SAFEQU

MAIN RISKS AND PREVENTION MEASURES IMPLEMENTED IN QUARRIES OF NATURAL STONE IN EUROPE.

Lifelong Learning Programme

THE FINNISH NATURAL STONE ASSOCIATION

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RESULTS OF THE ANALYSIS OF THE SURVEY OF RISKS AND PREVENTION MEASURES IN QUARRIES.

1.- Methodology.

The present report shows the average results obtained in GERMANY, FINLAND, SPAIN and CROATIA based on 45 surveys made in 45 quarries belonging to 45 companies in these countries.

Country	Number of surveys
Finland	8
Spain	17
Germany	10
Croatia	10

To this end, a survey was made, which is attached as Appendix. It was intended to determine the level of risk in the workplace that are scope of this project and the degree of implementation of preventive measures to eliminate or control the risk to tolerable levels.

In the survey, companies were encouraged to provide information about the occurrence of 25 previously identified risks. In addition to these risks, prevention measures were assessed in a quantifiable manner (based on a numeric value) regarding the level of implementation in the workplace, using 1 for the lowest score (little or no implementation of measures), 2 for an average (medium set) and 3 for a higher score (always or almost always).

The methodology for the collection of data was to visit the facilities of companies (factories, quarries, offices etc) and, in other cases, mails and faxes have been sent.

Afterwards companies sent back their responses, giving their support to the partners of this project.

Regarding the variables studied in the study, the following points were taken into account: safety risks such as falls or electrocutions, usually manifesting in the form of accidents, risks related to industrial hygiene such as exposure to noise or dust, which manifest themselves in the form of diseases and related risk, and, finally, ergonomic and psychosocial factors, these risks being a potential source of danger to generate mainly dissatisfaction and work-related diseases.

Based on to the previous classifications (occupational safety, industrial hygiene, ergonomics and social psychology) and by reviewing collected data, we can set out some conclusions that are provided in the following sections, and are being considered for realization, in the summary table (Appendix I) and statistical analysis shown on the following pages (Appendix II).

2.- Analysis of Risks

In the following sections we outline the considerations obtained from the collection of data:

- In general terms, we can confirm that there is a fairly acceptable level of implementation of measures, because average values are rarely there below 2 points.
- Regarding safety risks (not professional diseases), we observe the need for introducing measures which can be easily implemented, in some cases. There are low values for aspects such as objects obstructing passing areas and protection against flying objects.
- Regarding the hygienic risk of dust as a chemical agent in ambient, it is necessary to establish effective, collective prevention measures such as the aspiration of dust or injection of water, therefore emphasising the control of risks over the deterioration of working conditions.

- Regarding ergonomic, societal and psychosocial conditions, it is necessary to mention the risks arising from the lack of rotation of tasks. Nevertheless, it is assumed that in workplaces with few workers the implementation of these changes in the organization of work is not easily applicable.

3.- Conclusions

As the aims of the survey are to obtain a “state of the industry”, which considers existing risks and to develop a series of animations, we propose the following situations:

Proposal for animations dealing with industrial safety:

i. Lack of order and cleanliness in the workplace, causing workers to fall in the same level, crash into immobile objects and tread on objects.

ii. Due to the high risk and severity of the consequences, it is considered appropriate to portray the risk of falls to different levels (from heights) near quarry faces. Likewise, it would be important to highlight the risk of falls from blocks to be drill (both by hand or with drilling machines).

iii. Cuts and bruises of workers doing machine maintenance (checking, lubrication, substitution of elements, etc). In spite of not being a big risk, it should be taken into consideration because of the frequency with which this happens.

iv. Flying particles and objects must be taken into consideration. Tasks such as cutting and drilling cause risks that must be minimized.

v. As in the case of falling from heights, the risk of being run over by mining machinery is not common but the consequences are extremely dangerous and may even result in the death of the worker.

vi. It is important to consider the risk which arises from inclement weather, both for northern regions(coldness, slipping on ice, etc) and southern regions (dehydration, heat stroke, etc)

Proposal for animations dealing with industrial hygiene:

vii. Unfortunately, the presence of dust in the workplace is very common. Dust containing silica makes this risk an important consideration, mainly in drilling works.

viii. Noise is a real risk in the extraction process. Heavy machinery during its operation as well as cutting tasks, drilling and blasts create a very big risk that must be controlled. Due to the difficulty of controlling this risk, the animation could show workers working inside cabins (backhoe loader, dumper, drilling machine with cabin, etc) as well as the widespread use of ear protection).

ix. Regarding the values obtained in questionnaires, vibration must be taken into account. In this case, vibration affecting the whole body arising in machinery cabins as well as vibration caused by the use of tools and hand drilling (leads to hand-arm vibrations) require an animation focused on this risk.

