



Safety, Health and Behavior Rules

For the CTA Site at the FLWO

This document is intended to provide guidance for safe conduct at the CTA site located in Southern Arizona at the Fred Lawrence Whipple Observatory a Smithsonian Astrophysical Observatory run by the Smithsonian Institution's Center for Astrophysics



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1 Introduction and Scope

This document describes the safety and health procedures and rules at the CTA telescope site. **Visitors** may simply read the main body of this document and refer to Appendixes B to E.

All others (**workers**):

You must read and understand this document and follow the rules. Receive a guided tour by the construction manager and sign the printed copy of this document. Attending the daily briefing at the start of the shift to discuss specific tasks of the day and job assignments as well as safety concerns that will be involved with the day's process is mandatory.

2 General Site Descriptions

The CTA Site at the F.L. Whipple Observatory (FLWO) is relatively remote located in a desert at an elevation of 1268m. The CTA site is located in the Lower Yard area of the FLWO. The area around the structure marked by a red line indicates an area to be kept clear of personnel and vehicles during telescope operations. During construction this area will be limited to authorized workers wearing the appropriate PPE only. (Appendix E)

2.1 Wildlife

There are several pest concerns working in the desert. There are a variety of poisonous insects, bees, snakes, mountain lions, bears, javelina, and bats. Please read the information in the following link to learn about some of these hazards.

<http://www.atomicpestcontrol.com/wp-content/uploads/2010/03/ARIZONAS-VENOMOUS-CREATURES.pdf>



Arizona Black Bears have dark, brown fur and are not necessarily black. On Mt. Hopkins, you may see bears at any time during the year, but they are most often seen in the summer and fall. Trash, especially with discarded food, food wrappers, or containers, should never be left outdoors. If you see bear cubs DO NOT approach as the mother bear will be close by and is very protective of her cubs.

In general do not tease wildlife as you may provoke and attack. If you do suffer a bite or scratch from an animal please seek medical attention.

2.2 Monsoon Season

The Monsoon Season (Summer Thunderstorm Season) begins June 15th and ends September 30th. These storms can start sooner or possibly last longer, but usually fall within these dates. Heavy rains and thunderstorms occur during these months. Beware of flash floods in arroyos (creek beds), even from remote rainstorms. Do not enter arroyos when they are flooded. Observations are not possible during the summer months of July and August, due to local monsoon conditions.

2.3 Lightning Storm Precautions

Seek shelter; look for large, enclosed buildings. If you are in a car and not near a building, stay inside and keep the windows rolled up.

If you are unable to reach a safe building or car and your skin tingles or hair stands on end; crouch down on the balls of your feet with your feet close together. Keep your hands on your knees and lower your head. Get as low as possible without touching your hands or knees to the ground. DO NOT LIE DOWN! It is best to find a low spot away from trees, metal fences, pipes, tall or long objects.

2.4 Natural Hazards Present at the CTA Site

To help prevent sunburns visitors are asked to wear sunglasses and sunscreen or long sleeve shirts and pants to block UV rays. Attempt to limit exposure between 10 am and 4 pm as this is when UV rays are the most intense.

To minimize the chance of Heat Stress/ Heat Stroke visitors are encouraged to avoid heavy meals, caffeine and large amounts of sugar and alcohol. Drinking water and Gatorade as well as disposable cups will be provided at the work site as well as temporary shade.



3 General Work Requirements

3.1 Prior to Arriving at the FLWO

All persons working on site will be required to attend training on Fall Protection up the level of “Authorized User”. Below is a link to a site providing “Authorized User” training:

http://www.compliancetrainingonline.com/construction_fall_protection.cfm?gclid=CKepe-Fn8cCFc1ffgodj50HKg

Certification of this training should be emailed to the site prior to arrival. An orientation on aerial lifts and proper use of available fall protection will be required once on site. Please contact the Safety Coordinator prior to your visit to arrange a time for this training. All persons entering the site must wear at least sturdy, closed-toe, flat-soled footwear. Workers will be asked to provide their own safety footwear when required. Other Personal Protective Equipment (PPE) will be supplied by the FLWO. All will read and sign this document verifying they understand the safe work practices that will be expected while at the FLWO.

3.2 Daily Tasks

At the start of each work day at the CTA site there will be a “tail-gate” meeting. At this meeting the following will occur.

