وزارة السياحة
المديرية العامة للشؤون السياحية
الرقم ١٧٢٩
ورد في ١٦/٣/٢٠١٦

وزارة السياحة
مصلحة الاستثمار
الرقم ١٨٨/ل
ورد في ١٦/٣/٢٠١٦

SOCOTEC

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بيروت في 2016/03/15

جانب وزارة السياحة الموقرة،
حضرة معالي وزير السياحة الاستاذ ميشال فرعون المحترم،

المرجع: RM/RH/16.0416
رقم الملف: 016.0018

الموضوع: التقرير الفني والتقني النهائي لعمليات الكشف على المغارتين السفلى والعليا الواقعتان ضمن مرفق جعيتا السياحي

تحية طيبة وبعد،

بالاشارة إلى قرار معالي وزير السياحة الاستاذ ميشال فرعون رقم 10 تاريخ 2016/2/1 الذي كلف بموجبه شركة سوكوتيك لبنان ش.م.م. بإجراء الكشف التقني والفني على المغارتين السفلى والعليا في مرفق جعيتا السياحي، نودعكم ربطاً التقرير الفني والتقني النهائي المتعلق بنتائج عمليات الكشف التقني التي قامت به الشركة (المرحلة الثانية من القرار) على المغارتين السفلى والعليا والذي يتضمن الإجراءات الواجب إعتمادها لضمان سلامة السياح والزوار.

وتفضلوا بقبول فائق الاحترام،

المدير العام

SOCOTEC Technical Control Office LIBAN

المهندس رولان معري

Contact : Tél. : 01328189 - Fax : 01218310 - E-mail :roland.marie@socotec-liban.com

JEITA GROTTO

LIFE & FIRE SAFETY INSPECTION

Ministry of Tourism Decision No10 dated 1st of February 2016

Phase II – Detailed Inspection Report
Lower & Upper Caves

PREPARED BY SOCOTEC LIBAN
TO: **Ministry of Tourism**
ATTENTION: **His Excellency Mr. Michel PHARAON Minister of Tourism**
Beirut – Lebanon
DATE: 15th of March, 2016
REF.: RH/RM/16.0416
File No.: 16.0018

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SUMMARY

1. PREAMBLE

2. DESCRIPTION OF THE SITE

3. DOCUMENTS OF REFERENCE

4. FINDINGS & PHOTOGRAPHIC SURVEY

5. RECOMMENDATIONS

6. APPENDIX 1 – LOWER GROTTO - GENERAL LAYOUT – MAJOR REMARKS

7. APPENDIX 2 - LOWER GROTTO - GENERAL LAYOUT – MAJOR SAFETY RECOMMERNDATIONS FOR EMBARKATION AREA

1 - PREAMBLE

The present report is established within the scope of our technical inspection mission related to the JEITA caves based on the decision No. 10 dated 01/02/2016 of his Excellency Mr. Michel PHARAON Minister of Tourism. This decision follows the regrettable incident that had cost the life of an Egyptian tourist inside the lower grotto on the 23rd of January 2016.

SOCOTEC Liban's inspection mission is related to the life and fire safety of the lower and upper caves' occupants and visitors. The purpose of this audit is to detect all major risks that could endanger the occupant safety and to check the conformity of the current status of the two caves (Lower and Upper Grottos) with the applicable Safety Norms and Standards.

The present report includes a detailed description of the two caves current status with regards to the life safety point of view as well as the related recommendations aiming to enhance the level of safety inside these two caves. The structures covered by SOCOTEC LIBAN's audit are the following:

- Lower cave
- Upper cave
- Related equipment

The present report constitutes the phase II of our mission as specified in the Ministry of Tourism Decision No.10 dated 01/02/2016.

Our inspection mission was conducted by a team of qualified expert engineers disposing of a solid experience in the life safety field:
Mr. Dany ISSA: Senior Civil Engineer specialized in Life Safety.
Mr. Ahmad FAWAZ: Senior Electrical Engineer specialized in Life Safety.
Mr. Rabih TAWIL: Senior Mechanical Engineer specialized in Life Safety.

This team dedicated to the audit mission was managed by Mr. Roland Marie General Manager of SOCOTEC Liban, expert in life safety and licensed in this domain by the French Ministry of Interior.

Our inspection methodology was based on the following:

- Detailed visual inspections
- Miscellaneous measurement operations

Our mission has not covered the hazards aspects related to geology, hydrology, seismicity, ceiling stability of the grotto, cable car (Téléphérique) and train.

Our in situ inspections took place on January 29th, 2016 as well as on February 03rd, 2016..

2 - DESCRIPTION OF THE SITE

The Touristic Jeita Grotto site is composed of two caves (Upper Grotto and Lower Grotto).

The Lower cave can be visited by boat and is composed of a main entrance, a stair leading to a waiting area and a boarding dock serving four boats. Each Boat can accommodate 12 persons on board. The river tour lasts for about 15 to 20 minutes.

The Upper Grotto can be visited by walking and is composed of a main entrance, a Tunnel and a walkway of around 750m through the grotto.

The site is equipped with a cable car, a projection room, a restaurant, a gift shop and a train.

SOCOTEC Liban's mission concerns the inside space of two caves including all related equipment.

3 - DOCUMENTS OF REFERENCE

The following documents of Reference have been taken as a basis in our technical inspection of the caves safety provisions:

- Arrêté du 28 Avril 1999 portant règlementation des mesures de sécurité applicables dans les cavités naturelles aménagées pour recevoir du public.
- Arrêté modifié du 25 juin 1980 relatif aux établissements recevant du public. (Règlement Français).
- Norme NF C 15-100 concernant les installations électriques.
- Norme NF P01-012 : Règles de sécurité relatives aux dimensions des garde-corps et rampes d'escalier
- Sécurité et équipement des bateaux de plaisance naviguant sur les eaux intérieures - Arrêtés du11/4/2012, 16/12/2010 et 23/11/2007).
- Règles de l'art.

4 – FINDINGS & PHOTOGRAPHIC SURVEY

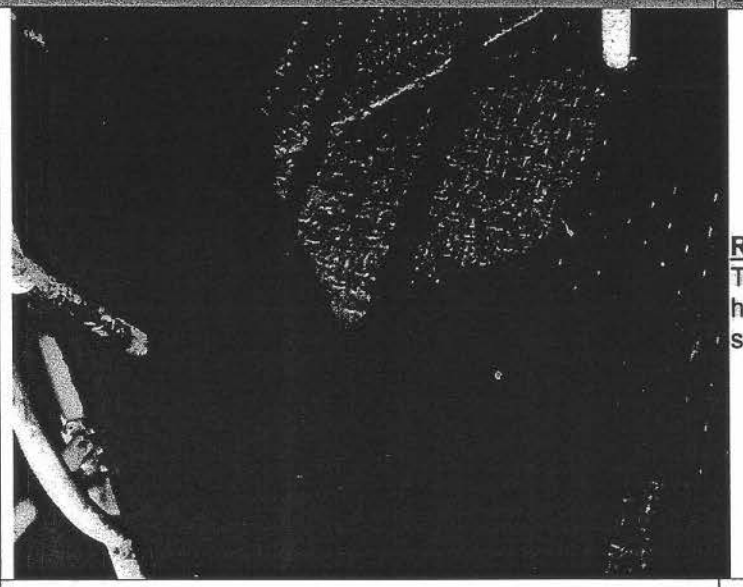
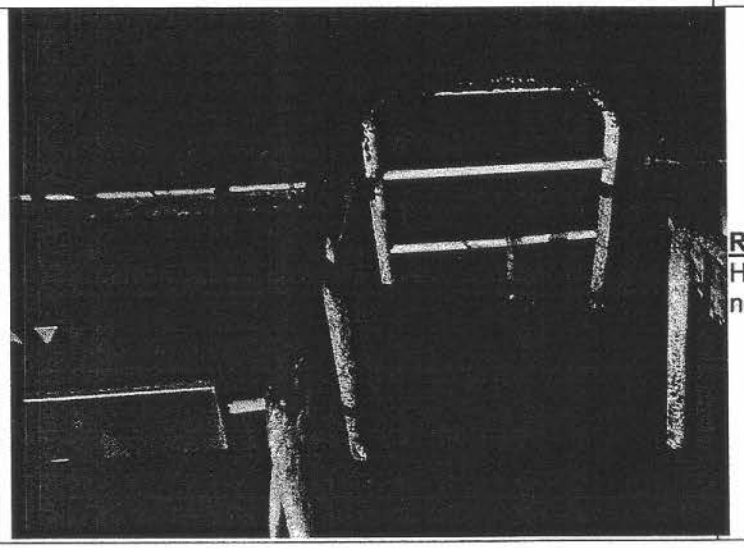
SOOTEC LIBAN's intervention on site took place on the 29th of January 2016 and on the 3rd of February 2016.

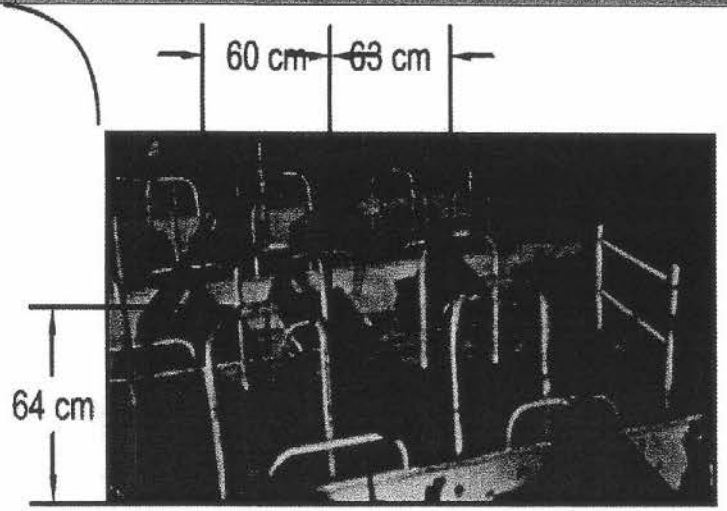
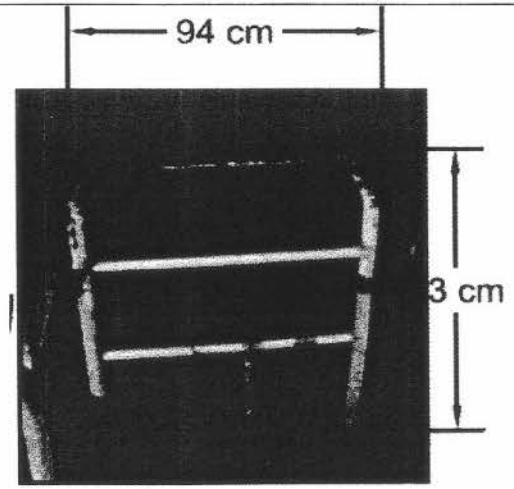
It has concerned both the lower and the upper caves including their related technical equipment. Our findings that were based on a detailed visual inspection of the accessible and apparent parts of the caves and their equipment are summarized in the following table:

