

# PLC BASED WATER RECYCLING IN STEEL PLANT

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**ABSTRACT:**The steel industry is one of the most important and vital industry of the present and the future. Steel industry recognizes the important role that water plays in its manufacturing operations and also its value to society. Even though the steel industry uses large quantities of water, very little of that water is actually consumed as most is reused or returned to source. Steel plants use a tremendous amount of water for waste transfer, cooling and dust control. Waste water contains many dissolved, undisclosed substances and chemicals. It is produced during different industrial processes. Our project is based on physical treatment. Physical treatment methods include sedimentation, floatation, filtering, stripping and other processes that accomplish removal of dissolved and undisclosed substances without necessarily changing their chemical structure. PLC is used to control all the operations automatically in this project. Due to this, waste water can be recycled for other purposes. It is an attempt to develop a cost effective water filtration and recycling system. The water filtration methods observed in nature and used conventionally for domestic purposes can be combined together and automated using PLC to create a reliable and cost-effective system to get clean usable water.

## 1.INTRODUCTION

Due to increasing in the usage of water in steel industry, the water is to be recycled for further process. This is mainly known as waste water treatment. It is an environmental friendly process for controlling the water. Now-a-days scientists are concentrated on new strategy for water conservation. In early days, water recycling is done by slow sand filtration. For recycling this process low technology system is used. Generally waste water has low concentration of organic matter, nutrients and microorganisms. The steel plants have sintering mills, coke plants, blast furnaces, chemical by products and chemical processes. Water cooled rolls, pumps, extrusion experiment, transfer lines for sludge and slurries. All these plants use a tremendous amount of water to cool the products and flush the impurities away from the finished stock.

Liquid and solid wastes produced by industrial activities pollute most of the water sources throughout the world. The most common wastewater treatment methods in developed countries are centralized aerobic wastewater treatment plants. There are some benefits or recycling of industrial waste water. Some of them are potential reduction in production costs from the recovery of raw materials in the wastewater and reduce water usage, heat recovery, potential reduction in cost associated with wastewater treatment and discharge.

Part of the water is used for dust control in sinter feeds, slurring and quenching iron ore and coal dust and slag in the blast furnace and as a solvent for acid in pickling, rinsing in coal rolling operation. The balance water is utilised in cooling and wet scrubbing of hot furnace gases. Furnace gases contain carbon monoxide and are reused as fuel for gas fired boilers and in waste heat recovery boilers.

PLC is interfaced with waste water treatment for operating the valves. PLC is used to control the function of machine automatically. It is computerized industrial microprocessor based controller that executes discrete or sequential logic in industrial environment. It was developed to replace mechanical relay, timer and counter hence it is also called industrial PLC.

Using ladder diagram PLC is programmed. A PLC has an integrated programmable microprocessor that is programmed with a dedicated computer language. After writing the PLC program it is downloaded to the non-volatile memory of Programmable Logic Controller directly through a cable connection via serial or USB ports.

## 2. EXISTING SYSTEM

Because of manual water recycling in early days, only for limited quantity of water they reuse and consume large amount of time. But by using automatic measuring technology we consume lot of time and get accurate result. Then they use contact method for recycling the water.

**Contacts:** one of the most confusing aspects of PLC programming for first-time users is the relationship between the device that controls a status bit and the programming function that uses a status bit. Two of the most common programming functions are the normally open (NO) and the normally close

(NC)contact. Symbolically, power flows through these contacts when they are closed. The normally open contact (NO) is closed when the input or output status bit controlling the contact is 1. The normally closed contact (NC) is closed when the input or output status bit controlling the contact is 0.

If the power supply wants turned ON when switch is closed use Normally Open.

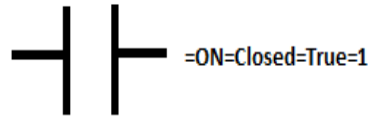


Figure-1 Normally Open (NO)

If the power supply wants turned ON when switch is open use Normally Close.

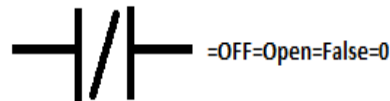


Figure-2 Normally Close (NC)

This method requires man power. But by using PLCs man power and human error is reduced.

### 3. PROPOSED METHODOLOGY

In our project, PLC is interfaced with the water treatment plant for controlling the valves and sensors. The wastewater entering into the treatment plant includes items like wood, steel piece, etc. most of these materials are sent to scale pit.