1. Assignment of a Work Manager (WM)
2. Assignment of a Safety Responsible Person (SRP, may be the same as the Work Manager)
3. The WM will provide a job briefing of the planned day’s activities. Each person should know what they will be doing that day and have a general knowledge of other work going on at the site.
4. Any general hazards will be discussed with all workers (i.e. crane work at the site, heavy equipment work, etc.)
5. Workers will have an opportunity to raise questions and discuss any safety concerns.
6. The SRP will verify that the required safety related equipment, including personal protection equipment (PPE), is available at the site.
7. If PPE is required for the work being performed it must be worn.
8. Any previously unapproved work activity must be discussed with the WM and the SRP prior to beginning the work. They shall have final authority to approve or deny any such work. They may determine that the hazards associated with the work are sufficiently significant that a Hazard Control Plan is required prior to beginning the work.
9. Every worker at the CTA site has the authority and responsibility to pause work that they perceive is being performed in an unsafe fashion. The SRP and WM will have the responsibility and authority to resume work after the concerns of the worker have been addressed to the satisfaction of the WM and



SRP.

3.3 Electrical Hazards

The electrical/fire safety codes in the USA may not be the same as those in the other States. All CTA electrical work (including facility wiring) will be in compliance with the U.S. National Electrical Code. All buildings intended for human occupancy will have proper grounding and lightning protection systems installed.

Verify all lines are de-energized prior to handling. All cabling should be verified by resistance testing prior to connecting to the source to prevent accidental grounds or shorts. Connections to the source (breaker) will be made and or verified by a Qualified Licensed Personnel only. Refer to Appendix K for wire color codes.

3.4 Lockout/ Tagout (Authorized Personnel Only)

Energy sources including electrical, mechanical, hydraulic, pneumatic, chemical, thermal or other sources in machines and equipment can be hazardous to workers. During the servicing and maintenance of machines and equipment, the unexpected startup or release of stored energy could cause injury to personnel.

All personnel who work in the area where the energy control procedure(s) are utilized need to be instructed in the purpose and use of the energy control procedure(s) and about the prohibition against attempting to restart or reenergize machines or equipment that is locked or tagged out.

All personnel who are authorized to lockout machines or equipment and perform the service and maintenance operations need to be trained in recognition of applicable hazardous energy sources in the workplace, the type and magnitude of energy found in the workplace, and the means and methods of isolating and/or controlling the energy. Lockout/ Tagout will be implemented using the procedure documented in the SI Safety manual Chapter 12.

3.5 Stop Work Program

In the event of an unsafe condition, or perceived unsafe condition, any worker can bring the issue to the attention of the work supervisor and call for a stop to work. At this time the issue will be addressed and investigated by the Construction Manager, Supervisor and Safety Coordinator to determine the appropriate course of action. Once the condition has been eliminated an all clear will be issued and work may re-commence. The Safety Coordinator will follow-up with the Supervisor, and worker if appropriate, to ensure the issue has been fully abated within a week of the issue being corrected.



4 Work Specific Hazards

In addition to the general work hazards given above, specific work at the CTA site may have additional safety related issues associated with its activities. Prior to the commencement of a new activity, the involved workers and a person-in-charge (PIC) shall discuss the work and identify potential hazards. (The PIC is in charge of the given work activity on site and may be different from the SRP or WM.) This group shall determine if the work is low or moderate hazard. High hazard work shall not be performed by CTA collaborators at the CTA site. (See the risk categorization matrix in Table 1 below.) If the work is of moderate hazard (Class 3b/4 lasers, energized electrical work, working at heights, use of heavy equipment, etc.) then a written procedure (referred to as an Hazard Control Plan or HCP below) shall be developed (and documented) that mitigates the risks associated with this activity. The HCP may require additional training for personnel involved in the work. Any such training will be given by the individual workers home institution (if available). If such training is not available (or deemed by the Safety Committee to not be sufficient), alternate training venues will be provided to the worker (i.e. at another CTA collaborating institution). The HCP must be reviewed by the Safety Committee and approved by the Project Manager before the start of work. The Safety Committee will approve a PIC for the activity, who will be responsible for completing a pre-job briefing with all the workers involved with the activity. Each worker will then sign a pre-job brief form, prior to beginning work. A copy of the HCP and pre-job brief form will be maintained on site and by the Safety Committee. During the course of an activity the PIC has the authority to make minor (non-safety significant changes) to the HCP, referred to as pencil changes. These changes will be made on the on-site copy of the HCP, briefed to the workers, and passed along to the Safety Committee when possible.

