




| | | |
|---|--|--|
|  | <p>Atacama Pathfinder EXperiment</p> <hr/> <p>Safety Regulations</p> | <p>APEX-APX-PRO-0001</p> <p>Revision: 1.9</p> <p>Release: 2019-06-01</p> <p>Category: 1</p> <p>Author: L.-A. Nyman</p> |
|---|--|--|

APEX Safety Regulations

L.-Å. Nyman
APEX Station Manager
APEX - European Southern Observatory

| | |
|---|--|
| <u>Keywords:</u> | |
| Management, Safety | |
| Author Signature: Lars-Åke Nyman | Date: |
| Approved by: Prof. Dr. K. Menten | Signature:  |
| Institute: Chairman of the APEX Board | Date: 2019-07-23 |
| Released by: | Signature: |
| Institute: APEX | Date: 2019 |
| <u>Distribution:</u> | |
| Institute: APEX Board | |
| Institute: APEX Staff (ESO) | |
| Institute: APEX Partner Staff (MPIfR, ESO, OSO) | |
| Institute: Chile Observers | |
| Institute: | |

| | | |
|---|--|--|
|  | <h1>Atacama Pathfinder EXperiment</h1> <h2>Safety Regulations</h2> | <p>APEX-APX-PRO-0001</p> <p>Revision: 1.9</p> <p>Release: 2019-06-01</p> <p>Category: 1</p> <p>Author: L.-A. Nyman</p> |
|---|--|--|

Change Record

| REVISION | DATE | AUTHOR | SECTIONS/PAGES AFFECTED | REMARKS |
|----------|------------|---------------|-------------------------|---|
| 0.1 | 08.07.04 | Nyman | New issue | |
| 0.2 | 19.07.04 | R. Kurz | All | edit for APEX |
| 0.3 | 25.07.04 | Nyman | Section 6, 7, 8 | |
| 0.4 | 01.08.04 | Nyman | all | Incl. comments from M. Boecker. Included fire fighting |
| 0.5 | 11.08.04 | Nyman | All | Incl. comments from R. Güsten |
| 0.6 | 18.09.04 | Nyman | All | Clarified the definition of APEX base and APEX telescope site. Added comments on use of oxygen in 7.1. Minor modifications to 8.1 and 8.2 |
| 1.0 | 27.09.04 | | | Approval of R0.6 by Board |
| 1.1 | 15.10.08 | Rabanus | 6; 7.1; 8.1 | Clarified wording of acclimatization procedure; truck usage for high site; radio communications; ALMA-related changes |
| 1.2 | 10.3.09 | Rabanus | various | Comments by R. Güsten |
| 1.3 | 29.4.09 | Rabanus | 8.2 | Comment by A. Kaufer |
| 1.4 | 03.10.11 | Wieching | 5; 6; 8 | |
| 1.5 | 17.08.17 | Klein | 7 | Introduced policy for nighttime activities at the antenna |
| 1.6 | April 2019 | Nyman, Spille | All | Rewriting to align with LPO/ESO safety docs |
| 1.7 | 15.04.19 | Nyman | | Comments from Conway and B. Klein |
| 1.8 | 23.04.19 | Nyman | | Comments from T. Klein and C. Spille and presented to the Board |
| 1.9 | 30.06.19 | Nyman | | Final version after Board approval |




| | | |
|---|--|--|
|  | <h1>Atacama Pathfinder EXperiment</h1> <h2>Safety Regulations</h2> | <p>APEX-APX-PRO-0001</p> <p>Revision: 1.9</p> <p>Release: 2019-06-01</p> <p>Category: 1</p> <p>Author: L.-A. Nyman</p> |
|---|--|--|

