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The Water Reuse in Training Center Firefighting in Petroleum Facilities

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ABSTRACT

The consumption of freshwater in the world has raised dramatically, due to the increase in population in urban areas, irrigation of agri-business and the use of water in industrial processes, leading consequently to municipal and industrial sewage. This refers to the need to assess, save, reduce and recycle industrial wastewater in order to develop reuses processes based on the precautionary principle, considering the possibility of occurrence of contamination of a chemical and microbiological present in the effluents. This study evaluated a critical process for reuse in general and more specifically in Training Centers Fire Fighting (TCFF) training which consumes considered volume of water as the extinguishing agent. The technologies developed simple and creative prove the success of water reuse in the fight against waste.

Keywords: *Reuse, contamination, training, fire, environment*

1. INTRODUCTION

In view of the critical specialists consumption and waste of water used in the various segments of the modern world will be a huge barrier to sustainable development.

The Global water usage increased six fold in the last hundred years and would double by 2050, mainly due to the culture of irrigation. Among the species on Earth, human is using all available freshwater, reaching in present day to about 54% of the water total accessible and, following the current trend in the next 25 years mankind will absorb 90% of available freshwater, leaving only 10% for the other inhabitants of our planet.

The water will become, in effect, a strategic center for the development and quality of life in many countries, particularly to Brazil and from the viewpoint of Braga et al. [1] water resources can be utilized in various ways, given the diverse industrial, social, agricultural, and so on developed by man.

The progressive increase in the demand for fresh water is a function of population growth in areas of irrigated agriculture and water use in various industrial segments. On the other hand, should also be added to this scenario, misuse, wastage and contamination of all kinds have been generating, consequently, the reduction and gradual deterioration of water quality [2, 3].

Regarding Brazil, in the critic view of various authors what is lacking is not exactly water, but a cultural pattern that adds ethics and improve the efficiency of political performance of governments, the society organized broadly, the public and private actions promoting economic development in general its fresh water in particular.

For many people in Brazil, water scarcity is not an imminent threat, because the country has one of the largest fresh water reserves in the world. It must be warned, the correct view of information, the main sources of fresh water are the rivers of the Amazon basin, far from large urban centers and therefore this water not letting the larger cities.

According Mainier [4] is common to see some cities where water quality is questionable, since there are no treatments of drinking water and no sewers, no piped water supply and, consequently, the outcrop ditches and proliferate everywhere. The local population gets the drift, forcing her to search for water in shallow wells, streams and ponds that somehow end up getting polluters. And yet, complete the untreated water has been identified as responsible, directly and indirectly, by the high occupancy of beds in public hospitals, although the ignorance, poverty, malnutrition and poor sanitation are associated with this scenario.

The reuse of water is already being widely used in industry, especially in cooling towers, boilers, construction, irrigation of green areas and some industrial processes where water use with lower quality standard does not cause major problems. Thus, the reuse of water for non potable purposes should be considered as the first option for the reuse [5, 6].

An alternative to integrating the activities of reuse that can be considered is the use of reject water from a production process, which requires higher quality water, in another process that can use water with lower quality. This alternative is environmentally friendly, however, continues to incorporate impurities when receives bodies of water [7, 8].

A better alternative is the reuse of water in a closed cycle, after the use of water in any activity that results in the incorporation of impurities, making getting an initial water quality, using a process of treatment.

Given these facts, the case study treated, then, refers to a training center for employees for teaching techniques designed to confrontation of fires in oil installations.

2. WATER REUSE IN THE TRAINING CENTER FIRE FIGHTING

This Training Center Fire Fighting (TCFF) belonging to company Sampling Planejamento S/A, has 17,000 m^2 and is located in Rio das Ostras, Rio de Janeiro, Brazil. This center (Figure 1) was built to meet the needs of oil companies targeting the training of specialized workers who must have knowledge of firefighting.

Fig 1: Overview of the Training Center Fire Fighting.

Workers are trained to acquire knowledge, skills and attitudes necessary to control and prevent a fire from small up to large proportions. Generally, a course of four to five days will accelerate learning and productivity of people with little or no work experience in the offshore oil and gas.

The course provides an overview of field development concepts and explains how onshore and offshore structures and facilities function as integrated systems.

The skills taught in the course are based on team building fire fighting using techniques of isolation, suffocation and cooling using extinguishing agents such as water, foam, dry chemical and CO_2.

This project, which is based in the provisions of Brazilian Standards NBR14.277/05 [9], has the demand of 50 oil works per day whose realize the training.

Still on the LPG tank storage system will be proportional using as a container vessel P 500 (capacity 500 kg). To support the operational activities of the training center, built area consists of the following facilities compressor pump house, house of fire fighting, room cleaning of PPE (personal protective equipment) and RPE (respiratory protective equipment), eat-in kitchen, living room distribution of PPE and RPE, male and female changing rooms, reception and room coordination, tank fire extinguishers, home control, nursing, and guardhouse.

The flowchart of the facilities (simulators) of the TCFF is presented in Figure 2, consisting essentially, the area of training with those obstacles (training field, helicopter, system processes, fire house, and tank), retention of fire (water storage of 40,000 L) and reuse system, object of the present study.

