or process if possible, or substitute a less-toxic or less hazardous alternative. The following pages include charts that compare products commonly used in the jewelry studio such as flux, pickle and oxidizers. These products often contain chemicals that are hazardous to your health. Use the charts to help you quickly identify hazardous products you may want to eliminate and to find less toxic alternatives that will meet your needs. Substituting less-toxic alternatives in your daily practices will help create healthier working conditions as well as extend your life and career as a jeweler.

Each product page offers a quick-reference chart as well as a product detail chart with more in-depth information. The quick reference chart includes an overall rating along with a health rating and listing of the product benefits. The product details include working characteristics, health and safety precautions, and proper storage and handling procedures. Remember that even less-toxic alternatives may require proper disposal as hazardous waste after being used in jewelry manufacture.






MULTIPLE BRANDS AVAILABLE

Some of the chemicals described here are proprietary, which means they are made by a specific company and sold under a single trade name. Others are either common products (such as vinegar) or are repackaged by distributors with their own names. In those cases, the “Multiple Brands Available” label is included. The image of a single product is shown for convenience, but this book does not recommend one product over another.

Flux

Fluxes often contain fluoride or chemicals in the fluoride family. Fluoride reduces the melting temperature of flux, allowing it to flow at the temperatures required for soldering. Breathing fluoride fumes is bad for your health. The pages that follow include flux options that do not contain fluoride or related ingredients. Charts for fluxes containing fluoride family ingredients are also included at the end of this section for your reference on the hazards involved.

Quick Reference Charts


-  **Best Choice** – No hazards, eco-friendly
-  **Excellent Choice** – Minimal hazards, eco-friendly
-  **Good Choice** – Some hazards; use with caution
-  **Hazards Present** – Use protection; avoid if possible
-  **Poor Choice** – Find a less toxic alternative

Health Rating

- 1** Exposure will cause irritation with only minor residual injury (*example*: acetone).
- 2** Intense or continued but not chronic exposure could cause temporary incapacitation or possible residual injury (*example*: diethyl ether). Protection advised.
- 3** Short exposure can cause serious temporary or moderate residual injury. Use protection. (*example*: chlorine).
- 4** Very short exposure can cause death or major residual injury (*example*: hydrogen cyanide, carbon monoxide, sarin). Find alternatives.

Borax Cone Flux



Overall Rating 

Health Rating: **1**

Benefits: No toxic fumes

MULTIPLE BRANDS AVAILABLE

Metals	Precious and non-precious.
Form	Solid; add water and grind to make a paste.
Soluble	Water soluble. Requires pickle for removal.
Working Temperature	1369°F (743°C)
Chemicals	Orthoboric acids, sodium borates.
Health Hazards	May cause skin and eye irritation.
Precautions	Use safety glasses, and gloves or barrier cream.
Storage	Keep dry in glass or polyethylene container.


Notes

Soldering: Grind in a ceramic dish or on a marble slab, adding water to create a paste or liquid. Tap water is commonly used but if problems arise, use distilled or bottled drinking water. This is perhaps the oldest and most universal flux.

Casting: Add to molten metal when melting.

Firescoff Flux



Overall Rating 


Health Rating: **1**

Benefits: Fluoride free
Alcohol free
No odor
No outgassing
No pickling required

Metals	Silver, gold, copper.
Form	Spray-on liquid.
Soluable	Water soluble. To remove flux, soak in warm water or use ultrasonic for 2 minutes. Do not dilute.
Chemicals	Ceramic matrix compound, non-metallic oxides.
Health Hazards	None with normal use.
Precautions	Safety glasses, ventilation.
Storage	Avoid low temperatures, store away from strong oxidizers, metal hydrides and alkali metal generating hydrogen gas.
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Notes	Aid in reticulation. Provides stray heat protection for gemstones. Prevents scaling of metal alloys. Spray application uses more flux, making it more expensive than other options.