Proposal for animations dealing with ergonomics and psychology

x. Persistent forced postures (standing and seated) over a long period of time may cause health disorders for the worker. Therefore, this risk must be taken into consideration.

xi. Finally, workload, worries, bad nutrition…cause psychological harm. Doing exercise, good nutrition, respecting programmed schedules, as well as a pleasant working environment are aspects worth showing in the animations.

Anexo I. Summary

GROUP	RISK	SUBGROUP	AVERAGE	PREVENTIVE MEASURES
1	Falls from height	1.1	2,00	All differences in height are protected with rigid elements (fences, etc).
		1.2	2,00	Risks of fall are signed.
		1.3	2,04	A distance of security of 5 metres is respected.
		1.4	2,28	Ladders are used to gain access to different heights
		1.5	2,04	Harness or safety belts are sed if collective safety measures are insufficient.
2	Falls and slips	2.1	1,68	Working areas are kept free of mud.
		2.2	2,00	Walking or moving areas are kept free of mud.
		2.3	2,56	Safety shoes are used.
		2.4	2,56	Vehicles (all terrain vehicles) are used to move if it is possible.
		2.5	2,20	All objects are out of displacement areas
		2.6	2,16	Power shovel´s driver keeps walking areas free of objects.
3	Falling objects caused by collapse or displacement	3.1	2,44	All parts that made up quarry facade are stable against landslide. In case it is not possible, hazard area is enclosed.
		3.2	2,48	Obstacles are not near places with different heights.
		3.3	2,72	All areas with risk of landslide are protected
4	Probably injury	4.1	2,76	Safety shoes with metal toe are always used.

GROUP	RISK	SUBGROUP	AVERAGE	PREVENTIVE MEASURES
	from falling objects	4.2	2,76	Workers know techniques for handling weights.
		4.3	2,84	Safety gloves are always used when handling weights.
		4.4	2,76	Machines are used to handle weights if it is possible.
		4.5	2,76	All vehicles and tools for transport have a properly periodic maintenance.
		4.6	2,40	All lift wires are checked and replaced when more than 10% of its section is damaged.
		4.7	2,84	and transport machinery are used by authorized and qualified workers.
5	Fallen of loose / unfixed objects or materials	5.1	2,16	Working areas with risk of fall are properly signed.
		5.2	2,44	Objects are not stored near quarry façades.
		5.3	2,56	Safety helmet use is obligatory
		5.4	2,68	Workers always avoid to stay below loads.
		5.5	2,36	When equipment with hook are used, it is always protected with safety trigger.
6	Possibility of trips	6.1	2,36	In working and passing areas it is avoided the presence of objects that can cause damages.
		6.2	2,20	Tools and other objects that can cause cuts, slips, etc will be kept away from workers habitual areas.
		6.3	2,76	It is obligatory to use safety shoes in all working places.
		6.4	2,40	Working and passing areas have adequate lighting.

GROUP	RISK	SUBGROUP	AVERAGE	PREVENTIVE MEASURES
7	Crashing into inmobile objects	7.1	2,12	Passing areas, exits and displacement paths of working areas are free of obstacles.
		7.2	2,24	Tools and other objects that can cause cuts, slips, etc will be kept away from workers habitual areas.
		7.3	1,71	Above mentioned places for displacement within working areas are properly signed (i.e: parking).
8	Crashing into mobile objects	8.1	2,24	It is kept a security distance of 5 metres between workers and radius of action of heavy machinery.
		8.2	2,00	Passing areas near to dangerous zones are properly signed.
		8.3	2,40	Distance between machines is enough for workers to do their work comfortably and safety.
		8.4	2,32	In machines that have mobile elements, these are protected by frames.
9	Cuts and blows from objects or tools	9.1	2,88	Safety gloves are always used when handling elements that can cause cuts or pinchs.
		9.2	1,52	Areas with permanent danger against an inmobile objects are always painted with yellow and black strips.
10	Flying objects	10.1	1,72	All machines or tasks that can cause projection of fragments of material are covered with protection barriers (i.e: transparent fronts between worker and machine).

