

HSE Concepts a Real Mean to Ameliorate Working Conditions

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Résumé

The aim of the case study is to evaluate the overall safety conditions in the area of the desalination unit of the liquefaction plant "GL1K Skikda" to recognize and categorize the hazards identified in this workplace area during the discaling operation.

The methodology used will be based on the hazards identification process by means of the observation of the onsite operator work and the task analysis procedure, with the study of the material safety data sheet "MSDS" of the chemical product "BS12" used during the discaling operation.

The hazard identification process carried out in the discaling section site has revealed a variety of physical and health hazards that seem to have none control measures, which could affect the safety and health of employees onsite and the organisation assets as well.

So, the risk assessment procedure undertaken in this section has came up with a range of practical recommendations that need to be set in a short term plan, to eliminate or reduce the risks of some significant hazards to preserve the overall safety and the health onsite.

Finally, an action plan of the practical recommendations is set with the timescale and the cost estimated for each action in cost benefit study.

Mots-clefs : Hazard identification, Task analysis, Ergonomic Design, Risk assessment, Cost benefit study.

1. INTRODUCTION

Sonatrach; the national oil and gas company, after the incident of the Skikda's Liquefaction plant on the 19th January 2004, has launched a vast programme to improve safety within all the plants of the company. The first stage was the signature by the top manager of a declaration of the occupational health and safety policy to show the commitment of the management towards the protection of the health and safety of their employees, the company assets and the environment.

Also, the adoption of a map road to obtain some useful accreditations from the certified organisms

for the quality, the occupational health safety and the environmental management system in accordance with the recognized international standards "ISO 9001:2008, ISO 14001:2004, in order to assure the effectiveness of the procedures used by the company and to satisfy their national and international partners.

Based on the current Sonatrach occupational health and safety "OH&S" management system in the liquefaction plant "GL1K Skikda", a hazards identification process is carried out to recognize and categorise the hazards in the workplace by the use of risk assessment procedure to identify the risks and the population that could be affected and how the harms could occur in order to review of the effectiveness of the control measures in place.

The main findings on the hazards identification and the risk assessment review will be subject of a report with the practical recommendations to the management in order to address the issues that are highlighted in this study to the effective implementation of the corrective measures recommended.

2. METHODOLOGY

Firstly, the observation and the use of the task analysis study; which consists of a break down of the discaling operation into several steps .And then we consider the tools and the materials used in each steps of the operation to look for the hazards associated with it ,through the observation of the movements and the behaviours of the on site operator during each stage of the discaling operation to identify the physical and the ill-health hazards to the on site operator and any potential risks for the environment.

Secondly, the study of the information of the "MSDS" and the label on the containers of the "BS12" to understand its characteristics and the risks associated with.

Finally, risk assessment review within the existing control measures in order to provide further protection means of the health and safety during this operation.

3. DESALINATION UNIT DESCRIPTION

The desalination section produces the necessary distilled water by vacuum evaporation of the seawater in order to produce 1440T/J of the distilled water, used by the boilers to generate the necessary quantities of steam that power the refrigeration turbo-compressors in the "GL1K" and to feed the refinery of Skikda.

The desalination unit flow diagram and the running parameters are shown in "Fig.1".

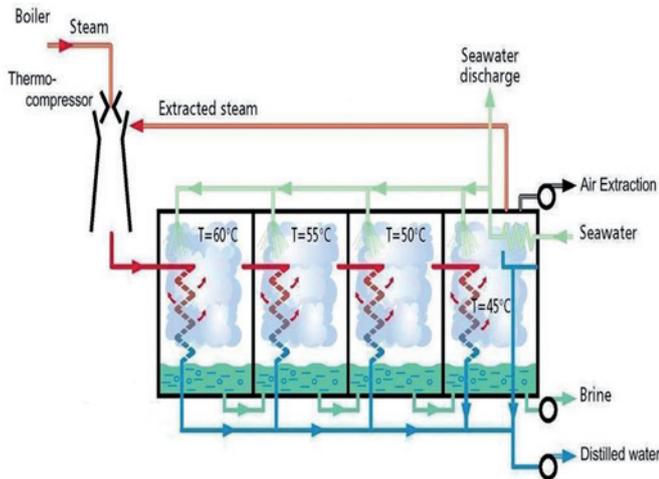


Fig.1. Desalination unit flow scheme.

This section comprises a set of four desalination units; each one has a limited running cycle, at the end of each cycle, the desalination unit is shut down and prepared for the discaling operation that aims to a removal of the mineral scale deposited on the tubes of the internal heat exchangers of the unit from the salty sea water passing through.

During the discaling operation an acid product provided in a solid form and commercialized under the name of "BS12" is used after a dilution with heated water in the preparation tank with the following parameters: "T=60°C", "PH=0.65".