TABLE OF CONTENTS

| | | |
|----------|--|-----------|
| 1 | Purpose | 5 |
| 2 | Scope | 5 |
| 3 | Acronyms/Definitions | 5 |
| 4 | Documents | 6 |
| 4.1 | Applicable documents | 6 |
| 4.2 | Reference documents | 7 |
| 5 | Safety Responsibilities | 7 |
| 5.1 | APEX Board..... | 7 |
| 5.2 | APEX Station Manager/Acting Station Manager | 7 |
| 5.3 | Staff..... | 7 |
| 5.4 | Visitors..... | 8 |
| 5.5 | Contractors | 8 |
| 6 | APEX Safety Rules | 8 |
| 6.1 | Safety Induction | 8 |
| 6.2 | Work at the APEX Telescope Site: General Rules | 8 |
| 6.3 | Work at the APEX Telescope Site | 9 |
| 6.4 | Work in the Antenna..... | 10 |
| 6.5 | Work at the APEX Telescope Site during Night Time..... | 10 |
| 6.6 | Work at the APEX Telescope Site during Remote Operations | 11 |
| 6.7 | Trips to and from the APEX Telescope Site..... | 11 |
| 6.8 | Driving APEX cars | 12 |
| 6.9 | Missions to APEX | 12 |
| 6.10 | Telescope Crane and Lifting Operations..... | 12 |
| 6.11 | Work with the Manlift..... | 12 |
| 6.12 | Special Activities | 13 |
| 6.13 | Work with Hazardous Materials and Conditions | 13 |
| 7 | Emergency Procedures | 13 |
| 7.1 | During emergencies | 14 |
| 7.2 | In case of an accident | 14 |
| 7.3 | Sickness | 14 |
| 7.4 | Fire | 14 |
| 7.5 | Snow | 15 |
| 7.6 | Road accidents | 15 |
| 7.7 | Earthquakes..... | 15 |
| 7.8 | Overnight stay at telescope site..... | 16 |
| 8 | Accident/incident reporting | 16 |
| 9 | Personal Protection Measures | 16 |
| 9.1 | Ultraviolet radiation from the sun | 16 |
| 9.2 | Heat and humidity | 16 |

| | | |
|---|--|--|
|  | <h1>Atacama Pathfinder EXperiment</h1> <h2>Safety Regulations</h2> | <p>APEX-APX-PRO-0001</p> <p>Revision: 1.9</p> <p>Release: 2019-06-01</p> <p>Category: 1</p> <p>Author: L.-A. Nyman</p> |
|---|--|--|

| | | |
|-----|--------------------|----|
| 9.3 | Lightning | 17 |
| 9.4 | Getting Lost | 17 |
| 9.5 | Landmines | 18 |

| | | |
|---|--|--|
|  | <h1>Atacama Pathfinder EXperiment</h1> <h2>Safety Regulations</h2> | <p>APEX-APX-PRO-0001</p> <p>Revision: 1.9</p> <p>Release: 2019-06-01</p> <p>Category: 1</p> <p>Author: L.-A. Nyman</p> |
|---|--|--|

1 Purpose

In accordance with the APEX Safety Plan (AD-01), the purpose of this document is to define the safety regulations, required in addition to the existing applicable ESO safety regulations (AD-02) to establish a safe environment for work at APEX, both at the APEX Base and at the APEX Telescope Site on Chajnantor. The reduced oxygen pressure at high altitude, in particular at the 5050-meter altitude of Chajnantor, impairs mental performance and judgment and increases the likelihood of making mistakes (see RD-01, the ESO safety web-pages, for information on the effects of high altitude on human mental and physical performance). Therefore, clear regulations and strict adherence to these regulations are essential to reduce the risk of injury or illness.

2 Scope

This document applies to all persons working at or visiting the APEX site, including APEX staff, staff from APEX partners, Chile observers, contractors and visitors.

3 Acronyms/Definitions


| | |
|------|---------------------------------|
| ACHS | Asociacion Chilena de Seguridad |
| ASM | Acting APEX Station Manager |
| AoD | Astronomer on Duty |
| EoD | Engineer on Duty |
| HSE | High Site Engineer |
| LPO | La Silla Paranal Observatory |
| SM | APEX Station Manager |

APEX Partners – the signatories of the APEX Memorandum of Understanding (MOU):

- Max-Planck-Institut für Radioastronomie (MPIfR)
- European Southern Observatory (ESO)
- Onsala Space Observatory (OSO)

APEX Site – the site of APEX operations in Chile that consists of:

1. APEX Base located in Sequitor near San Pedro de Atacama (altitude 2440 meters)
2. APEX Telescope Site located in the ALMA Science Reserve on the Chajnantor plateau east of San Pedro de Atacama (altitude 5050 meters)

| | | |
|---|--|--|
|  | <h1>Atacama Pathfinder EXperiment</h1> <h2>Safety Regulations</h2> | <p>APEX-APX-PRO-0001</p> <p>Revision: 1.9</p> <p>Release: 2019-06-01</p> <p>Category: 1</p> <p>Author: L.-A. Nyman</p> |
|---|--|--|

APEX Staff:

- The employees of ESO and contractors who are assigned to work at the APEX Site on a regular basis.

