

Chajnantor Observatory Safety Regulations

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Prof. A. C. S. Readhead: Director, Chajnantor Observatory, Caltech

**Casimir W. (Caz) Scislowicz, Director Environmental, Health & Safety,
Caltech/JPL**

All visitors to the Chajnantor Observatory (“CO”) and all people working at or visiting the site (“Visitors”) are required to follow these Safety Regulations. The CO Safety Regulations are administered by the CO Chief Engineer and the CO Administrator/secretary, who are the Safety Officer and the Safety Administrator, respectively. Both are employees of Astro-Norte.

Safety Responsibilities of all Principal Investigators: Principal Investigators are responsible for the safety of faculty, staff, students, and visitors (“team members”) from their respective institutions who are working at or visiting the CO. Each Principal Investigator is responsible for: (i) reviewing environmental, health and safety requirements laid out in these Safety Regulations with their faculty, staff, and students who will be visiting the CO; (ii) providing the CO Administrator with a completed Pre-Arrival Checklist verifying that medical clearances for work at high altitudes have been obtained by all their team members who will be traveling to the CO; (iii) ensuring their team members understand that accidents or injuries must be reported to the CO Chief Engineer and/or the CO Administrator; and (iv) encouraging all their team members to become CPR and first aid certified.

Safety Responsibilities of all team members and Astro-Norte employees:

Before Travelling to San Pedro: Notify the CO Administrator in San Pedro (Lorena Toro, cbichile@astro.caltech.edu) before your trip to San Pedro de Atacama.

To prepare for work at high altitudes and for driving in Chile: All visitors to the CO must have had a medical examination and have been cleared for work at high altitude (5000 m). Visitors should discuss this with their doctors to determine whether there are any reasons why it might be dangerous for them to work at high altitude, such as pulmonary or heart problems. Your medical examination should take place not more than one year prior to commencing work at the CO and should be repeated annually. Visitors to Chile who intend to drive must have a valid international driving license. (Note although some car rental agencies permit foreigners to drive their vehicles using their regular driving licenses, the US State Department has pointed out that this is not sufficient by Chilean law and that some visitors to Chile have suffered the consequences).

On Arrival in San Pedro: Check in with Lorena Toro, or with one of the CO engineers, and show her your international driving license (or Chilean driving license) if you intend

to drive. She will make a copy of your license and keep it with your personal information.

Before Travelling to the CO Site: Visitors and workers arriving in San Pedro must sleep at least one night in San Pedro before visiting the CO site. The night before going up to the mountain, do not drink alcohol for at least 9 hours before your scheduled departure time. Do not visit the CO if you are not feeling well, especially if you have a cold or a respiratory problem, as the stresses of high altitude can aggravate your condition. A minimum of two people is required for all trips between San Pedro and the CO except in cases of emergency, or if you have pre-arranged to meet a party at the other end.

Use of CO vehicles: Each vehicle is supplied with a first aid kit equipped following the recommendations of ACHS (see below). It is primarily intended for first aid treatment in case of an accident. All vehicles used in operations are permanently equipped with additional gear to deal with the difficulties that can be found on the way to the site. Before departing from San Pedro the driver must (i) report to the assigned contact person in San Pedro or at the site, or to ALMA security, both the departure time and the estimated arrival time; (ii) check the fuel level in the truck; (iii) check first aid kits and other safety equipment in vehicles; (iv) make sure that there are enough oxygen sets in the car so that each traveler will have his/her own oxygen set at the site – at least one oxygen set should be carried in each vehicle at all times; (v) ensure that there is an adequate supply of drinking water in the car; (vi) if not familiar with 4-wheel drive vehicles, the driver must ask how to use the 4-wheel drive vehicle.

Basic First Aid Kit: Adhesive bandage; Cotton; Sterile gauze dressing pads; Elastic bandage 6 & 8 cm; Fixing bandage 6 & 8 cm; Sterile gauze dressing pads; Immobilizing bandage; Antiseptic cleansing wipe; Vinyl gloves; Eye wash; Scissors; Tweezers; Haemostatic tweezers. *Medicines:* Aspirin; paracetamol; Hydrogen peroxide; Povidone – iodine; Mucaine (antacid); Perenteryl (antidiarrheal); Naprogesic (anti-inflammatory – analgesic); Viadil (antispasmodic); Serum. *Additional equipment:* Fire extinguisher; Emergency light; Towing cord; Snow chains; Cord attachments; Battery jumper cables; Shovel.