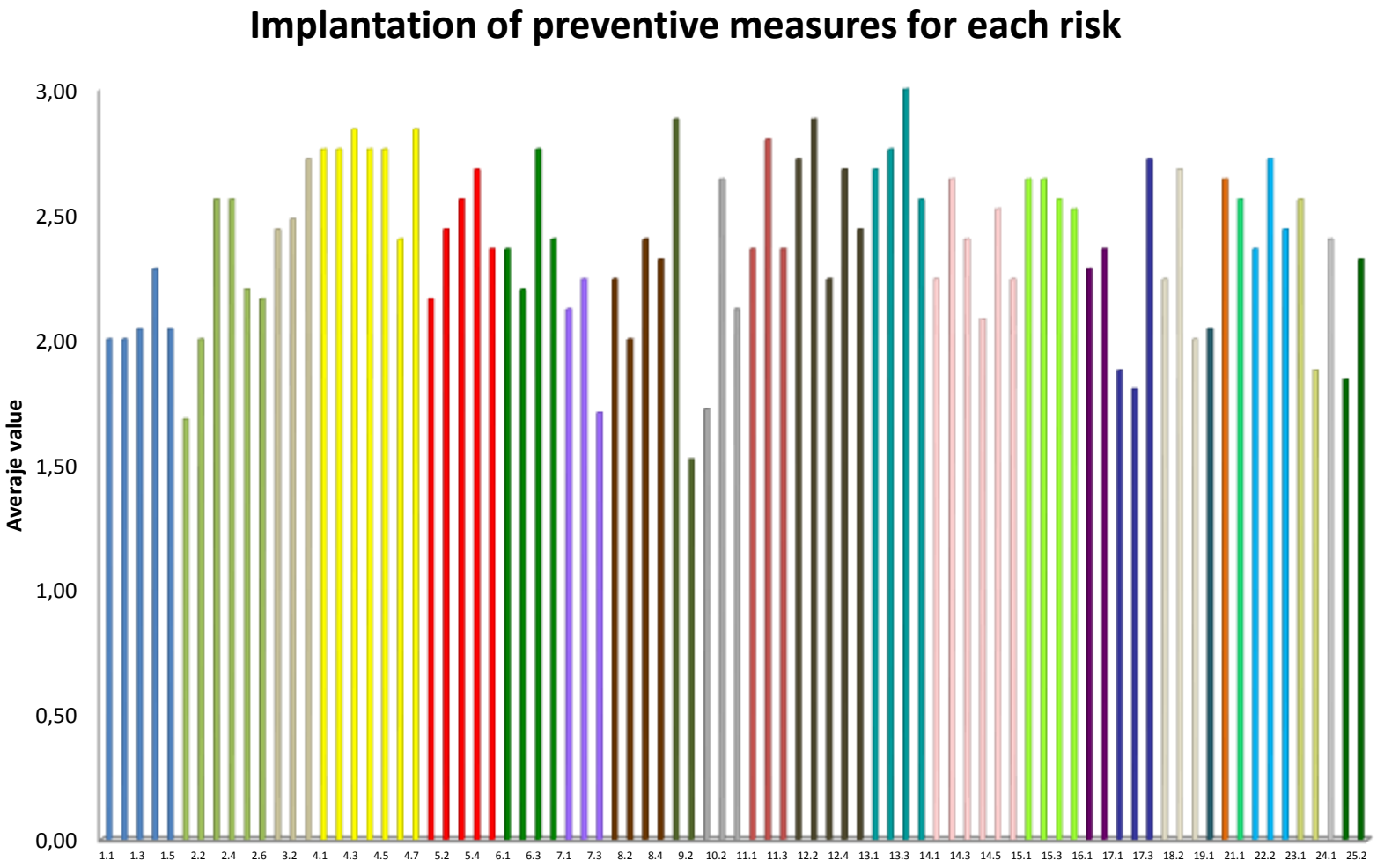
GROUP	RISK	SUBGROUP	AVERAGE	PREVENTIVE MEASURES
		10.2	2,64	When collective protection measures do not eliminate the risk, protection glasses are use by workers.
		10.3	2,12	Workers wear protection clothes against projection of objects when it is necessary.
11	Trapping in or between objects	11.1	2,36	Mobile parts of machines are covered by frameworks
		11.2	2,80	Handling loads can also cause trapping. When depositing loads on a surface (floor, table, etc) it is always done with care.
		11.3	2,36	Worker do not wear loose clothing, bracelets, chains…that can be trapped by machines in movement.
12	Trapping under machines or vehicle	12.1	2,72	Traffic rules are respected
		12.2	2,88	State of vehicles is regularly checked.
		12.3	2,24	Vehicles transit areas are enclosed.
		12.4	2,68	Caution is maximized in areas with slope, curves, etc
		12.5	2,44	The presence of workers near to vehicles or heavy machinery is avoided.
13	Manual handling	13.1	2,68	The load to handle is previously examined looking for cutting edges, nails, grease, etc
		13.2	2,76	The height, characteristics and dimensions of load to handle is always taken into account and other workers can help in case it is considered necessary.
		13.3	3,00	When it is possible, loads are lifted and moved using mechanical systems.

