

## Hazard Analysis Form

This form can be used by Fermilab Employees, Fermilab Supervisors, Fermilab Task Managers and Construction Subcontractors. This is a dynamic document which may require modification as the project moves from start to finish and should be readily available at the site where the work is being performed.

**Note: Not all sections of the first page are applicable to every job or task, complete what is necessary for your specific job or task.**

Job Title

Job Location

Contract/Work Order #

<b>TO BE COMPLETED FOR WORK INVOLVING SUBCONTRACTORS</b>	
<u>Subcontractor (if applicable)</u>	<u>Fermilab</u>
Company <input type="text"/>	Project Eng./C.M. <input type="text"/>
Project Manager <input type="text"/>	Phone <input type="text"/>
Phone <input type="text"/> Page <input type="text"/>	TM/CC/SC <input type="text"/>
ESH Rep. <input type="text"/>	Phone <input type="text"/> Page <input type="text"/>
Phone <input type="text"/> Page <input type="text"/>	ESH Rep. <input type="text"/>
	Phone <input type="text"/> Page <input type="text"/>

<b>AT LEAST TWO SIGNATURES ARE REQUIRED</b>	
<input checked="" type="checkbox"/> Prepared _____ Print Name <input type="text" value="Dana Walbridge"/>	Date <input type="text" value="May 7 2014"/>
<input checked="" type="checkbox"/> Accepted _____ Print Name <input type="text" value="Andrzej Makulski"/>	Date <input type="text"/>
<input type="checkbox"/> Accepted as noted _____ Print Name <input type="text"/>	Date <input type="text"/>

Description of Work:

Personnal Protective Equipment: (Check protective equipment required for the job)	
<input checked="" type="checkbox"/> Safety glasses <input checked="" type="checkbox"/> Side shields	<input type="checkbox"/> Chemical splash goggles
<input type="checkbox"/> Hearing Projection	<input checked="" type="checkbox"/> Hard Hats
<input type="checkbox"/> 3.0 Brazing goggles	<input type="checkbox"/> Impact Goggles
<input checked="" type="checkbox"/> Face shield	<input type="checkbox"/> Rubber apron
<input checked="" type="checkbox"/> Leather gloves	<input type="checkbox"/> Hot/Cold thermal protective gloves
<input type="checkbox"/> Chemical resistant gloves (specify type): <input type="text"/>	<input type="checkbox"/> Respirators
<input checked="" type="checkbox"/> Other required PPE (specify): <input type="text" value="Safety Shoes"/>	<input type="checkbox"/> Fall protection equipment (specify): <input type="text"/>

**Environmental Aspects (check one):**

Yes, I have thought about the environmental aspects of this job and will document such aspects and mitigation steps within this document.

Yes, I have thought about the environmental aspects of this job and no such credible aspects exist and therefore do not need to be written in this document.

**Equipment required for the job:** (List the tools needed to perform the job.)

Remote computer setup near the test area for remote operations of the SELVA machine.  
Building crane.

**Work plan history information:** (List any lessons learned incidents from this job, tips from previous jobs)

**Improvement/Feedback:** At the conclusion of the job, the Task Manager, Supervisor and / or Project Leader shall work with those involved to consider lessons learned and receive in order to improve future work plans.

**Check one:**

Yes we have considered lessons learned and accepted feedback on this job and will communicate such information so that in future work plans may be improved.

Yes we have considered lessons learned feedback and determined that future work plans do not need to be improved.

*Utilizing the format below, identify hazards and environmental aspects, and their corresponding safety precautions/procedures to mitigate hazards. Use as many sheets as necessary.*

