
	<p style="text-align: center;">Atacama Pathfinder EXperiment</p> <hr style="width: 10%; margin: auto;"/> <p style="text-align: center;">Safety Regulations</p>	<p>APEX-APX-PRO-0001</p> <p>Revision: 1.3</p> <p>Release: 2009-03-14</p> <p>Category: 1</p> <p>Author: L.-A. Nyman</p>
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APEX Safety Regulations

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APEX - European Southern Observatory

<p><u>Keywords:</u></p> <p style="text-align: center;">Management, Safety</p>		
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<p>Institute: APEX Project Manager</p>	<p>Date: 2009.03.14</p>	
<p><u>Distribution:</u></p> <p>Institute: APEX Council</p> <p>Institute: APEX Project Team</p> <p>Institute: APEX Partner Institutes</p> <p>Institute:</p> <p>Institute:</p>		

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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



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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, incl. APEX staff, staff from APEX partners, contractors and visitors. The applicability of each set of regulations by location is indicated in the title by APEX/SP, if applicable for the APEX base facility near San Pedro de Atacama, and by APEX/CH, if applicable for the APEX telescope site at Chajnantor.

3 Acronyms/Definitions

ACHS	Asociacion Chilena de Seguridad
LSO	La Silla Observatory
SCS	Site Certified Staff

APEX Partners – the signatories of the APEX Memorandum of Understanding:

Max-Planck-Institut fur Radioastronomie (MPIfR),
European Southern Observatory (ESO),
Onsala Space Observatory (OSO), and
Ruhr-Universitat Bochum (RUB).


APEX Site – the site of APEX construction and operations in Chile that consists of

APEX Base located in Sequitor near San Pedro de Atacama (altitude 2440 meters)

APEX Telescope site located in the ALMA Science Reserve on the Chajnantor plateau east of San Pedro de Atacama (altitude 5050 meters)

APEX Staff – the employees of the APEX Partners who are assigned to work on APEX at the APEX Site on a regular basis.

APEX Partner Staff – the employees of the APEX Partners who periodically work on APEX at the APEX Site, but not on a regular basis.

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4 Documents

4.1 Applicable documents

AD-01	APEX Safety Plan	APEX-APX-PLA-0004
AD-02	Manual of ESO's Policies, Rules and Regulations concerning Safety, Health and Environmental Protection; Issue 2, 1 Sep 1997	SAF-POL-ESO-00000-0001
AD-03	APEX Medical Examination	APEX-APX-PRO-0005
AD-04	APEX Visitor Waiver Release Form	APEX-APX-PRO-0003
AD-05	APEX Contractor Waiver Release Form	APEX-APX-PRO-0004
AD-06	APEX Safety Training	APEX-APX-PRO-0002
AD-07	APEX List of Safety Material	APEX-APX-LIS-0001
AD-08	APEX Visitor Instructions	APEX-APX-MAN-0006

4.2 Reference documents

RD-01	The ESO web page on safety and work at high altitude http://www.eso.org/safety/
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5 Before travel to the Sites (APEX/SP and APEX/CH)

5.1 APEX and APEX Partner Staff

Before going to the APEX telescope site all APEX, APEX partner staff and APEX collaborators must have taken the high-altitude medical examination and been certified for work at high altitude as described in AD-03.

5.2 Visitors

Requests to visit the APEX telescope site must be submitted in writing to the APEX Station Manager. APEX can only authorize visits directly related to the APEX project. The APEX Station Manager will inform the ALMA safety officer about the visit.

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.

All visitors to the APEX telescope site must sign the Visitor Waiver & Release Form (AD-04). Visitors should be accompanied by at least one member of the APEX staff who is SCS.

5.3 Contractors

All contractor personnel planning to work at the APEX Site must sign the Contractor Waiver & Release Form (AD-05). Contractors are responsible to perform a proper safety management and are obliged to consider applicable safety, health and environmental rules and regulations.

6 Trips to and from the APEX Telescope site (APEX/CH)


6.1 General

Notify the APEX Station Manager or his representative of all trips to the APEX telescope site. To assist your body to acclimatize to the high altitudes, arrive on the day before at the APEX base camp altitude in San Pedro or Calama for a good sleep before going up to Apex Telescope site on Chajnantor. The first working day after the day of arrival starts at 05:00h local time. Do not drink alcohol for at least 10 hours before the trip. Do not visit the APEX telescope site if you are not feeling well, especially if you have a cold or a respiratory problem, as the stress of the high altitude can worsen your condition.

Mandatorily, the ALMA road is to be used.