APEX Partner Staff:

- Staff members from one of the APEX partners or staff that installs equipment in the telescope on behalf of one of the APEX partners, that comes on a mission to work at APEX

Observers on Chilean time (Chile observers):

- Persons sent by CONICYT to perform observations during Chilean time


Visitors:

- Persons visiting the APEX Site for the purpose of a visit only (not to work)

4 Documents

4.1 Applicable documents

| | | |
|-------|--|------------------------|
| AD-01 | APEX Safety Plan | APEX-APX-PLA-0004 |
| AD-02 | ESO Safety Policy and Organisation | SAF-GEN-POL-0001 |
| AD-03 | Health, Safety & Environmental Manual - LPO | ESO-201112 |
| AD-04 | Contractor Safety Procedure – LPO | ESO-231076 |
| AD-05 | Hazardous Material Procedure – LPO | LPO-PRO-ESO-20100-0002 |
| AD-06 | ESO Crane Operation Procedure | ESO-2013117 |
| AD-07 | Earthquake Emergency Procedures - LPO | LPO-PRO-ESO-20100-0006 |
| AD-08 | Personal Protective Equipment Procedure | LPO-PRO-ESO-20100-0007 |
| AD-09 | Driving Procedure – LPO | LPO-PRO-ESO-20100-0003 |
| AD-10 | Procedure for Medical Exams – LPO | ESO-252676 |
| AD-11 | APEX Online Safety Induction: https://www.eso.org/lpo-safety/english/safety.php?id=19405&site=apex | |
| AD-12 | APEX Visitor Waiver Release Form | APEX-APX-PRO-0003 |

| | | |
|---|--|--|
|  | <h1>Atacama Pathfinder EXperiment</h1> <h2>Safety Regulations</h2> | <p>APEX-APX-PRO-0001</p> <p>Revision: 1.9</p> <p>Release: 2019-06-01</p> <p>Category: 1</p> <p>Author: L.-A. Nyman</p> |
|---|--|--|

| | | |
|-------|--|-------------------|
| AD-13 | APEX Crane Lifting Procedure | APEX-APX-PRO-0008 |
| AD-14 | APEX List of Safety material | APEX-APX-LIS-0001 |
| AD-15 | APEX Safety Training | APEX-APX-PRO-0002 |
| AD-16 | Procedure for SciOps-R High Site Activities | APEX-APX-PRO-1005 |
| AD-17 | ESO Adm. Circular No 12 "Hours of Work: Overtime, Night Work, Sunday Work, Official Holiday work and Compensatory Leave", 2005 | |

4.2 Reference documents

| | |
|-------|---|
| RD-01 | The ESO web page on safety and work at high altitude http://www.eso.org/safety/ |
|-------|---|

5 Safety Responsibilities

5.1 APEX Board

Approves site related safety documentation and agrees on the implementation of LPO Safety documentation as common safety rules, described in this document.

5.2 APEX Station Manager/Acting Station Manager


The APEX Station Manager (SM) or the designated Acting Station Manager (ASM, safety responsible in the absence of the SM) are responsible for all safety related activities on site, coordinating internal and/or external support, communicating with the LPO Director/Site Safety Engineer about situations and follow up on emergencies. Every staff member, APEX partner, Chile observer, contractor or visitor falls under the authority of the SM/ASM in safety related matters.

5.3 Staff

The APEX staff shall follow safety rules, identify areas of risks, stop unsafe activities and participate in mandatory and recommended trainings.

APEX Partner Staff shall provide necessary information (dates, description of activities, support from APEX staff) before the start of a mission, comply with the valid safety documentation and follow instructions of the SM/ASM.

All APEX staff and APEX partner staff shall undergo the medical examination as described in AD-10 prior to arriving to APEX. For Chile Observers the persons going to the Telescope Site must have a valid high altitude medical certificate. The names and certificates of all medically-certified staff and Chile observers shall be submitted to the

| | | |
|---|--|--|
|  | <h1>Atacama Pathfinder EXperiment</h1> <h2>Safety Regulations</h2> | <p>APEX-APX-PRO-0001</p> <p>Revision: 1.9</p> <p>Release: 2019-06-01</p> <p>Category: 1</p> <p>Author: L.-A. Nyman</p> |
|---|--|--|

APEX SM. The LPO Site Safety Engineer shall organize the annual High-Altitude Medical Exams for the APEX staff.

