

## Design of corrosion protection in waste water plants – an example

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The basis for the successful realisation of corrosion protection measures in waste water plants is a corrosion protection concept which has to be adapted to the specific conditions in the respective installation and the existing boundary conditions (service life, specific requirements defined by the operator/owner, new or existing installations ...). It is important that the corrosion protection concept is already elaborated in the planning phase and co-ordinated with the grounding concept of the plant. In sewage systems usually different preventive measures are combined. It is to be made certain that these are compatible among themselves. On the basis of a practical example the most important points to be considered in the corrosion protection concept are discussed and it is shown how its demands can be met in practice. Apart from the material choice, the clear indication of requirements/acceptance criteria (eventually with appropriate working instructions) and the implementation of quality assurance measures are of particular importance. A corrosion protection concept should contain also instructions concerning the maintenance and the inspection or control of the effectiveness of the corrosion protection measures during operation.

### 1 Introduction

Since there is no standard waste water treatment plant, there is also no standard corrosion protection concept. Therefore in the development of a corrosion protection concept always the specific conditions in the respective plant are to be considered. This is particularly valid for modifications or extensions of sewage systems, where the corrosion protection concept for new plant parts must be co-ordinated with existing, respectively re-used components of the already existing plant.

Apart from the choice of materials and protective measures the corrosion conception concept should also contain the necessary measures to reach the protection goals and to ensure the effectiveness of the corrosion protection measures also during operation (Fig. 1).

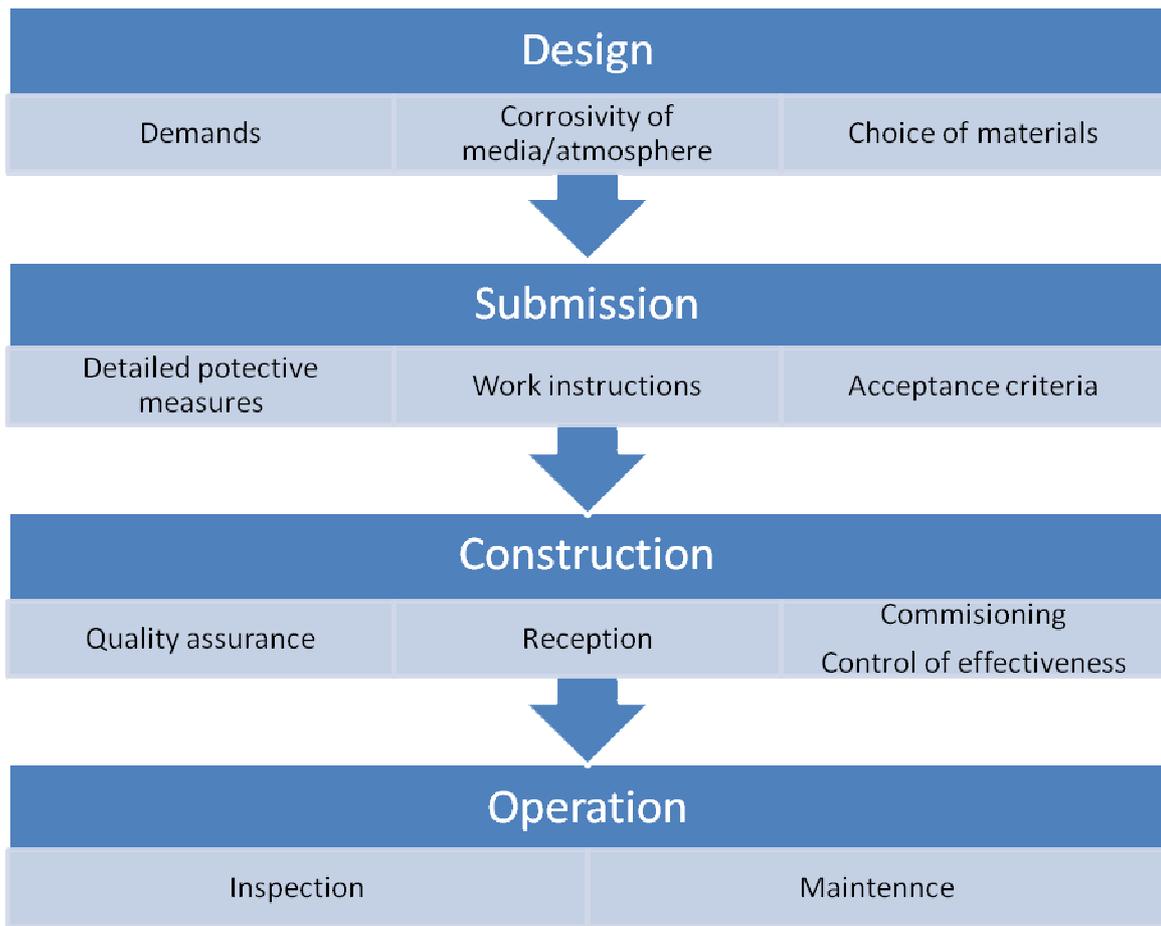


Fig. 1: Corrosion protection concept in different project stages

## 2 Premises

### 2.1 Basics

The bases for the corrosion protection concept are the legal and contractual regulations, contract and product specifications, special requirements of the owner as well as the standards and guidelines which have to be considered.