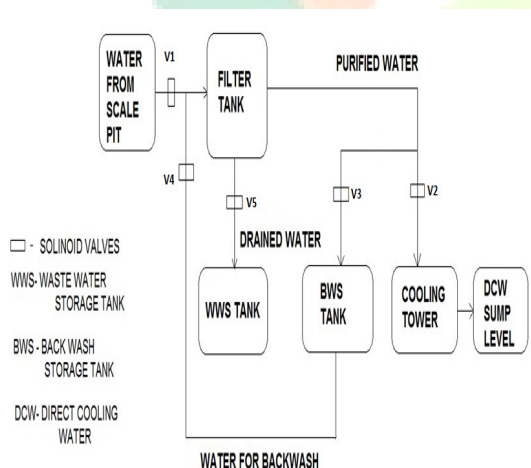


Figure-3 Block Diagram

Whenever the water level in the sump level decreases, the PLC senses the water level and automatically opens the valve V1. The wastewater from the scale pit has to be pumped up to the filtration tank through the valve V1 in which filtration process takes place. As the density of the scale pit is higher compared to water, the sludge settles to the bottom of the sedimentation tank automatically. Due to further process lighter material float on the surface of water is removed.

After the completion of filtration process, the PLC opens the valve of outgoing filtration tank. The purified water is given to back wash storage (BWS) through the valve V3 tank and then to cooling tower through

the valve V3. Depending on the BWS tank level the water first fill in the BWS tank and the remaining water enters into cooling tower.

According to the sediments present in the filtration tank, the backwash process takes place. The valve V4 automatically opened by the PLC and the filtration tank is cleaned through back wash. The waste water from the filtration tank is collected by the waste water storage (WWS) tank through the valve V5.

In the wastewater treatment plant the following process parameter are continuously measured:

- Air and water temperature
- pH value of wastewater
- Water flow
- The flow of mud and sludge
- Precipitation
- Humidity

#### 4. TOOLS REQUIRED

**Hardware** is the name given to all the physical components of a system. The PLC, the programming device and the connecting cable are of hardware.

**Software** is the name given to computer instructions, regardless of the programming language. Essentially, software includes the instructions or programs that direct hardware.

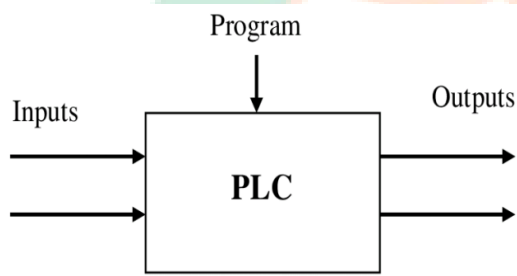


Figure-4 Programmable Logic Controller

Siemens SIMATIC software is used in our project. It is the universal configuring and programming environment for SIMATIC controllers, human machine interface systems, and process control systems. A variety of programming options are available. This includes basic programming languages (ladder logic), high-level languages (structured text and sequential function chart), and engineering tools (S7-Graph).

LOGO! Soft comfort stands for sensationally easy and quick configuration.

This allows the creation of user programs by selecting the respective functions and their connection via drag-and-drop. This applies to the function block diagram and ladder diagram.

#### 5. LADDER LOGIC

A PLC takes input from real-world devices and sensors, and based on the programming instructions, controls the real-world output devices. Ladder logic diagrams are used in PLCs to write programming instructions.

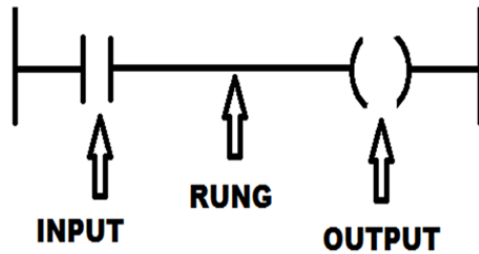


Figure-5 Simple ladder logic

A ladder logic diagram consists of the following three elements

- Input
- Output
- Rung

A ladder logic diagram consists of one or more horizontal lines, called rungs. The rungs contain the input and the output elements. In a ladder logic diagram, the input element is referred to as the *contact* and the output element is referred to as the *coil*.

## 6. ADVANTAGE

- Improves productivity and quality.
- Availability of accurate information/data, enabling timely decision making and better process control.
- Use of man power in other value creating activities.
- Reduced human errors.
- PLC is rugged and designed to withstand vibrations, temperatures, humidity and noise.

## 7. APPLICATION

The water recycling is not only used in steel plant, it is also used in

- Power plant
- Domestic application
- Printing industries
- Textile industry

## 8. RESULT AND DISCUSSION

The proposed automation solution for wastewater treatment plant involves the series of small control system that run the intelligent terminals (Remote Terminal Unit) and PLC (Programmable Logic Controller). The intelligent terminals continuously monitor the operation of pump, closure and other device, collect and execute commands coming from the higher levels, while Programmable Logic Controller are used to control various processes based on the data and the built-in algorithm.

## 9. CONCLUSION

In this paper we presented an effective system for water recycling and water filtration can be easily implemented by using different techniques. The working of above system can be implemented by interfacing the system with PLCs which are present in the industry for minimizing the cost. This system can also be used for domestic purposes.

## 10. ACKNOWLEDGEMENT

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