Boric Acid



Overall Rating 

Health Rating: **1**


Benefits: Minimizes firescale
Inexpensive

MULTIPLE BRANDS AVAILABLE

Metals	Silver and gold.
Form	Dissolve powder in denatured alcohol to use.
Soluable	Water soluble. Remove with pickle.
Melting Temperature	140°F (171°C)
Chemicals	Boric acid.
Health Hazards	Mild irritant.
Precautions	Use safety glasses, gloves or barrier cream. Ventilation recommended.
Storage	Store in a tightly closed container in a cool, well-ventilated area; do not exceed room temperature.
Notes To prevent firescale and preserve the luster on polished gold pieces, either spray the solution onto warm metal and or dip the work into the solution and burn off the alcohol. Apply flux to joints for soldering.

Pro Craft Jel Flux



Overall Rating 

Health Rating: **2**

Benefits: Biodegradable
No toxic fumes

Metals	All nonferrous metals.
Form	Gel
Soluable	Water soluble. Requires pickle for removal.
Max. Temperature	1700°F (927°C)
Working Temperature	1100°F (593°C)
Chemicals	Boron oxides.
Health Hazards	Irritant if splashed on skin or mucous membranes. Category 1b reproductive toxicant.*
Precautions	Use safety glasses, gloves or barrier cream Dust or splash mask recommended. Ventilation
.....	
Storage	Keep dry in tightly closed container in a cool dry area.
Notes	Recommended for sweat soldering; corrosive.

** Presumed human reproductive toxicants - largely based on animal studies.*

Ergonomics & Injury Prevention

The human body is an amazing and complex system. We rely on our bodies to be in good working order to make jewelry. To keep our bodies functioning well for the long-term, it's necessary to take care of ourselves. Self-care comes in many forms. Avoiding hazardous materials is a good place to start, and so is the use of safety equipment and procedures. This section will discuss ergonomics, posture, stretching and ways to maintain our bodies for years to come.

Each person's body is unique. The guidelines that follow suggest ways to design or modify an existing workspace to minimize stress while performing daily tasks. The following information on ergonomics has been adapted from *Practical Ergonomics: This Won't Hurt - Trust Me*, by Douglas Hall, used with permission.

Ergonomic Ranges of Motion

For maximum comfort and efficiency, keep movements within the ranges shown. Our bodies are made up of hinges and, like hinges in the jewelry we make, each one has a specific range of motion. In a body, pushing a hinge further than it was designed to go leads to stress, fatigue and pain. Overflexing, especially when combined with repetition and poor posture can cause stress, strains, aches and pain as well as a variety of musculoskeletal disorders including carpal tunnel syndrome and tendonitis.

Even when we are aware of the problems, making jewelry can involve tasks that cause some level of body strain. To minimize impact, limit the length of time performing high-impact, repetitive jobs to 30 minutes or less. After 30 minutes, change tasks to allow the muscles to recover before beginning another similar activity. Regardless of impact level, it is best to change tasks, working postures and workstations frequently throughout the day by alternating jobs that can be performed seated or standing.

Working Conditions to Avoid

- Slouching over work, jutting head forward or bending neck down
- Crossing feet at ankles or wrapping feet around legs of chair
- Extended reach or twisting the back while working
- Awkward body position
- Forceful exertion
- Repetitive motion
- Vibration
- Low temperatures
- Soft tissue compression
- Impact

Working Conditions to Practice

- Change positions throughout workday. When possible, alternate between sitting and standing.
- Select a comfortable chair fitted to the body and adjust height properly.
- Chair backrest should conform to the natural curvature of spine, and provide adequate lumbar support.
- Armrests should be soft, positioned to allow shoulders to relax and elbows to stay close to body.
- Adjust chair height as needed to create a comfortable relationship with the work surface.
- Adjust height of working surface to bring work closer to eyes and/or use magnification as needed to see work clearly.
- Use adequate lighting appropriate to the task.
- Take regularly scheduled stretch breaks.