Number of vehicles - roads sufficiently clear of snow to drive to the site without off-roading: When the roads are clear of snow it is permitted to drive one truck to the site, but only if you arrange to call back to San Pedro, or ALMA security, once you have arrived safely at the site, or, for travel from the site to San Pedro, only if you call ahead to San Pedro, or ALMA security, to inform a contact person of your expected arrival time in San Pedro.

Number of vehicles - roads not sufficiently clear of snow to drive to the site without off-roading: If the roads are either hazardous or blocked by snow, it is not permitted for a single vehicle to drive to or from the site, except in case of emergency when the ALMA access road must be used if it is clear of snow. However, if you happen to be at the site with a single vehicle and it happens to snow before you can return to San Pedro, then it is permitted to drive from the site to San Pedro provided: (a) you first inform a contact

person in San Pedro, or ALMA security, of your expected arrival time in San Pedro; (b) you check that the car is outfitted with water, food, chains, shovel, first aid kit, and oxygen; (c) you only off-road when absolutely necessary; (d) you stay close to the road: you should never deviate by more than 1 km from the road, and you should attempt at all times to remain within visual contact of the road.

Driving at night: the ALMA access road must be used except in cases where it is impassible or dangerous.

Getting Stuck: Do not walk out of sight of the CO site or your vehicle on your own. Be aware that there are many poorly defined roads in the vicinity of the CO and finding the correct route can be difficult, especially in poor visibility. **Don't Forget:** In case of a severe snowstorm when the road is blocked by snow, people have to stay inside the containers. A permanent stock of food is kept at the site, as well as an emergency box with imperishable supplies. In case of a power failure, which causes low temperatures inside the containers extra blankets, and sleeping bags are located in the sleeping containers.

In Case of a Car Accident: Remain at the site of the accident and try to get help as soon as possible. If possible, contact ALMA security, the San Pedro first aid station, police or fire brigade. Ensure that you and your party are kept warm and drink plenty of water.

Fire Fighting: Fire extinguishers are located in all major observatory structures. They are of the CO₂ type. In case of fire: (i) if it is possible to control the fire, always use a fire extinguisher; (ii) if the fire is out of control, evacuate everybody to a clearly designated safety area; (iii) keep phone lines and radio channels open; (iv) call ALMA security and the San Pedro fire brigade and ambulance (if somebody is hurt). If there is a fire at the generators, control the fire using the fire extinguisher at the generator sites. If the fire is out of control evacuate and call ALMA security and the San Pedro fire brigade.

Use of Oxygen: All vehicles going to or coming from the CO must carry at least one oxygen set ready for use in case of need. All people working at the CO must have a portable oxygen system. The CO administrator, or one of the CO technicians or engineers can help to set up your system and demonstrate how it works. Supplemental oxygen is available at all times at the CO and at the San Pedro base. Supplemental oxygen must be used at the CO when working outside the oxygenated containers: on an instrument, on a telescope, on containers, in the machine shop, in the power plant, when using power tools, and in all potentially dangerous situations except in those rare situations where using supplemental oxygen would impede the performance of the task and/or make the situation more dangerous (examples include but are not limited to, working in a tight space), or if deemed detrimental to the health of an individual team member by written order of his/her physician.

Ultraviolet radiation from the sun: Minimize direct exposure to the sun throughout the

day. The ultraviolet (UV) radiation from the sun is damaging to human skin and eyes. UV radiation is particularly intense in summer and in the 4-hour period around solar noon. Wear clothing that covers arms and legs (clothing is UV-protective and generally more effective than even good-quality sunscreen) and a hat. It is recommended to wear UV-protective sunglasses. It is recommended that people working outside at the CO apply a broad-spectrum sunscreen of sun protection factor (SPF) 25+ liberally on areas of the body not protected by clothing and reapply as needed. Check that medication being taken will not affect sensitivity to UV radiation. If adverse skin reactions have occurred previously, avoid any exposure to the sun.