GROUP	RISK	SUBGROUP	AVERAGE	PREVENTIVE MEASURES
		13.4	2,56	Loads are always handled in a comfortable, ergonomic and safe position.
14	Exposure to extreme temperature	14.1	2,24	Workers do not consume tobacco or alcohol in the working hours.
		14.2	2,64	Workers always drink enough water to avoid dehydrations in hot periods.
		14.3	2,40	Clothes are adequate to temperature, as well as necessary protection of head, skin and eyes.
		14.4	2,08	In case it is necessary, workers have a parasol or umbrella for sun and rain protection.
		14.5	2,52	Under extreme weather conditions (hard rain or strong wind) works at quarry are canceled.
		14.6	2,24	Reduced time of exposure to extreme environments. Huts are used to take shelter from rain and sun. It is intended to stay the maximum time possible in shaded places.
15	Direct Electric Shock	15.1	2,64	Plugs are duly fastened, clean and without accessible active parts.
		15.2	2,64	Defects in insulation of wires are repaired immediately.
		15.3	2,56	Repairs on wires insulation are never done with insulation tape. Wires are completely replaced or tight boxes are used.
		15.4	2,52	Workers keep a safe distance from high-voltage facilities. If it is necessary, the area is enclosed using flashing lights.

GROUP	RISK	SUBGROUP	AVERAGE	PREVENTIVE MEASURES
16	Indirect Electric Shock	16.1	2,28	All electric machines are connected to an electrical board which has a differential switch. In addition, the machine is earth connected
		16.2	2,36	At least once a month, the differential switch is tested pressing “reset” button.
17	Exposure to noxious or toxic substances (dust)	17.1	1,88	Collective measures take priority over individual ones always. Dust collectors are implemented in place with high dust levels.
		17.2	1,80	In tasks where it is necessary, workers have a hut to protect themselves from dust.
		17.3	2,72	In situations where the implementation of other prevention measures is not possible or do not work properly, workers use masks.
18	Vehicle accident	18.1	2,24	Workers only walk in areas intended for it.
		18.2	2,68	Heavy machine´s drivers are extremely cautious and are helped by workers to do those operations that are not absolutely safe.
		18.3	2,00	Workers wear hi-visibility clothes.
19	Exposure to solar radiation	19.1	2,04	Workers use glasses with protection against solar radiation (ie: ultraviolets ray) and protection cream.
20	Blasts	20.1	2,64	All those elements and systems that may have risk of explosion (i.e: compressors), are frequently inspected.

GROUP	RISK	SUBGROUP	AVERAGE	PREVENTIVE MEASURES
21	Accidents caused by animals	21.1	2,56	It is avoided the presence of animals in working areas.
22	Noise	22.1	2,36	Noise is reduced in this way: Firstly in noise source (frames, etc), Secondly in environment (fronts, etc) and in thirst place in works (Individual protection equipment).
		22.2	2,72	Worker have at their disposal hearing protection in function of their exposition noise, which level is measured.
		22.3	2,44	When it is possible, workers keep a prudent distance from noise source.
23	Vibrations	23.1	2,56	In machinery in movement, drivers´ seat has got suspension system.
		23.2	1,88	When using hand machinery that cause vibrations, workers alternate tasks.
24	Inadequate lighting	24.1	2,40	When natural lighting is insufficient, auxiliary lighting is used guaranteeing an adequate illumination for task to be done.
25	Psychological stress	25.1	1,84	There is an alternation in tasks.
		25.2	2,32	There are breaks established.