5.4 Visitors

Requests to visit the APEX Telescope Site must be submitted in writing to the APEX SM. APEX can only authorize visits directly related to the APEX project. The APEX SM will inform the ALMA safety officer about the visit.

All visitors not employed by the APEX Partners must sign a Visitor Waiver and Release Form (AD-12), and submit it to the APEX SM or delegate before visiting the APEX Telescope site. The visitors shall follow the safety rules and instructions given by the APEX staff and be accompanied by an APEX staff member. Visitors employed by an APEX Partner must submit a valid high-altitude medical certificate.

Visits to the Chajnantor site, not related to APEX, will be handled by ALMA. All such visits must be authorized by the ALMA Director and will be taken care of by ALMA staff.

5.5 Contractors

All contractors working at the APEX Telescope site must follow the LPO Contractor Safety Procedures (AD-04). As described the contractor shall provide safety related documentation and medical certificates, including the High Altitude Medical Exam for all staff working at altitudes above 3000 m. All contractor documentation needs to be available at least 3 (three) days prior to start of work.

6 APEX Safety Rules

6.1 Safety Induction


New APEX Staff and new APEX Partner Staff, as well as new Contractors will receive a safety induction before starting activities on site by the SM/ASM or delegate. The safety induction should be signed by the participant.

APEX Staff and APEX Partner Staff shall annually go through the APEX Online Safety Induction (AD-11). Visitors and Contractors shall go through the Induction before going to the APEX Telescope Site.

6.2 Work at the APEX Telescope Site: General Rules

The LPO Health, Safety & Environmental Manual (AD-03) specifies the following:

- Within ESO all works that take place at 3000m or higher are considered High Altitude Works, in accordance with Chilean legislation.

| | | |
|---|--|--|
|  | <h1>Atacama Pathfinder EXperiment</h1> <h2>Safety Regulations</h2> | <p>APEX-APX-PRO-0001</p> <p>Revision: 1.9</p> <p>Release: 2019-06-01</p> <p>Category: 1</p> <p>Author: L.-A. Nyman</p> |
|---|--|--|

- Due to the oxygen deprivation in the air human functions are impaired and this might have serious effects on personal health, as well as work performance. Effects on persons might include:
 - Headaches, drowsiness, nausea, altered mental state, loss of balance, impaired reason, acute mountain sickness, high altitude cerebral edema, or high altitude pulmonary edema.
- To prepare for working in High Altitudes all ESO members of personnel, contractors, and professional visitors require a valid medical exam or a release form of their respective insurance. ESO cannot grant any exemptions from this rule for any professional activity. The particular exam requirements have been established in the LPO Medical Exam Procedure (AD-10), according to Chilean legislation.
- Anyone working at high altitudes needs to get adjusted to altitude by spending at least one day and night at a level between 2000 and 3000m.

In addition:

- Do not drink alcohol for at least 10 hours before the trip.
- Do not go to the APEX Telescope Site in case of not feeling well, especially if in case of a cold or a respiratory problem, as the stress of the high altitude can worsen the condition.

6.3 Work at the APEX Telescope Site


During daytime work activities at the Telescope Site, at least two persons should be present at all times, and at least one of them someone from the APEX staff assigned the responsibility of High Site Engineer (HSE, AD-16) and trained in accordance with AD-15.

People working at the Telescope Site should be aware of their own state of health, and also try to determine if anybody else has problems. On any person's first day at the telescope it is not allowed to work without someone else in the immediate vicinity to monitor the state of health is not allowed. People working alone in a place shall always carry a walkie-talkie and appoint somebody to check on them periodically.

It is strongly recommended to use oxygen during work at the Telescope Site. The oxygen saturation level in the blood should be monitored regularly. If the oxygen saturation level goes below 80%, oxygen must be used immediately. People going to the APEX telescope site for the first time should always use oxygen.

If case of feeling sick, notify the HSE, the APEX Base or a co-worker at the telescope, and arrange to descend immediately.