Hazardous Materials: All hazardous materials used at the CO must be recorded and approved prior to use by the CO Chief Engineer. A list of hazardous materials as well as information about them is available at the CO and at the San Pedro Base. Recognize that the reduced oxygen pressure at the high altitude reduces mental ability and increases the likelihood of making mistakes, thus take particular care when doing potentially dangerous work, such as working with hazardous materials or voltages. Take particular care not to start a fire. Because of the reduced oxygen pressure, solids generally burn more slowly than at lower altitude, but the reduced oxygen often results in increased smoke general and less time to exit a smoke filled enclosure. Take particular care also when working with volatile liquids. The reduced barometric pressure lowers the flashpoint of volatile liquids and increases their volatility. Volatile liquids may therefore ignite more easily and spread more rapidly than at lower altitudes. Volatile liquids that are not flammable at lower altitudes may burn at the CO. Only trained staff should handle gases and cryogenic liquids that are kept at the CO.

Hazardous Waste: Waste is not to be disposed of at the CO. Dispose of flammable and hazardous wastes properly by contracting the CO Chief Engineer. In the event of a spill or leak, report to the CO Chief Engineer immediately.

Environmental Conservation: It is forbidden to destroy or harm the cultural heritage in the area. Verbally report any environmental damage or accident occurring at the CO to the CO Chief Engineer immediately.

Altitude Sickness: Types and Symptoms of Altitude Sickness: There are inherent risks in working at high altitude. This text is designed for general information only, and is not a substitute for specific training or experience and does not constitute a clinical document. When visiting the Chajnantor Observatory, which is located at an elevation of 5080 meters (16,700 feet), you should be prepared to recognize and respond to the symptoms of altitude sickness caused by the lower level of partial oxygen pressure in the lungs at high altitudes. If you are concerned about this you should consult your doctor for specific recommendations about prevention and treatment.

The symptoms of Acute Mountain Sickness (AMS) may include one or more of the following: headache, insomnia, irritability, dizziness, muscle aches, fatigue, loss of appetite, nausea or vomiting, swelling of the face, hands and feet. If you experience any

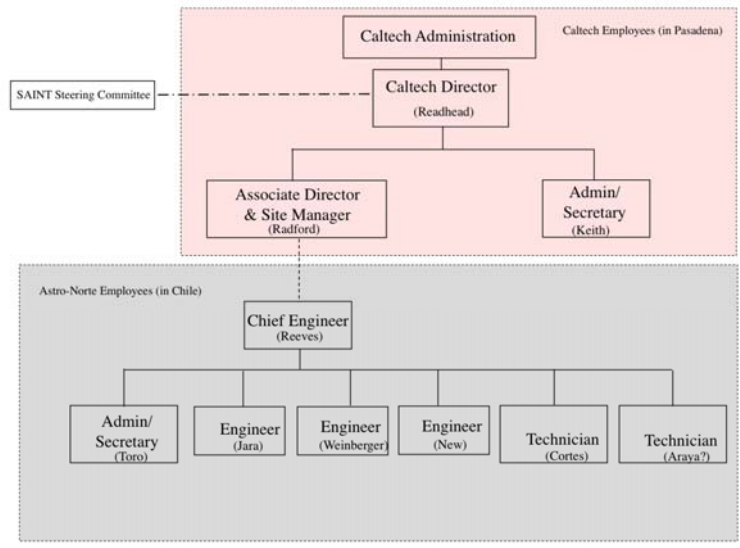
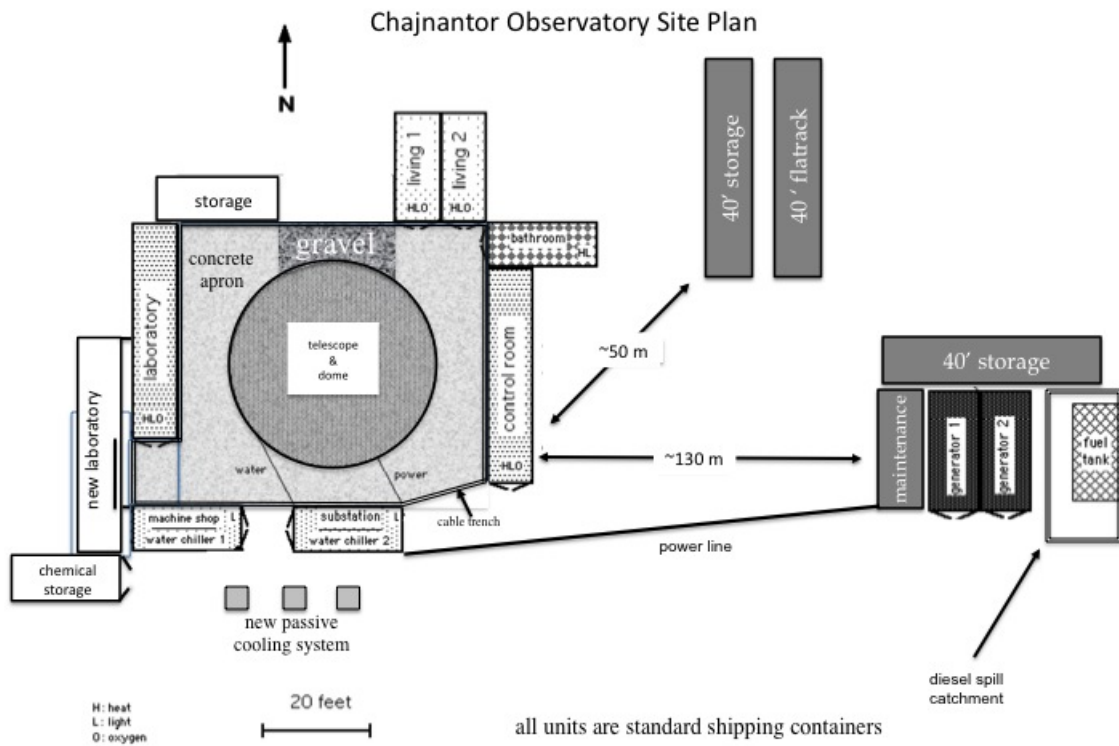
AMS symptoms, please inform CO personnel immediately and limit your activity level. Stay in the control building and keep using your portable oxygen system, drink plenty of water. If appropriate for your medical status, aspirin or ibuprofen can be used for headaches. If symptoms become worse during the visit, it is very important to return to San Pedro as soon as possible. *Your health is always the highest priority, regardless of what work is being done at the observatory, so do not hesitate to tell people that you are unwell.* Please note that AMS often passes unrecognized by the victim, so that it is important to keep a watch on others at the CO, who might be experiencing AMS without realizing it. Any signs of incoherence or irritability should be reported immediately to the CO engineer or technician.

