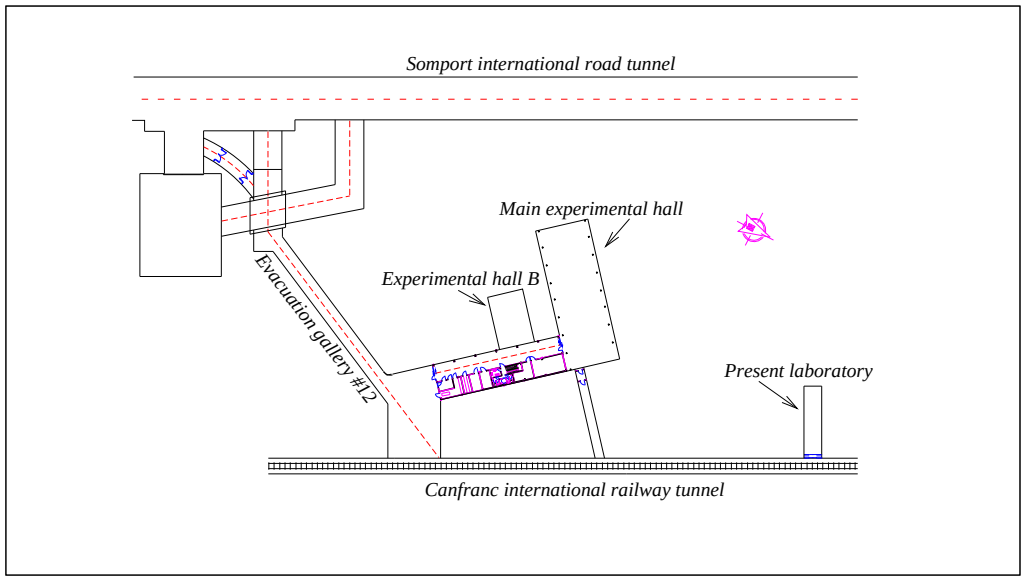
N2 – WP2 – Safety report

Canfranc Underground Laboratory (LSC)

November 2004

1 Access to the experimental area

The Canfranc Underground Laboratory (LSC) is located inside the Canfranc railway tunnel (~ 6 km long, not in use), in the Spanish Aragonese Pyrenees, connecting Spain and France. The laboratory is being significantly enlarged with two new experimental halls 50 m from the old facility, in a zone between the railway tunnel and the new Somport road tunnel, which flows parallel to the railway tunnel (see figure). The access to the laboratory is made from the Spanish side of the road tunnel, through a bypass connecting the road tunnel with an evacuation gallery (number 12).



There is a security protocol which is integrated in the security normative of the road tunnel. As an example, the protocol for the entrance and leaving which is used for the present laboratory is the following:

- Vehicles entering the lab have to show their identification at the road tunnel entrance.
- They are escorted by an official road tunnel van from the entrance of the road tunnel to the lab entrance (bypass).
- From the tunnel control room, traffic lights are set to yellow light in the zone at the entrance of the lab, the speed limit is changed to 40 km/h in that zone (by means of announcements in electronic display panels), and a system of video monitoring at the entrance of the lab is activated.
- The van activates its rotary lights and slows down near the entrance of the lab.
- The lab vehicle turns right at the entrance of the lab. The van continues ahead and turns round at an appropriate place.

- Before leaving the laboratory, it is necessary to phone to the tunnel control room. They send an official road tunnel van to escort the lab vehicle from the exit of the lab to the outside of the tunnel. They also set the yellow lights, the speed limit and the video monitoring at the entrance of the laboratory.
- The road tunnel van arrives to the entrance of the lab and escorts the lab vehicle to the French exit of the tunnel (since it is forbidden to turn left to the Spanish side), where it turns round and comes back to the Spanish side.
- When the new laboratory is ready, the access to the lab will be done by using an electronic card and the entrance will be registered at both computers in the tunnel control center and in the laboratory.

