Accelerated Corrosion on Reinforcing Steel Bars Procedure: Cleaning Corrosion

Procedure title	Accelerated Corrosion on Reinforcing Steel Bars Procedure: Passive Layer Generation	
Author	Victor Alejandro Calderon	
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Principal Investigator	Mervyn J Kowalsky	
Location	Building and room number	
1.	**This standard operating procedure (SOP) is for**	

☐ Specific laboratory procedure or experiment

This document outlines the procedure to safely remove the corrosion products in reinforcing steel bars. This procedure uses hydrochloric acid to remove the iron oxides from the surface of the reinforcing steel. Since this procedure uses hydrochloric acid, the user must understand the hazards, and procedure to safely handle this chemical. Under no circumstances should this procedure be performed without the knowledge of your PI, lab manager or any other person in the laboratory. Do not attempt to perform this procedure outside operating hours or without the presences of someone in the laboratory. The reasoning behind this is that there should be someone to assist you in case you need assistance. Please refer to the training section before attempting to perform this procedure.

2.	**Process or experiment description**

The reinforcing steel bars are placed in an airtight container and are submerged in a calcium chloride saturated solution.

The required chemicals are listed below:

- Hydrochloric acid
- Acetone
- Distilled water

Other equipment:

- Beaker 500 ml
- Steel brush
- Clean rags
- Plastic tray to catch hydrochloric acid

3.	**Hazard and risk assessment**.

Chemical hazard:

Hydrochloric Acid

The hydrochloric acid is a corrosive chemical and must be handled carefully.

Signal Word: **Danger**
Pictograms(s):

Hazard Statements	
H290	May be corrosive to metals.
H314	Causes severe skin burns and eye damage.
H318	Causes serious eye damage.
H335	May cause respiratory irritation.

Acetone

The acetone is a flammable solvent and should be kept away from heat and fire sources.

Hazard pictograms (GHS US) :

GHS02 GHS07

Signal word (GHS US) : Danger

Hazard statements (GHS US) : H225 - Highly flammable liquid and vapour
H319 - Causes serious eye irritation
H336 - May cause drowsiness or dizziness

4.	**Safety equipment** *Specify all equipment needed to perform procedure safely and to respond to emergencies.*
4.a.	Engineering / ventilation controls If available use vapor vent
4.b.	Personal protective equipment • Nitrile gloves with puncture and chemical resistance • Hazmat suit covering the head, skin, clothes. • Googles • Face shield • Boots with steel toes • Respirator • Chemical spill kit
4.c.	Location of nearest emergency safety equipment

Item	Location

Eyewash / safety shower	**See laboratory floor plan**
First aid kit	**Safety box**
Chemical spill kit	**Contact lab manager**
Fire extinguisher	**See laboratory floor plan**
Fire alarm manual pull station	***See laboratory floor plan***
Telephone	**(919) 515-3000**
Other	

5.	**Step-by-step methodology** *The methodology explained below is made for 1 liter (L) of saturated solution. If required multiply the concentrations below by the desired volume.*

Step 1: Ensure that there is adequate ventilation for the hydrochloric acid. If vapor ventilator is not available, consider performing this procedure outside with enough ventilation room.

Step 2: Place the specimen in the tray and pour the hydrochloric acid on the reinforcing steel bar. The acid will immediately react with the iron oxide. Brush off any residue with the steel brush.

Figure 1 Apply hydrochloric acid to reinforcing steel bar.

Figure 2 Brush any corrosion product off the reinforcing steel bar

Step 3: Clean the specimen with abundant distilled water.

Step 5: Dry the surface of the specimen with a clean cloth.

Step 6: Apply acetone to the reinforcing steel bar to dry the surface. Repeat steps 5 and 6 as necessary.

Step 7: Store specimen in an airtight container

6.	**Designated area** .

Outside of the lab or in a vapor vented designated area of the laboratory.

7.	**Special handling procedures, transport, and storage requirements** *Describe special handling and storage requirements for hazardous chemicals used in this procedure, especially those that are highly reactive/ unstable, flammable toxic and corrosive. Describe secondary containment requirements for transport between laboratory rooms.*

The disposal of the solution should be performed as follows.

Step 1: Thoroughly clean the tray with water in the cement waste area. If the procedure is performed inside the lab, the unwanted waste material must be stored per EHS regulations and disposed correspondingly.

8	**Unwanted material disposal** **Identify and list all hazardous waste to be generated and appropriate disposal procedures. Include liquid and solid waste.**

The procedures outlined by EHS should be followed. The unwanted material generated in this process is the calcium hydroxide solution. A waste accumulation label should be obtained and correctly disposed after the passive layer generation process is performed.

9.	**Emergency procedures**

Life-threatening emergencies (for example, medical event, fire, explosion, large-scale spill or release, toxic or flammable gas leak, valve failure)

- Call 911. Provide dispatch the following information: your name and call back number, location of incident, material released, if known, if there are any injured person and their location.
- Pull the nearest fire alarm.
- Exit the building using the nearest stairway.
- Proceed to designated assembly area.
- Provide information to emergency responders as able.

Chemical spills

1. Determine if it is a “major” or “minor” spill. Minor spills are well contained, able to be cleaned using the spill kit at hand and clean-up would not require special PPE such as a respirator.
2. Assist anyone who may have been contaminated or injured during the spill.
3. Clean up minor spills using appropriate spill control equipment.
4. Call 911, NCSU Police ((919) 515-3000) and EHS ((919) 515-7915) for all major spills.
5. Contain major spill with appropriate absorbent only if trained to do so and your safety is not compromised.
6. Post “DO NOT ENTER” on entrance door and evacuate the area.

   Do not re-enter until Emergency Responders have cleaned up the spill and declare the area safe for reentry.

If personnel exposed to chemicals

1. Call 911 to seek emergency medical help.
2. Assist exposed person away from incident or source of exposure, to the emergency shower or eyewash. Do this only if able and personal safety is not compromised. Exposed person decontaminates using the nearest emergency shower or eyewash.

2.1. Pull the safety shower lever to start the water flowing (or push the eyewash lever to start the water flowing).

2.2 To wash off chemicals from your eyes, hold your eyes open to get the water under your eyelids.

2.3 Remove all contaminated clothing and shoes to effectively wash chemicals off your body.

2.4 Stay under the water for at least 15 minutes to wash all the chemicals off.

3. Report incident
4. Seek follow-up medical treatment.

Building maintenance emergencies (for example, power outages, plumbing leaks, fume hood malfunction)
Call *(919) 515-2991* to report facility emergency.

10.	**Training requirements** *List the general and laboratory-specific training required for authorized users of this SOP*

☐ EHSA Chemical and Lab Safety Training
☐ CFL Safety Training
☐ Laboratory Unwanted Material Management Training
☐ Respirator Training