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CONSIDERATIONS ON THE MANAGEMENT OF PREVENTIVE MAINTENANCE TO ELECTRICAL TRANSFORMERS

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Abstract: This paper aims to highlight the importance of power transformers in the evaluation of conditions that must be respected by all persons who are directly or indirectly involved in: performance measurement, oil sampling, oil analysis carried out and those involved in tracking the actual operation of transformers in each branch of the park.

1. INTRODUCTION

Operation of Interconnected Power System UCTE synchronous network safely is increasing operational safety of the transport sector of electricity and sound and efficient management of equipment.

Thus, the strategy of development and modernization of its equipment fleet required to achieve the following objectives:

- Standards of quality and security;
- Fleet insurance processing units in the UCTE requirements;
- Optimize maintenance costs;
- Extend the life of the units of processing up to 35-40 years;
- Reducing environmental impact (without the use of PCB oils);
- Reducing operating costs;
- Compliance with requirements concerning: safety, quality management requirements, fire protection, etc.

Power system availability and continuity of supply of electricity to consumers are highly conditional, inter alia, the quality of maintenance actions, which during operation of equipment, are subject to a constant process of adaptation and modernization.

The main objectives of any strategy is to maintain operational maintenance of equipment as long a time, reduce equipment damage and avoid unexpected failures that could have disastrous consequences or costly. To attain these objectives, method of maintenance should be chosen that best fits the specific situation examined[1].

In general, changes in maintenance strategies used or in use in the power system are presented as in Figure 1.

It is known that the most vulnerable and costly equipment in a power station is the processing plant.

Although Romania is generally executed planned maintenance works for the processing units have been developed that allow for maintenance programs based on reliability, the advantages of this system consisting of:

- Improving plant reliability;
- Optimizing maintenance resources;
- Prioritization and selection of a particular type of equipment requires maintenance;
- Reducing administrative labour content using powerful software.

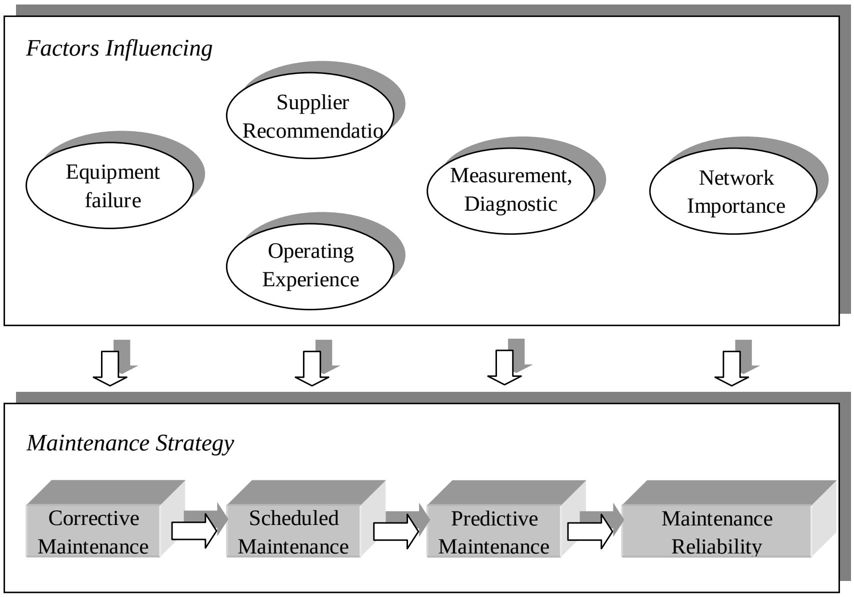

Fig. 1. The evolution of maintenance strategies

The strategy follows a certain procedure which mainly consists of [2]:

- Equipment health assessment;
- The significance of each item that is throughout the system (reliability of components influence on the overall network reliability);
- Correlation and evaluation of the above information for the hierarchy in terms of equipment maintenance actions priority.

2. HIERARCHICAL CONTROL POLICY

Power transformers are equipped with an insulation system composed of organic material that deteriorates (aging) over time, such as:

- Mineral oil;
- Paper;
- Trafoboard.

Deterioration of properties of these materials occurs under the action of one or more applications that depend very much on operating conditions [3].

Evaluation of power transformers is basically through the progress of degradation of the insulation system using chemical tracer, derived from tests taken from the insulating oil equipment investigated. Given the growing financial implication, the accuracy of diagnosis and accurate assessment of the potential risk of damage became significant. The variety and complexity of methods used and the difficulty of interpretation has led naturally to follow the hierarchy of operations on different levels of intervention and decision. The current policy of control and maintenance of transformers used in fleet management tracking methods require the use of three levels:

- Level 1 - whose use is regular and systematic in each branch;
- Level 2 - the use of which involved laboratory-Engineering Group Diagnostics;
- Level 3 - collective meeting of specialists.

3. DATABASES

Preparation of computerized data banks, with clear records and guaranteed to progress measured parameters, is a major help in diagnosing the condition and estimate the time already consumed life of power transformers.