## HAZARD ANALYSIS

	Description	Hazards / Environmental Aspects	Precautions / Safety Procedures
1	<p>BRIDGE MOTOR AND MOTION TEST</p> <p>This test exercises the two motors used by the bridge to move on the track. Initially, the motor tests will be done with the bridge lifted off of the track. Both motors will be tested individually, then together in synchronized fashion. After motors are observed to be working as expected, the bridge will be put on the track to test control and emergency stopping of the bridge's motion.</p>	<p>Unpredictable or inconsistent movements</p>	<p>During all tests, testers must be familiar with the user interfaces, the remote controls, and the work environment.</p> <p>Before any tests, the work area must be checked to make sure that it is clear of persons, equipment, and debris which could be affected by the motion of the subsystem.</p> <p>If at any time motion goes awry (performs in a manner which is either dangerous, inconsistent, or unpredictable), the tester must hit an Emergency Stop Button, either from the user interface, or the physical button at the remote computer location.</p> <p>The testing personnel must have read and become familiar with the test plan for testing the bridge. It is titled "SELVA Bridge Subsystem Test Plan"</p>
2	<p>Motor Tests</p>	<p>Motor spinning hazards.</p> <p>During the motor tests, where the bridge is off of the track, hazards should be minimal as the motors will not be attached to anything. However, motors will be spinning, so the threat of harm exists for anyone working in close proximity to them.</p>	<p>I) PRECAUTIONS FOR MOTOR TEST, with the bridge lifted off of the track:</p> <p>a) All non-test personnel must stay behind the barriers during the test.</p> <p>b) Testers should work in groups of no less than two persons.</p> <p>c) Testers and equipment must stay clear of the motors.</p>

			<p>d) Motors should be checked to make sure that their shafts are not attached to or will come into contact with anything that will cause a moving hazard.</p> <p>e) Safety glasses, safety shoes, and any other PPE required for working on the main floor of IB3 are required of the testers.</p> <p>f) Ropes and/or barricades must be in place to keep persons on the green aisle at greater than arms length from the motors.</p> <p>g) All Emergency Stop buttons must be tested before starting the test. This includes the "Mushroom" buttons as well as the "Stop" buttons on the remote controls and computer screens.</p>
3	Placing Bridge on Tracks	<p>Rigging hazards.</p> <p>Lifting the bridge off of the timbers and placing it on the track is moving the largest and heaviest part of the machine, presenting the same types of hazards that exist when lifting any heavy object with a crane. Since the bridge will be placed on the track, it is important that the track be clean of any objects or debris to prevent damage and possible harm.</p>	<p>II) PRECAUTIONS FOR LIFTING AND SETTING BRIDGE ON TRACK</p> <p>Only the authorized crane operator and the helpers are allowed in the vicinity of the bridge. Personnel must wear PPE required for crane usage. The lifting apparatus used to lift the bridge in the past in IB-3 must be used. The area in and around the SELVA machine must be clear of any equipment which could get in the way.</p>
4	Bridge Motion Tests	<p>Mechanical Motion hazards: pinch, crush.</p> <p>The chance for greatest harm comes when the bridge is placed on the track and is moving. This presents a mechanical hazard to anyone in the vicinity of the bridge, so access to the test area must be restricted.</p>	<p>III) PRECAUTIONS FOR BRIDGE MOTION TESTS, where the bridge will move on the track.</p> <p>a) The tracks must be clear of all obstacles or anything that could impede or compromise the motion of the bridge.</p> <p>b) All non-test personnel must remain behind the ropes/barriers for the test.</p> <p>c) Testers should work in groups of no less than two persons.</p> <p>d) Ropes, barricades, and warning signs must be in place to indicate no access in or around the SELVA machine.</p> <p>e) The green aisle next to the SELVA machine must be roped off to prevent persons from being on the aisle during</p>