On the first day of a shift or a mission the maximum hours of work at the APEX Telescope Site shall not exceed 6 hours. The maximum regular working hours at the Telescope Site shall not exceed 8 hours, in compliance with the maximum total of 10 daily working hours, taking into account the commuting time to and from the Telescope

| | | |
|---|--|--|
|  | <h1>Atacama Pathfinder EXperiment</h1> <h2>Safety Regulations</h2> | <p>APEX-APX-PRO-0001</p> <p>Revision: 1.9</p> <p>Release: 2019-06-01</p> <p>Category: 1</p> <p>Author: L.-A. Nyman</p> |
|---|--|--|

Site. On written approval by the LPO Director or by a person delegated in writing by the LPO Director, the working hours can be extended to a maximum of 10 working hours at the Telescope Site, in compliance with the absolute maximum working time per day of 12 hours.

Keep an eye on the weather and the weather forecast. In case of bad weather, leave the site as soon as possible by the ALMA road. In case of severe snow storms that may block the ALMA road or bad visibility, inform the SM/ASM and follow the instructions given to you.

All persons working at the Telescope Site shall follow the instructions and orders from ALMA safety officers in case of an evacuation due to bad weather and other emergencies.

6.4 Work in the Antenna


All personnel operating the antenna must have received training on antenna operation (AD-15).

Before the antenna drive system is started up there is an audio alarm sounding for 5 seconds. A blinking light above the antenna platform shows that the antenna is under computer control (and can be moved at any time from the Telescope Site or Base).

- Everybody working in the antenna should have received instruction on how to put the antenna in safe mode.
- Do not work below or close to the antenna unless it is in safe mode.
- During work inside the antenna, the antenna should be in safe mode. If for any reason the antenna is not in safe mode (e.g. work in an antenna cabin during observations), everybody working in the antenna should be aware of this condition and be in contact with the AoD and APEX staff operating the antenna.
- When entering and leaving the antenna through the antenna stair case, always watch the blinking light status. If the light is blinking, be aware that the antenna can move at any time.
- Hard hats or the more convenient Bump Caps shall always be used during work on the platform, in the antenna cabins and below the antenna.
- People working alone in the antenna shall always carry a walkie-talkie and appoint somebody to check on them periodically.

6.5 Work at the APEX Telescope Site during Night Time

Engineering work at nighttime shall be an exception and requires the approval of the SM/ASM. Particularly, work in any of the antenna cabins requires the presence of at least 3 persons at the high site. In addition, Apex staff presence in the APEX Base control room is required to safeguard the activities, assuring continuous radio presence and camera control.

| | | |
|---|--|--|
|  | <h1>Atacama Pathfinder EXperiment</h1> <h2>Safety Regulations</h2> | <p>APEX-APX-PRO-0001</p> <p>Revision: 1.9</p> <p>Release: 2019-06-01</p> <p>Category: 1</p> <p>Author: L.-A. Nyman</p> |
|---|--|--|

Each person at the high site has to have a radio at hand in order to keep contact with staff in the Sequitor control room.

6.6 Work at the APEX Telescope Site during Remote Operations

During remote operations of the antenna [SciOps-R] from Sequitor control room, high site activities at the APEX antenna are regulated in AD-16.

6.7 Trips to and from the APEX Telescope Site

The ALMA road shall be used at all times. In very exceptional circumstances, in case the ALMA road is blocked and expected to be blocked for a significant amount of time (more than a day), but with good weather and no snow on the ground, the road through Simon's observatory can be used with the authorization of the LPO Director. In this case two 4-wheel drive vehicles must be used, driven by APEX staff, and continuous radio contact with the APEX Base must be held.

ALMA enforces a site access policy. It is therefore required to submit positive identification (i.e. a Chilean RUT, or a passport number for international collaborators) to the SM/ASM, who informs ALMA safety.


Each trip to and from the antenna must be monitored by radio communications. Check points are: leaving the base, reaching the ALMA gate, and reaching the antenna at the high site. Each time a check point is passed, call the base with the information about the vehicle, driver, additional persons in the vehicle and the actual location. Inside the ALMA concession the radio communications protocol of ALMA is to be followed with checkpoints at km 21, 31 and 41 on the ALMA road. Details are given in the safety induction [AD-11]. The driver shall report any problems or any abnormal road conditions through the radio, and inform about any problems with the car.

Work at the Telescope Site is not permitted with less than two people. In case of good weather and no snow on the road, one vehicle can be used for the trip up and down. Any trip must be monitored by radio by an assignee as a contact person in the APEX Base.