Posture

Good posture is a form of fitness in which the muscles of the body support the skeleton in stable and efficient alignment. Most people are born with the ability to support the body in this natural alignment but over time gravity, lifestyle, habits, repetitive tasks, and injuries make it difficult for muscles to hold proper alignment. Poor posture puts pressure on the spine, reducing its natural ability to absorb shock. Constrictions of nerves, blood vessels and breathing can reduce oxygen and nutrient flow to the muscles, and cause fatigue, muscle aches and pains.

SEAT HEIGHT

Adjust seat height so feet rest flat on the floor with thighs fully supported and knees bent at 90°. Proper seat height should avoid contact stress with the back of the knees, thighs, pelvis or lower back. Ideally, select the most appropriate chair and adjust the seat height accordingly. Then adjust (lower or raise) your working surface to fit your chair. The ideal height for the bench top is the height of the jeweler's breastbone. To change the height of the working surface, carefully cut the legs of a bench or table shorter, place risers under table legs, or find a work surface designed with a height adjustment mechanism. Use a footrest to support feet if they do not rest flat on the floor.

BACKREST

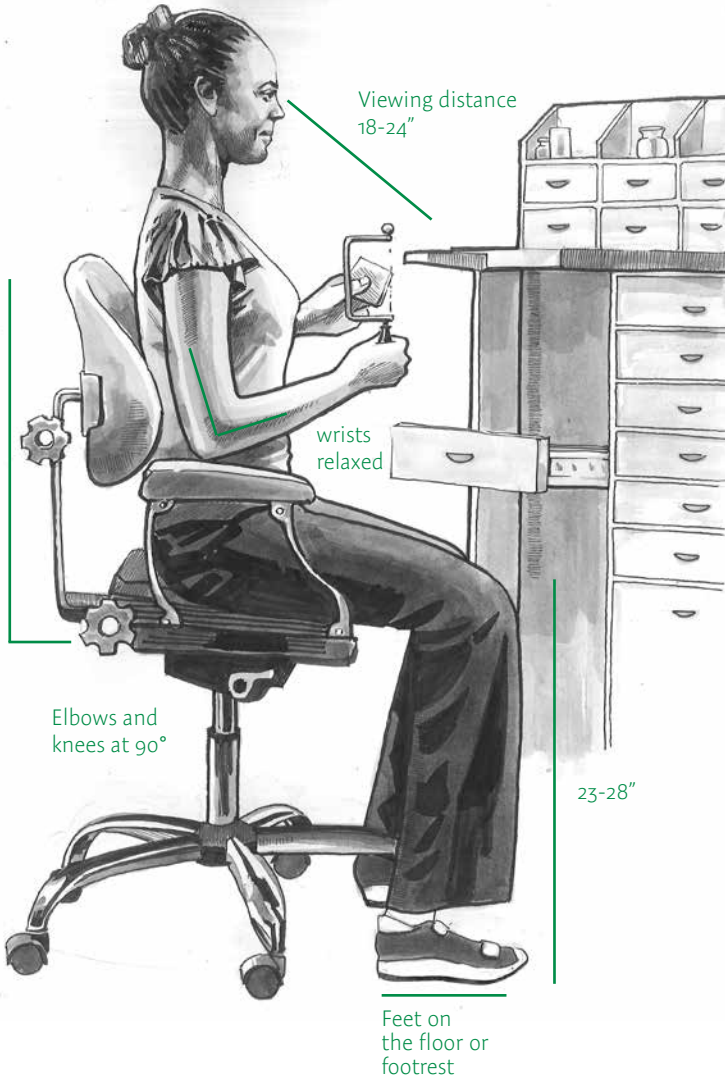
An ideal backrest provides adequate support to maintain the natural S-curve of the lumbar spine. Choose a backrest with an adjustable height, and position it such that the outward curve of the lumbar support fits into the small of the back. For chairs without adequate lumbar support, use a removable back support or small towel rolled to fit the curve of your low back. Adjust the tilt between 90 and 110°, and lean back slightly while seated.