			<p>testing.</p> <p>f) Test personnel should make persons in either the Microscopy or Metallurgy labs aware of testing and the restriction of access to the green aisle. If anyone using those rooms needs access to or egress from them, it should be coordinated with test personnel.</p> <p>g) Testers must wear any PPE that are required for working on the main floor of IB3.</p> <p>h) All Emergency Stop buttons and Bump Guards must be tested before starting the test. This includes the "Mushroom" buttons, the "Stop" buttons on the remote controls and computer screens, the Bump Guards on the Bridge, and the Bump Guards on the boom.</p> <p>i) When the warning light is flashing and/or the motion klaxon is sounding, no one is to be inside the ropes and barriers, whether the bridge is moving or not.</p>
5	<p><b>TENSIONING SYSTEM TEST</b></p> <p>This tests the capability of the SELVA machine to provide the correct range of tensions for cable winding.</p>	<p>Tension in rope/cable resulting in the following hazards: pinch, crush, entanglement, whipping.</p> <p>Although unlikely, it is possible that that tension could exceed that expected by the rope/cable, causing a break and possible whipping motion.</p> <p>Use of weights to calibrate the tensioning system can create a pinch or crush hazard.</p> <p>Use of the winch could potentially damage the tensioning mechanism.</p> <p>Both in the case of the test rope or the cable on the winch, an entanglement hazard exists.</p>	<p>a) During all tests, testers must be familiar with the user interfaces, the remote controls, and the work environment. Test personnel must have read and be acquainted with the test plan, titled "SELVA Tension Subsystem Test Plan".</p> <p>b) For all tests, the testers must wear any PPE required for working on the main floor of IB3.</p> <p>c) The green aisle adjacent to the SELVA machine should be roped off to prevent access.</p> <p>d) Testers should wear safety shoes and safety glasses. When handling cable, winch, and the tensioning mechanism, testers should wear leather protective gloves for hand protection.</p> <p>e) Testers must work in groups of no less than two persons.</p> <p>f) All Emergency Stop buttons and Bump Guards must be tested before starting the test. This includes the "Mushroom" buttons as well as the "Stop" buttons on the remote controls and computer screens.</p>

			<p>g) During the calibration phase of the test, leather gloves must be worn when adding weights to the weight platform.</p> <p>h) At no time is the total weight to exceed 100 Kg.</p> <p>i) Before using the winch, the test personnel should read the user guide, entitled "Anchor Windlass Owner's Installation &amp; Operation Manual". The winch must be anchored sufficiently to withstand 265 lb (120.5 Kg) of force (although the maximum force to be used for this test is 100 Kg).</p> <p>j) When using the winch to test the PID's, at no time is the force supplied by the winch to exceed 100 Kg.</p> <p>k) When the tensioning system is powered, testers should be far enough away from the tensioning system so that if the cable breaks, they are out of harms way.</p> <p>l) If, at any time during the test, the system starts to behave in a dangerous or unpredictable way, an Emergency Stop Button should be pressed.</p>
<p>6</p>	<p><b>CABLE REEL UP/DOWN TEST</b></p> <p>This tests the ability of the system to adjust the height of the cable reel. In practice, this is done to adjust the height of the cable so that it is properly fed in to the winding mechanism.</p>	<p>Adjusting the height of the reel feeding cable to the winding machine can cause a pinch or crush hazard.</p>	<p>a) Before all tests, test personnel must read and be familiar with the test plan for the cable reel up/down subsystem, titled "SELVA Reel Subsystem Test Plan".</p> <p>b) For all tests, the testers must wear any PPE required for working on the main floor of IB3.</p> <p>c) Barriers must be placed so that persons using the green aisle are safely distant from the cable reel.</p> <p>d) All non-test personnel must stay behind the barriers during the test.</p> <p>e) All test personnel must wear safety glasses and safety shoes.</p> <p>f) All Emergency Stop buttons and Bump Guards must be tested before starting the test. This includes the "Mushroom" buttons as well as the "Stop" buttons on the remote controls and computer screens.</p> <p>g) All test personnel must remain over an arm's length from the up/down mechanism</p>