At a minimum the following activities will require such documentation.

- a. Working at heights (over 2 meters above grade)
- b. Working with energized electrical equipment (or verification of a de-energized state)
- c. Construction activities (crane, forklift, use of heavy machinery)

Table 1
Table 1 - Hazard Categorization Matrix

	Minor Injury	Moderate Injury	Major Injury/ Fatality
Low Probability	Low Hazard	Low Hazard	Moderate Hazard
Medium Probability	Low Hazard	Moderate Hazard	High Hazard
High Probability	Moderate Hazard	High Hazard	High Hazard

The left column shows the probability of an occurrence (Low Probability < 25%, Medium >25% and < 75%, High > 75%). The rows indicate the severity of a potential injury. Minor - cuts not requiring stitches, minor bruising, etc. Moderate - broken bone, laceration requiring stitches, any injury requiring a visit to a hospital. Major - loss of life or limb. Moderate hazard work requires the use of an HCP. High Hazard work may not be performed by CTA collaborators on the CTA site.



4.1 Fall Hazards

Fall hazards must be minimized through the use of fall prevention or fall protection. Fall prevention should always be considered first. Fall prevention refers to using permanent engineering controls so that hazards associated with working at elevated locations are reduced or eliminated. Fall protection is a temporary system that is designed to protect personnel from the risk of falls when working at elevated heights. Fall protection includes:

- a. Scaffolds;
- b. Stairways with railings;
- c. Floor and wall opening/ hole covers;
- d. Guardrails;
- e. Bucket trucks or aerial lifts with work platforms;
- f. Personal fall arrest equipment; and
- g. Other fall arrest systems/ programs, including safety monitoring, safety nets, controlled access zones, warning lines, and site/ project specific fall protection plans

All personnel that will be required to use fall prevention or fall protection equipment need to have been trained to at least the level of Authorized User. On site the User will receive additional training on use of the available harnesses and lanyards as well as acceptable tie off points on the structure. If you have not used a harness in more than 6 months an expert has to check your harness and verify that you put it on correctly.

4.2 Personal Protective Equipment (PPE)

All PPE will be provided, except Safety shoes. The purpose of Personal Protective Equipment (PPE) is to protect personnel from the risk of injury or illness by creating a proper barrier against workplace hazards. PPE is NOT a substitute for good engineering or administrative controls, or good work practices, in eliminating the hazard source. However, when used in conjunction with these controls, or in the interim as more permanent controls are implemented, PPE can serve as an effective means of reducing risk.

4.2.1 Hearing Protection

Hearing Protection Devices (HPDs) will be made available to all personnel and visitors exposed to 85 dBA or greater. While loud equipment operations are underway, staff and visitors will be asked to leave the noise area or wear HPDs.

4.2.2 Eye Protection

Eye protection and/or face protection shall be worn when there is the potential for exposure to the eyes or face from flying particles, molten metal, chemical splashes, gases or vapors, or potentially injurious light radiation.



4.2.3 Hand Protection

Hand protection shall be worn when hands are exposed to hazards such as skin absorption of harmful substances, severe cuts or lacerations, severe abrasions, punctures, chemical burns, thermal burns and harmful temperature extremes.

4.2.4 Foot Protection

Safety Shoes (steel toed or composite toe) shall be worn when there is the potential for injury to the feet from falling or rolling objects, objects piercing the sole of the foot, electrical hazards, hot surfaces and slippery surfaces.

Safety shoes will be required at all times when in the CTA construction area (Appendix I - Red Circle).

4.2.5 Head Protection

Head protection shall be worn when:

1. There is a potential for injury to the head from impact or flying objects;
2. There is potential for injury to the head from falling objects (e.g., working below other workers who are using tools and materials that could be dropped);
3. Any worker or visitor enters a construction site;
4. There is danger of contact with energized power lines or equipment;
5. Hair may be caught in machinery; or
6. Sanitary protection is required

4.3 Hot Work

Hot work operations include, but are not limited to, welding and allied processes (arc welding, oxy-fuel gas welding, open-flame soldering, brazing, thermal spraying, oxygen cutting, and arc cutting), grinding, heat treating, thawing pipe, torch-applied roofing, and similar applications producing or using a spark, flame, or heat. Hot work also includes laboratory operations that are open flame in nature, such as propane torches, Bunsen burners, or similar operations.