In case there are people already working on Telescope Site, one person is allowed to go up alone in one vehicle, provided that the trip is monitored by radio from the APEX Base and the weather, visibility and road conditions are good. One person is allowed to go down from the Telescope Site in one vehicle under the aforementioned conditions.

On the ALMA road, mandatorily the gears have to be put in 4x4 (double traction, or H4). Depending on road conditions, it may be advised to switch to low gear (L4).

It is not allowed to drive off-road within the ALMA concession.

| | | |
|---|--|--|
|  | <h1>Atacama Pathfinder EXperiment</h1> <h2>Safety Regulations</h2> | <p>APEX-APX-PRO-0001</p> <p>Revision: 1.9</p> <p>Release: 2019-06-01</p> <p>Category: 1</p> <p>Author: L.-A. Nyman</p> |
|---|--|--|

6.8 Driving APEX cars

APEX staff and authorized contractors are allowed to drive APEX cars using a Chilean driver's license. Partner staff and staff on a mission to APEX should preferably have an international driver's license but are allowed to drive APEX cars using their national driver's license. The LPO driving procedures shall be followed (AD-09). Only drivers who have taken first-aid, high altitude training and the ALMA driving course are permitted to drive to the APEX telescope site alone.

All vehicles going to the APEX telescope site must be equipped as specified in the APEX List of Safety Materials (AD-14).

Before leaving, the driver should in any case:

- Check that the tank is at least 1/2 full. If it is less, fill up the tank.
- Check that no safety equipment is missing (there is a list in the each car).
- Make sure that there are enough oxygen bottles in the car for the trip.
- Always carry drinking water in the car.
- Check that the radio is working and report the departure.

6.9 Missions to APEX

For missions by APEX partner staff and other teams e.g. for observations or instrument installation, the maximum continuous stay at APEX per staff member is 14 days. The staff member can return for another stay after a break of at least 2 days (AD-17).

Justified by the nature of a mission and the convenience of staying at the Sequitor basecamp, the following exception to the above is permitted:

If an APEX partner staff on mission, longer than 14 days, takes a 24h rest time per 7 days stay, or a 48h rest period per 14d, she/he is permitted to use all services provided in the basecamp for this rest period.

6.10 Telescope Crane and Lifting Operations


The ESO crane operations procedures shall be followed (AD-06) as well as the procedures specific to APEX (AD-13).

All lift operations shall be previously authorized, the lift procedure written down and a risk assessment done.

6.11 Work with the Manlift

All personnel working with the manlift must have received training on operation of the manlift (AD-15) and the driver must be certified.

- Always use a safety harness and helmet in the manlift.

| | | |
|---|--|--|
|  | <h1>Atacama Pathfinder EXperiment</h1> <h2>Safety Regulations</h2> | <p>APEX-APX-PRO-0001</p> <p>Revision: 1.9</p> <p>Release: 2019-06-01</p> <p>Category: 1</p> <p>Author: L.-A. Nyman</p> |
|---|--|--|

- The manlift can be used only if one person is on the ground monitoring the work by radio.
- Only two persons can stay in the basket at the same time.
- Always respect the maximum rated load.
- The antenna must be in safe mode if the manlift is operated within the area of the antenna.
- The manlift should only be operated at wind speeds of less than 10 m/s in unshielded conditions, and at wind speeds of less than 15 m/s in case of work in front of antenna with the antenna shielding the wind. In case of strong wind gusts, the manlift should not be used.

6.12 Special Activities

Activities not regularly performed need to be authorized by the SM and a previous risk assessment done. This includes trips to the holography transmitter.

6.13 Work with Hazardous Materials and Conditions

The reduced oxygen pressure at altitude reduces mental ability and increases the likelihood of making mistakes. 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 will generally burn more slowly than at lower altitude. However, the reduced oxygen often results in increased smoke generation and less time to exit a smoke-filled enclosure.


Take particular care 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 high site.

Gases and cryogenic liquids are kept both at the APEX telescope site and base. Only trained staff should handle gases and liquids (AD-15)

All hazardous materials used at the site shall be recorded and approved prior to their use by the APEX SM. A list of hazardous materials as well as information about them shall be available at the APEX Telescope Site and the APEX Base.