			<p>and reel while the test is running.</p> <p>h) If, at any time during the test, the system starts to behave in a dangerous or unpredictable way, an Emergency Stop Button should be pressed.</p>
7	<p><b>BOOM TEST</b></p> <p>This test adjusts the position of the boom, which moves about the mandril upon which the cable is being wound.</p>	<p>Hazard: a swinging arm (boom) with a large force, squeeze hazard.</p> <p>The boom, although anchored in the center at the top of the bridge, pivots the cable reel, tensioning device, and bump guard mechanisms from one side of the bridge to the other during the winding process. It could knock persons and equipment down if they are in the path of its motion.</p>	<p>a) Before all tests, test personnel must read and be familiar with the test plan for the boom subsystem, titled "SELVA Boom Subsystem Test Plan".</p> <p>b) For all tests, the testers must wear any PPE required for working on the main floor of IB3.</p> <p>c) Barriers must be placed so that persons using the green aisle are safely distant from the cable reel.</p> <p>d) All non-test personnel must stay behind the barriers during the test.</p> <p>e) All test personnel must wear safety glasses and safety shoes.</p> <p>f) All Emergency Stop buttons and Bump Guards must be tested before starting the test. This includes the "Mushroom" buttons as well as the "Stop" buttons on the remote controls and computer screens.</p> <p>g) All test personnel must remain over an arm's length from the path of the boom during the test.</p> <p>h) The area affected by the motion of the boom must be clear of ladders or other equipment which could be hit by the boom.</p> <p>i) The motor, encoder, and slip ring associated with the boom are accessible from the top of the bridge. If any of these devices requires service, a step ladder will be needed to reach them. Any person working on these devices must use the stepladder in a safe way. The ladder must be tall enough to enable a worker to stand on the "safe" steps (usually the steps below the top two steps) while working over the bridge at both of its heights (on timbers and on the track). The ladder must also be placed in a way such that the worker's balance is maintained while working bent over the bridge. The ladder should also be placed so that the mandril</p>

			<p>rail is not an obstruction, and so that the boom and/or the tensioning system are also not in the way. During work over the bridge there should be no power to the motor or to the slip ring, and no power to the encoder unless necessary to implement the repair. Appropriate PPE should be worn. No one should be working under or near the ladder while work happens over the bridge, and others in the vicinity should wear hard hats and safety glasses as well as safety shoes.</p> <p>j) If, at any time during the test, the system starts to behave in a dangerous or unpredictable way, an Emergency Stop Button should be pressed.</p>
<p>8</p>	<p><b>MANDRIL MOTION TEST</b></p> <p>This tests the motion of the mandril, which needs to be angled properly for the correct installation of the cable on the mandril during the winding process.</p>	<p>Hazard: moving parts, entanglement.</p> <p>Tests without a cable present hazards from the motion of the mandril and the motors and pistons that drive the motion. There must be no access to these parts while the test is being performed.</p> <p>Entanglement hazards exist when testing with rope or cable.</p>	<p>a) Before all tests, test personnel must read and be familiar with the test plan for the SELVA machine, titled "SELVA System Test Plan."</p> <p>b) For all tests, the testers must wear the PPE required for working on the main floor of IB-3.</p> <p>c) The green aisle next to the SELVA machine must be roped off so that non-test persons know that they cannot be in the test area.</p> <p>d) All non-test personnel must stay behind the barriers during the test.</p> <p>e) All test personnel must use the buddy system and work in teams of at least two people.</p> <p>f) All test personnel must wear safety glasses and safety shoes.</p> <p>g) All Emergency Stop buttons and Bump Guards must be tested before starting the test. This includes the "Mushroom" buttons as well as the "Stop" buttons on the remote controls and computer screens.</p> <p>h) The protective curtains/shields must be lowered on both sides of the piston assemblies holding the mandril rail.</p> <p>i) Test personnel must not touch the mandril, the rail, or the support and motion mechanisms during the test, or at any time that power is supplied to the motors, even if they are not running.</p>

			<p>j) If, at any time during the test, the system starts to behave in a dangerous or unpredictable way, an Emergency Stop button must be pressed.</p>
9	<p><b>COMPLETE SELVA SYSTEM TEST</b></p> <p>Testing of the complete SELVA system to verify that it can successfully wind cable on a mandril in an efficient and safe way.</p>	<p>Hazards: all hazards listed in the above sections.</p> <p>In testing the complete SELVA system, every subsystem either is in motion or can start up in an instant.</p> <p>There is the possibility that a person within the travel range of the machine could get caught between the boom/winding mechanism and the bridge.</p>	<p>a) Before all tests, test personnel must read and be familiar with the test plan for the SELVA machine, titled "SELVA System Test Plan."</p> <p>b) For all tests, the testers must wear the PPE required for working on the main floor of IB-3.</p> <p>c) The area around the SELVA machine must be barricaded with ropes, tape and/or other barrier so that non-test personnel outside of the barriers cannot be in harms way. There should be appropriate signage informing non-testers of the hazards and to stay outside the barriers.</p> <p>d) The green aisle next to the SELVA machine must be roped off so that non-test persons know that they cannot be in the test area.</p> <p>e) Test personnel must make persons in the Microscopy and Metallurgy Labs (if present) aware of the testing and the restriction of access to the green aisle. If anyone using these rooms needs access to or egress from them, it should be coordinated with test personnel.</p> <p>f) All Emergency Stop buttons and Bump Guards must be tested before starting the test. This includes the "Mushroom" buttons, the "Stop" buttons on the remote controls and computer screens, and the Bump Guards on the bridge and the boom.</p> <p>g) There must be no ladders, stools, seats, or other equipment in the test area of the machine. The area must be checked for such items before the test starts.</p> <p>h) Test personnel need to remain outside of the barricades while testing. The only exception to this is when testing the controls on the computer touch screen console located on the operator platform in the bridge.</p> <p>i) No personnel, including testers, shall be</p>