Anexo II. Graphical analysis.



SAFEQU- A 3D ANIMATION FOR PROMOTING HEALTHY WORKPLACES IN STONE QUARRYING.

TEST FOR THE ASSESSMENT OF RISKS AND RISK´S PREVENTION IMPLEMENTATION OF MEASURES.

1. IDENTIFICATION OF RISKS IN QUARRYING WORKPLACES

Please fill the box with YES or NO depending on the existence of the related risk in your workplace within quarry:

	Risk	Yes/No
1	Falls from height	
2	Falls and slips	
3	Falling objects caused by collapse or displacement	
4	Probably injury from falling objects	
5	Fallen of loose/unfixed objects or materials	
6	Possibility of trips	
7	Crashing into inmobile objects	
8	Crashing into mobile objects	
9	Cuts and blows from objects or tools	
10	Flying objects	
11	Trapping in or between objects	
12	Trapping under machines or vehicle	

13	Manual handling	
14	Exposure to extreme temperature	
15	Direct Electric Shock	
16	Indirect Electric Shock	
17	Exposure to noxious or toxic substances (dust)	
18	Vehicle accident	
19	Exposure to solar radiation	
20	Blasts	
21	Accidents caused by animals	
22	Noise	
23	Vibrations	
24	Inadequate lighting	
25	Psychological stress	

2. LEVEL OF IMPLEMENTATION OF RISK PREVENTION MEASURES.

Regarding the aforementioned risks and in case you have written Yes, please write the level (from 1 to 3) of implementation of each one of the prevention measures.

Level 1	Non-existent prevention measures.
Level 2	Prevention measures are partially implemented and/or applied.
Level 3	Prevention measures are fully implemented and/or applied.

	Risk	Measure	Level of implementation
1	Falls from height	All differences in height are protected with rigid elements (fences, etc).	
		Risks of fall are signed.	
		A distance of security of 5 metres is respected.	
		Ladders are used to gain access to different heights	
		Harness or safety belts are used if collective safety measures are insufficient.	
2	Falls and slips	Working areas are kept free of mud.	
		Walking or moving areas are kept free of mud.	
		Safety shoes are used.	
		Vehicles (all terrain vehicles) are used to move if it is possible.	
		All objects are out of displacement areas.	
		Power shovel´s driver keeps walking areas free of objects.	

3	Falling objects caused by collapse or displacement	All parts that made up quarry facade are stable against landslide. In case it is not possible, hazard area is enclosed.	
		Obstacles are not near places with different heights.	
		All areas with risk of landslide are protected.	
4	Probably injury from falling objects	Safety shoes with metal toe are always used.	
		Workers know techniques for handling weights.	
		Safety gloves are always used when handling weights.	
		Machines are used to handle weights if it is possible.	
		All vehicles and tools for transport have a properly periodic maintenance.	
		All lift wires are checked and replaced when more than 10% of its section is damaged.	
		and transport machinery are used by authorized and qualified workers.	

5	Fallen of loose/unfixed objects or materials	Working areas with risk of fall are properly signed.	
		Objects are not stored near quarry façades.	
		Safety helmet use is obligatory.	
		Workers always avoid to stay below loads.	
		When equipment with hook are used, it is always protected with safety trigger.	
6	Possibility of trips	In working and passing areas it is avoided the presence of objects that can cause damages.	
		Tools and other objects that can cause cuts, slips, etc will be kept away from workers habitual areas.	
		It is obligatory to use safety shoes in all working places.	
		Working and passing areas have adequate lighting.	
7	Crashing into inmobile objects	Passing areas, exits and displacement paths of working areas are free of obstacles.	