ARMRESTS

Many jewelers rest elbows on the bench top or use armrests that are built into or added to the workbench. Resting the arms on a solid surface can prevent mid-back strain and give jewelers stability and support during precision work. To add armrests, purchase pre-made models that slide onto the working surface, or make your own. Shoulders should be relaxed when working. Armrests should not interfere with moving close to work.

Armrests can also be used while performing seated tasks at a standard table height. In this case, position arm rests so they just make contact with forearms when positioned comfortably at sides. The placement of armrests should be such that arms are close to the body but do not interfere with hips when getting in or out of the chair.

To avoid potential hazards, be sure armrests are adequately padded and at the correct height. If armrests are too high, it may cause you to maintain raised shoulders, which can result in tension in the neck, shoulders and back. Armrests made of hard materials, or with sharp corners, can irritate nerves and blood vessels in the forearms, which can create pain or tingling in the fingers, hand and arms. If resting arms on the bench top, consider rounding sharp corners of front edge or adding padding to protect forearms and elbows.



Seat back at 90°

Elbows and knees at 90°

Viewing distance 18-24"

wrists relaxed

23-28"

Feet on the floor or footrest

Stretching for Jewelers

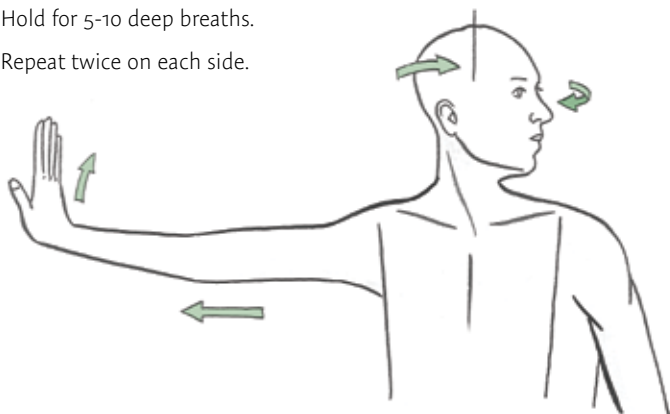
The exercises that follow are specifically designed to target muscles of common concern for jewelers. They can be performed seated or standing. If you usually work seated, stand while stretching. Start with stretches targeted to those work areas where you feel tightness or discomfort. Stretches that feel difficult are likely those most needed. Try to relax and breathe, even when a stretch is difficult. One side of the body may feel tighter than the other. In this case, start stretching on the tight side, then switch to the more flexible side, and finish by performing the stretch a second time on the tighter side.

Jewelry techniques require a high level of concentration. Many jewelers enjoy their work, become absorbed, and do not notice time passing. Such high levels of working concentration can make it difficult to remember to take breaks or change positions. Use a timer set at regular intervals.

CHEST STRETCH

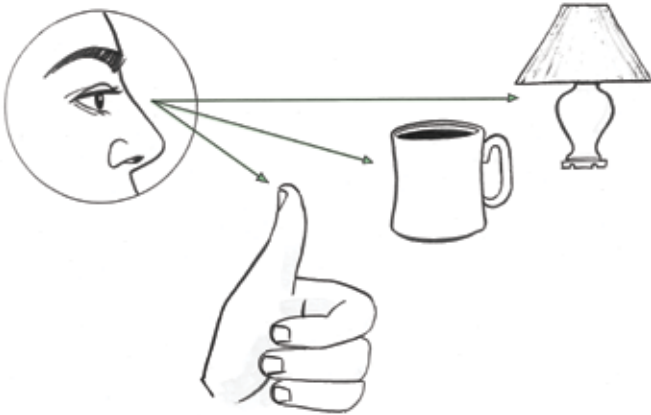
1. Extend an arm away from your body, parallel to the floor.
2. Rotate your arm and shoulder back.
3. Press the palm of the outstretched arm against the wall, fingertips pointed away from the wall. Relax shoulders and allow them to drop.
4. Turn your feet, legs and torso away from the outstretched arm.
5. Turn your head away from the outstretched arm to add a neck stretch.
6. Look (with eyes) behind you, away from the outstretched arm to add an eye stretch.
7. Hold for 5-10 deep breaths.