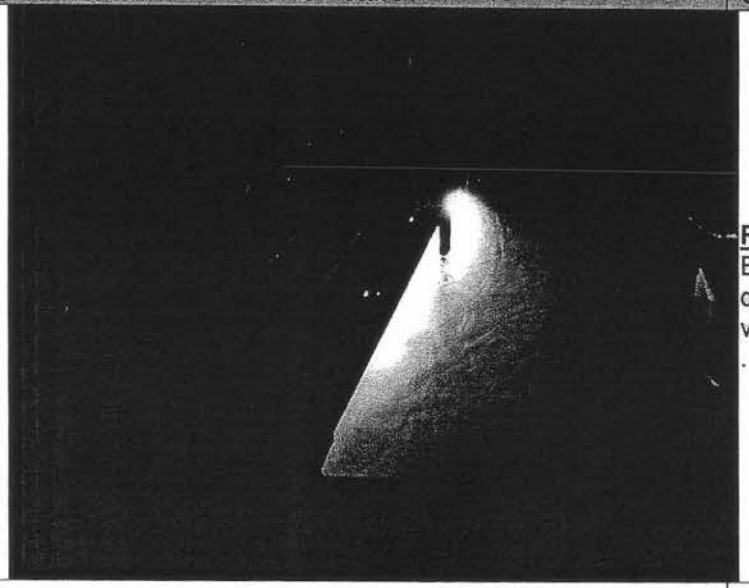
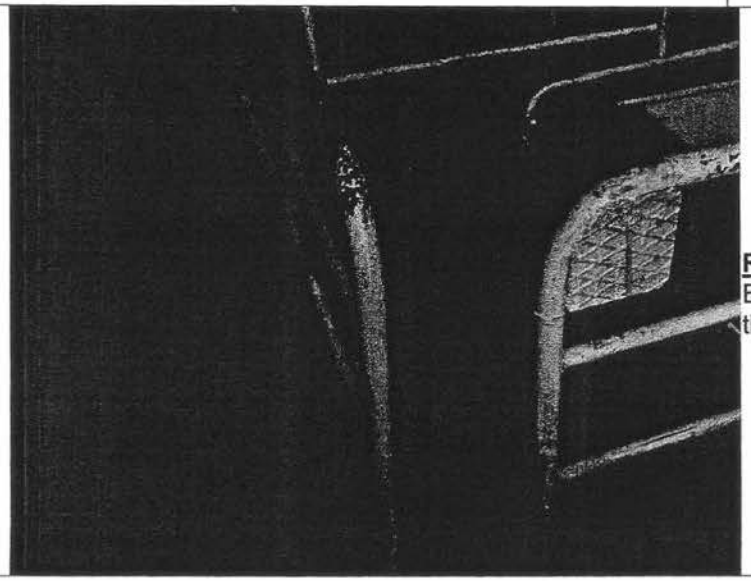
It is to be noted that each remark or observation in these tables is affected by a letter "Px" indicating the order of priority for remedial actions. This order of priority is defined as follows:

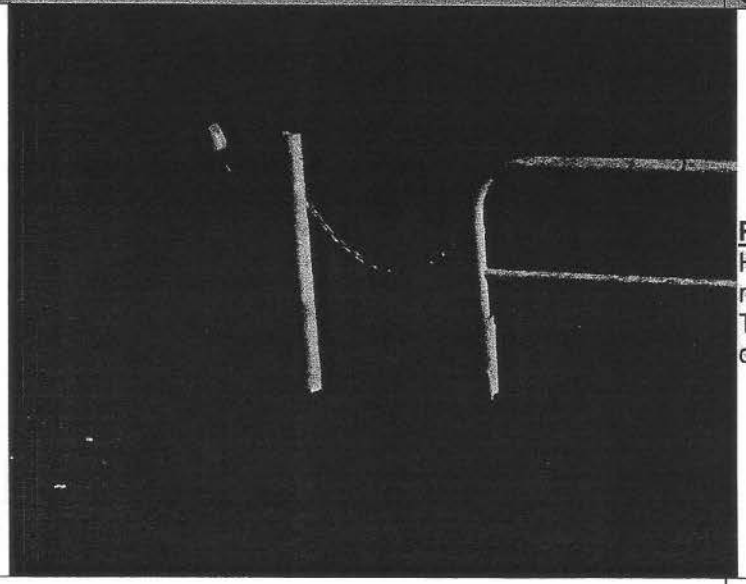
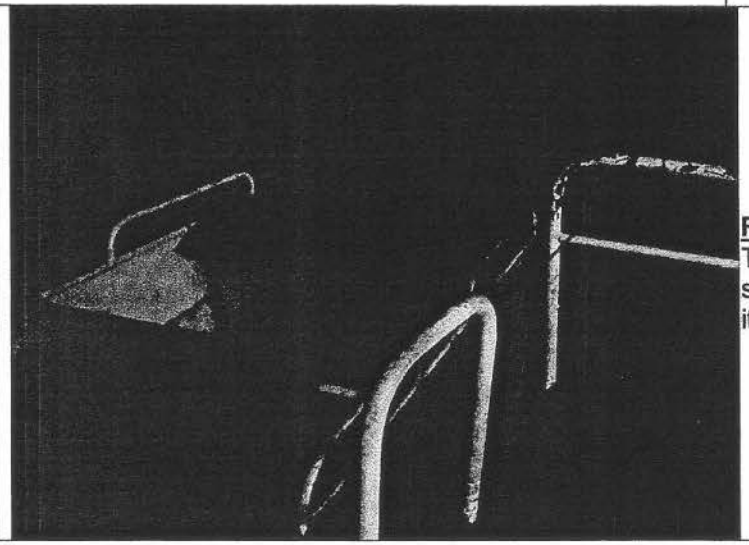
P1: Urgent.
P2: action to be undertaken in the upcoming 2-5 months.
P3: action to be undertaken in the upcoming 6-12 months.

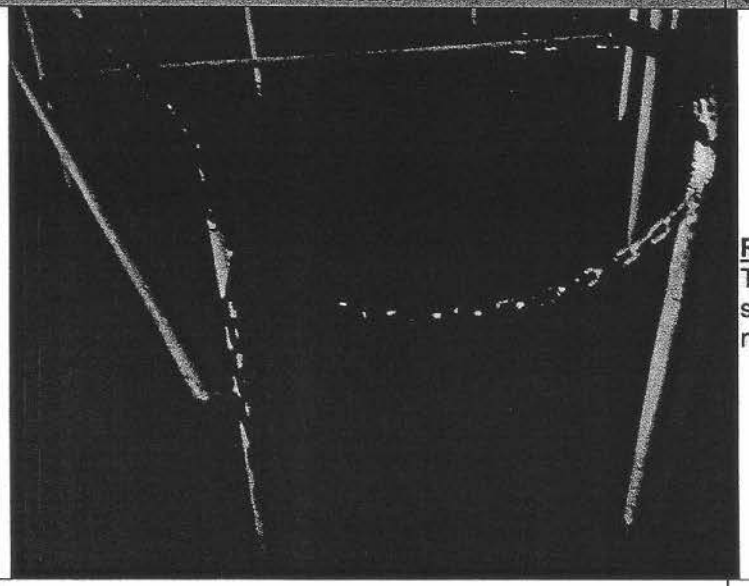
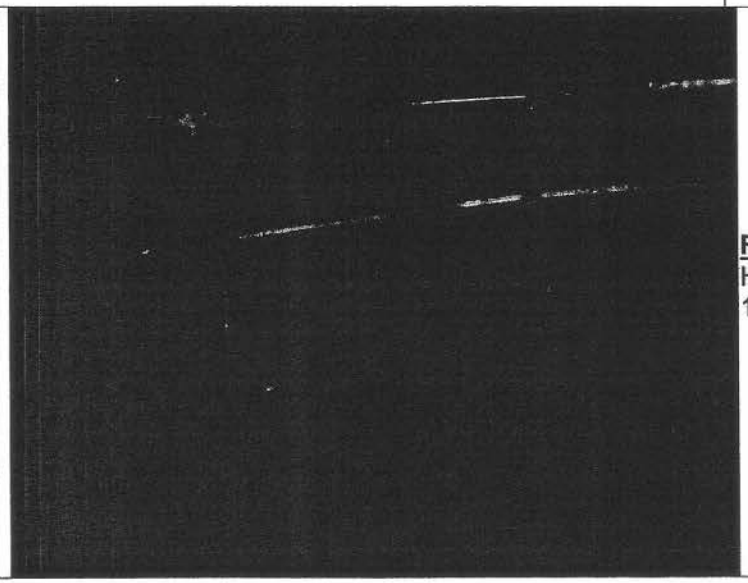
A- Lower Cave (Refer to Appendix 1 of the present report)

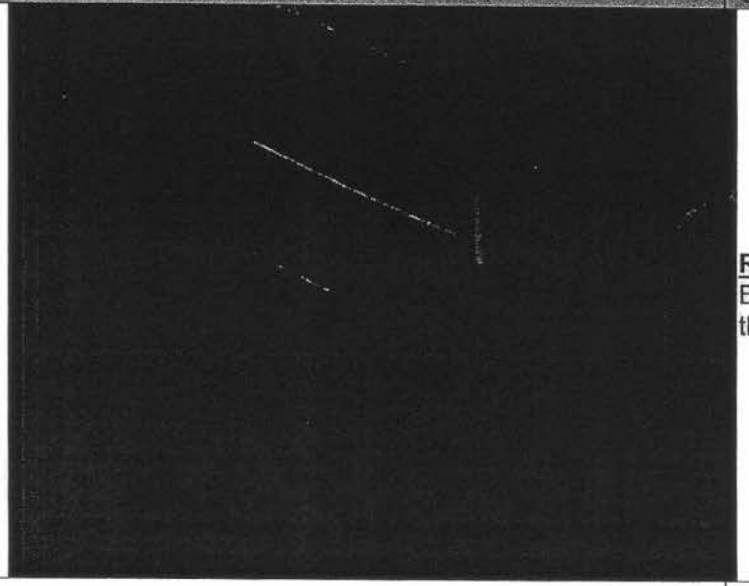
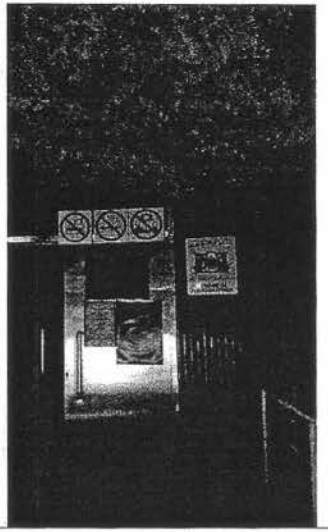
Location	Picture	Observation	P1	P2	P3
Lower Grotto		**R1:** Traces of corrosion on the steel plates of the dock, holes and weaknesses points. These steel plates should be replaced.	x		
Lower Grotto		**R2:** Height of guardrails at dock area is less than 1m and not conforming to standard (NF P01-012).	x		

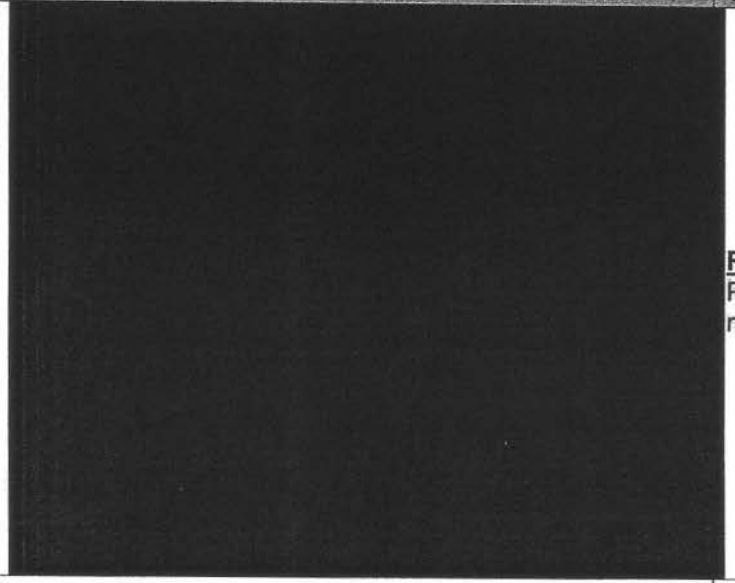
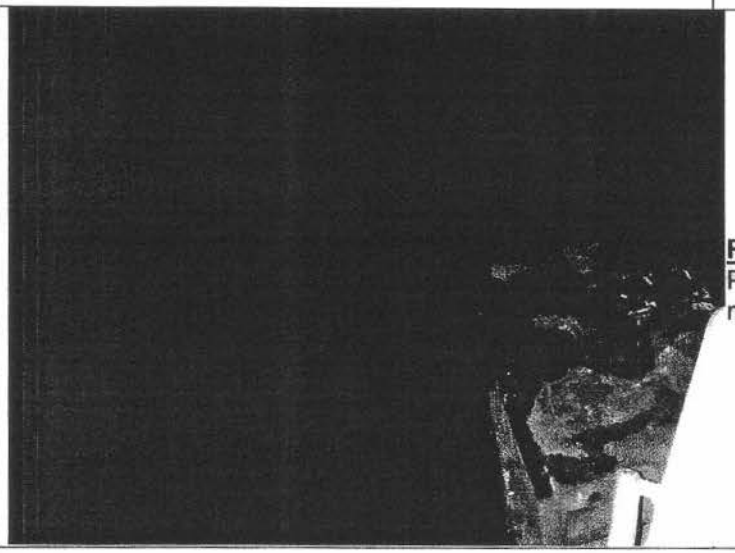
Location	Picture	Observation	P1	P2	P3
Lower Grotto		**R3:** Height of guardrails at dock area is less than 1m and not conforming to standard (NF P01-012). Horizontal voids between guardrails of 63 cm: falling hazard.	x		
Lower Grotto		**R4:** Height of guardrails at dock area is less than 1m and not conforming to standard (NF P01-012).	x		

