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Technical Conference Paper

PLANT SCREENING "ENGINEERING EVALUATION AND ASSESSMENT OF PLANT COMPONENTS WITH AN EXAMPLE OF A CAVERN"

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Abstract

Cavern operators intend to determine the required investment volume for the next years based on a system evaluation. This presupposes that all plant components are recorded and analyzed in-depth.

A cavern operator asked us for an engineering evaluation and assessment of his plant components. As a complex investigation program had just started at that time, exact information concerning the investment volume could not be provided.

To obtain reliable results, however, the plant components were assessed based on experience of the staff, contractors and specialist companies and classified in a first schematic assessment grid.

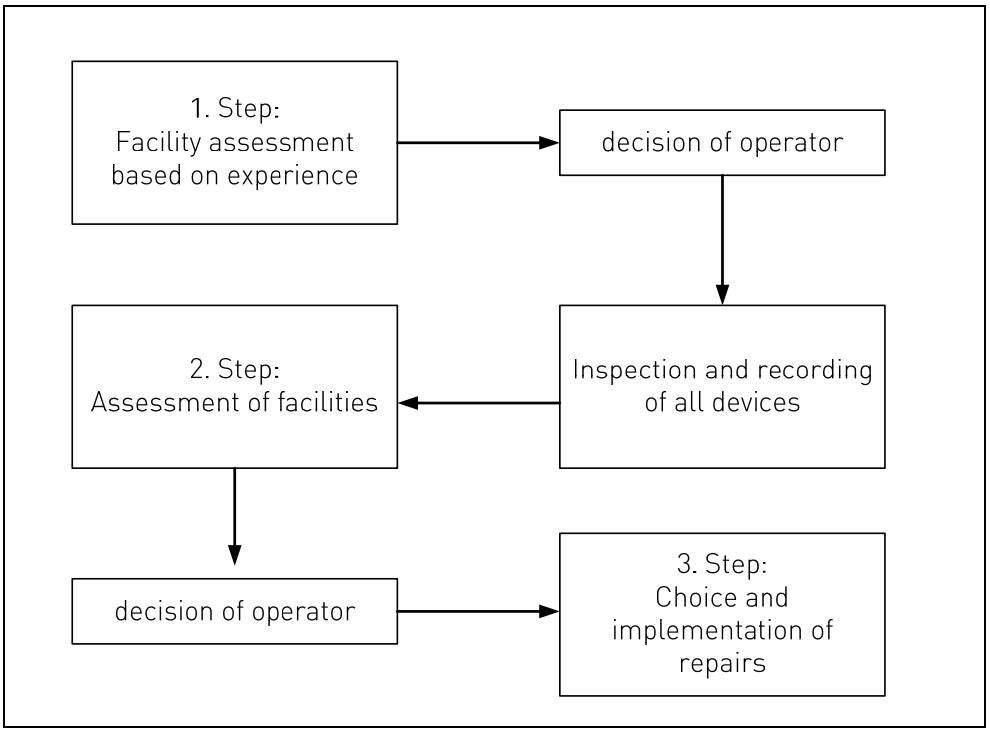
To make this schematic assessment as objective as possible, the failure probability for each plant component was determined as a result of operational issues and experience, design, wear including corrosion and third party impact. Furthermore, the impact of a possible failure was determined with respect to safety/health/fatalities, public impact/damage to reputation, environmental consequences and financial aspects.

Based on our rating schedule, we compiled maintenance and repair costs for the cavern operator's plant components over a specific period of time. We would like to share with you our project experiences and the results we have obtained in solving this task and introduce you to our assessment approach to determining the investment volume for the coming years.

Key words: Assessment, Integrity, Pipeline, Gas, Oil, Risk, Probability, Failure probability, Plant Components

Introduction

From the vantage point of the present we suggest the following flow sheet, that we consider to be realistic. From this standpoint we focus our attention on the Step 1, that is “plant assessment based on experience of the staff, contractors and specialist companies”.



The assessment matrix, which is based on experiences, investigations of systems at selected points, maintenance reports etc, should be set up so, that the addressee, who is not possibly an expert on the subject, could evaluate the type of the assessment. That is why we take only three assessment groups into account and present them further on.

The assessment should be structured as objective as possible to make it understandable for the third parties. Best practice shows, that the schematic assessment should be classified in separate Objects under the influences of the different aspects.

Failure risk

It is possible to describe the failure risk and the consequences of a blackout in terms of the plant components, even if the actual inspection doesn’t occur at this time. That leads to the classic definition

Risk = failure probability x effect

Usual, the failure probability of the technical facilities is based on the following aspects:

- Company’s concerns and experiences
- Design
- Wear out including corrosion
- Influence through third parties

Maybe a differentiation for the separate devices will be necessary. The effects apply to:

- Environmental effects
- Safety / health
- Economic consequences
- Reputation / impairment of the public

In particular cases it could be made a differentiation also here. The matrix given below represents these dependences.

Effects	Failure probability				
	negligible	low	middle	high	very high
little					
middle					
high					
very high					

full integrity / low risk
doubtful integrity / middle risk
poor integrity / high risk

The allocation of the impacts into the categories of the matrix is not surely a absolute objective process, however, it makes its contribution to the objectification of the subjective experiences and evaluations particularly for the case of teamwork.

Assessment groups

The assessment group “full integrity“/ low risk includes all the facilities, where are no signs given, that the stability and the functional safety are limited and the large effects could be possible. That encloses also all the facilities, where the wear out and the defects could not be impossible, but it doesn’t give any relevant information about it. This “proved integrity assumption” presents the level of the technology in the assessment of the technical facilities, which are the subject to monitoring, service and control for the specialists. The residual risk, that these facilities could fail cause of not identified or not visible faults, is considered to be a general business risk. It is important to plan further monitoring and services but also general maintenance expenses for these technical facilities.

The assessment group “doubtful integrity “ / middle risk includes all the technical facilities, where are the signs given, that the quality losses could be present without indications of imminent damages. This would be a case when there are enough signs of the observable corrosion without known corrosion areas, which make applying the nominal and operating pressure impossible. Another example would be an assumption, that components could not resist the applied loads in the future. (e.g. assumed restriction of the flow rate). For this group it must be expected the significant expenses to maintain the facilities and to avoid the effects.

All the components, which do not resist the future loads of the strengthened target process, are part of the assessment group “defective Quality”/ high risk. This kind of classification occurs when it is known on the basis of monitoring, services and appeared damages, that future loads to these components should not be applied. However it could be possible, that these components can absolutely resist the present low loads. This group includes also the facilities, which are of low value

and simple to substitute, but if they fail, then big negative consequences can occur. Here must be controlled, if the restrictions concern only the definite areas and if it is necessary the rehabilitation or the reconstruction on the basis of the present information.

Budgeting
On the basis of the precedent definitions there is important information for the budgeting.

1. green

   The special loads are not expected here and that is why it is not necessary to plan the budget for the repairs and reconstructions. Nevertheless it is necessary to plan in the budget the required service, monitoring and the general repairs.

2. yellow

   The budget for the rehabilitation and reconstruction must be planed only for a part of the facilities of this group. The possible bandwidth is about from 25% to 75%.

3. red

   The total budget must be planed for the rehabilitation and reconstruction.