7 Emergency Procedures

Emergency phone numbers are listed in http://www.apex-telescope.org/safety/emergency_contacts/

| | | |
|---|--|--|
|  | <h1>Atacama Pathfinder EXperiment</h1> <h2>Safety Regulations</h2> | <p>APEX-APX-PRO-0001</p> <p>Revision: 1.9</p> <p>Release: 2019-06-01</p> <p>Category: 1</p> <p>Author: L.-A. Nyman</p> |
|---|--|--|

7.1 During emergencies

- Stay calm!
- Provide First Aid to injured persons, if necessary
- Communicate as soon as possible with the SM/ASM and report the situation in order to get help:
 - How many people are affected
 - Any injured persons
 - Any missing persons or persons without contact
 - Current situation in the container or in the car
 - Weather conditions

7.2 In case of an accident

General:

- Follow the instructions of the safety responsible present at the site or a staff member trained in first aid procedures.
- Make sure that the information is passed to the SM/ASM.

Accidents at Chajnantor or on the road (see also section 7.5):

- Call ALMA safety on channel 4 for assistance. APEX has an agreement with ALMA about the use of the ALMA first aid station and assistance from the ALMA paramedics.

7.3 Sickness

In case of somebody getting sick and need medical treatment the following procedure shall be followed:

- Contact the ALMA polyclinic or
- Contact the San Pedro clinic depending on the situation
- ESO has an agreement with Clinica El Loa in Calama for emergency treatments. Bring the form located in the petty cash box and present it to the staff of the Clinica.


7.4 Fire

Fire protection:

- Fire protection at the APEX Base consists of smoke detectors in facilities, water hoses, high pressure water extinguishers, and fire extinguishers.
- Fire protection at the APEX Telescope Site consists of smoke detectors in facilities and fire extinguishers.
- Everyone on site should know about the location and have instructions/training.

In case of fire:

- If it is possible to control the fire, always use a fire extinguisher.

| | | |
|---|--|--|
|  | <h1>Atacama Pathfinder EXperiment</h1> <h2>Safety Regulations</h2> | <p>APEX-APX-PRO-0001</p> <p>Revision: 1.9</p> <p>Release: 2019-06-01</p> <p>Category: 1</p> <p>Author: L.-A. Nyman</p> |
|---|--|--|

- If the fire is out of control, evacuate everybody to the designated safety area close to the APEX Base parking lot.
- Keep phone lines and radio channels open.
- If somebody is hurt, call the ALMA paramedics.
- Alternatively, call the San Pedro fire brigade and/or ambulance, if somebody is hurt. Note that the San Pedro ambulance may not be occupied around 24h.
- 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. Call the San Pedro fire brigade.

7.5 Snow

- In case of bad weather leave the site before it is too late. Always follow the instructions given by ALMA safety officers for evacuating the site.
- If the ALMA road is blocked after a snow storm, contact ALMA safety for information about road clearance.

7.6 Road accidents

- Stand by the site of the accident and try to get help as soon as possible.
- Communicate by radio to anyone that responds to your call and request that they complete the notification procedure in case of accident as described above. On the ALMA road, call ALMA safety on channel 4 for assistance. APEX has an agreement with ALMA about the use of the ALMA first aid station and assistance from the ALMA paramedics.
- Concentrate yourself on the health condition of your party and yourself.
- If necessary, contact the San Pedro first aid station, police or fire brigade.


7.7 Earthquakes

Be aware that Chile is a seismic country and earthquakes can happen at any time.

- Everybody should know where the safe zones are located.

Preparations by APEX staff:

- Ensure that large and/or heavy objects are stored on lower shelves to prevent injury during an earthquake.
- Ensure that bottled goods, glass, and chemicals are not stored in overhead places or left where they can freely slide on shelves, and that chemicals are not stored near places of potential ignition.
- Check the proper fixation of all gas cylinders in the kitchen area
- Be aware of the gas, diesel, electric and water main shutoff locations and know how to switch these utilities off
- Be aware of fire risks

| | | |
|---|--|--|
|  | <h1>Atacama Pathfinder EXperiment</h1> <h2>Safety Regulations</h2> | <p>APEX-APX-PRO-0001</p> <p>Revision: 1.9</p> <p>Release: 2019-06-01</p> <p>Category: 1</p> <p>Author: L.-A. Nyman</p> |
|---|--|--|

During the earthquake:

- Move away from windows and places where objects may fall
- Go to an area identified as safe zone
- Depending on severity evaluate if there are personnel injuries and/ or facility damages
- Coordinate with ALMA Safety to report about status

7.8 Overnight stay at telescope site

Never plan to sleep at the APEX Telescope Site overnight. In case it is not possible to leave the site, there is emergency equipment in the containers and the vehicles. This includes food, water, warm clothes and sleeping bags. If there is no electricity, there is a gas stove and a gas bottle available. Emergency lights are installed in the control and dormitory containers.