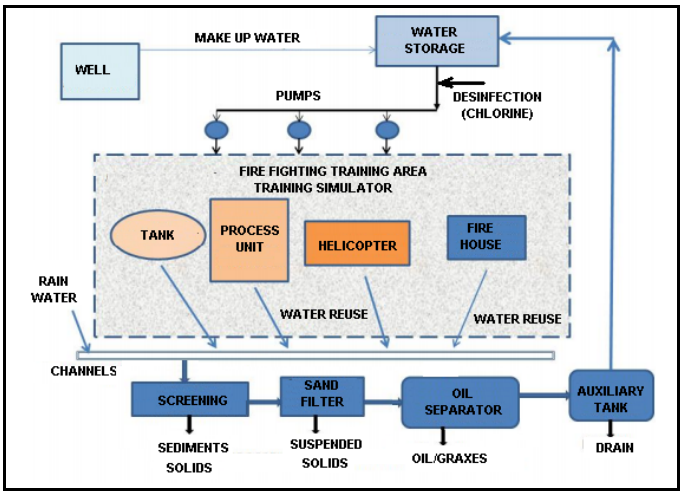

Fig 2: Flowchart of the fire fighting installation.

In figure 3 are shown the various obstacles that act as fire fighting simulators.

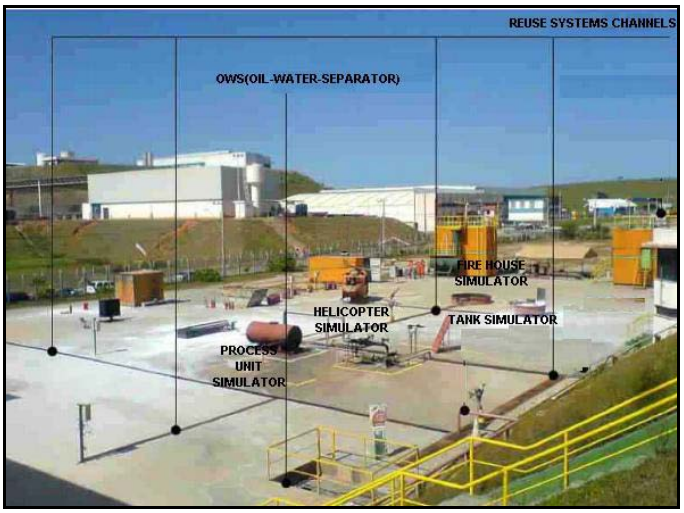

Fig 3: Field aspect of firefighting training.

A photographic sequence shown in Figures 4 to 8 shows the scene of the fire fighting training in simulation several obstacles, such as, "firefighting field", "engine room", "helicopter" and "system processes (and vessel flange) ", consolidating the large water consumption in these operations.

It is essential to remember that the great volume of water used in training operations remove mud, sludge, oily emulsion, solid waste

Fig 4: Training in the fire tank simulator.

Fig 5: Training in the fire tank simulator.

Fig 6: Training in the process unit simulator.

Fig 7: Training in the process unit simulator.

Fig 8: Training in the process unit simulator.

Fig 9: Training in the helicopter simulator.

Fig 10: Training in the fire house simulator.

As shown in the flowchart (Figure 2) Training Center (TCFF) all water used in the training of fire fighting and water rains drain into the channels shown in Figure 11.

Fig 11: Channels through which water flows from fire fighting.

In order to keep the training area practically dry the used water flows into the channels and quickly to the Effluent Treatment Plant.

First, the water used passes through a bar screen (mechanical filter) to remove large objects, such as can, sticks, rags and plastics, from fire fighting training. They typically consist of a series of vertical carbon steel bars spaced between 2 to 8 cm.

Then, the water passes through sand filter where suspended solids are retained.

The water continually flows into the SWO system (separation of water-oil) where is retained much of the oily sludge that forms in the interaction between water-oil. In SWO the sewage arriving in turbulent regime are routed inside the box separator in laminar flow velocity and with a retention time exceeding 30 minutes, most of the oily products is separated from the water.

Aiming to retain the oily particles with minimum diameter of 10 mm are used coalescent plates consisting of a bundle of plates of PVC (Poly Vinyl Chloride) inclined at an angle of 60. The effluent obtained has a maximum of 20 mg/L of oils and greases.

The oily mass retained in the separator is concentrated in the interior, by gravity and the ability to coalescence of the plates. This accumulated oil, according to Brazilian environmental standards, must be placed in drums and sent to the accredited treatment plant oily residues.

The water without oil flows into the auxiliary tank (reused) where it is pumped to the water storage. The water circulated, as well as the makeup water (artesian well) is chlorinated to achieve the recommended values for disinfection.

Water used in the system is continuously monitored by the laboratory where are made physic-chemical (pH, turbidity, chloride, iron, total alkalinity, sodium, total solids, conductivity and chlorine residual) and bacteriological analysis (*coli form, Escher coli*).

The water tests show the need for a constant control water quality, especially regarding the possibility of microbiological contamination of character, especially in the contamination by fecal coli forms and *Escherichia coli*. Moreover, it is essential that the levels of residual chlorine be consistent with the processes of disinfection, so the levels should be between 0.2 to 0.5 mg Cl_2/L.

When the values of physico-chemical and microbiological water reused exceed the standards set by environmental agencies the water is discarded and sent to the Effluent Treatment Plant.

When the water is discarded for any reason or there was no volume in the water storage replacement water, the water from the well enters automatically in the water storage.

The number of oil workers trained in this center is of the order of 4.000 per year. This fact means that the operations of firefighting training consume much water.

The annual volume of water reused and discharged to the Effluent Treatment Plant is 120 m^3. In the past when the methodology was not applied reuse water disposal was of the order of 100-300 times depending on the number of trained workers. It is a waste without any need

3. CONCLUSİONS

Based on studies conducted in the Training Center Fire Fighting concludes that:

- Water reuse is an important route to be used in various urban and industrial segments, however, its use should be linked to criteria based on quality, environmental standards and public health;
- Water scarcity, especially in large cities leads to rational reuse of water from domestic sewage or industrial effluents;
- The reuse water used in the Training Center of Firefighting is a simple and creative technology option because it reduces the disposal of water used and does not use water from natural springs protected by environmental laws.

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