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 APEX station manager, 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

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high site. Each time a check point is passed, call the base with the information about the truck, driver, additional persons in the truck and the actual location. Inside the ALMA concession the radio communications protocol of ALMA is to be followed. See 6.2 for the ALMA checkpoints.

A minimum of two people must go up and down if no team is at the antenna on the Chajnantor site to receive. Single person commute is only allowed during daytime and if there is a team already at the high site. 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. Any trip must be monitored by radio by an assignee as a contact person in the APEX base.

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

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

Only drivers who have taken first-aid and high altitude training (AD-06) are permitted to drive to the APEX telescope site alone. Drivers must have a valid Chilean driving license or a license recognized by Chilean authorities.

6.2 ALMA checkpoints:

ALMA checkpoints for radio communications, while on the ALMA road, are:

- The ALMA main gate at the Toconao road at km 15
- The Operations Support Facility (OSF)
- Km 21 of the ALMA road (a blue reminder sign is installed)
- Km 31 of the ALMA road (a blue reminder sign is installed)
- Km 41 of the ALMA road (a blue reminder sign is installed)
- The APEX antenna site

At these locations the ALMA safety officers are to be informed about the commute status. This is done by switching to "Channel 4" on the APEX radios.


Single trip procedure:

Channel 1 (APEX channel):

- Check out at APEX Sequitor base
- Notify upon arrival at ALMA access gate

Channel 4 (ALMA safety channel):

- Check in at ALMA access gate
- Notify upon passing OSF
- Notify upon passing km 21
- Notify upon passing km 31
- Notify upon passing km 41

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- Notify upon arrival at APEX antenna
- Channel 1 (APEX channel):
- Notify upon arrival at APEX antenna

When leaving the high site of APEX, proceed in reverse order.

6.3 Before leaving:

All vehicles going to the APEX telescope site must be equipped as specified in the APEX List of Safety Materials (AD-07).

Depending on the activities at the APEX telescope site one or two Site Certified Staff (SCS) may be assigned for the work during the day. The SCS checks the amount of fuel in the cars and fill up (or request to fill up) the fuel tanks if it is necessary. They also check the safety equipment and make sure that there is enough oxygen bottles in each car and that they are operative. The SCS should be informed in advance how many people are going and how many cars are needed. The SCS fills in the car log book for departure after verifying the condition and the equipment in the car.

Before leaving, the driver should in any case:

- Check that the tank is at least $\frac{3}{4}$ full. If it is less, fill up the tank.
- Check that no safety equipment is missing (there is a list in the log book).
- Make sure that there are enough oxygen bottles in the car.
- Make sure that the car log book is filled in and verify that the safety checks have been performed.
- Check that the radio is working and report that you are leaving. If you are the first person to leave the base on that day, make sure that the assigned person in the base camp listens to the radio.
- Always carry drinking water in the car.

6.4 During the trip:


- The driver shall report the departure on the radio and the estimated arrival time to APEX (on channel 1)
- The driver shall report to the ALMA safety officer during commute on the ALMA road (on channel 4).
- The driver shall report any problems or any abnormal conditions through the radio.

6.5 Arrival to the APEX telescope site:

The driver must report on radio (to ALMA on channel 4, and to APEX on channel 1) or by phone to the APEX Base that (s)he has arrived.

6.6 Leaving the APEX telescope site:

Report by radio or phone to the APEX Base that you are leaving. Any trip to or from the antenna must be monitored from the APEX Base. Equally, report to ALMA on channel 4

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6.7 Arriving to the APEX base:

- Report that you have arrived.
- Fill in the car log book.

7 Work on Site (APEX/SP and APEX/CH)

7.1 Work at the APEX Telescope site (APEX/CH)

There must always be at least two people working on the site. One of these people must be a Site Certified Staff (SCS) trained in accordance with AD-06.

You should try to be aware of your own state of health, and also try to determine if anybody else has problems. Working without someone in the immediate vicinity to monitor your state of health is not allowed on any person's first day working at the telescope. If you work alone in a place, always carry a walkie-talkie or the wireless phone and appoint somebody to check on you periodically.

It is strongly recommended to use oxygen during work on site. Monitor the oxygen saturation level in your blood regularly. If you are not using oxygen and the saturation level goes below 80%, start to use oxygen immediately (recommended by Dr. Sandoval, the high altitude expert giving the APEX training courses). People going to the APEX telescope site for the first time should always use oxygen.


If you feel sick, notify the APEX Base and a co-worker at the telescope, and arrange to descend immediately.