High Altitude Cerebral Edema (HACE) results from blood plasma being released into the cranial cavity. It is a worsening of AMS symptoms, and can lead to a loss of coordination as intracranial pressure increases, or loss of consciousness. Those affected may appear confused and begin to stumble or stagger. They can have severe headaches and incapacitating fatigue. This is a dangerous form of altitude sickness, and it can be life-threatening. It is crucial for the victim to descend and receive drug and oxygen treatment. Watch each other for symptoms, since victims may be unable to recognize the problem. People who have experienced HACE should never visit the CO.

High Altitude Pulmonary Edema (HAPE) is a buildup of fluid in the lungs that can occur along with HACE or as a separate illness. Those affected will be breathless and very tired when walking, and have a sense of fullness or pressure in the chest. Eventually victims will be short of breath even while resting. Victims must be driven down to San Pedro and receive drug and oxygen treatment as soon as possible.

Emergency Procedures: Call ALMA security, which is the most rapid way to get help. During office hours, you should also call the San Pedro Base (55 85 12 42) and make sure that the information is passed on to the CO Administrator or her representative, who will take further steps to address the emergency. Cellular telephone at telescope: Mobile phone number: (9) 76492076. First aid station San Pedro: (055) 85 10 10. San Pedro police (Carabineros): (055) 85 10 03 or (from mobile phone): 133. San Pedro fire brigade: (055) 85 10 74 or (from mobile phone): 132

Stop Work Authority: It is mandatory for all personnel working at or visiting the CO to abide by a stop work order from the senior Astro-Norte employee on site. If there is no Astro-Norte person on site, but there is a senior Caltech or JPL employee, then this person has stop work authority. If there is no senior Caltech or JPL employee, then the senior PI on site has stop work authority. If there is no PI on site, then the senior team member present has stop work authority.



Principal Investigator Pre-Arrival Checklist

I. Principal Investigator: _____

II. Institution: _____

III. Contact Information: (email, phone number):

IV. Team Membership (List all members)

Name	CPR and First Aid Certified?	Date of Medical Clearance	International Driver's License Expiration Date

V. Emergency Contact in the event of mishap:

I certify that I have confirmed that each team member is cleared to work at high altitude and that I have reviewed the CO Safety Regulations with each team member.

Signed: _____