2 Fire and evacuation

The general type of security measurements of the lab against fire risk are determined by the Spanish Building Basic Normative NBE-CPI-96. Besides them, there are specific security measurements for different zones inside the lab according to the risk level of the activities that will be carried out in each one. Following this approach, the whole laboratory is divided into thirteen sectors, which include the experimental halls, the container of chemical and waste spillage, offices, workshop, clean room and rooms of electric power and equipments.

From the underground character of the Canfranc laboratory, the NBE-CPI normative specifies that the stability and resistence against fire of the walls will be of 120 minutes. Doors between different fire sectors will have a resistence of 60 minutes. For sectors of special risk (low: experimental halls, workshop and tank of spillage) the covering material of walls and ceiling will be of M1 class.

There will be two exits out of the new LSC. The first one uses the evacuation gallery number 12 of the tunnel. Besides this exit, there will be a completely new gallery which will connect the lab to the railway tunnel. According to the normative, the length between an origin of evacuation and one of the exits will be less than 50 meters. The dimensions of the different elements (doors, stairs, corridors) have been designed following the NBE-CPI normative for a maximum number of 130 people inside the lab (which accounts for a maximum occupation of one person for every $10\,\mathrm{m}^2$).

There will be a number of temperature and smoke detectors inside the lab, together with 16 alarm switches next to each exit door, which will complement the automatic detection, and electronic alarm sirens. Fire extinguishers will be distributed inside the lab in such a way that the minimum distance from any point to a fire extinguisher will be less than $15\,\mathrm{m}$. Besides this, there will be an automatic system of fire extinction by CO_2 which will be installed in the electric plant, low voltage room and in the experimental halls, where it will be possible to direct the gas to the appropriate places according to the specific experimental set-ups. All information coming from fire detectors and alarm switches, and the corresponding actions to follow, will be managed by the laboratory automatic control system, which will have a permanent connection with the tunnel control center.

3 Ventilation

Vents and return air ducts ensure 1.5 renovations per hour of the total volume of new air and 3 renovations per hour of the conditioned air. The main hall will be maintained in overpressure conditions with respect to the rest of the laboratory to avoid external contaminations. More than 40% of the total volume of air in the lab, $25000\,\mathrm{m}^3$/h, will be fresh air, the rest being circulating air. At the entrance of the external air, there will be sensors to control its quality.

All sectors of the lab will have an independent exhaust system for fumes. Smoke extraction will be possible at the main hall by means of an special fan of $27600\,\mathrm{m}^3$/h. Sensors of dangerous gases (CO, NO, NO_2) and sensitive to oxygen absence will be situated in appropriate places, including the clean room, the storage room for special gases, and, of course, at the air entrance of the lab. The corresponding alarms will be managed from the control room inside the laboratory, which has an independent, conditioning, air entrance, and which will be in permanent contact with the tunnel control room and with the information center at the University of Zaragoza.

Temperature and humidity will be measured at the exit of the main experimental hall, ensuring that their values are around $18 - 20°$and 50%, respectively.

4 Waste spillage and chemical products

All spillages that may be produced inside the experimental hall will be collected by a peripheral circuit, which will transfer them to two concrete tanks, of $500\,\mathrm{l}$ each, where they will be stored until removal by specialized personnel. Two other tanks of $1000\,\mathrm{l}$ will serve to store dangerous residues. All these tanks will be situated a small excavation of $5 \times 3 \times 5\,\mathrm{m}^3$, having adequate ventilation and sensors of toxic gases.

The storage of dangerous chemical products (alcohols, acids, inflammable liquids, solvents, etc.) will be limited and, in any case, kept in appropriate places according to the Spanish normative.

5 Cryogenic liquids

Cryogenic liquids will be stored outside the tunnel and transported inside in an adequate vehicle when needed. They will be managed by specialized workers that will carry personal sensors of oxygen absence. Ar and N_2 gas will be conducted through two different circuits provided with the same kind of sensors from the bottles at the entrance of the lab at supply pressure (not dangerous).