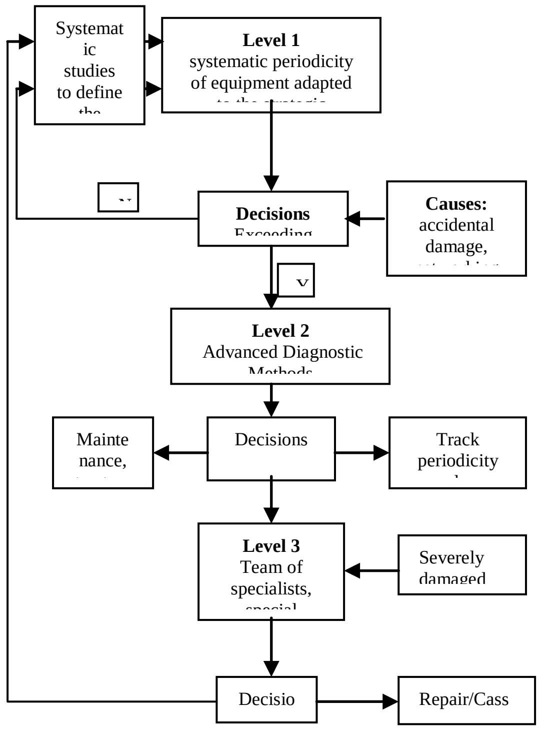

Fig. 2. Flowchart for tracking, monitoring, maintenance and diagnosis of power transformers

Databases containing all information required:

- Diagnosis of the condition;
- An estimate of operational risk;
- Efficient scheduling of maintenance funds;
- An estimate of remaining life of transformers.

This database allows the development of a unified strategy for restructuring / development of the park transformer by:

- Replacement of obsolete equipment or strategic energy nodes physical state of the art equipment;
- Repair/modernization of power transformers and auto transformers;
- Reducing losses in the energy system;
- Drawing up budgets for repairs and investments based on technical specifications drawn up family of transformers and planned periods of time.

All equipment in normal use is subject to further degradation [4]. The transformers are no exception to this rule and degradation while pursuing a curve following form:

Defects that occur during the first two years of life are mainly due:

- Manufacturing defects (eg imperfect contacts, poor welds, spare parts for different electric potential, magnetic core defects etc.);
- Assembling the station (accidental contamination of water contamination when filling / oil filling, installation of defective bushings, etc.);
- Improper operation.

Between 2 and 20 years life of a transformer aging is characterized by a constant and it depends largely normal operating conditions. Major defects that occur in this period are: moisture in liquid and solid insulation; depolymerization paper (split) chemical aging of the insulation liquid, aging transformer auxiliaries (cooling system, fittings, equipment protection, monitoring, etc.).

Over 20 years operational risks increase with each year of life, maintenance costs are substantial. Defects are characteristic of the above.

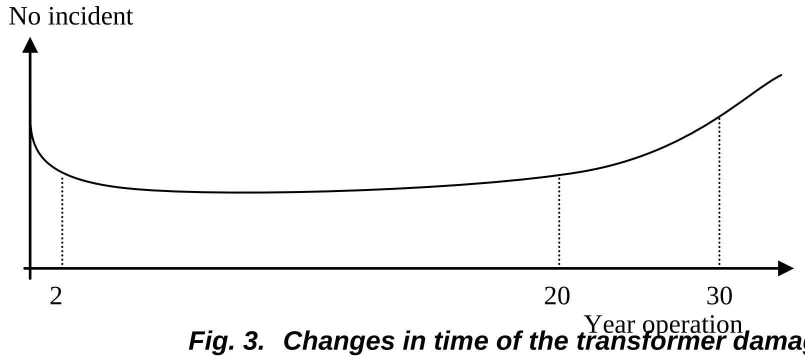

Fig. 3. Changes in time of the transformer damage

For transformers that extend beyond the life of 40 years if major defects, their recommended disposal taking account of technological progress: qualitative difference of new materials (especially siliceous sheet), reduction in iron losses and coils, heat exchange performance, computer-assisted projects with judicious sizing of the techno-economic point of view, reducing consumption of materials/labour.

4. CONCLUSIONS

Most measured parameters characterizing the technical condition of power transformers are: temperature dependent (R_{iz}, R_{Ω}, tgδ, water content,), dependent on water content, the no. particle nature (oil, oil tgδ, R_{iz} and tgδ Inf.) influenced by environmental conditions (R_{iz}, tgδ,), influenced by the degree of cleaning of bushings (R_{iz}, tgδ,), influenced by the degree of cleaning of tanks sampling is made of oil influenced the type and class of precision equipment.

Given the above it is recommended:

- Avoiding performance measurement and sampling of oil on bad weather (rain, fog, snow, high wind and generally the atmosphere is polluted with dust and / or humidity is over 85%);
- If, however, to oil sampling run in atmospheric conditions stated above shall take special precautions so as to eliminate the possibility of contamination of samples with external agents processor;
- Making the coward Sample collection;

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