8 Accident/incident reporting

Any accident or incident at the APEX base, the APEX telescope site or during driving shall be reported directly to the SM/ASM and the LPO Site Safety Engineer.

9 Personal Protection Measures

9.1 Ultraviolet radiation from the sun


Avoid direct exposure to the sun in the middle of the day, when the UV intensity is greatest. The ultraviolet (UV) radiation from the sun includes UVA (wavelength 315–400 nm) and UVB (280–315 nm) radiation, both of which are damaging to human skin and eyes. UVB radiation is particularly intense in summer and in the 4-hour period around solar noon.

Wear clothing that covers arms and legs (summer clothing is UV-protective and generally more effective than even good-quality sunscreen) and a hat. It is recommended to wear UV-protective sunglasses. Apply a broad-spectrum sunscreen of sun protection factor (SPF) 25+ liberally on areas of the body not protected by clothing and reapply frequently.

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 and avoid any products that have previously caused the adverse reactions.

9.2 Heat and humidity

| | | |
|---|--|--|
|  | <h1>Atacama Pathfinder EXperiment</h1> <h2>Safety Regulations</h2> | <p>APEX-APX-PRO-0001</p> <p>Revision: 1.9</p> <p>Release: 2019-06-01</p> <p>Category: 1</p> <p>Author: L.-A. Nyman</p> |
|---|--|--|

In the dry conditions of the APEX Site, and especially the APEX Telescope site, dehydration is particularly likely to develop unless care is taken to maintain adequate fluid intake. Consumption of salt-containing food and drink helps to replenish the electrolytes (unless this is contraindicated for the individual). Exposure to dry, dusty air may also lead to irritation and infection of the eyes and respiratory tract.

9.3 Lightning

Easy lightning rule: If you see it, flee it. If you hear it, clear it.

The Altiplanic Winter brings lightning risks to the site. Listen for thunder, watch for lightning, and observe the direction of storm movements. Be aware of the nearest safe structure or vehicle, and how long it will take to reach it.

- Use the Flash/Bang (F/B) technique to measure lightning distance. Five seconds from seeing the lightning flash to hearing the associated thunder is equal to 1.61 km.
- A “Safe Location” is a properly protected building or telescope.
- The safest place commonly available is the containers or antenna, i.e. a large, fully enclosed, substantially constructed building which can conduct lightning current safely to ground.
- If you can’t reach the containers or the antenna, get in an enclosed vehicle with a solid metal roof and metal sides. Close the windows, lean away from the door, put your hands in your lap and don’t touch any other car part.
- A fully enclosed metal vehicle is a safe location because of the (partial) Faraday Cage effect.
- Stay away from corded telephones, electrical appliances, lighting fixtures, ham radio microphones, electric sockets and plumbing.


More lightning information is available under: www.nssl.noaa.gov

9.4 Getting Lost

Do not walk out of sight of the APEX Telescope Site or your vehicle by yourself.

In case it is necessary to drive off the designated road (for example in case the road is covered by snow), carry a GPS receiver. Familiarize yourself with the use of the GPS receiver before going to the site.

Be aware that there are many poorly defined roads in the vicinity of the site and route finding can be difficult, especially in poor visibility.

| | | |
|---|--|--|
|  | <p>Atacama Pathfinder EXperiment</p> <hr style="width: 10%; margin: auto;"/> <p>Safety Regulations</p> | <p>APEX-APX-PRO-0001</p> <p>Revision: 1.9</p> <p>Release: 2019-06-01</p> <p>Category: 1</p> <p>Author: L.-A. Nyman</p> |
|---|--|--|

9.5 Landmines

Be aware that there are landmines and other unexploded munitions in the general vicinity of the Chilean frontier. The Chilean military have assured that there are no mines or munitions on the Science Preserve which includes the ALMA site. However, no such assurance exists for other areas and it is strongly recommended that all individuals stay on the established roads when visiting the surrounding area outside the Science Preserve.