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REACTOR, PLANT ENGINEERING SHORT-RANGE PROGRAM
IN SUPPORT OF REACTOR OPERATING CONTINUITY

AUTHOR

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IN SUPPORT OF REACTOR OPERATING CONTINUITY

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REACTOR, PLANT ENGINEERING SHORT-RANGE PROGRAM IN SUPPORT OF REACTOR OPERATING CONTINUITY

September 15, 1960

INTRODUCTION

Reactor maintenance problems and engineering studies have identified various reactor rear face piping problems at 105-B, D, DR, F, and H. The long-range solutions to these problems are outlined in classified document HW-65269, "Existing Reactor Rear Face Piping Review". These problems, however, must also be considered from the short-range view to minimize their effects on continuity of reactor operation during the interim until the permanent remedy can be accomplished. This is expected to be a minimum period of approximately four years. Flow and bulk outlet temperature up to 90,000 gpm and 95°C respectively are assumed to prevail in these short-range considerations. The purpose of this report is to review Reactor, Plant Engineering's efforts on the short-range aspects of this problem.

SUMMARY

Reactor, Plant Engineering is conducting the following work on process water piping in support of reactor operating continuity.

1. A Production Test Authorization PT-IP-352-AE, "Reactor Rear Face Piping Examination, 105-B, D, DR, F, and H Reactors", covering removal of a rear crossheader and expansion loop at 105-DR and a rear crossheader sample from 105-H has been prepared for acceptance by the Manufacturing Section.
2. The responsibility to develop a new rear connector suitable for use at 105-B, D, DR, F, and H has been accepted by Materials Development Operation. R,PEO has assisted this effort by providing a development criteria, commenting on candidate connectors, assisting in formulating tests and providing data on service environment.
3. Downcomer approach flow characteristics are being studied on the premise that this may be a source of excitation for certain frequencies of rear crossheader vibration at 105-B, D, DR, F, and H.
4. Installation of some type of expansion joint in the rear crossheaders at 105-B, D, DR, F, and H is being scoped. The purpose of this installation is to reduce crossheader vibration and thermally induced stresses.
5. Data are being obtained on pressure, temperature and vibration in support of the 105-DR Increased Bulk Temperature Test. This includes installation of instrumentation.

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6. Rear header vibration is being measured in conjunction with the test of bored out rear Parker fittings at 105-F to determine what effect, if any, this has on vibration levels.
7. A study is in progress to obtain precise information on rear riser motion during an operating cycle.
8. An outline of information and a test procedure deemed necessary to evaluate piping stress and flow stability while operating the K Reactors at increased bulk outlet temperature has been provided to K Area Management at their request. The outline has been accepted and work is proceeding toward initiation of the test. This is significant to this report because it will provide information useful to the design of replacement rear face piping for the older areas.

DISCUSSION

The work summarized above is significant to reactor operating continuity and it will also provide certain design information for replacement of rear face piping.

1. Removal of a rear face crossheader for examination was proposed in FEO Document HW-65269, "Existing Reactor Rear Face Piping Review. It will provide a more intimate knowledge of the integrity and weaknesses of existing rear crossheaders and fittings. It will also provide experience in replacing a rear header should this become necessary on an emergency basis. This work has been scoped and the information, complete with cost estimate, has been presented to the Manufacturing Operation in the form of Production Test Authorization PT-IP-352-AE for their final concurrence.
2. Failure of rear face connectors has become a significant problem, particularly at 105-H. Responsibility for developing a connector which would withstand existing rear face conditions for five years was accepted by Materials Development Operation. Reactor, Plant Engineering prepared the development criteria and has continued to support the development work by providing environmental information such as vibration data. A final prototype connector, a flexible type, has been selected and development plans call for equipping one crossheader at 105-H with these units for final evaluation. Procurement has been started.
3. Flow disturbances in the downcomer approach piping may be providing excitation for low frequency rear header vibration. Also, tests conducted by Research and Engineering indicate the possibility of a significant increase in rear riser pressure at 90,000 gpm flow due to restriction provided by the downcomer approach piping. R & E has initiated model test work at Washington State University to more clearly define the hydraulics at this point under various conditions. The model is also expected to provide insight to the above mentioned vibration problem. It presently appears that two to three months will be required to complete the model test work.

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4. FEO studies of existing rear face piping at 105-B, D, F, DR, and H indicate that two major mechanical problems exist, which require prompt attention.
- Over-stress of crossheader elbows and riser connections is caused by thermal expansion.
 - Excessive vibration of crossheaders occurs during normal operating periods.

It is proposed to install rear header expansion joints to alleviate these problems for the interim until the piping is replaced. These joints are expected to reduce low frequency vibration by preventing the headers from bowing off their supports due to thermal expansion. Indications are that this is the manner in which the headers become receptive to low frequency excitation. An additional incentive for reducing header vibration is provided by the fact that present plans show the replacement rear connector to be a flexible type. This will reduce current crossheader vibration damping and tend to increase vibrational amplitudes under existing conditions. The expansion joints will also relieve the thermally induced stresses in the crossheader elbows and riser connections.

- 105-DR has been designated by the Manufacturing Section as the lead reactor of the five older reactors to investigate the feasibility of operating at 95°C bulk outlet temperature limits. Reactor, Plant Engineering is supporting this investigation by providing instrumentation for and obtaining data on rear face vibration, effluent pressure and temperatures. Assistance is also being provided in interpretation of the data.
- Enlargement of rear face header and nozzle fittings by reaming is considered to be a necessary step for optimum utilization of additional reactor cooling water at 105-B, D, F, and DR. Mechanical Development and Research and Engineering are conducting Production Test IP-318-E, "Reaming of Rear Face Parker Fittings", at 105-F. As part of this test, Reactor, Plant Engineering will monitor rear header vibration to determine the change, if any, in vibration level brought about by reamed fittings. The progress of the test will be observed closely in order that appropriate engineering action be taken after completion of the test.
- A study by Reactor, Plant Engineering is in progress to determine the movement of rear face risers during an operating cycle. This information will allow more accurate calculation of rear crossheader stresses for current operating conditions and will also be of use in designing replacement rear face piping for 105-B, D, DR, F, and H.
- 105-K does not have the rear face piping stress problems common to the older areas at current operating levels, however, an increased bulk temperature test at K will provide information useful in designing older area replacement piping. The primary objective of the test, of course, is to evaluate 105-K rear face piping integrity and water flow conditions at a

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bulk outlet temperature of 95°C as requested by K Area Management. The test will include pressure, temperature, strain gage and vibration measurements. Target date for completion of the test is May, 1961.

Comments on the program outlined above will be welcomed.

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