This acid solution is pumped along through the internal heat exchangers tubes of the desalination unit by the transfer hoses to remove the deposited mineral scale.

4. DISCALING SECTION LAYOUT

The acid used during the discaling operation is prepared by dilution of the "BS12" product in the hot water inside the preparation tank before is pumped along it the desalination unit to remove the deposited, as it's shown in the Image1.

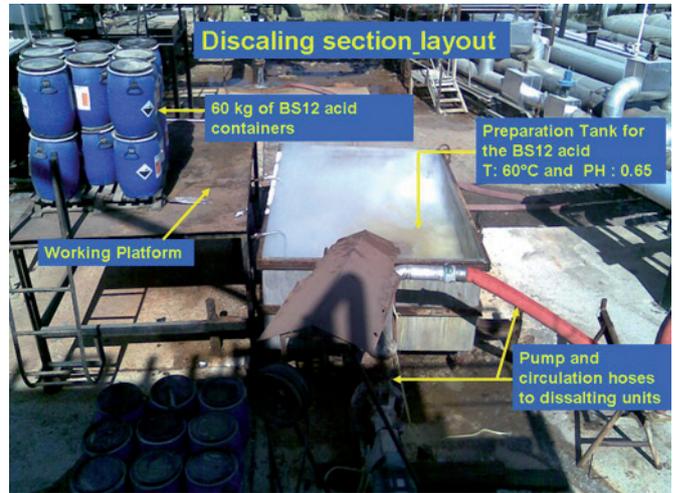


Image1

5. STUDY OF THE INFORMATION OF THE CHEMICAL

The "MSDS" of the chemical "BS12" used in the discaling operation aware us about the corrosive and irritant nature of this chemical product, besides the information of the risk and safety phrase on the container label "R36/38", "R52/53", "S26", "S28,S61".

6. ONSITE OBSERVATION

The observation of the operations of discaling and the cleaning of preparation tank in addition of the equipment used, have revealed a large variety of hazards and risks incurred by the onsite operator.

The identified risks are a potential source accidents and ill-health effects which could happen even after years of exposure to these multiple hazards.

The lack of a risk management system and the bad site organisation (trilling hoses and electrical cables on the floor besides the high level of noise ...) are multiplying factors of the risks incurred.

7. HAZARD IDENTIFICATION

The hazards observed onsite in the discaling section area are categorised depending on their nature into two groups physical and ill-health hazards, then they prioritized according to their potential impact on the onsite operator.

7.1. Physical hazards

7.1.1. Fall from height

The heavy weight of the "BS12" containers involve the need of the onsite operator to use a high working platform, about 1.9 meters high to empty the "BS12" containers into the preparation tank to be diluted and heated before use.

So, this situation could give rise to a fall hazard either on the ground due to the absence of barriers around the working platform and restricted working space or into the preparation tank because the awkward posture adopted by the operator while emptying these containers.

The likely implication of this hazard would definitely be serious injuries and bones break or in case of fall into the preparation tank would be very serious burns on the whole body or even the death of the onsite operator.

7.1.2. Slips and falls on the working platform

The working platform used to empty the "BS12" containers into the preparation tank has lots of surface defects (corroded and uneven surface) combined with the spilled water and the "BS12" solid acid product; turn this platform to a very slippery area.

The likely implication of this situation could result in injuries and cuts to different parts of the body in case of fall.

7.1.3. Splashing of hot and acid water

When the onsite operator empties the "BS12" containers into the preparation tank, the hot and acid water splashed onto his face and other exposed parts of his body, especially because of the absence of any personal protective equipment (specific overall, gloves and face visor).

The likely implication of this situation could result in burns at the face or to the other exposed parts of the body by the splashed hot and the acid water.

7.1.4. Collapse of working platform

The corrosion of the metal sheet of the working platform surface due to the acid used in the discaling which is already too loaded with the heavy weight of the stacked containers of the "BS 12" chemical product in addition of the weight of the operator working on may cause it collapse.

The likely implication of this collapse will result in the fall of the operator or the fall of the containers on the floor with a severe accident with serious injuries to the on site operator or other employees working nearby.

7.1.5. Turnover of the tank

The corroded supports of the preparation tank could cause the turnover of the tank full of the hot and acid water and the spillage of its corrosive content on site which could come in contact to all employees working nearby and cause the pollution on the site.

The likely implication of that could result in accidental contact with the hot and acid water to on site operator and other people on the site with the consequence of burns and other type injuries.

7.1.6. Slips, trips and falls on the ground

The trailing electrical cables and the transfer hoses of the pump in addition to the wet and uneven ground of the working site could cause the slip trip and fall of the on site operator and other employees working on site.