Hot work permits will be issued by a Permit Authorizing Individual (PAI) and a copy will be posted on site during hot work operations.

4.4 Housekeeping

Keep work areas uncluttered, and clean work areas upon completion of operations or at the end of each work day. Regular cleaning is particularly important for areas with hazardous materials and equipment. Ensure all cables and cords are properly routed and secured to prevent snags on moving equipment and to prevent trip hazards.

4.5 HAZCOM

A separate binder will be kept on site with all applicable MSDS/SDS. Please contact



Thomas Gerl with a complete list of necessary chemicals as soon as possible or when the need arises to make sure the binder is up to date. As soon as the project is complete all chemicals not required for operation of the CTA will be disposed of via a hazardous waste facility (i.e. Safety Kleen). Please inform the Safety Coordinator if any chemicals will be required to be kept on hand after construction.

4.6 Confined Space Entry

All confined spaces located within the facility or under the facility's control shall be identified and labeled as such. When directed you must complete the steps for entering a Permit Required Confined Space per the *SI Safety Manual*.

4.7 Reflecting Solar Radiation

SECTION TO BE ADDED BY VLADIMIR VASSILIEV AND DAVE KIEDA

4.8 Laser Safety

SECTION TO BE ADDED BY MARC LACASSE

5 Special Equipment

Certain activity at the CTA site requires the use of special equipment.

Aerial lifts are vehicle mounted, boom-supported aerial platforms and scissor lifts.

- It is critical that the equipment is inspected and maintained regularly.
- It is critical that the personnel operating the lift are trained in the safe use of the equipment.
- It is critical to use body harness or restraining belt with a lanyard attached to the boom or basket to prevent the worker from being ejected or pulled.
- It is critical not to exceed the load of the equipment (combined load of worker, tools and material).
- It is critical to receive hands-on training from a certified individual. This is not a substitute for appropriate training.

5.1 Crane and Rigging

All Crane operations will be performed by an SI certified crane operator. Likewise all rigging will be performed or verified by an SI certified rigger.

5.2 Forklift

All forklift operations will be performed by SI staff that is authorized to perform the action.



5.3 Aerial Lifts

Aerial lift operators **must complete training** and demonstrate proficiency in the recognition and mitigation of hazards associated with the operation of aerial lifts. Prior to using an aerial lift all workers will be briefed by SI staff on precautions when using the lift and appropriate tie off points. Web based training for Aerial Lift Safety is available through either of the following links:

http://www.compliancetrainingonline.com/aerial_boom_lift_safety.cfm?gclid=COidIYXAscGCFQuqaQodqSICng

<http://www.certifymeonline.net/?gclid=CPbTsYbAscGCFZSMaQodFJwGFA>





Worker Verification of Review

Please Print and fill out:

I _____ affiliated with _____
Name (Last, First) Home Institution

Have read this document and understand the hazards and risks associated with the work at the CTA site, in particular the potential health risks of working in a desert.

I have read the CTA Safety and Health document and will follow the safety rules.

X


Signature



Appendix A

Lists of Qualified Experts

Name	Duties				
Steve Criswell	Construction Manager				PAI
Pascal Fortin	Construction Supervisor				PAI
Thomas Gerl	Safety Coordinator		Electrician	Fork Lift/ Aerial Lift Operator	PAI
Marc Lacasse	Safety Committee	Fall Arrest	Laser Safety		PAI
Emmet Roache	Safety Committee	Fall Arrest	Rigger	Fork Lift/ Aerial Lift Operator	PAI
Danny West	Safety Committee	Fall Arrest	Rigger	Fork Lift/ Crane Operator	PAI
Larry Simkins	Safety Committee		Rigger	Fork Lift Trainer	PAI
Jack Musser	Electronics	Fall Arrest		Fork Lift/ Aerial Lift Operator	
George Jones	Electronics	Fall Arrest	Rigger	Fork Lift/ Aerial Lift Operator	

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Appendix B

Medical Assistance at FLWO/CTA

All workers and visitors will be shown the location of the following first aid equipment:

- Emergency eye wash station, (located in the Tire Repair area of the Motor Pool)
- Trauma Kit (located inside the door to the Ready Room on the lower level of the Administrative Complex)
- AED (located inside the door to the Ready Room on the lower level of the Administrative Complex)
- Stokes Basket (located inside closet labeled First Aid Equipment in the Ready Room on the lower level of the Administrative Complex)
- First Aid/ Bloodborne Pathogen kits (located inside closet labeled First Aid Equipment in the Ready Room on the lower level of the Administrative Complex)

In the event of an emergency contact 9-911. Inform the operator that you are located in Santa Cruz county and the type of assistance you require. Or contact the local Emergency Room at (520) 393-4700.