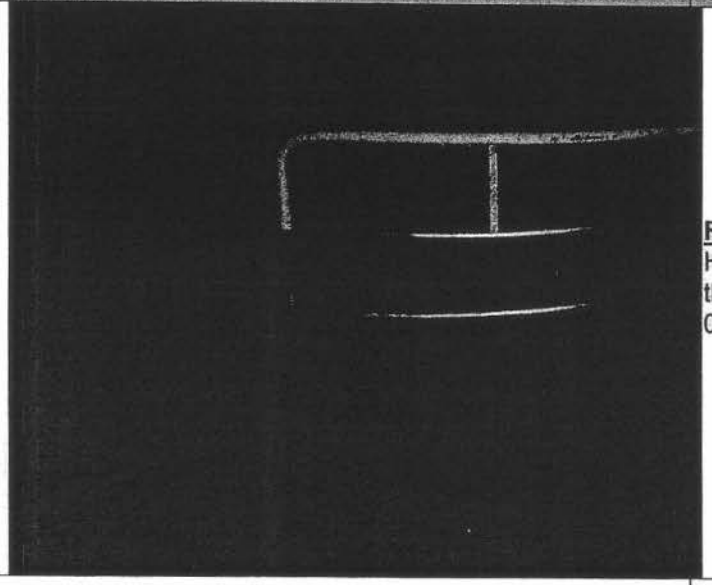
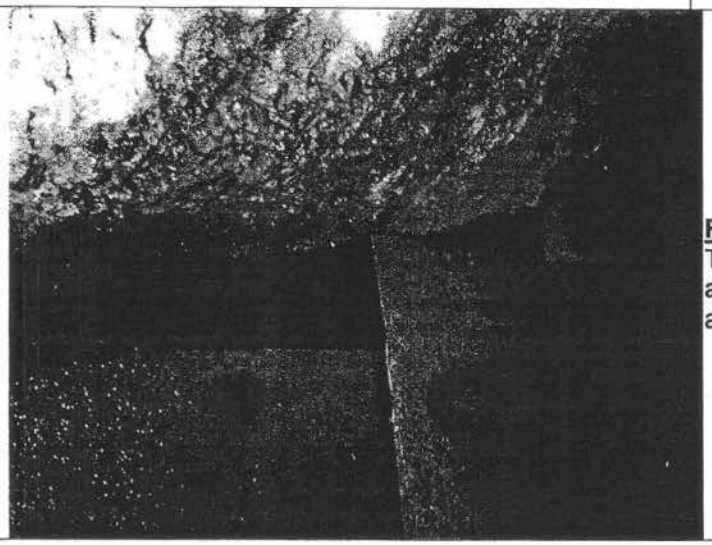
Location	Picture	Observation	P1	P2	P3
Lower Grotto		**R5:** Easy access service stair at the right side of the dock that may constitute a source of hazard for visitors. To be isolated.	x		
Lower Grotto		**R6:** Existence of a gap between guardrails that is greater than 5 cm. To be closed.	x		

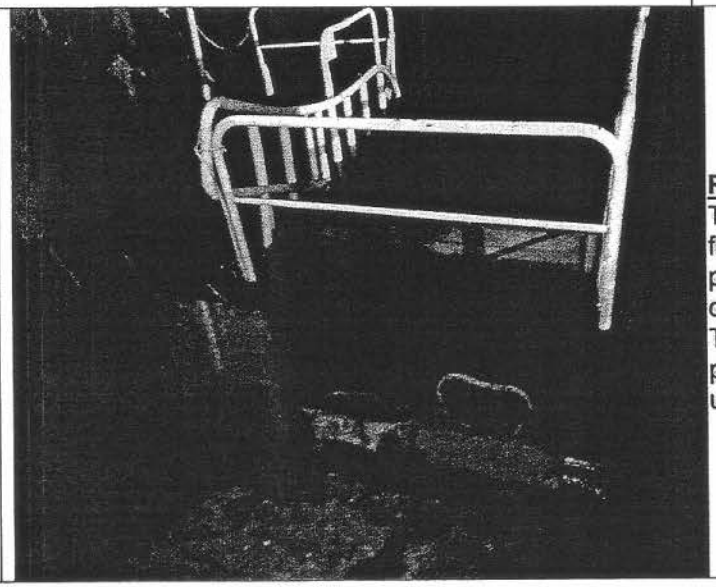
Location	Picture	Observation	P1	P2	P3
Lower Grotto		**R7:** Height of guardrails at dock area is less than 1m and not conforming to standard (NF P01-012). The chain should be replaced by a guardrail or by a closing gate of minimum 1m height.	x		
Lower Grotto		**R8:** The boat at the dock area is fixed by a rope. It should be fixed mechanically to the dock to ensure its stability.	x		

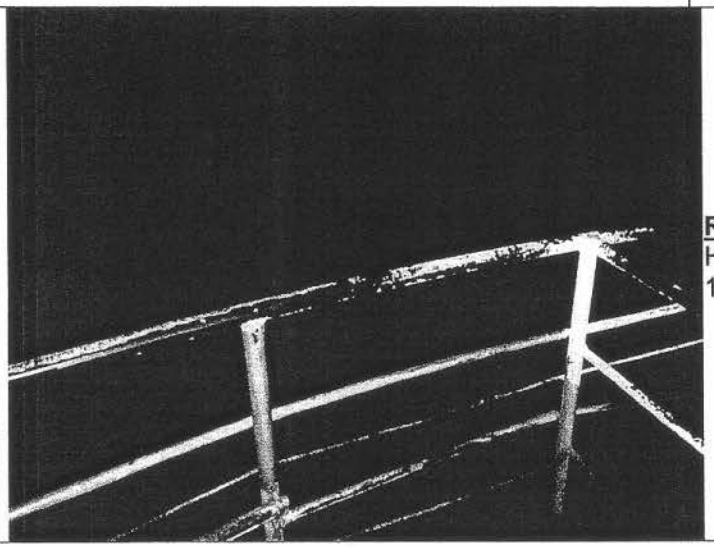
Location	Picture	Observation	P1	P2	P3
Lower Grotto		**R9:** The Chain at the end of the visitors waiting area should be replaced by an access door permanently monitored by the cave agent.		x	
Lower Grotto		**R10:** Height of guardrails at the waiting area is less than 1m and not conforming to standard (NF P01-012).	x		

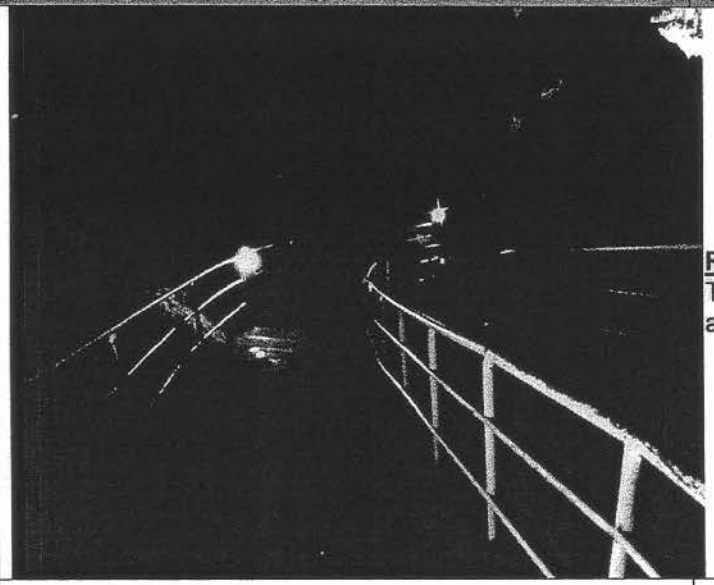
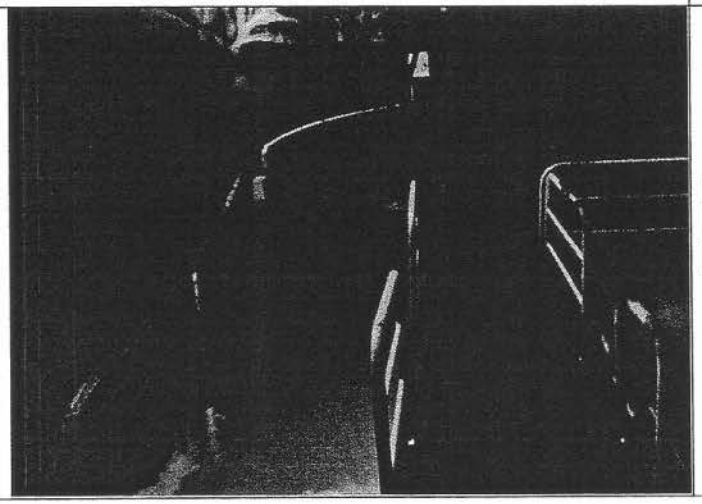
Location	Picture	Observation	P1	P2	P3
Lower Grotto		**R11:** Existence of gap between guardrails that is greater than 5 cm. To be closed.	x		
Lower Grotto	 	**R12:** There are insufficient warning signs and safety instructions inside the lower grotto and currently signs are limited to : - **Non-Smoking** - **Don't touch the rocks** - **No food inside grotto** - **No photography** - **Slippery Floor**	x		

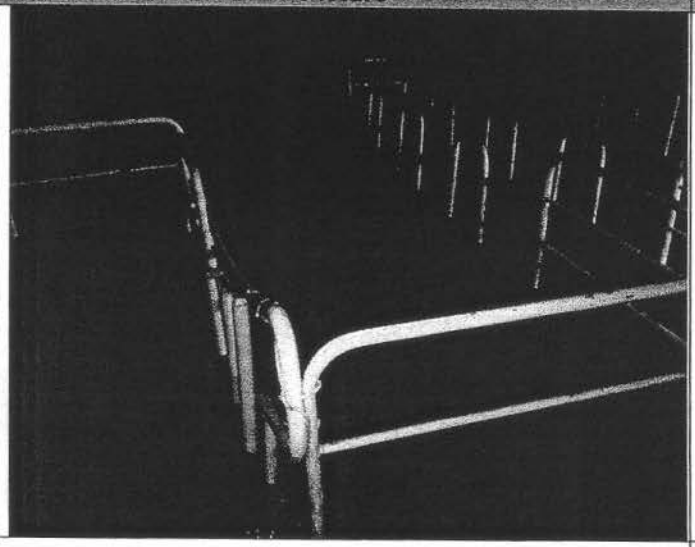
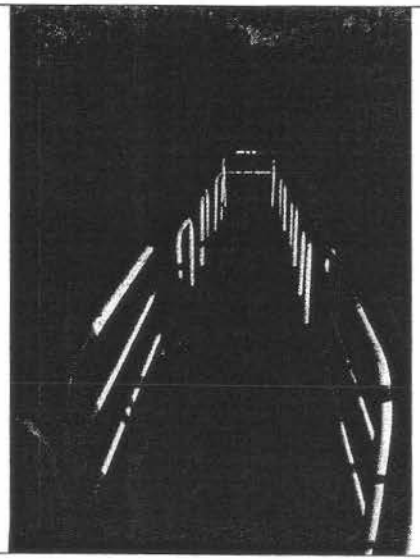
Location	Picture	Observation	P1	P2	P3
Lower Grotto		**R13:** Provide Guardrail behind the concrete bench in the middle of the stair. Major falling hazard.	x		
Lower Grotto		**R13:** Provide Guardrail behind the concrete bench in the middle of the stair. Major falling hazard.	x		

