

## **HO 120001 - Beautiful Colours – Background**

Welcome to “Beautiful Colors”, a small textile company which specializes in dyeing and printing fabrics. The management of “Beautiful Colors”, has engaged you for helping them in chemical management. To better understand the situation at hand, you are organizing a meeting with the company management and visit to the factory. During the first walk-through of the factory, you have observed and noticed the following:

1. There is a general storage area, where the raw material and chemicals are received. When chemicals are delivered by the suppliers, the company workers straight away places these in store after without any further quality control. One of the workers points out the red symbol with the black exclamation mark on a chemical bag wondering about its meaning, but the store supervisor does not know. The storage area is quite full. In the front yard, the workers have stored two containers with Aniline and Acetone.
2. All the dyes and chemicals are stored in bags and containers next to the fabric material, directly on the floor. Since the last rainy season, the roof of the storage area has been leaking. A few bags got wet and were put aside in a corner. New materials have already been ordered. John, the most skilled worker, is the only one who can identify different chemicals even though labels or markings on many chemical containers are damaged, missing or in foreign language.
3. Because of his long experience, John hands out the chemicals needed in dyeing or printing process to each worker individually. In case of any questions regarding the chemicals everybody checks with him. When inquiring with him about material safety data sheets, he indicates that there seems to be a folder somewhere in the manager`s office but he does not know exactly. You see some chemical containers with acetic acid, and dye stuff such as reactive black and basic yellow.
4. Once the workers have received the chemicals they carry these in open and unmarked buckets to the respective production areas. In the dye kitchen the color baths are prepared by mixing water with dyes and auxiliary chemicals. Jeff is responsible for the preparation of the chemicals used in these operations – a task which demands most of his time and which is done according to recipes based on long years of working experience. Jeff claims that about 25-30% of articles are dyed in lighter colors. After all these years, Jeff is not very enthusiastic about his job and sometimes does not really pay attention to the mixing of the exact quantities of chemicals, adding more or less than “usual”. Sometimes he lets one of the helpers do the mixing. The staff keeps a few open bags and containers of powdery dyestuffs and other chemicals in the mixing place. Sometimes, bags get spoilt when they have been lying on the wet floor for too long. To clean the dye kitchen from dust and spilt materials, the floor is swept by the cleaning personnel every week. When you leave the dye preparation area, you notice that your white shirt is covered with black dye partides.
5. Ben, who is responsible for dyeing the fabric, wears boots, saying it makes him feel better and safer, unlike his colleagues, who wear open sandals. During the dyeing process, Ben adds further auxiliary chemicals (salt) for color fixation, and he regulates the temperature of the heated dye bath in the machine. Dyeing is done in old, open machines, which use large amounts of water. Every now and then the machines start leaking. When the leakage in the machines gets too big, it just gets fixed in an improvised way by Richard, who oversees general maintenance. Occasionally, when the coloring vessels are filled too much, liquids spill out of the vessels onto the floor. Lots of water and spillages end up on the floor, making it really slippery and keeping the cleaning staff very busy all day. Once the process is complete, the waste dye liquor is drained into the drainage going to the treatment plant. It is estimated that up to 40% of the dyes and 80% of the auxiliaries end up in the wastewater. You quickly compare the recipe log of dyeing, current storage in dye kitchen, and chemical issuance estimates by John for few batches, and find out that John`s estimates show at least 8-9% more quantities than consumption

6. The cleaners also hose the floor, with the wash water flowing out into the sandy factory yard. The cleaning effluent goes directly into the nearby drainage. Several times the drainage is blocked by some old packaging and the cleaning effluent flows into the yard.
7. The next step after dyeing is drying of the fabric which is done outside in the open air, before going to printing. While you walk from the dyeing to the printing area, you slip several times on the wet floor.
8. In the printing area, you meet Jeff who is the production supervisor. At the entrance of the printing areas there is a small "colourful" area where a helper is mixing the printing paste as per instructions from Jeff. Apart from a container with 2-Naphthol and Sodium hydroxide, there is one more chemical container without a label, but some handwritten sign. You observe how several female workers carry out the manual screen printing. You immediately notice the solvent smell in the air. There is an exhaust fan mounted on the rear wall, which blows the air to the outside toward the neighbouring building. On the rear side of the room you also see some containers with dry printing paste lined up. When inquiring about the containers with the workers, they indicate that quite often they prepare too much printing paste. The left-over paste is collected and thrown out with the waste into the yard every now and then. It is estimated that 95% of printing paste gets applied to the fabric. You quickly compare the quantity of paste in drums against the consumption estimates and estimate about 10% paste in the waste drums. Since you start feeling dizzy in the printing area, you proceed to the backyard.
9. On the way to the backyard you pass the product storage area, the entrance to product storage area and the walkways are rather narrow, so workers carry heavy bundles of materials in and out. Apart from the final products and some spare parts, you also see a one container with Citric acid and one container without any label.
10. The factory has a simple wastewater treatment plant (ETP) which has been built ten years ago located in the backyard. Richard, who is in charge of general maintenance, seems to be also responsible for running the effluent treatment plant. During the treatment process, the ETP staff adds some chemicals to adjust the pH and some other chemical to help the settling of solids. You note that the electrical control panel is quite corroded and hangs on one hinge. It seems that it will fall off any time. Also, the railings of the walkways over the treatment tanks are quite corroded and partly missing. The treatment sludge from the wastewater treatment process is dried and stored in the factory yard and taken away for some land-filling. Some solid wastes, including the packages of some hazardous chemicals, collected every week by the local garbage collector.
11. According to the manager, the company gets its process water from a ground well in its own compound. Electricity is provided through the company's own diesel generators. When the chemical containers in the storage area are empty, some of the workers take them home to use them as storage for drinking water. Before doing so, they do some basic cleaning the empty containers by washing off the remainder chemicals with tap water in the factory yard. Empty chemical bags are thrown out into the factory yard and burned in a corner of the yard from time to time together with other types of waste (e.g. plastic wrappings, office papers) collected from the different parts in the factory. Manager also briefly referred to a recent stock assessment which revealed that about 10% of the material has not been used for past two years.
12. On your way home, you stop at the tea stall next to the factory and get in conversation with some local people from the neighborhood who share their concerns about the daily color changes of the river water and the chemical smell from the factory.