Report the injury to a Smithsonian Employee as soon as possible (within a day) so the incident can be reported in the AIRS system.



Appendix C

Locations of First Aid Equipment





Appendix D

Emergency Evacuation Plan

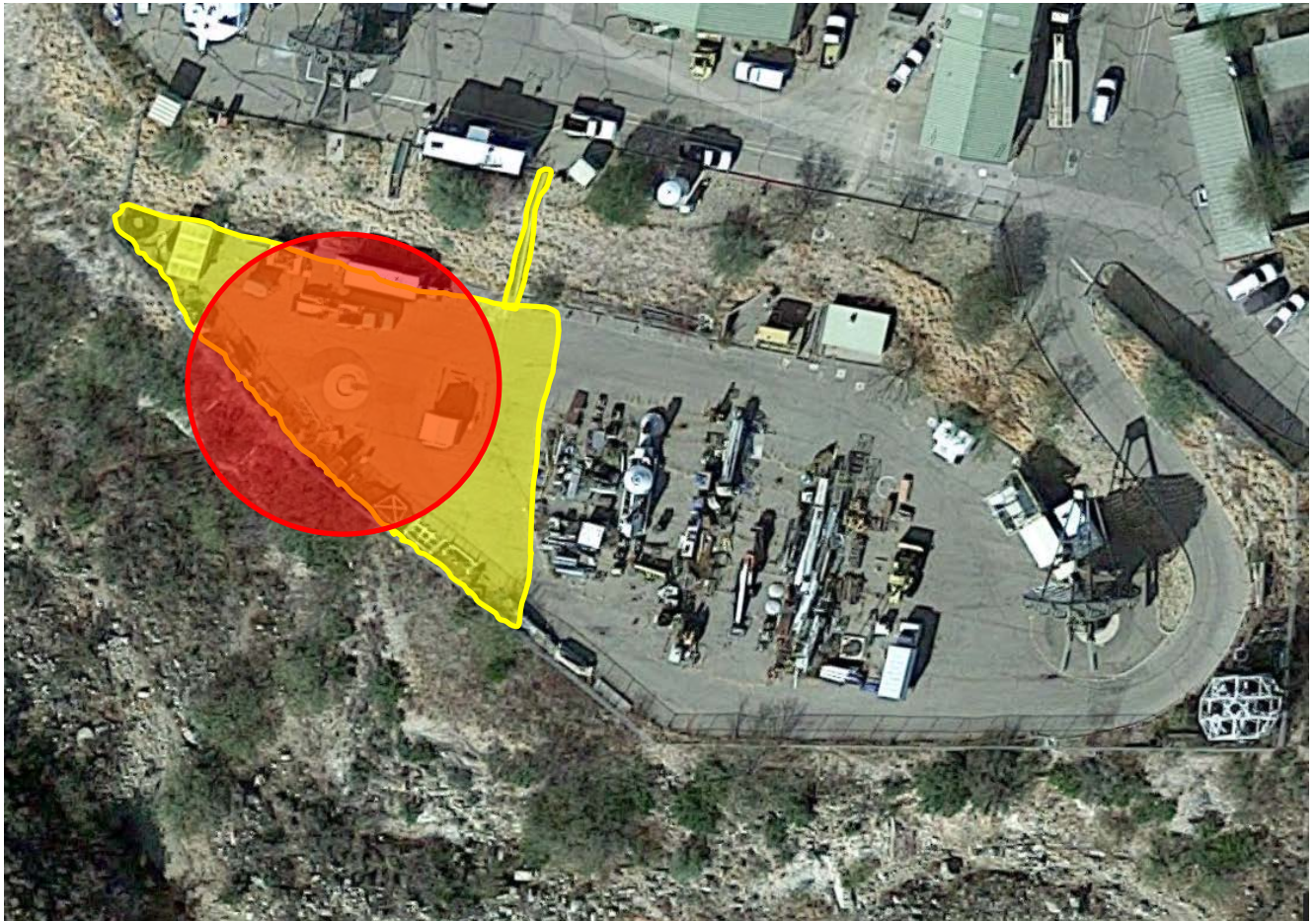
In the event of a fire, or a severely unsafe condition that warrants evacuation, all personnel will leave the CTA area and proceed in a calm fashion to the designated meeting zone in the upper parking lot. When at the meeting zone report your arrival to your supervisor so a list can be verified to ensure all personnel are accounted for. In the event of a forest fire please refer to the latest *Mt. Hopkins Fire Action Plan* for specific information.