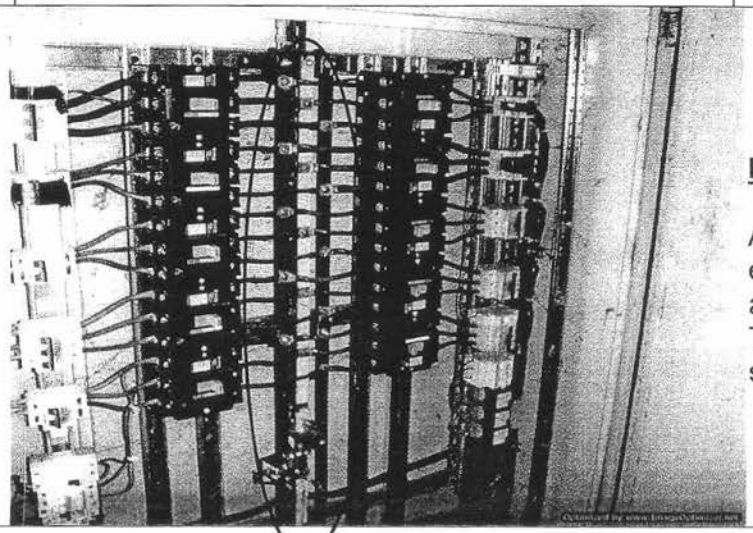
Location	Picture	Observation	P1	P2	P3
Lower Grotto		**R14:** Height of guardrails near the concrete bench is less than 1m and is not conforming to standard (NF P01-012).	x		
Lower Grotto		**R15:** The void between the waiting area and the rock along the left rock wall should be closed (hazardous area for visitors).	x		

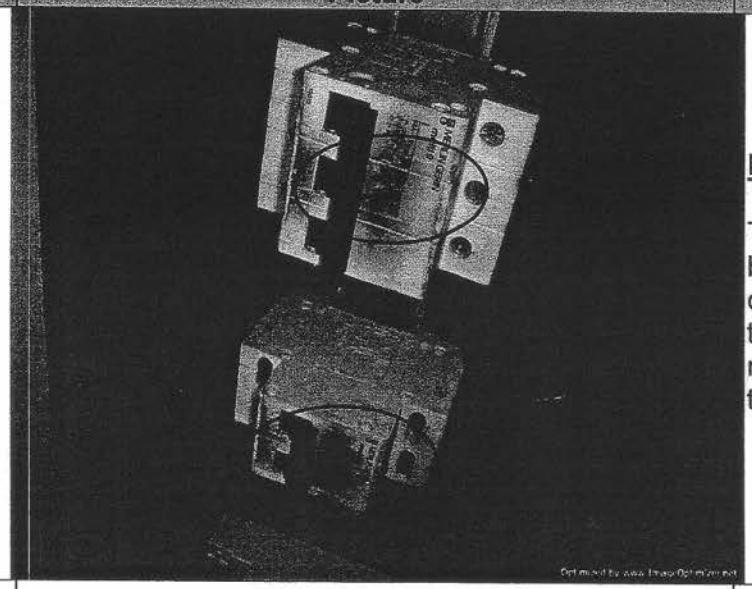
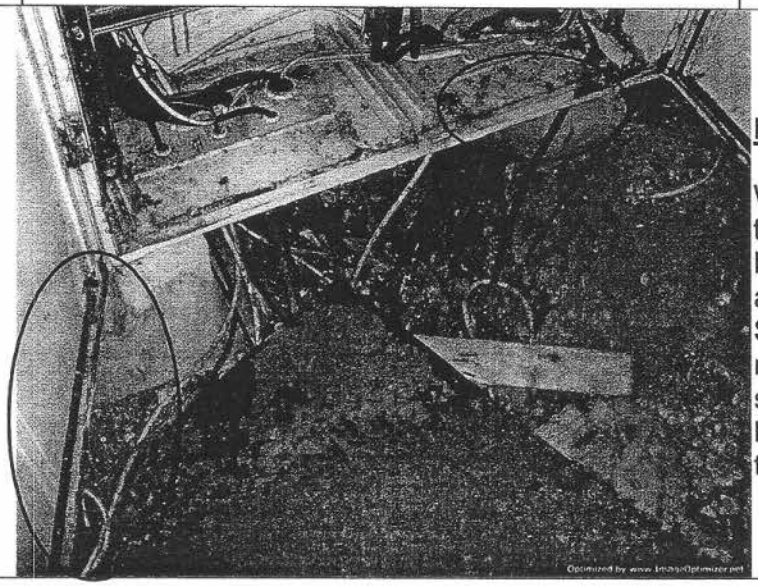
Location	Picture	Observation	P1	P2	P3
Lower Grotto		**R16:** The bottom part of the main stair leading to the waiting area has a width exceeding 2.4m (> 4 UP). Provide an intermediate handrail in the middle of the stair. (Height not less than 90cm)		x	
Lower Grotto		**R17:** The two water level control devices located on the floor between the waiting area and the dock presents obstacles in their opened position which can be dangerous for visitors (risk of stumbling). They should be marked and surrounded by protection barriers; otherwise they should be kept unopened in the presence of visitors.	x		

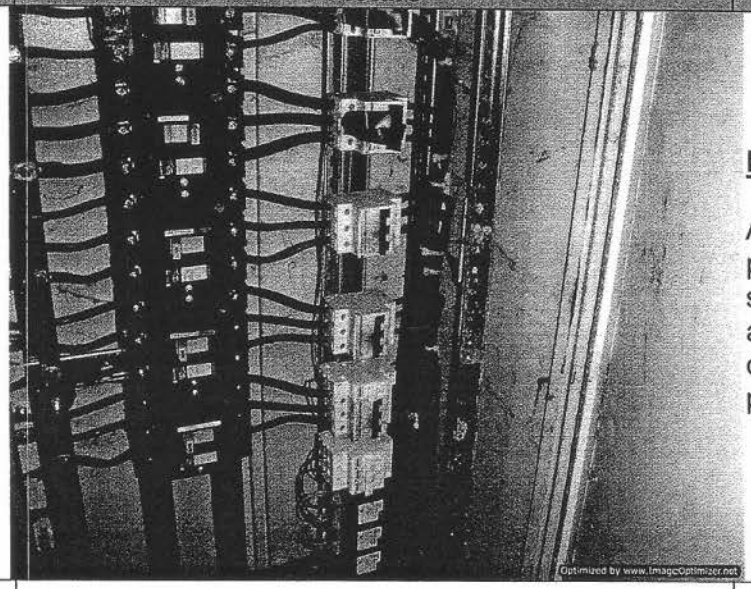
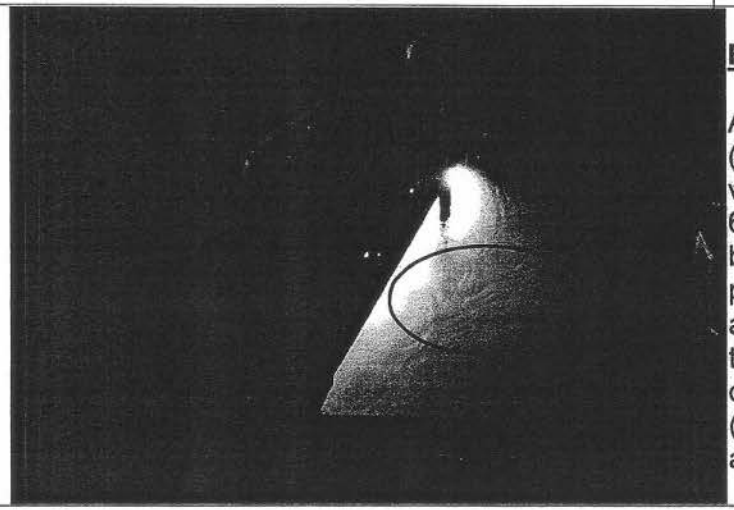
Location	Picture	Observation	P1	P2	P3
Lower Grotto		**R18:** Since the load of occupancy inside the cave is exceeding 50 persons, the door at the main entrance should open to the outside in egress direction and should open easily from inside without the use of keys (Provide a fire Exit hardware or panic bar).	x		
Lower Grotto		**R19:** Height of guardrails in the waiting area is less than 1m and is not conforming to standard (NF P01-012).	x		

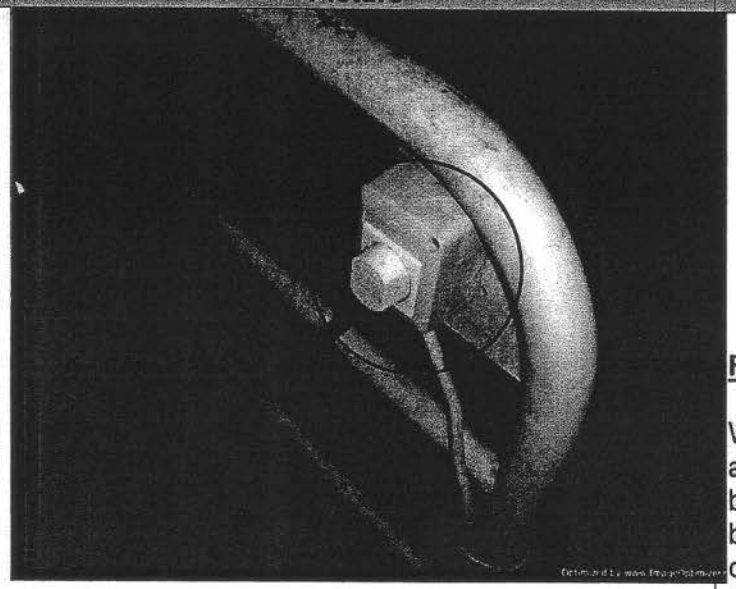
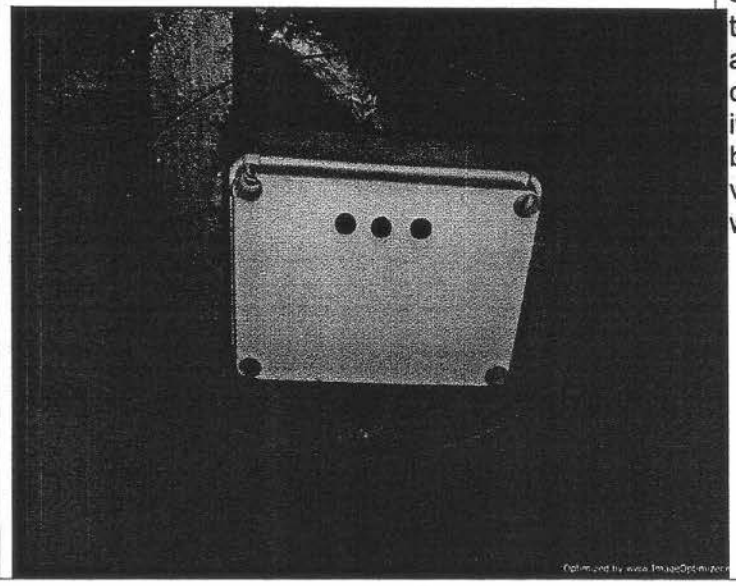
Location	Picture	Observation	P1	P2	P3
Lower Grotto		**R20:** The edges of the main stair's steps are very sharp and can be dangerous in case of slipping or falling	x		
Lower Grotto		**R21:** Easy access service stair at the left side of the dock that may constitute a source of hazard for visitors. To be isolated.	x		