			<p>within the barricades while the caution light is flashing and/or the klaxon is sounding. The only exception to this is as stated above, when testing at the computer console.</p> <p>j) Test personnel must not touch any of the motion systems during the test, or at any time that power is supplied to the motors, even if they are not running.</p> <p>k) If, at any time during the test, the system starts to behave in a dangerous or unpredictable way, an Emergency Stop button must be pressed.</p>
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### GUIDELINES FOR COMPLETING THE HAZARD ANALYSIS

Phase of Work	Safety Hazard	Precautions / Safety Procedures
<p>Examining a specific job by breaking it down into a series of steps or tasks, will enable you to discover potential hazards employees may encounter. Each job or operation will consist of a set of steps or tasks. For example, the job might be to move a box from a conveyor in the receiving area to a shelf in the storage area. To determine where a step begins or ends, look for a change of activity, change in direction or movement. Picking up the box from the conveyor and placing it on a hand truck is one step. The next step might be to push the loaded hand truck to the storage area (a change in activity). Moving the boxes from the truck and placing them on the shelf is another step. The final step might be returning the hand truck to the receiving area. Be sure to list all steps needed to perform the job. Some steps may not be performed each time; an example could be checking the casters on the hand truck. However, if that step is generally part of the job it should be listed.</p>	<p>A hazard is potential danger to a person or equipment. The purpose of the Job Safety Analysis is to identify ALL hazards - both those produced by the environment and those connected with the job procedure. To identify hazards, ask yourself these questions about each step:</p> <p>Is there a danger of the employee striking against, being struck by, or otherwise making injurious contact with an object?  Can employees be caught in, by, or between objects? Is there potential for slipping, tripping, or falling?  Could the employee suffer strains from pushing, pulling, lifting, bending, or twisting?  Is the environment hazardous to safety and/or health (toxic gas, vapor, mist, fumes, dust, heat, or radiation)?  Are there electrocution hazards?</p> <p>Close observation and knowledge of the job is important. Examine each step carefully to find and identify hazards - the actions, conditions, and possibilities that could lead to an accident. Compiling an accurate and complete list of potential hazards will allow you to develop the recommended safe job procedures needed to prevent accidents.</p>	<p>Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the hazards that could lead to an accident, injury or occupational illness. Begin by trying to: 1) engineer the hazard out; 2) provide guards, safety devices, etc.; 3) provide personal protective equipment; 4) provide job instruction training; 5) maintain good housekeeping; 6) insure good ergonomics (positioning the person in relation to the machine or other elements in such a way as to improve safety). List the recommended safe operating procedures. Begin with an action word. Say exactly what needs to be done to correct the hazard, such as, "lift using your leg muscles." Avoid general statements such as, "be careful", "use caution", and "be alert". List the required or recommended personal protective equipment necessary to perform each step of the job. Give a recommended action or procedure for each hazard. Serious hazards should be corrected immediately. The JSA should then be changed to reflect the new conditions. Finally, review your input on all three columns for accuracy and completeness. Determine if the recommended actions or procedures have been put in place. Re-evaluate the job safety analysis as necessary.</p>

**I have reviewed this hazard analysis and I understand the hazards and required precautionary action. I will follow the requirements of this hazard analysis or notify my supervisor or Fermilab contact if I am unable to do so.**