➤➤ Repeat twice on each side.



EYE EXERCISE – NEAR AND FAR FOCUSING

1. Place your thumb 10 inches in front of your face. Focus on it for 10–15 seconds.
 2. Focus for 10–15 seconds on an object 5–10 feet away without moving your head.
 3. Focus for 10–15 seconds on a distant object (for instance out a window or on a distant wall) without moving your head.
 4. Refocus on your thumb held in front of your face for 10–15 seconds.
- Repeat the cycle five times.



NECK ROLLS

1. Gently clasp hands behind your back.
 2. With head centered, inhale and lengthen your spine and the back of your neck.
 3. Exhale and drop your chin toward your chest.
 4. Inhale and smoothly roll your head and neck to the right, bringing your right ear toward your right shoulder.
 5. Exhale and return to center.
 6. Inhale and smoothly roll your head and neck to the left to bring your left ear toward your left shoulder.
- Repeat 5-10 times in each direction.



Hands are clasped behind the back as the head rolls side to side.

NECK ROTATION STRETCH

1. Gently clasp hands behind your back.
 2. With your head centered, inhale and lengthen the spine and back of your neck.
 3. Exhale and gently turn your head to the right side.
 4. Look over one shoulder to add an eye stretch.
 5. Inhale and bring your head back to center.
 6. Repeat in the opposite direction.
- Repeat 5-10 times in each direction.



Hands are clasped behind the back as the head rotates side to side.

SHOULDER ROLLS

1. Relax your arms at sides, palms facing the body.
 2. Shrug your shoulders up toward your ears, pull your shoulder blades back, then squeeze them together and push them down. The effect is an exaggerated circle.
 3. Repeat 5-10 times.
- Reverse the direction of circle and repeat 5-10 times.



SHOULDER ROTATION STRETCH

1. Stand with your heels close to a wall, with your pelvis and shoulder blades touching the wall.
2. Brace your abdominals and pull the back of your rib cage toward the wall. Your lower back will naturally curve slightly away from the wall.
3. Bend your elbows to 90°.
4. Raise your upper arm perpendicular to your body; wrists straight, palms facing down, fingertips pointed forward and elbows pressing against the wall.
5. Pull your shoulder blades together and down, keeping them flat against the wall.
6. Keeping your elbows in place, wrists straight, and the top of your shoulders close to the wall, rotate your right shoulder to point the fingertips of your right hand up and left shoulder to point fingertips of left hand down. Ideally, the back of your right hand will touch the wall and your left forearm will form a 45° angle with the wall below.
7. Reverse the motion and rotate shoulders so fingertips point in the opposite direction.
8. Breathing deeply, slowly rotate your shoulders back and forth 5–10 times.
9. Hold static stretch with one hand pointing up and the other pointing down for five deep breaths.

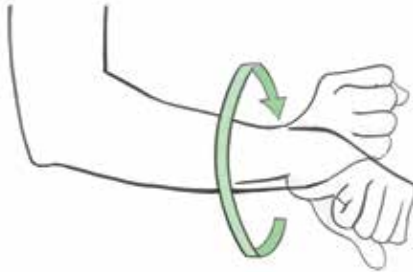
➤➤ Reverse and repeat on the other side.



WRIST CIRCLES

1. Relax your arms at your sides, palms facing the body.
2. Make fists with both hands and slowly move your wrists in 10 clockwise circles without moving your elbows or shoulders.

➤➤ Repeat movement counterclockwise.



WRIST FLEXION STRETCH

1. Extend one arm to the front, elbow straight.
2. Point fingers up and flex wrist. (As if telling someone to “stop.”)
3. Use your opposite hand to gently pull the thumb and fingers back.
4. Hold for five deep breaths.
5. Gently move head side-to-side, as necessary to release tension from neck and shoulders.

➤➤ Repeat on the other side.