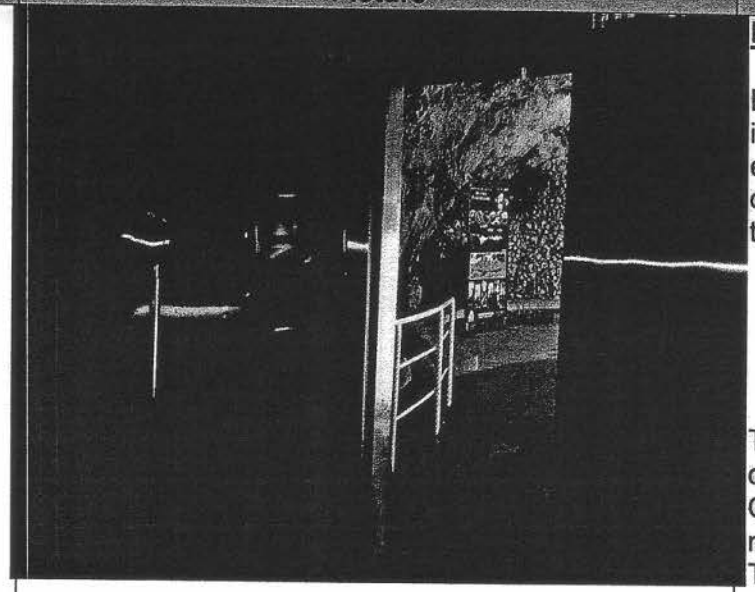
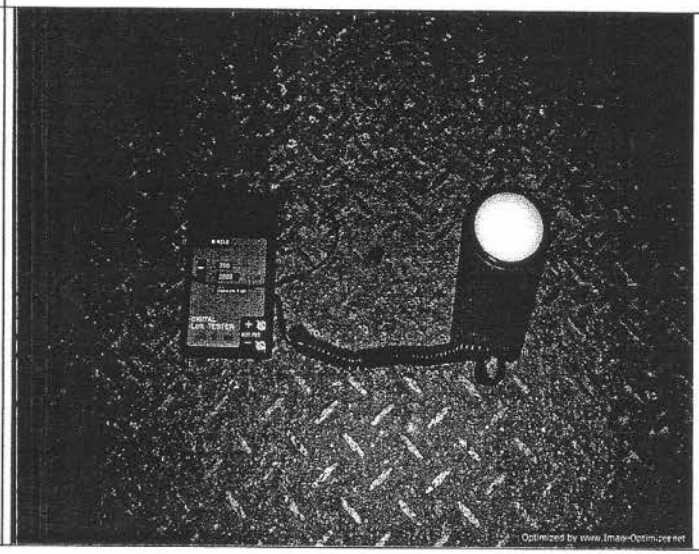
Location	Picture	Observation	P1	P2	P3
Lower Grotto		**R22:** The handrails system at the embarkation area is no more nowadays of a safe type; the horizontal voids between guardrails varies between 55cm to 70 cm and present a risk of falling when boat are not yet accosted. These handrails should be replaced by a modern Security Access boarding gate system on each dock.	x		
Lower Grotto		**R23:** On the perimeter of the submerged part of the dock a rigid perforated screen should be installed to prevent visitors and notably children to pass under the dock in case they fall down inside the water.	x		

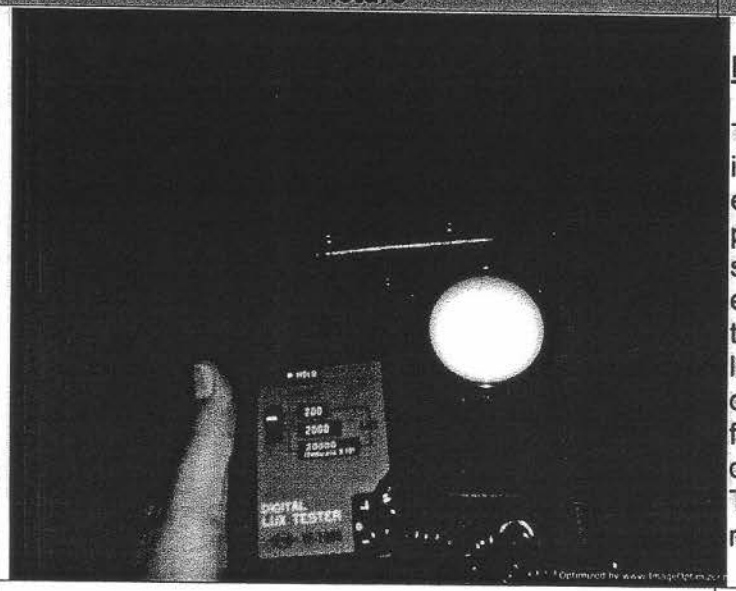
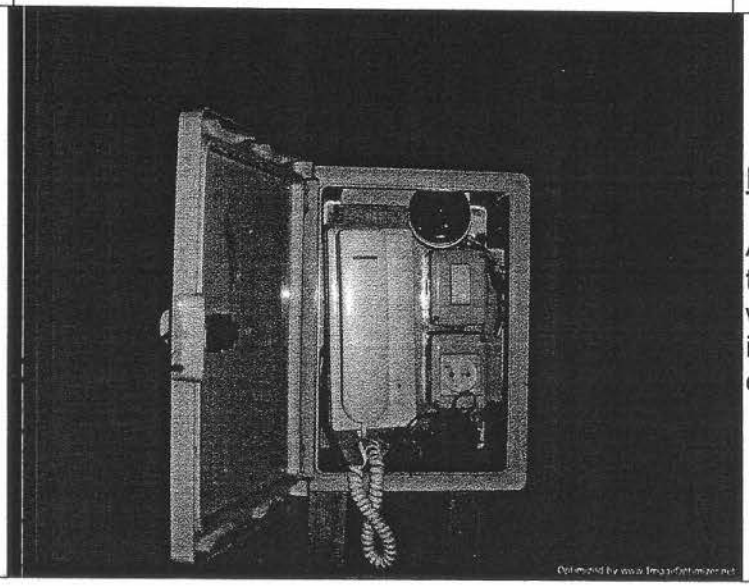
Location	Picture	Observation	P1	P2	P3
Lower Grotto		**R24:** The main electrical panel that feeds the lower Grotto is located near the main entrance in unlocked area easily accessible by visitors, making them in danger of electrocution, so it requires the isolation of these area by a locked door having an appropriate warning sign of danger of electrocution in different languages (Arabic, English & French)	x		
Lower Grotto		**R25:** A plexi glass shall be installed isolating the energized bus bars and to ensure protection against direct accidental contact. The Internal cover of the panel is missing and shall be installed.	x		

Location	Picture	Observation	P1	P2	P3
Lower Grotto		**R26:** The Lighting fixture installed inside the panel board used for maintenance purpose is always on and shall be relocated outside the panel or to be controlled by lighting switch, since we noticed an overheating signs are appeared on the most of circuit breakers.		x	
Lower Grotto		**R27:** We noted that the panel board enclosure begin to corrode and shall be treated. Panel boards shall be cleaned from any dust and debris. Since the panel is installed in wet areas the IP rating shall be at least IP55, all opening shall be sealed to preserve its IP rating so that the humidity will not affect the energized part inside the panel.		x	

Location	Picture	Observation	P1	P2	P3
Lower Grotto		**R28:** A grounding system (Mise à la Terre) shall be provided for all electrical installations, such system is mandatory to ensure the protection against electrocution, furthermore all electrical circuits that are supplied by 220V shall be protected by 30 mA differential devices.	x		
Lower Grotto		**R29:** All lighting fixtures installed inside water (volume 0) shall be supplied by extra low voltage 12V AC and shall have an IP rating of 68, for instance the installed ones are supplied by 220V AC with built-in transformer and present a risk of electrocution for the visitors and they are not having the required IP rating, the built-in transformers shall be relocated outside the water in a weatherproof enclosure (minimum IP65) and away 2 meters horizontally and 2.5 meters vertically from the water level.	x		

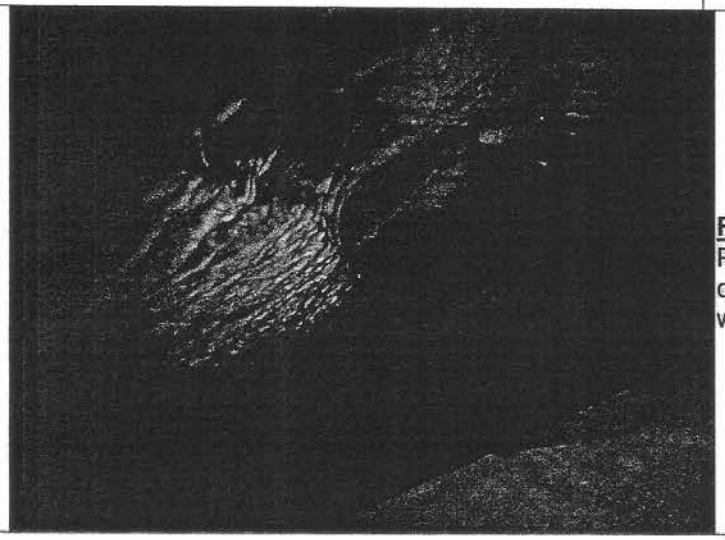
Location	Picture	Observation	P1	P2	P3
Lower Grotto	 	**R30:** We noted the presence of 220V socket outlets and junction box being used for charging boats batteries, are currently installed on the steel balustrade at the boarding zone, which constitutes a danger to the safety of visitors and staff due to its proximity to the water level and they are not resistant to water leakage as well as that installing them on balustrades constitutes a danger to the safety of visitors, so it requires relocating these sockets and junction box at least 2.0 m away horizontally and 2.5 m vertically from the water level and using waterproof types (minimum IP65).	x		

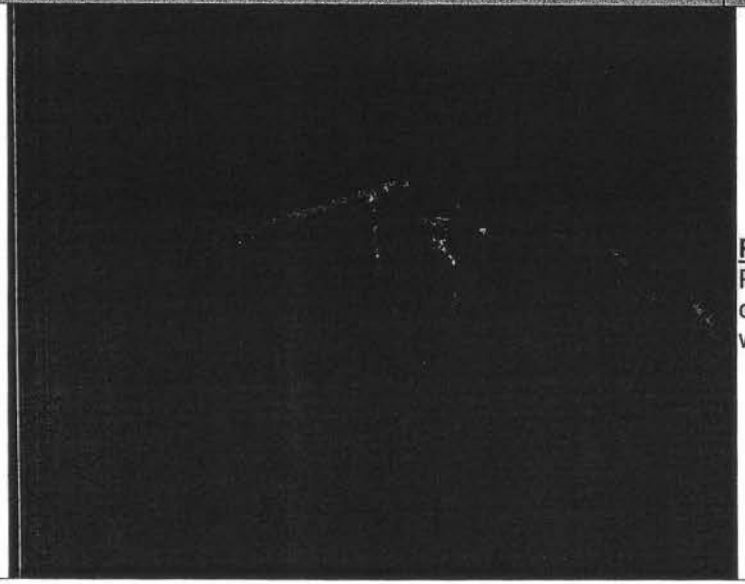
Location	Picture	Observation	P1	P2	P3
Lower Grotto		**R31:** EXIT lights shall be provided to aid the visitors in reaching safely the exterior in case of emergency by marking escape routes, exits, obstacles and changes of directions according to the following: • **Along exit circulations each 15 m.** • **Above the main exit door of the Grotto** • **Above intermediate exit doors (applicable for upper grotto).** These EXIT lights shall be of battery self-contained types and maintained (permanently ON) working for one hour at least in case of normal lighting power failure. The EXIT lights shall be subject for regular maintenance and verification.	x		
Lower Grotto		**R32:** We noted that in the lower grotto the existing lighting Lux level at the boarding zone is between 0.5 Lux and 2.3 Lux and at the stair and entrance between 0.1 Lux & 1.8 Lux, while for the upper grotto it is not more than 1 Lux in most of areas, however the minimum accepted lux level for ambiance lighting shall be not less than 5 Lux to ensure the minimum requirement of visibility, accordingly the lighting lux level shall be enhanced especially at the boarding zone of lower grotto, at the entrances & at stairs for upper and lower grottos to avoid any accident that may occur due to the low lighting level.	x		

