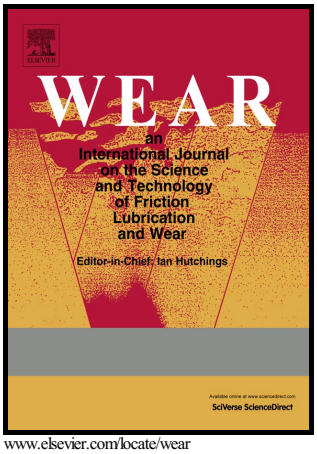
Erosion Wear on Francis Turbine components due to sediment flow

Adnan Aslam Noon, Man-Hoe Kim



www.elsevier.com/locate/wear

PII: S0043-1648(17)30358-7
DOI: http://dx.doi.org/10.1016/j.wear.2017.02.040
Reference: WEA102094

To appear in: *Wear*

Received date: 20 July 2016
Revised date: 13 February 2017
Accepted date: 14 February 2017

Cite this article as: Adnan Aslam Noon and Man-Hoe Kim, Erosion Wear or Francis Turbine components due to sediment flow, *Wear* http://dx.doi.org/10.1016/j.wear.2017.02.040

Erosion Wear on Francis Turbine components due to sediment flow

Adnan Aslam Noon and Man-Hoe Kim*

School of Mechanical Engineering, Kyungpook National University, Daegu 41566, South Korea

*Corresponding Author. Tel.: +82-53-950-5576; Fax: +82-53-950-6550. E-mail addresses: manhoe.kim@knu.ac.kr (M.-H. Kim)

Abstract

Sediment particles flowing through the turbine components erode the surface in interaction. Erosive wear of hydro turbine components generally depends on different parameters such as concentration, size and shape of the sediments particle, velocity of flow, properties of the base material of the turbine components and operating hours of the turbine. Tarbela Dam Hydel Project (TDHP) located in the Himalayan range in Pakistan is facing the same problem. The sediments particle have caused damage to the plant equipment, mainly to the turbine components; stay vanes, guide vanes, runner and draft tube. As a result, these components are disassembled and refurbished almost every year. Analysis have been performed on one of the Francis turbine units to predict the effect of sediment particles concentration, size and shape on erosion rate. Gradual removal of the base material has changed the profiles of various components of the turbine and also has weaken its structure. One of the major concerns of these effects is the continuous loss of turbine hydraulic efficiency. The governing equations of fluid flow are solved numerically on an unstructured grid using FEM based software ANSYS CFX. Finnie erosion model is used to compute average erosion rates. Simulation results are compared with the actual site data. The CFD analysis showed good agreement with the results of experimental work done previously using similar kind of geometries and operating conditions.

Keywords: **Sediment particles, TDHP, Francis turbine, Runner, Erosive wear**

1. Introduction

Pakistan has a big potential of hydropower due to the existence of large quantity of water resources originating from the snow covered mountains and glaciers of the Himalayan range and the areas exposed to regular monsoon rainfall. Indus River is one of them that flows through the whole country. It carries large amount of sediments containing high percentage of hard abrasive