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Postgraduate Certificate in Pipeline Integrity Management

## Corrosion Control in Pipelines

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### **\*\*Anode\*\***

An anode is an electrode through which electric current flows into a polarized electrical device. In cathodic protection, anodes are used to protect pipelines by providing a sacrificial current that flows from the anode to the pipe, protecting it from corrosion. Anodes can be made of various materials, including sacrificial anodes made of zinc or magnesium and impressed current anodes made of high-silicon cast iron, graphite, or mixed metal oxides.

Related terms: Cathodic protection, Sacrificial anode, Impressed current anode

### **\*\*Cathodic Protection\*\***

Cathodic protection is a technique used to control corrosion in pipelines and other metal structures. It involves applying a current to the pipeline to counteract the natural electrochemical processes that cause corrosion. By making the pipeline a cathode, the current flow is directed away from the pipe, protecting it from corrosion. Cathodic protection is an effective and widely used method of corrosion control in pipelines.

Related terms: Anode, Sacrificial anode, Impressed current anode

### **\*\*Corrosion\*\***

Corrosion is the deterioration of a metal or alloy through a reaction with its environment. In pipelines, corrosion can lead to leaks, failures, and environmental damage. It is a complex process that depends on a variety of factors, including the material properties of the pipeline, the properties of the surrounding soil, and the presence of water and oxygen. Corrosion control is an essential part of pipeline integrity management.

Related terms: Pipeline integrity management, Corrosion control

### **\*\*Corrosion Control Documents (CCDs)\*\***

Corrosion control documents (CCDs) are a set of documents that provide a comprehensive plan for controlling corrosion in pipelines. CCDs typically include information about the pipeline's construction, operating conditions, and corrosion history, as well as a detailed plan for monitoring and controlling corrosion. CCDs are a critical part of a pipeline operator's integrity management program, as they provide the framework for preventing and mitigating corrosion-related failures.

Related terms: Integrity management program, Corrosion monitoring

### **\*\*Corrosion Monitoring\*\***

Corrosion monitoring is the process of measuring and evaluating the rate and extent of corrosion in pipelines. Corrosion monitoring can be done using a variety of techniques, including electrical resistance probes, linear polarization resistance, and ultrasonic testing. The data collected from corrosion monitoring is used to assess the effectiveness of corrosion control measures and to identify areas of the pipeline that require additional protection.

Related terms: Corrosion control, Electrical resistance probe, Linear polarization resistance, Ultrasonic testing

#### **\*\*Current Requirement (I<sub>corr</sub>)\*\***

Current requirement (I<sub>corr</sub>) is the amount of current required to protect a pipeline from corrosion. I<sub>corr</sub> is typically measured in amperes (A) and is calculated based on the length and size of the pipeline, the properties of the surrounding soil, and the type of corrosion protection being used. I<sub>corr</sub> is an important parameter in the design and operation of cathodic protection systems, as it determines the amount of current that must be supplied to maintain adequate protection.

Related terms: Cathodic protection, Anode, Current density

#### **\*\*Current Density\*\***

Current density is the current flowing per unit area of a surface. In corrosion control, current density is used to describe the amount of current being applied to a pipeline for cathodic protection. Current density is typically measured in amperes per square meter (A/m<sup>2</sup>). The optimal current density depends on a variety of factors, including the material properties of the pipeline, the properties of the surrounding soil, and the type of corrosion protection being used.

Related terms: Cathodic protection, Current requirement, Anode

#### **\*\*Dielectric Isolation\*\***

Dielectric isolation is a technique used to prevent electrical current from flowing between different parts of a pipeline system. In pipelines, dielectric isolation is typically used to isolate sections of the pipeline that are not being cathodically protected, such as sections made of plastic or other non-conductive materials. Dielectric isolation is achieved by placing a non-conductive material, such as a plastic or rubber coating, between the conductive parts of the pipeline.

Related terms: Cathodic protection, Coating, Non-conductive material

#### **\*\*Galvanic Corrosion\*\***

Galvanic corrosion is a type of corrosion that occurs when two different metals are in electrical contact with each other in the presence of an electrolyte. The more noble metal becomes the cathode, and the less noble metal becomes the anode, resulting in a flow of current between the two metals. This flow of current can cause the less noble metal to corrode at an accelerated rate. Galvanic corrosion is a concern in pipelines, as different parts of the pipeline may be made of different materials, and the presence of water

and soil can create an electrolyte.

Related terms: Anode, Cathode, Electrolyte

#### **\*\*Impressed Current Cathodic Protection\*\***

Impressed current cathodic protection (ICCP) is a type of corrosion control that involves applying a direct current to a pipeline to protect it from corrosion. In ICCP systems, the current is supplied by an external power source, such as a rectifier, and is delivered to the pipeline through an impressed current anode. ICCP systems are highly effective in controlling corrosion, but they require a constant power supply and regular maintenance to ensure optimal performance.

Related terms: Anode, Rectifier, Corrosion control

#### **\*\*Internal Corrosion\*\***

Internal corrosion is the corrosion that occurs on the inside of a pipeline. It is caused by the presence of water, oxygen, and other corrosive substances in the pipeline contents. Internal corrosion is a concern in pipelines, as it can lead to leaks and failures. It is typically controlled through the use of corrosion inhibitors, which are added to the pipeline contents to reduce the rate of corrosion.

Related terms: Corrosion inhibitor, Pipeline contents, Leak

#### **\*\*Microbiologically Influenced Corrosion (MIC)\*\***

Microbiologically influenced corrosion (MIC) is a type of corrosion that is caused by the presence of microorganisms in the pipeline environment. MIC can occur in both the internal and external surfaces of a pipeline, and it can cause significant damage if left unchecked. MIC is typically controlled through the use of biocides, which are added to the pipeline contents or applied to the pipeline surface to kill the microorganisms.

Related terms: Pipeline environment, Biocide, Corrosion control

#### **\*\*Pipe-to-Soil Potential\*\***

Pipe-to-soil potential is the electrical potential difference between a pipe and the surrounding soil. It is used as a measure of the effectiveness of cathodic protection systems, as a negative potential indicates that the pipeline is being protected. Pipe-to-soil potential is typically measured using a reference electrode, such as a copper-copper sulfate electrode.

Related terms: Cathodic protection, Reference electrode, Electrical potential

#### **\*\*Polarization\*\***

Polarization is the change in the electrical potential of a metal surface due to the flow of current. In corrosion control, polarization is used to describe the effect of cathodic protection on the electrical potential of a pipeline. Polarization is typically measured using a technique called linear polarization

resistance (LPR), which involves applying a small voltage to the pipeline and measuring the resulting current.

Related terms: Cathodic protection, Linear polarization resistance, Current

**\*\*Rectifier\*\***

A rectifier is a device that converts alternating current (AC) to direct current (DC). In impressed current cathodic protection (ICCP) systems, rectifiers are used to convert the AC power from the grid to DC power for the cathodic protection system. Rectifiers are typically designed to provide a constant output voltage and current, and they require regular maintenance to ensure optimal performance.

Related terms: Impressed current cathodic protection (ICCP), Alternating current (AC), Direct current (DC)

**\*\*Sacrificial Anode\*\***

A sacrificial anode is a type of anode that is used in cathodic protection systems to protect pipelines and other metal structures from corrosion. Sacrificial anodes are made of a more active metal than the structure they are protecting, and they are designed to corrode preferentially, providing a sacrificial current that protects the structure. Sacrificial anodes are typically made of zinc or magnesium and are installed in strategic locations around the pipeline.

Related terms