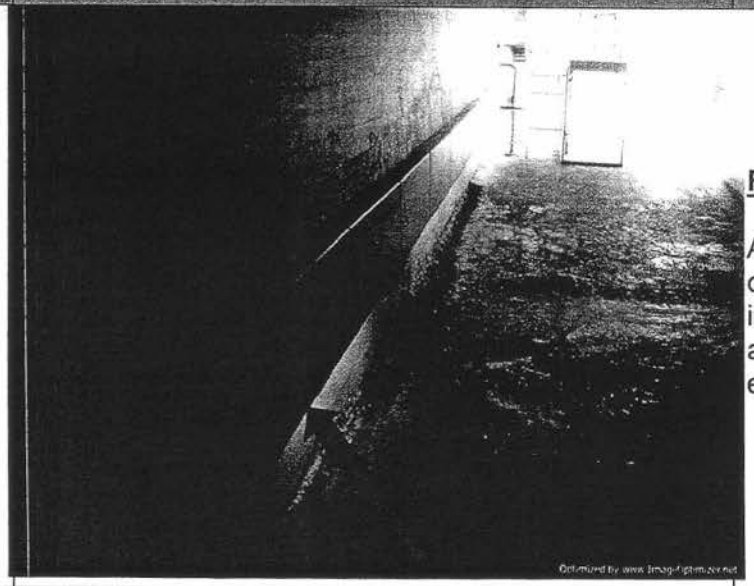
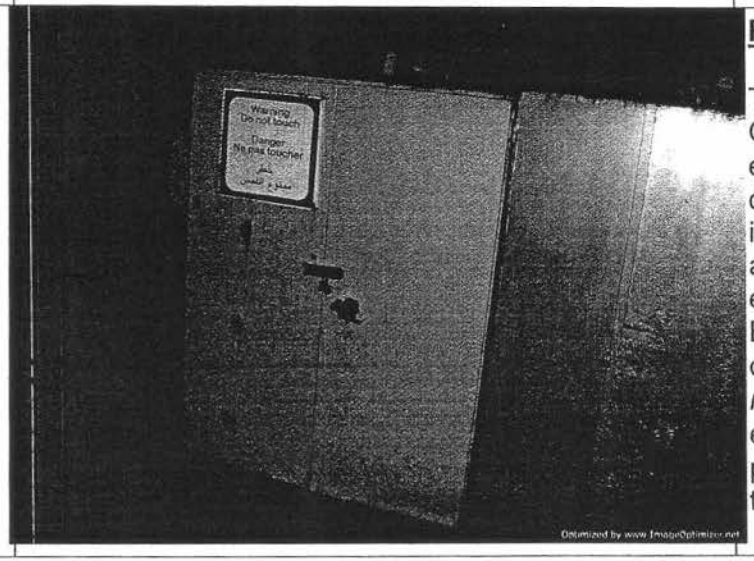
Location	Picture	Observation	P1	P2	P3
Lower Grotto		**R33:** The lux level of the existing emergency lighting is very low (around 0.1 Lux) and shall be enhanced to reach 5 lux, allowing visitors not to panic and indicate the escape routes to reach safely the exterior of the grotto in case of emergency, it might be used for this purpose the existing lighting after improving their lux level and supply them by batteries operating for one hour without interruption in case of power failure, or otherwise dedicated battery self-contained emergency lights to be added. The emergency lights shall be subject for regular maintenance and verification.	x		
Lower Grotto		**R34:** A communication system shall be provided near the boarding zone allowing permanent contact with a rescue service or control room, for instance it is currently only connected to the exterior entrance of the lower grotto.	x		

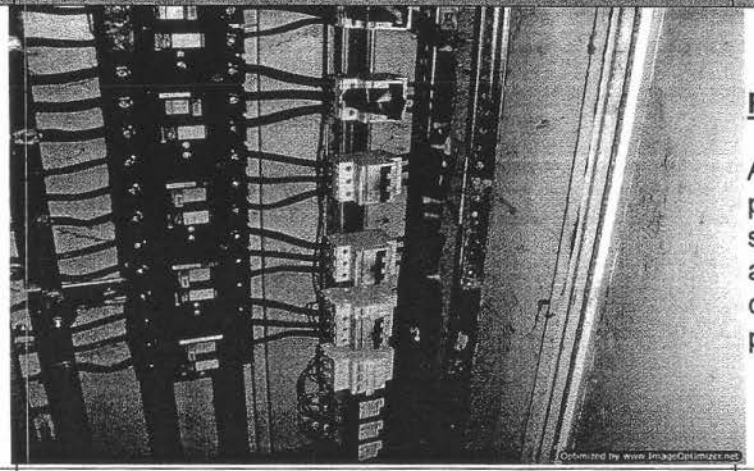
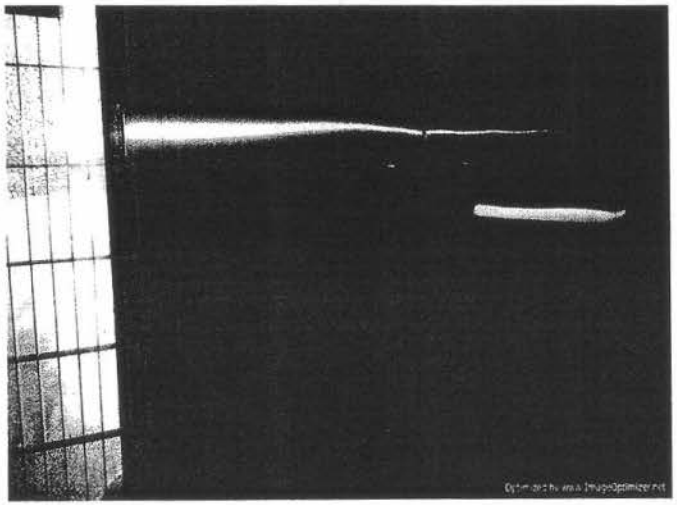
Location	Picture	Observation	P1	P2	P3
Lower Grotto		**R35:** During our visit we have noted that the only portable extinguisher present in the lower grotto was of a CO2 type and was located at the cave upper part near the entrance door; simply laid on the floor. Appropriate fire extinguishers should be provided inside the cave (ABC powder type) and properly fixed on dedicated apparent supports. CO2 portable extinguishers are to be provided only next to the electrical panel boards.	x		

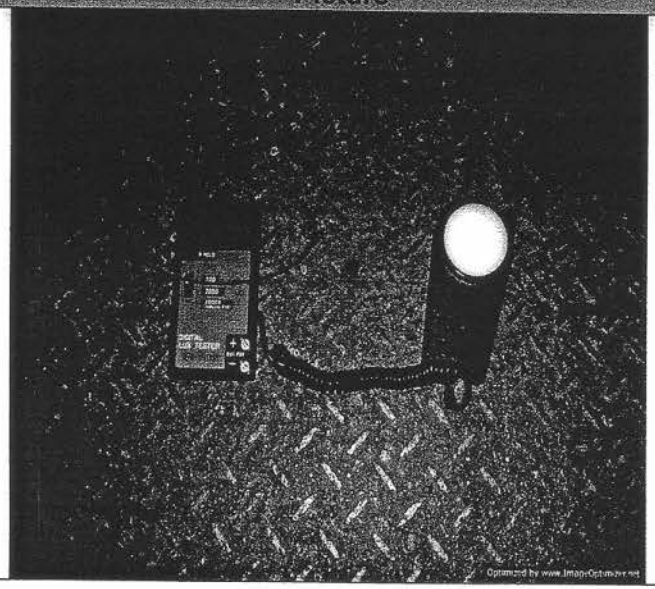
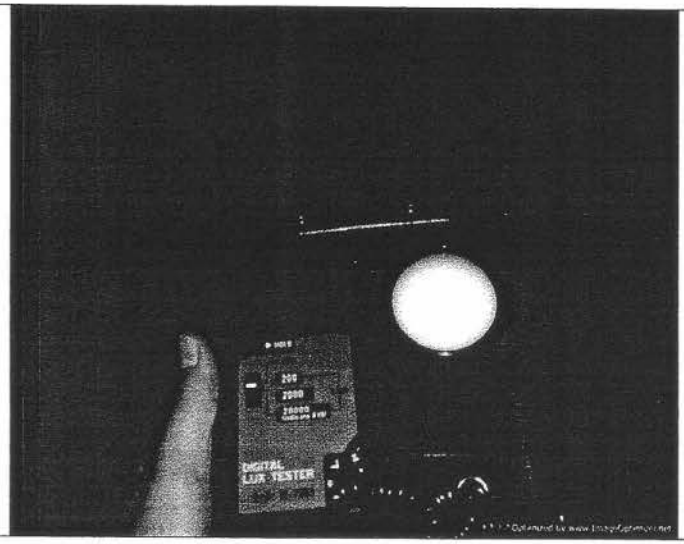
B- Upper Cave

Location	Picture	Observation	P1	P2	P3
Upper Cave		**R36:** Height of guardrails at upper grotto is less than 1m and is not conforming to standard (NF P01-012).	X		
Upper Cave		**R37:** Provide a guardrail conforming to NFP01-012 to close the void (that is greater than 5cm) between the walkway and the rock wall.	X		

Location	Picture	Observation	P1	P2	P3
Upper Cave		**R38:** Provide a guardrail conforming to NFP01-012 to close the void (that is greater than 5cm) between the walkway and the rock wall.	x		

Location	Picture	Observation	P1	P2	P3
Upper Cave		**R39:** A plexi glass shall be installed to close the opening under the cable trunk cover for the indirect light to avoid electrocution due to accidental direct contact by the visitors with energized part (especially for children)	x		
Upper Cave		**R40:** The main electrical panel that feeds the upper Grotto is located at the main entrance and easily accessible by visitors, making them in danger of electrocution, so it requires the isolation of these area by a locked door having an appropriate warning sign of danger of electrocution in different languages (Arabic, English & French). For instance the panel's door has a lock and warning sign (*Warning do not touch*) such disposition is not sufficient to ensure the safety for the visitors unless this panel is not accessible so that it is not possible to touch the panel by any visitor.	x		

Location	Picture	Observation	P1	P2	P3
Upper Cave		**R41:** A grounding system (Mise à la Terre) shall be provided for all electrical installations, such system is mandatory to ensure the protection against electrocution, furthermore all electrical circuits that are supplied by 220V shall be protected by 30 mA differential devices.	x		
Upper Cave		**R42:** EXIT lights shall be provided to aid the visitors in reaching safely the exterior in case of emergency by marking escape routes, exits, obstacles and changes of directions according to the following: • **Along exit circulations each 15 m.** • **Above the main exit door of the Grotto** • **Above intermediate exit doors (applicable for upper grotto).** These EXIT lights shall be of battery self-contained types and maintained (permanently ON) working for one hour at least in case of normal lighting power failure. The EXIT lights shall be subject for regular maintenance and verification.	x		

Location	Picture	Observation	P1	P2	P3
Upper Cave		**R43:** We noted that in the lower grotto the existing lighting Lux level at the boarding zone is between 0.5 Lux and 2.3 Lux and at the stair and entrance between 0.1 Lux & 1.8 Lux, while for the upper grotto it is not more than 1 Lux in most of areas, however the minimum accepted lux level for ambiance lighting shall be not less than 5 Lux to ensure the minimum requirement of visibility, accordingly the lighting lux level shall be enhanced especially at the boarding zone of lower grotto, at the entrances & at stairs for upper and lower grottos to avoid any accident that may occur due to the low lighting level.	x		
Upper Cave		**R44:** The lux level of the existing emergency lighting is very low (around 0.1 Lux) and shall be enhanced to reach 5 lux, allowing visitors not to panic and indicate the escape routes to reach safely the exterior of the grotto in case of emergency, it might be used for this purpose the existing lighting after improving their lux level and supply them by batteries operating for one hour without interruption in case of power failure, or otherwise dedicated battery self-contained emergency lights to be added. The emergency lights shall be subject for regular maintenance and verification.	x		

5 – RECOMMANDATIONS

The purpose of this part of our report is to recommend the provisions that are of a nature to ensure the safety of persons against risks of accidents, fire and panic inside the natural upper and lower Jeita caves notably their areas dedicated to receive visitors.

