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2462

PILOT PLANT FOR NONCONDENSABLE GAS REMOVAL BY UPSTREAM REBOILING

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(Proposed)

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Introduction. Geothermal steam at The Geysers contains non-condensable and particulate materials which can be costly to deal with. There are direct effects such as deposition of borates inside steam turbines and the equipment or chemicals needed for H_2S removal. There are also indirect costs such as that for replacement power when units require maintenance, or the derating of units when side effects of some mitigation measure interfere with plant design. PGandE is studying the Coury Process in the course of a continuing search for cheaper and more flexible ways of dealing with these problems.

The preceding paper in this conference is an account of laboratory-scale work done on the process. Proposed as the next development step is a 42,000 lb/hr pilot plant at The Geysers.

Status. Conceptual design of the pilot plant was done last year by Coury and Associates. PGandE and C&A expect soon to begin detailed design of the pilot plant, with costs to be shared by EPRI and PGandE. The procurement and construction schedule have not yet been established.

Importance. The Coury approach is attractive because it would have minimum impact on the power plant proper and should have low operating costs. The equipment is not highly integrated with the power plant. It could be retrofitted to existing units without the long outages that go with surface condensers. It has potential for reliable, simple and non-interfering operation. Questions requiring evaluation are the size of capital costs, the loss in thermodynamic availability of the energy processed, and the fact that H_2S is only diverted, not converted; an additional sulfur recovery or disposal step is required.

Objectives. The pilot-scale study will have as its objectives:

- -to determine overall heat transfer coefficients and removal efficiencies under various operating conditions,
- -to accumulate data necessary for sizing the heat exchangers for a full-scale application,
- -to develop information necessary to predict capital and operating costs,
- -to evaluate equipment servicability for unattended operation,
- -to determine the behavior of the system during upsets and transients.

Conceptual Design. The conceptual design and test program are based on siting at Unit 13. The low levels of non-condensable gases at Unit 13, coupled with the inclusion of a chemical injection system will make possible testing over a broad range of gas concentrations. Furthermore, if most of the gas reaching the condenser/reboiler is injected gas, fluctuations in steam-field gas concentrations will be attenuated, and the sampling and analysis problems will be eased.

In order to utilize the steam fed to it, the pilot plant is sized to supply the unit's main condenser gas ejectors. Provision is made to supply the gas ejectors with untreated steam when the pilot plant is unavailable

A second stage condenser/reboiler is included in the pilot plant to simulate the control situation of the full-scale design. The purpose of a second stage in a commercial-scale plant is to recover steam (representing water and energy) which would otherwise be lost in the vent-gas stream from the first stage.

TEST PROGRAM. The objective is to make heat and mass balances on the vent gas cooler, the two condenser/reboilers, and the overall system. Flow rates and concentrations of H_2S, CO_2, and NH_3 will be required on nine streams.

Steam flow rate, reboiler recirculation rate, and rate of vent gas withdrawal will be treated as independent variables.

Present plans call for manual sampling and chemistry, sending liquid-phase ammonium analyses to an off-site laboratory and doing other analyses in the field.

The accompanying figure indicates the major systems of the pilot plant.

Coury Process Pilot Plant