The likely implication of this situation could result in different type of injuries to different parts of the body of the on site operator and other people working on site.

7.1.7. Work equipment and machinery

The equipment on the site like the transfer pump used by the operator could be a source of some mechanical hazard such as; the entanglement and the drowning in case of the entrapment of the clothes of the on site operator on the rotating shaft of the pump and even worse if there is an entrapment of any body parts, especially fingers.

The likely implication of this hazard could result in different type of injuries and even loss of fingers.

7.2 Ill health hazards

7.2.1. Manual handling

The provision of the "BS 12" acid in 60Kg containers and their bad stacking by the fork lift truck on the working platform (two levels stack) creates bad working conditions and increase the need to awkward movement (i.e. up reaching) to handle these containers from the top of the stack and the lifting and carrying of the heavy containers in bad manner due to the total ignorance of the basic safe manual handling techniques.

The likely implication of this hazard could range from the back injury; which could be very disabling ill-health to the work related-upper limbs disorder "WRULDs" due to repetitive movements (up reaching and carrying of the heavy containers) and the evolution of this ill-health to the musculoskeletal disorder syndrome as a chronic effect.

7.2.2. Contact with chemical substance

The handling of the containers of the "BS 12" chemical product containers, which is corrosive and slightly irritant substance into the preparation tank sometimes without adequate protection or when mixing the solution in the preparation tank with an inadequate tools (absence of agitator in the preparation tank) could have a bad impact on the health of the onsite operator even in long terms.

The likely implication of this situation will cause skin irritations and hand contact dermatitis as first stage response which could with the prolonged contact with the “BS 12” chemical product lead to a secondary or sensitisation dermatitis as the chronic effect which could be a very disabling ill-health.

7.2.3. Noise

The exposure of the onsite operator to daily high level of noise from the four sea water desalination units and the surrounding equipment of the liquefaction plant (Boilers and Turbo-Compressors) that produce a noise level above the 85dB, which is the upper action limit for the provision of adequate hearing protection (ear defenders, ear muffs or ear plugs), but the absence of adequate hearing protection for the onsite operator could have a bad impact on his hearing capacity and other employees working nearby.

The likely implication of the high level of noise range from the temporary threshold shift “TTS” as short time response with ranging in the ears, but the prolonged exposure to high level of noise could irreversibly damage the hearing system, especially the cochlea and lead to the noise induce hearing loss “NIHL” which is the loss of the natural ability of hearing with all the social and professional impact.

7.2.4. Environmental acid discharge

The direct discharge of the used up acid to the sewage system without any neutralization or treatment in accordance with “MSDS” recommendations will cause a severe pollution to the marine environment where the sewage system end up and affect the marine fauna and flora in the long term, accordingly to the risk phrases “R52/53” on the product label.

The likely implications of this situation will definitely be the contamination of the food chain by the accumulation and the build up of toxins in the organisms of the consumable fish then the transfer of these toxins to people which will certainly affect the health of a larger population in the long term.

7.2.5. Chemical body Absorption

The manual emptying of the “BS 12” chemical beside the cleaning of the preparation tank without adequate tools or protection (safety goggles, gloves and overall) could cause the particles of the “BS 12” to penetrate by absorption through the skin hand (especially the thin skin barriers of the eyes and the nose) to end up in the blood stream.

The likely implication will certainly be an irritation and reddening of the skin with burns feeling in the exposed body parts especially the eyes, besides the build up of the chemical in the body system in long term with deferent ill health effects.

8. PRIORITISATION OF HAZARDS

The prioritisation of the hazards is done by the examination of the potential consequence of each hazard identified (i.e. “Severity (S)”) and the estimation of the probability of occurrence of the risk associated with (i.e. “Likelihood (L)”), then the risk rate is calculated by the given formula (1).

Risk rate (R) = Severity (S) × Likelihood (L)

Then, by application of a five degrees matrix for both the severity and the likelihood to undertake the calculation of the risk rating values for each hazard (Risk Assessment Matrix).

The results for both physical and ill-health hazards are shown in the Table 1 and Table 2 below respectively :

Table 1

Physical Hazard	Risk rate		
	S	L	R
1-Fall from height	5	3	15
2- Slips and falls on the working platform	3	3	9
3- Splashed of the hot and acid water	2	3	6
4- Collapse of platform	2	2	4
5-Working machinery	3	1	3
6- Turnover of the tank	2	1	2
7-Slip, trip and fall on ground	2	1	2

Table 2

Ill-Health Hazard	Risk rate		
	S	L	R
1-Manual handling	4	3	12
2-Contact with chemical substance	3	3	9
3-Noise	3	3	9
4-Acid discharge in the environment	2	3	6
5-Absorption of the chemical substance	2	2	4

The prioritization of hazards help decision making to deal with the most significant hazards (with severe or death risk) first (immediately in general) and the other in a timescale action plan.