5.1 Information for visitors and public

The general and special conditions of the caves' visits should be displayed at the entrance of the site and recalled by the guide prior to the visit. They should be written in Arabic and at least in two of the foreign languages (French and English) to the attention of foreign tourists. Visitors should be aware of the security measures and safety instructions and should respect the natural site. **(P1)**

To be respected.

5.2 Load Occupancy (Lower and Upper Caves)

As per the French Norm "ERP", the load occupancy for an assembly occupancy provided with only one single exit, should not exceed 19 persons.
Taking into account, that the natural caves are not covered by any specific safety code classification, we recommend the following:

- Lower Grotto:
  The occupant load inside the lower grotto should be limited to 50 persons on boats and 50 persons in the waiting area which leads to a total occupant load in the lower grotto of maximum 100 persons.
- Upper Grotto:
  It is recommended that the load occupancy in the upper grotto should not exceed 300 persons.

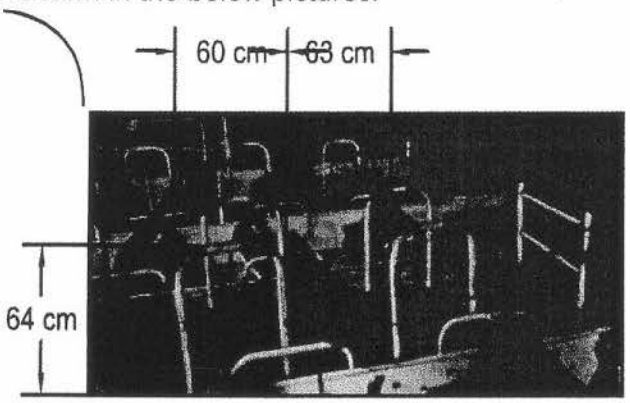
To be respected and displayed at the entrance of each Grotto **(P1).**

5.3 Security of Walkways / Guards and Balustrade (Lower and Upper caves)

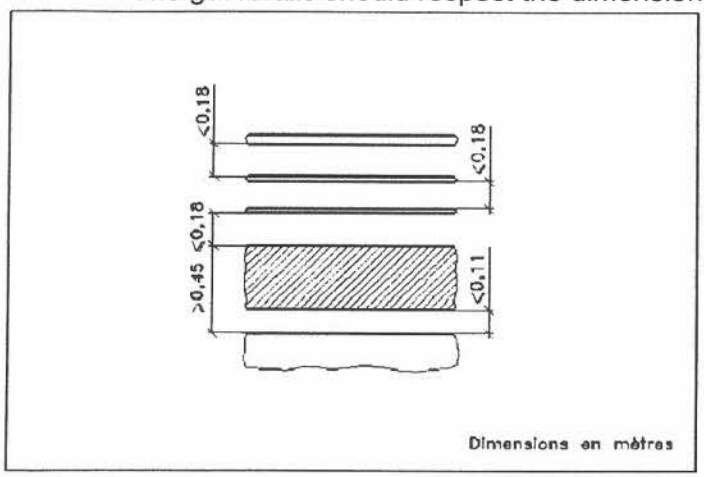
- The walkways should be protected in a way to insure the maximum safety of the visitors. Dangerous sections (areas where the difference in height between the walkway and the underneath area exceeds 1m) should be equipped with guardrails, complying with NF P 01 012 standard.

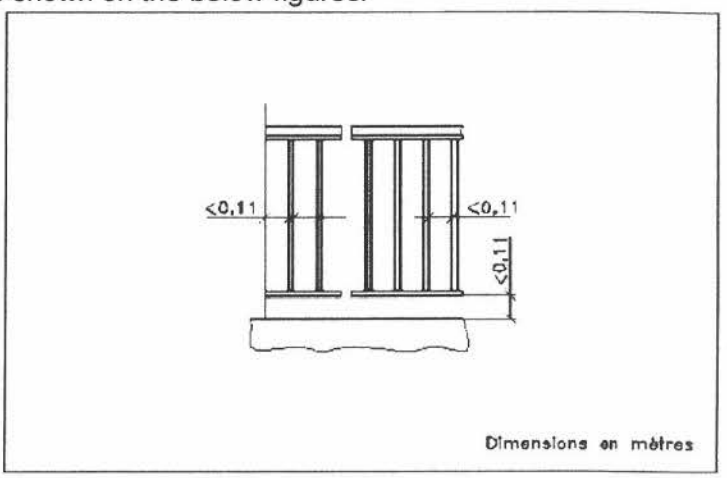
- The height of all guardrails, in the two grottos, is less than 1.00m and the voids between vertical and horizontal rails is not conforming to the corresponding safety standard (NF P01-012) as shown in the below pictures.

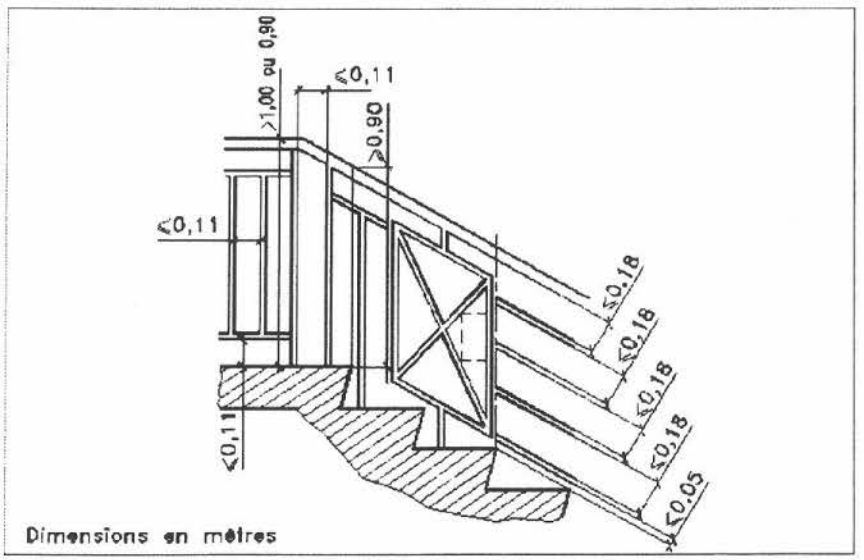
Not Conforming



The guardrails should respect the dimensions shown on the below figures:





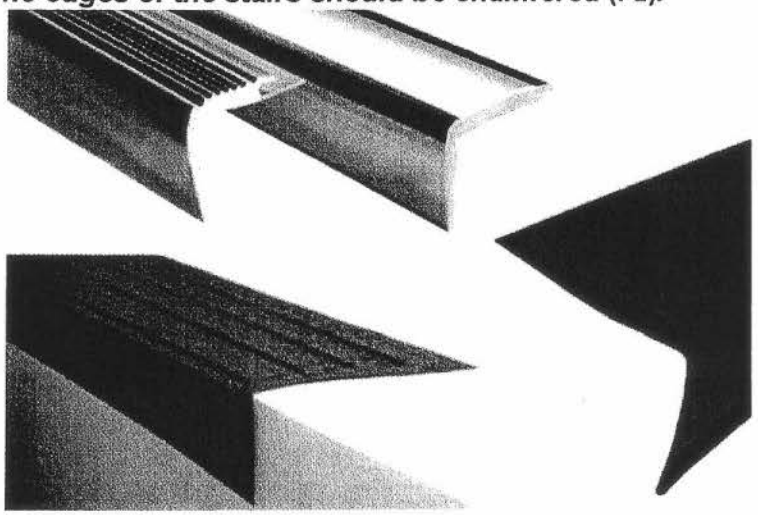


- The guardrails in the two caves are not conforming to safety standard notably the guardrails on the dock area. To be respected **(P1).**
- We noted in several locations a gap between adjacent guardrails more than 5 cm. This gap should be closed **(P1).**
- In several places, we noted areas without guardrails and that present a serious falling hazard (The concrete bench, the boarding dock in lower grotto, the void at the connection between the waiting area and the left rock wall, ...) - **(P1).**

- Provide an intermediate handrail for the bottom part of the main stair leading to the waiting area (since the width of the stair is exceeding 4 UP). The height of this intermediate handrail should not be less than 90 cm. As for the upper part of this stair, the existing intermediate handrail has currently a height of 80 cm that should be heightened to reach minimum 90 cm. **(P2).**

To be respected

- The edges of the stair's steps are very sharp and can be dangerous in case of slipping or falling. ***The edges of the stairs should be chamfered*** **(P1).**



- The two water level control devices located on the floor between the waiting area and the dock present obstacles and can be dangerous for visitors (stumbling and falling hazard).They should be marked and isolated by safety barriers; otherwise they should be kept closed in the presence of visitors **(P1).**

To be respected

5.4 Main Entrances (Lower and Upper caves)

The doors at the main entrances, in the two caves, should open to outside in egress direction; they should equally open easily from inside without the use of keys (Provide a fire Exit hardware or a panic bar) - **(P1).**

Not Conforming

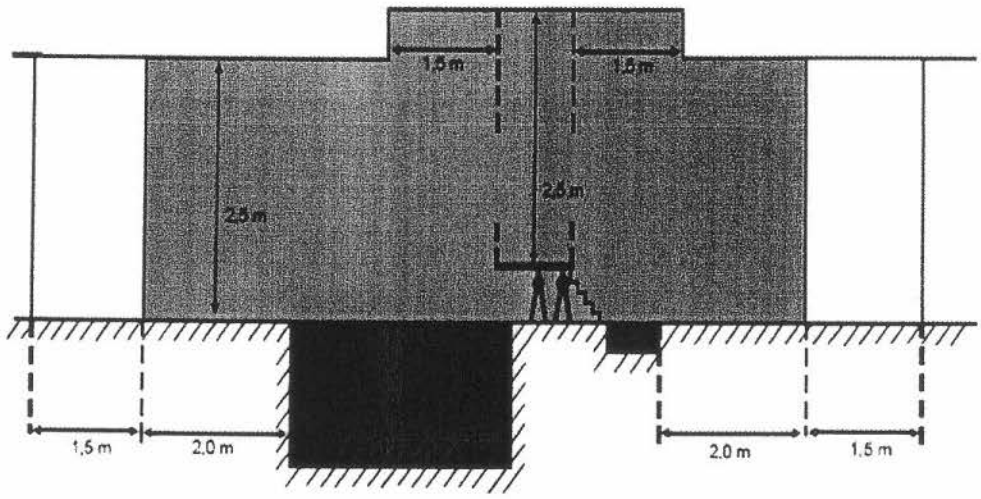
5.5 Electrical Installations (Lower and Upper caves)

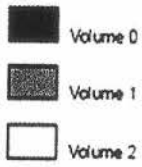
The Electrical Installations should be in compliance with NF C 15-100, notably the following points:

- Provide isolation of the main panel boards, at the entrance of the two grottos by a locked door having an appropriate warning sign of danger of electrocution in different languages (Arabic, English & French). **(P1).**
- A plexi glass shall be installed inside panel boards isolating the energized bus bars and to ensure protection against direct accidental contact. **(P1).**
- A grounding system (Mise à la Terre) shall be provided for all electrical installations, such system is mandatory to ensure the protection against electrocution, furthermore all electrical circuits that are supplied by 220V shall be protected by 30 mA differential devices. **(P1).**
- All electrical installation in volume 0 & 1 as defined in the sketches mentioned below extracted from the French Norm NFC-15-110 Article 7-702 shall be supplied by a extra low voltage 12V AC or 30 V DC and shall have an IP rating of 68 for volume 0 and IP66 for volume 1, while for volume 2 the electrical installations might be supplied by 220V with 30 mA differential devices protection or by 12V. **(P1).**

VOLUMES	1	2
DEGRES DE PROTECTION	IPX6	IPX2 *
CANALISATIONS	II	II
APPAREILLAGE	X	- Séparation - ou TBTS ou DR 30 mA
APPAREILS D'UTILISATION	X	- II ** - ou Séparation - ou TBTS - ou DR 30 mA

X Interdit (sauf TBTS limitée à 12 volts)
II En classe II ou équivalente
III en TBTS
* IPX5 pour les piscines à l'extérieur des bâtiments ou si ce volume peut être soumis à des jets d'eau pour nettoyage
** Pour les luminaires.