### 2.2 Service life

A substantial point for the planning of an economic corrosion protection are the requirements to the service life of the plant respectively their components which are specified by the owner. Typical service lives for different components of a waste water plant are indicated in Tab. 1.

| <b>Component / Structure</b>                                      | <b>Typical service lives [years]</b> |
|---|--------------------------------------|
| Supporting structures<br>Steel constructions                      | 50-80                                |
| Concrete constructions<br>Basins, ducts                           | 40 - 50                              |
| Process equipment<br>Piping, fix steel constructions<br>Machinery | 20-25<br>15-20                       |
| Interior constructions  | 15-25                                |
| Electrical equipment  | 15-20                                |
| Electro-mechanical equipment<br>Motors, pumps                     | 10-15                                |
| Electronic devices  | 5-10                                 |

Tab. 1: Typical service lives in waste water plants

### 2.3 Classification of environments

It is recommended to provide an overview with the locally different climatic conditions and to introduce a uniform classification. For the allocation of the respective zones to aggressiveness classes a co-operation with architects, building physicists and process engineers is recommended.

### 2.4 Grounding concept

For an efficient corrosion protection it is essential to co-ordinate the corrosion protection concept with the grounding concept. Thus for example the use of the rebar of concrete structures for earthing purposes may lead to the formation of galvanic cells between the rebar and immersed or buried construction units made of carbon steel or cast iron which are then subject to increased corrosion rates.

For corrosion protection reasons it is often necessary to realise galvanic separations between construction units made from different materials e.g. between stainless steel pipes and cast iron valves. For these "isolated" units special measures for earthing

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and potential equalisation are necessary to meet personnel safety regulations which are to be considered in the grounding concept.

### **3 Corrosion protection**

#### **3.1 Conception of corrosion protection**

The demanded service life can be achieved both by active corrosion protection measures as for example the use of corrosion resistant materials or the application of a cathodic protection or by passive corrosion protection measures e.g. by coatings.

In the corrosion protection concept the choice of materials and if necessarily, further corrosion protection measures are fixed in detail for the different structures, taking into account the aggressiveness of the surrounding media as well as economic aspects. It is to be made certain that the individual protective measures are compatible among themselves. For the simplification of the execution and control "room sheets" may be provided, where the materials and corrosion protection measures planned for the different construction units are arranged per room (e.g. offices, storage rooms) or area of the plant (e.g., rake hall, aeration basin).

#### **3.2 Description of corrosion protection methods**

The requirements for the individual corrosion protection systems should be defined exactly, e.g. the type of coating materials and the coating thickness, the type of cathodic protection systems (sacrificial anodes or impressed current) or the realisation of galvanic separations. For coatings also demands concerning the surface preparation or pre-treatment and the application conditions may be established.

#### **3.3. Basic conceptions of different installations**

To facilitate the overview particularly in larger plants, it can be meaningful to describe also the individual protection concepts for different range-spreading installations like e.g. heating, cold and warm-water systems, ventilation, balustrades, platforms, pipings, fastenings ...

## **4 Construction**

### **4.1 Technical regulations**

In practice positive experience has been made in issuing specific implementing regulations for certain work, e.g. the application of coatings or the processing of stainless steel. These regulations serve above all to get a uniform quality of the work and to avoid elementary errors, also within the design of components.

### **4.2 Quality assurance, reception**

The quality assurance should also be part of the corrosion protection concept. A control plan should be provided, where time, kind and extent of controls as well as the responsibility for their execution is fixed. It is generally advisable to accomplish controls already in the initial phase of the work to give the possibility to take corrective actions.

Generally acceptance tests should be accomplished for all corrosion protection measures in order to examine the quality of the work and to check their effectiveness. In this context it is important that clear and mandatory acceptance criteria are specified already in the corrosion protection concept and in the tender phase.

## **5 Operation**

### **5.1 Inspection**

During operation the efficiency of the corrosion protection measures and the condition of the installations should be periodically examined. The corrosion protection concept should therefore contain recommendations on the type and frequency of controls which have to be accomplished as well as on the necessary qualification of the inspection personnel / company.

## **5.2 Maintenance**

Maintenance can extend the service life of plant components substantially. Appropriate maintenance measures for specific groups of construction units (e.g. coated steel constructions) or protective measures (e.g. cathodic protection systems) should therefore be part of the corrosion protection concept.

## **6 Summary**

The elaboration of a corrosion protection concept for a waste water plant is a complex task, which requires much specialized knowledge. It applies to find the optimal combination of materials and corrosion protection measures for the respective plant under economic criteria. Additional measures must be planned in order to ensure the implementation of the concept during the construction of the plant and the effectiveness of the corrosion protection measures during operation.