9. CONCLUSIONS & RECOMMENDATIONS

The case study undertaken on the desalination unit of the complex "GL1K" during the descaling operation has come up with a variety of the practical recommendations that could be easily achieved within a short time plan and with a little cost.

The following recommendations summarise the hazards identification and the risk assessment carried on site, the main findings to be set within an appropriate scale time and according to the resources available to improve the safety and health for the on site employees :

The review of the working platform design to meet the basics of ergonomics design, should start by the reduction of the height of the legs of that platform to be only (1000 mm) above the ground level to render the work less dangerous and to be adapted to the preparation tank level, this will reduce drastically the way of the emptying the "BS 12" containers (eliminate the dangerous posture of bending on the preparation tank).

The replacement of the corroded and uneven working platform metal sheets by new ones, preferably from stainless still sheets to withstand wear and the corrosive action of the chemical "BS 12" used in the descaling operation to avoid the collapse of the working platform under weight of the heavy containers stacked on.

The installation of safety barriers of (900 mm) around the working platform with a spacing of (100 mm) between the upright bars with a toe board of (50 mm) high and hand rail.

The refecton of the preparation tank supports of (350 mm) length with non corrosive material, preferably stainless steel to resist to the corrosive action of the "BS 12".

The installation of a new fixed ladder welded to the structure of the working platform to give a safe access for the on site operator to the working platform.

The installation of a chute of a (500 mm) length welded to the preparation tank, made from non corrosive material preferably from stainless steel to resist to the corrosive action of the BS 12 chemical. This chute should be provided with arrest rod to hold the BS 12 container while is being emptied into the preparation tank, which will render the emptying task easier to the on site operator, as shown in Fig.2.

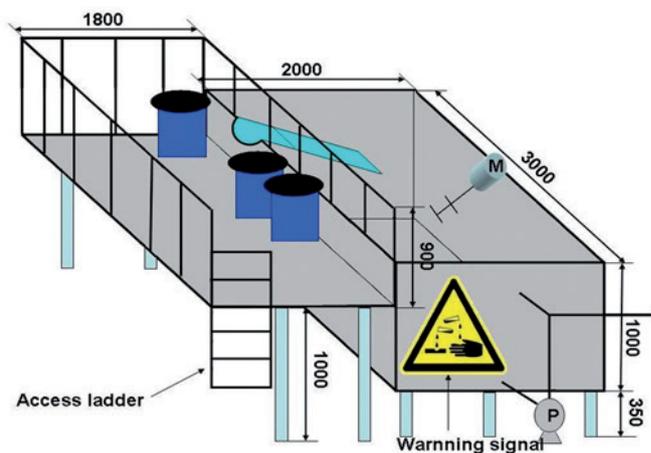


Fig 2. final design with the all dimensions

The provision of a training of two days to learn the basic knowledge on the good manual handling techniques to promote the safe behaviours and awareness and help him in the performance of his tasks without risks to his safety and health.

The supervision of the all descaling operation by the safety inspector to implementation on the site rules and the use of the personal protective equipment by the on site operator.

The provision of the on site operator with personal protective equipment accordance with the following standards adopted by Sonatrach in "Manuel des Equipments de Protection Individuelle Rev: 01", 05 Avril.2008":

Chemical resistant overall "Work clothes must comply with the requirements of the standard

"EN 465" combined test methods "EN 369" (permeation by liquids).

Safety protective chemical mask (Screen acetate treated hydro stop and anti-mist) meeting the standard "EN 166" for proposed services (laboratory and utilities) or Cartridge Mask complete complying with standard "EN 136".

Hard hat responding to the requirements of "EN 397" fitted with slots for mounting attachment of hearing protection, earplugs and ear defender responding to the standards "EN 352-2" and "EN 352-3".

Safety boots responding to "EN 344": General requirements.

Protection of hands and arms gloves responding to following standards: "EN 420": General requirements (manufacturer's identification, size, dexterity)

"EN 374-3": permeation test.

The discharge of the effluent of the used up acid to the reffected neutralization well and the stack of the "BS12" containers on one level.

The use of new hoses fitted with the adequate connectors and the health surveillance to the onsite operators.

10. ACTION PLAN AND COST BENEFIT STUDY

The Action plan summarizes the time scale and the approximate cost of each action in the recommendations.

The calculation of the cost of the hazards and risk control measures is based on the average price of material used and the average working day for the maintenance staff and the price of the personal protective equipment is the supplier's

average price.

The results of the cost benefits study shows that with only a little cost the actions will have a huge impact on the health and safety onsite and contribute effectively in the preservation of workers life.

11. REFERENCES

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