- Electric sockets (power outlets) fixed on the balustrades of the dock area (Lower cave) that serve to charge the boats batteries should be removed from this area since they constitute a major danger for visitors. **(P1).**

5.6 Normal Lighting (Lower and Upper caves)

The minimum accepted lux level for normal lighting shall be not less than 5 Lux to ensure the minimum requirement of visibility, accordingly the lighting lux level shall be enhanced especially at the boarding zone of lower grotto, at the entrances & at stairs for upper and lower grottos to avoid any accident that may occur due to the low lighting level. **(P1).**

To be respected

5.7 Emergency Lighting (Lower and Upper caves)

The Emergency lighting should allow for normal lighting failure to perform all maneuvers affecting the safety and wait for the startup of replacement lighting or to ensure the safe evacuation safely and easily of the public outwards.
The lux level of the existing emergency lighting shall be enhanced to reach 5 lux, allowing visitors not to panic and indicate the escape routes to reach safely the exterior of the grotto in case of emergency, it might be used for this purpose the existing lighting after improving their lux level and supply them by batteries operating for one hour without interruption in case of power failure, or otherwise dedicated battery self-contained emergency lights to be added.
The autonomy of the Emergency lighting in case of normal lighting failure should be at least 1 hour.
All Guides shall be equipped with portable lighting such as Torch, to be used in case of emergency.
The Emergency lighting shall be subject for regular maintenance and verification. **(P1).**

To be respected

5.8 Exit Lights (Lower and Upper caves)

EXIT lights shall be provided to aid the visitors in reaching safely the exterior in case of emergency by marking escape routes, exits, obstacles and changes of directions according to the following:

- Along exit circulations each 15 m.
- Above the main exit door of the Grotto
- Above intermediate exit doors (applicable for upper grotto).

These EXIT lights shall be of battery self-contained types and maintained (permanently ON) working for one hour at least in case of normal lighting power failure.



The EXIT lights shall be subject for regular maintenance and verification. **(P1).**

Not Conforming

5.9 Control of Electrical Installations (Lower and Upper caves)

The electrical installation should be checked on annual basis by a qualified person or accredited body. The presence of a competent person is required during public presence to ensure the daily operation and maintenance of the electrical systems. **(P1).**

To be respected

5.10 Means of Alert communication – Control room - (Lower and Upper caves)

- A Voice message system for informing the visitors and guides of any incident or any instructions for evacuation should be provided. **(P2).**
- A two way communication system should be provided to alert, in the shortest possible time, the control room. **(P2).**
- It is highly recommended to equipped the two grottos with a restricted alarm system operating as follows:
  - Monitoring system installed inside control room.
  - Alarm push button distributed along the passageways inside the two grottos.

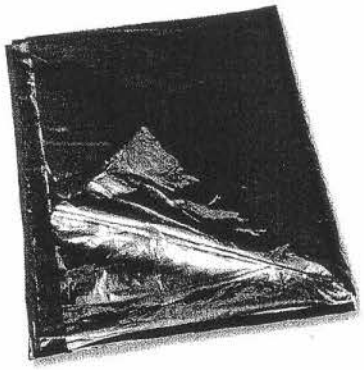
The above mentioned systems as well as the monitoring CCTV system should be located inside a protected control room operated by a dedicated safety monitoring agent, on a permanent basis during the presence of visitors inside the grottos. **(P3).**

To be respected

5.11 First Aid means (Lower and Upper caves)

- Inside each grotto, several First Aid stations should be provided including an emergency kit and survival blanket, notably at dock area in lower grotto and for upper grotto each 200m. **(P1).**





- At least one trained person on First Aid should be present on site in each cave during the presence of visitors. **(P1).**

5.12 Fire Fighting system (Lower and Upper caves)

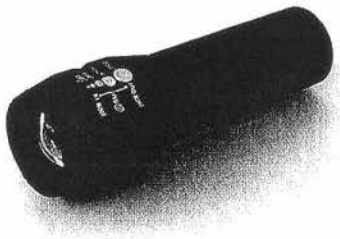
- Portable fire extinguishers of 6kg type ABC should be provided in the two caves. The distance from any point accessible to public to reach the extinguisher should not exceed in principle 15m. On the other side, CO2 portable extinguishers are to be provided next to the electrical panel boards. **(P1).**

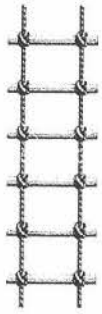


5.13 Boarding dock / Specific safety measures (refer to Appendix 2 of the present report) – Lower cave

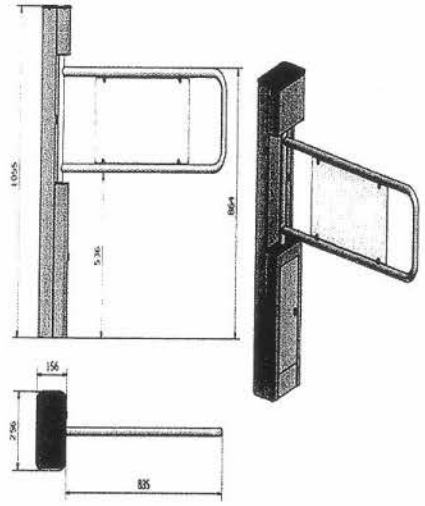
- The mariners' guides should in the same time insure the role of lifeguards and must be trained on First Aid operations.
- Boats should be of an approved model conforming to applicable standard (CE or equivalent) and should be certified and controlled periodically.
- Each boat must be equipped with portable fire extinguisher, first aid kit, life buoy, portable torch and rope ladders.







- Each dock must be equipped with survival blankets, rope ladders, life buoy and approved life jackets available to the public. **(P1).**
- The handrails system on the dock area are no more nowadays of a safety type , the horizontal voids between guardrails varies between 55cm to 70 cm and present a risk of falling when boats are not accosted. These handrails should be replaced by a modern Security Access boarding gate system on each dock. **(P3).**

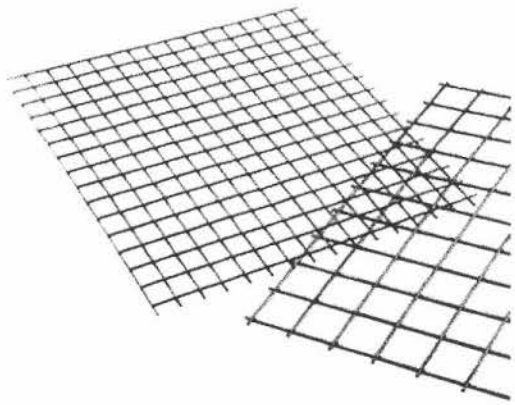


- Each Boat should be fixed mechanically to the dock. **(P1).**
- A minimum of 3 agents should be present on the dock area in order to ensure the boarding and disembarkation process of visitors notably the children. **(P1).**
- The waiting area should be separated from the dock area by a physical access door that should be monitored by a dedicated agent. This agent should control the number of the persons on the dock area (maximum two persons on each dock at the same time) and should ensure that visitors returning back from the tour have effectively left the dock area. **(P1).**
- It is highly recommended to limit the boarding and disembarkation of visitors to one side of each dock and to close the other side by guardrail conforming to NF P 01-012. **(P2).**
- Visitors shall not be permitted to gather and wait on the dock if the boat has not yet accosted and been fixed mechanically to the dock. **(P1).**
- Provide life jacket for visitors that are shorter than 1.10 m before entering the grotto. A stature measuring Instrument should be installed at the main entrance of the grotto for this purpose. A dedicated agent shall be responsible of this measuring operation. **(P1).**





- It is highly recommended to add a physical separation equipped with 3 access doors (as shown in Appendix 2) between the dock area and the space leading to exits; this will definitely help the organization of the boarding and disembarkation process and will avoid any incident due to crowd gathering in this area **(P2).**
- There are traces of corrosion, holes and weaknesses points, in the steel plates constituting the dock walking platform. All steel plates in the dock area should be checked and replaced if necessary. **(P1).**
- The steel structure of the dock, notably its submerged part, should be checked periodically to detect any disorder mainly the conditions of the steel, connections and supports. **(P1).**
- On the perimeter of the submerged part of the dock a rigid perforated screen should be installed to prevent visitors and notably children from passing under the dock when falling down inside the water. (This screen should have voids such as a sphere of 100 mm in diameter is not able to pass through any opening) **(P1).**



- Electric Water level control device should be provided to control the level of the water inside the lower grotto and should be linked to the alarm station. The maximum allowable level of water inside the cave should be clearly specified and in case this level is reached the entry of visitors should then be prohibited. (The maximum allowable level of water is the one permitting to conduct the river tour in total safety conditions for the visitors) **(P2).**

5.14 Access for Disabled Persons (Lower and Upper caves)

The two caves, in their current status, are not equipped to receive disabled persons.
Future fitting works conforming to Disabled Accessibility Standards could be carried out in order to permit the entrance of disabled persons inside the two caves **(P3).**

5.15 Safety Instructions and Warning signs (Lower and Upper caves)

Alert, Safety signs and warnings should be provided inside the two grottos and should include but not limited to:

- Showing direction of means of egress and exits.



- Showing location of first aid station and Portable extinguishers.





- Keep Quite



- Don't cross the yellow line at the waiting area.



- Don't climb the balustrades.

To be respected (P3).

On the other hand, safety instructions should be clearly displayed at each cave entrance and recalled by the guides to the visitors during the caves tours. These safety instructions include notably:

- Children under 12 years must be accompanied by adults
- It is strictly prohibited to hold children on shoulders.
- Visitors must stay inside the grotto in their assigned places.
- Visitors should stay seated in the boat.
- Don't take off the life jacket.



To be respected (P3).

5.16 Qualification of escorting staff – Rescue team – Training - (Lower and Upper caves)

We were informed during the course of our inspection mission that the current escorting staff agents that control the entrance of visitors in the lower grotto were composed of:
- Two agents at entrance tickets check point.
- One agent in front of the lockers (cabinets) at the main entrance of the lower grotto.
- One agent in the waiting area.
- Four mariners.

Accordingly, we highly recommend to increase the number of agents in the dock and waiting area up to three persons to ensure the safe boarding and disembarkation of visitors and to treat any possible incident that may occur. **(P1).**

Besides, permanent technicians should be present during visiting hours inside the upper and lower cave to treat any possible incident that may affect any equipment of the caves. **(P1).**

The above mentioned increased staff notably the agents in the waiting area as well as the mariners should be trained on first aid and rescue (lifeguard) as well as on how to assist and guide visitors. **(P1).**

The increase in the agents' staff applies equally for the upper cave. **(P1).**

The General Manager



Roland MARIE

The Engineer In Charge



Dany ISSA

6 – APPENDIX 1

LOWER GROTTO - GENERAL LAYOUT – MAJOR REMARKS

7 – APPENDIX 2

LOWER GROTTO - GENERAL LAYOUT – MAJOR SAFETY RECOMMERNDATIONS FOR EMBARKATION AREA