		Tools and other objects that can cause cuts, slips, etc will be kept away from workers habitual areas.	
		Above mentioned places for displacement within working areas are properly signed (i.e: parking).	
8	Crashing into mobile objects	It is kept a security distance of 5 metres between workers and radius of action of heavy machinery.	
		Passing areas near to dangerous zones are properly signed.	
		Distance between machines is enough for workers to do their work comfortably and safety.	
		In machines that have mobile elements, these are protected by frames.	
9	Cuts and blows from objects or tools	Safety gloves are always used when handling elements that can cause cuts or pinchs.	
		Areas with permanent	

		danger against an inmobile objects are always painted with yellow and black strips.	
10	Flying objects	All machines or tasks that can cause projection of fragments of material are covered with protection barriers (i.e: transparent fronts between worker and machine).	
		When collective protection measures do not eliminate the risk, protection glasses are use by workers.	
		Workers wear protection clothes against projection of objects when it is necessary.	
11	Trapping in or between objects	Mobile parts of machines are covered by frameworks.	
		Handling loads can also cause trapping. When depositing loads on a surface (floor, table, etc) it is always done with care.	
		Worker do not wear loose	

		clothing, bracelets, chains…that can be trapped by machines in movement.	
12	Trapping under machines or vehicle	Traffic rules are respected	
		State of vehicles is regularly checked.	
		Vehicles transit areas are enclosed.	
		Caution is maximized in areas with slope, curves, etc	
		The presence of workers near to vehicles or heavy machinery is avoided.	
13	Manual handling	The load to handle is previously examined looking for cutting edges, nails, grease, etc	
		The height, characteristics and dimensions of load to handle is always taken into account and other workers can help in case it is considered necessary.	
		When it is possible, loads	

		are lifted and moved using mechanical systems.	
		Loads are always handled in a comfortable, ergonomic and safe position.	
14	Exposure to extreme temperature	Workers do not consume tobacco or alcohol in the working hours.	
		Workers always drink enough water to avoid dehydrations in hot periods.	
		Clothes are adequate to temperature, as well as necessary protection of head, skin and eyes.	
		In case it is necessary, workers have a parasol or umbrella for sun and rain protection.	
		Under extreme weather conditions (hard rain or strong wind) works at quarry are canceled.	
		Reduced time of exposure to extreme	

		environments. Huts are used to take shelter from rain and sun. It is intended to stay the maximum time possible in shaded places.	
15	Direct Electric Shock	Plugs are duly fastened, clean and without accessible active parts.	
		Defects in insulation of wires are repaired immediately.	
		Repairs on wires insulation are never done with insulation tape. Wires are completely replaced or tight boxes are used.	
		Workers keep a safe distance from high-voltage facilities. If it is necessary, the area is enclosed using flashing lights.	
16	Indirect Electric Shock	All electric machines are connected to an electrical board which has a differential switch. In addition, the machine is earth connected.	

		At least once a month, the differential switch is tested pressing “reset” button.	
17	Exposure to noxious or toxic substances (dust)	Collective measures take priority over individual ones always. Dust collectors are implemented in place with high dust levels.	
		In tasks where it is necessary, workers have a hut to protect themselves from dust.	
		In situations where the implementation of other prevention measures is not possible or do not work properly, workers use masks.	
18	Vehicle accident	Workers only walk in areas intended for it.	
		Heavy machine´s drivers are extremely cautious and are helped by workers to do those operations that are not absolutely safe.	
		Workers wear hi-visibility clothes.	

19	Exposure to solar radiation	Workers use glasses with protection against solar radiation (ie: ultraviolets ray) and protection cream.	
20	Blasts	Todos aquellos equipos que pudieran tener un riesgo de explosión deberán de ser revisados con frecuencia (p.e. compresores). All those elements and systems that may have risk of explosion (i.e: compressors) , are frequently inspected.	
21	Accidents caused by animals	It is avoided the presence of animals in working areas.	
22	Noise	Noise is reduced in this way: Firstly in noise source (frames, etc), Secondly in environment (fronts, etc) and in thirst place in works (Individual protection equipment).	
		Worker have at their disposal hearing protection in function of	

		their exposition noise, which level is measured.	
		When it is possible, workers keep a prudent distance from noise source.	
23	Vibrations	In machinery in movement, drivers´ seat has got suspension system.	
		When using hand machinery that cause vibrations, workers alternate tasks.	
24	Inadequate lighting	When natural lighting is insufficient, auxiliary lighting is used guaranteeing an adequate illumination for task to be done.	
25	Psychological stress	There is an alternation in tasks.	
		There are breaks established.	