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3 DATE February 2, 1952

SUBJECT Investigation of the 1954-55-56
Student Loan Program (Final Report)

To

FROM Mr. J. E. O'Connell

COPY 1 OF 1.

COPY NO. 25-a

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This Document consists of

3 Pages

Serial 17

COPY 1 OF 1

February 1, 1950

To: File

FINAL REPORT
PRODUCTION TEST NO. 105-214-P
SILICA FEED ELIMINATION

Introduction:

Pilot plant studies under the direction of C. P. Kidder in late 1943 and early 1944 had indicated that the addition of sodium silicate to process water would be necessary to prevent rapid deposition of the hydrous oxides of iron and aluminum on the slugs and tubes of the piles. However, it was recognized that sodium silicate feed might not be necessary if a very high quality filtered water could be produced in the 100 Area filter plants then under construction. In November 1944, water quality in 100-8 Area was so good that serious consideration was given to the elimination of sodium silicate feed. However, before action could be taken, filter plant operation was seriously affected by a drop in the temperature of the river water, resulting in an accelerated rate of film formation on the slugs and tubes of the pile. Difficulty with filter operation continued throughout the winter and spring periods making it impractical to consider the elimination or reduction of sodium silicate feed. By the summer of 1945 control of water quality was so firmly established that sodium silicate feeds were reduced gradually by about 20%. With the exception of seasonal fluctuations, water quality and the rate of film formation remained so well under control that by the summer of 1948 it was decided that the need for sodium silicate feed should be re-evaluated. Consequently, a production test was planned and started in August 1948.

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Production Test No. 105-214-P
Silica Feed Elimination

Object:

The object of the production test was to determine whether or not sodium silicate feed to process water is necessary.

Summary:

Starting in August 1948 sodium silicate feed to process water was reduced slowly in one of the 100 Areas to one half of the normal rate. After several months had elapsed it became apparent that the low feed rate was successful. Consequently, the silicate feed was eliminated in one of the 100 Areas on May 18, 1949 and on August 6, 1949 in the remaining 100 Areas. The effects of the elimination of the sodium silicate feed appear to be as follows:

- a. 80 - 90% reduction in the rate of film formation.
- b. 10 - 15% reduction in 107 basin effluent activity.
- c. No detectable change in corrosion rates.
- d. \$200,000 per year reduction in cost.

Recommendation:

It is recommended that sodium silicate feed to process water be discontinued permanently.

Discussion:

The reduction in the rate of film formation appears to be due to the elimination of one of the constituents of the old type film, namely silica. There is some evidence that the film formed since the elimination of silicate feed is more delicate and is sloughed off by the high velocity water passing through the tubes of the unit. This leads one to the theory that silica may have caused greater rates of film formation by producing with iron hydroxide a tough adherent film which did not slough off readily.

One might ask, how results obtained by the pilot plant studies could have been so erroneous. A possible explanation may be with the poor water treatment equipment and methods used in producing the filtered water for the pilot plant tests. For example, the typical iron content of the filtered water at the pilot plant was 0.10 PPM while it was 0.02 in the 100 Areas. The effect of sodium silicate then on the pilot plant water may have been entirely different than the effect on 100 Area filtered water. Kidder, in his final report states that sodium silicate feed would not be necessary if a very high quality filtered water was produced.

The reduction in 107 basin effluent activity due to the elimination of sodium silicate feed was predicted by Mr. West of the Pile Physics group to be between 20 and 30 percent. As no good data are available concerning the normal sodium content of the process water it has been impossible to get

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Production Test No. 105-214
Silica Feed Elimination

an exact quantitative value for the reduction in activity caused by the elimination of the sodium silicate feed. As normal unexplained fluctuations of $\pm 20 - 30\%$ in activity are fairly common in the effluent from the 107 basin, it has been impossible to do more than show that the elimination of sodium silicate feed probably caused a 10 - 15% reduction in activity readings.

Mr. Botsford and Mr. Greenfield of the Pile Technology Division are of the opinion that corrosion rates have not changed since sodium silicate feed has been eliminated. However, they state that their data is limited and that slight modifications may have to be made at a later date.

Sodium silicate had been fed at the minimum rate of 5 - 6 PPM expressed as silica. The cost of the silicate required for four pile operation was approximately \$139,000 a year; however, only 90% of this amount is a saving because additional lime feed is necessary to compensate for the loss of alkalinity resulting from the elimination of sodium silicate feed. The net saving in material is then \$125,000 a year.

A total of 16 men from the 100 areas were eliminated for a cost reduction of \$75,000 a year as a result of the silicate feed elimination.

Total annual material and labor savings resulting from the elimination of sodium silicate feed, therefore, amount to \$200,000.

W. R. Conley

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