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CONSIDERATIONS IN THE CAPACITY UPRATING OF AN EOR HRSG

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ABSTRACT

In enhanced oil recovery operations, the steaming capacity of a heat recovery steam generating unit is limited by the available energy provided from the gas turbine generator, however, there are a number of other component parameters that limit the thermal and mechanical performance of any specific heat recovery steam generator. These additional parameters reside on both the flue gas side and water / steam side of the heat recovery steam generator.

Repetitive failures of steam generator components are evidence of damage mechanisms that are active during operation. Some of these damage mechanisms are explored to determine the immediate impact in up-rating the steam generators to higher capacity throughput and also, on longer term reliability. A resulting finding of this study examines the efficacy of using P22 low alloy piping in lieu of carbon steel piping to address flow accelerated corrosion.

INTRODUCTION

Heat recovery steam generators [HRSG] are used in diverse applications; one application is thermal enhanced oil recovery [EOR] operations which uses steam flooding to recover heavy oil from subsurface formations. By using steam injection, access to deeper hydrocarbon resource deposits is achieved and the environmental footprint is reduced in comparison to the open mine and extraction method. For both these types of facilities, large capital outlay and high operating costs necessitate effective and efficient equipment operation.

The HRSG in EOR service is a major component in the combined cycle power scheme with energy supplied by a gas turbine generator [GTG] set. The HRSG represents an evolution in design of a conventional heat exchanger for which HRSG steam generation rates have become comparable to a fired steam generator unit [SGU] in either power generation service or to a process plant utility boiler. HRSG units for oil field application are provided by a number of suppliers. Typically, materials of construction for the pressure boundary consist of plain carbon steel piping; however, a recent trend has been to substitute low alloy chrome – molybdenum [Cr – Mo] piping to address issues with flow accelerated corrosion [FAC]. The incremental cost of this initiative is substantial. The exchangers are routinely constructed to the rules of ASME I for power boilers [1].

Although pressure boundary calculations are customarily disclosed to the equipment owner, the detailed calculations for rating of the heat transfer surfaces are withheld as confidential and proprietary. Given the recent economic environment of low commodity pricing, equipment operators should be keen to construct cost effective equipment operating with optimal performance.

A review of the current operating data of a particular plant will be conducted with the aim of determining if the HSRG is operating at the design capacity. Furthermore, the operational limits of the various components and of possible component upgrades will be assessed to determine whether HSRG performance can be improved beyond the design operating capacity.

DESIGN & OPERATIONAL CONSIDERATIONS

The HRSG is located downstream of the GTG; the GTG produces electrical power for plant operation and export to the power grid. This combined cycle gas turbine plant [CCGTP] is capable of achieving a power efficiency rating in excess of 50% [2].

The wet steam produced by the HRSG is used to thermally recover heavy oil from the subsurface formation either on a continuous basis, such as in steam assisted gravity drainage