It is recommended to stay no more than 6 hours on the site the first day of the shift, and no more than 8 hours the following days. Specific authorization by the APEX Station Manager is required to stay on the site for more than 10 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, contact ALMA safety for prospects on road clearance. Only if ALMA recommends AND the safety responsible staff at APEX authorize (see posted lists of safety responsible staff in control rooms), you may leave by the Paso de Jama or the ACT road (this reaches the Paso Jama at km 35). Always inform the APEX Sequitor base about which road you take. Use APEX radio channel 2 on the ALMA road for direct contact with the APEX base (the radio repeater on Cerro Chico is not reachable during some parts of the ALMA road). Usually the ALMA road will be cleared from obstacles/snow much quicker than the public Paso de Jama. The APEX antenna site is equipped sufficiently to stand longer waiting hours.

7.2 Work on the Antenna (APEX/CH)

All personnel operating the antenna must have received training on antenna operation (AD-06).

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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 Chajnantor or San Pedro).

- Everybody working on 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 this is not possible, everybody working in the antenna should be aware of this unsafe condition.
- 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 should always be used during work on the platform, in the focus cabins and below the antenna.
- If you plan to work alone in the antenna, always appoint somebody else to check on you periodically. You must carry a walkie-talkie with you.

7.3 Work with the Cherry Picker (APEX/CH)


All personnel working with the cherry picker must have received training on operation of the cherry picker (AD-06).

- Always use a safety belt when you are in the cherry picker.
- The cherry picker 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 cherry picker is operated within the area of the antenna.
- The cherry picker 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 cherry picker should not be used.

7.4 Work with Hazardous Materials and Conditions (APEX/SP & APEX/CH)

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

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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-06)

All hazardous materials used at the site shall be recorded and approved prior to their use by the APEX Station Manager. A list of hazardous materials as well as information about them shall be available at the APEX telescope site and the APEX base.

8 Emergency Procedures (APEX/SP and APEX/CH)

8.1 In case of an accident


- Follow the instructions of the safety responsible present at the site or a staff member trained in first aid procedures.
- Call the APEX Base and make sure that the information is passed to the Station Manager or his safety representative.
- APEX has an agreement with ALMA about the use of the ALMA first aid station and assistance from the ALMA paramedics. Call ALMA safety on channel 4 for assistance.
- Call Asociacion Chilena de Seguridad (ACHS) in Calama and ask for instructions. If necessary ACHS will contact the San Pedro first aid station and police. APEX has an agreement with ACHS for treatment of APEX staff and APEX visitors. If there is no answer by ACHS, call the first aid station in San Pedro and get instructions from the paramedic. Ask the paramedic to contact Asociacion Chilena de Seguridad (ACHS).
- Call the APEX Base and make sure that the information is passed to the Station Manager or his representative

Phone numbers:

In order to dial out from the San Pedro base, use 0 (or 1) and your personal code, then dial the number given below. From Chajnantor, dial 9 – tone – 0 (or 1) personal code – number given below. The intention is to connect the emergency numbers given below directly to the telephone plant, and it should not be necessary to dial the personal code.

ACHS in Calama:

055 34 08 26

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First aid station San Pedro:	055 85 10 10
San Pedro police (Carabineros):	055 85 10 03
San Pedro police (from mobile phone):	133
San Pedro fire brigade:	055 85 10 74

APEX base: 055 448 200 or 055 448 230
(see telephone list for extension numbers)

David Rabanus (Station Manager):	097 899 7825
Andreas Lundgren (Deputy)	099 915 6773
Juan Fluxá (Safety Officer):	099 429 3409
Rodrigo Olivares (Safety Officer Deputy)	099 845 1111
Ernesto Orrego (Administrator):	097 968 0871
ALMA Paramedics/First Aid Station	055 448 555
ALMA Safety Manager	055 448 417

8.2 In case of fire

- If it is possible to control the fire, always use a fire extinguisher.
- If the fire is out of control, evacuate everybody to the designated safety area close to the Sequitor 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.

8.3 Car accident

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 in 8.1 above. If necessary, contact the San Pedro first aid station, police or fire brigade. Concentrate yourself on the health condition of your party and yourself.


8.4 Overnight stay at telescope site

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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.

8.5 Accident/incident reporting

Any accident or incident at the APEX base, the APEX telescope site or during driving shall be reported directly to the Station Manager or his representative.

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9 Personal Protection Measures (APEX/SP and APEX/CH)

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


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 lighting rule: If you see it, flee it. If you hear it, clear it.

The Bolivian 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.

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

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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.

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.