Appendix E

Visual Definition of CTA Site



During Construction

Yellow Zone is the barrier for unescorted visitors.

Red Zone denoted working area in which proper PPE **must** be worn.

After Construction

The Red Zone denotes a safety zone around the telescope in which there is:

- No Parking
- No Storage
- No personnel unless authorized and necessary for CTA Operations



Appendix F

Working at Night

SECTION TO BE ADDED BY PASCAL FORTIN AND EMMET ROACHE





Appendix G

Installing Mirrors

SECTION TO BE ADDED BY EMMET ROACHE





Appendix H

Lightning Shutdown Procedure

SECTION TO BE ADDED BY MICHAEL SCHNEIDER





Appendix I

Loss of Power Procedure

SECTION TO BE ADDED BY MICHAEL SCHNEIDER





Appendix J

Mountain Road Safety

All Visitors to the FLWO staying at the Dormitory will be required to read and sign a copy of the *FLWO Vehicle Operator's Guide* to verify they are familiar with the safety concerns of driving on the sites mountain roads.

Be aware the mountain road is a rural road that is narrow, mostly unpaved and has sharp drop-offs in places.





Appendix K

Electrical Wire Color Codes

Electrical Color Code standards should be adhered to when connecting to a source (breaker) and whenever possible. The standard color codes used at the FLWO are detailed in Table 2.

	480/277 V_{AC}	208/125 V_{AC}	DC
Phase A	Brown	Black	Red
Phase B	Orange	Red	
Phase C	Yellow	Blue	
Neutral	Gray	White	Black
Ground	Green	Green	Green
Isolated Ground	Green w/ Orange Tape	Green w/ Orange Tape	

Grounding - Several “grounds exist in this installation. For equipment safety and to prevent damage from lightning strike the ground should be understood and not interconnected. The CTA structure is connected to a grounding ring to provide a path for lightning only. Do not connect any other grounds to the structure. Dirty power grounds will be tied back to the 45kva transformer ground rod. “Clean” power grounds will be tied back to the 30kva transformer ground rod. 480Vac Grounds will connect to the grid in the lower parking lot area via the ground buss in the Main Complex Electrical Room. To prevent the potential of ground loops ensure grounds remain separate until the connection to their respective grounding rods. For personnel safety the grounding conductor (neutral) will be connected to the ground bus in the feeder box only.

GFCI - All GFCI outlets and breakers will be documented and added to the FLWO monthly inspection list.



Appendix L

Maintenance

To ensure proper and reliable operation of the CTA telescope several Maintenance items should be performed on a regular basis. These maintenance items will be logged and maintained in a digital format.

- ✓ Verify the Air Terminal connection to the ground ring is in good condition annually.
- ✓ Test the ground ring conductivity annually. Ensure resistance reading is less than 25 Ω (baseline of 11 Ω).
- ✓ Verify the rotation alarm is audible Quarterly.
- ✓ Test all GFCI outlet and breakers monthly.
- ✓ **ADD MORE ITEMS AS THEY BECOME AVAILABLE**





Appendix M

Document Revision History

Date	Revision No.	Reviser Name	Summary of Changes
8/25/2015	Draft	Thomas Gerl	New Document

Document Approval

Name	Signature	Project Job Title	Date
Thomas Gerl		Safety Coordinator	
Robert Cameron		Project Manager	
Michael Schneider		Project Engineer	
Pascal Fortin		Site Director	
Steve Criswell		Site Manager	

I AM NOT SURE WHO WE WANT TO SIGN THE FINAL COPY OR THEIR ROLES