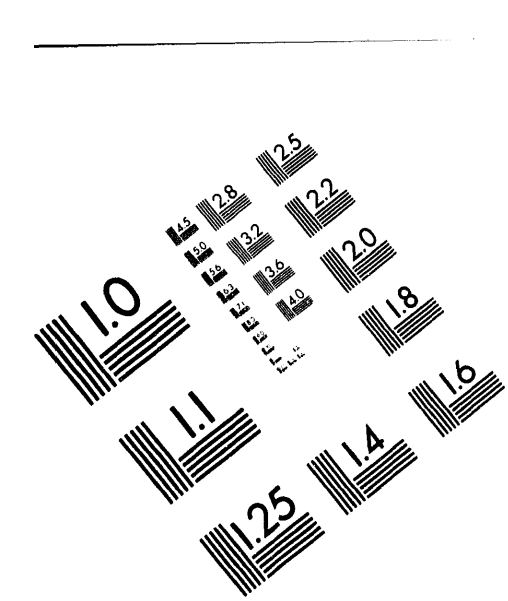

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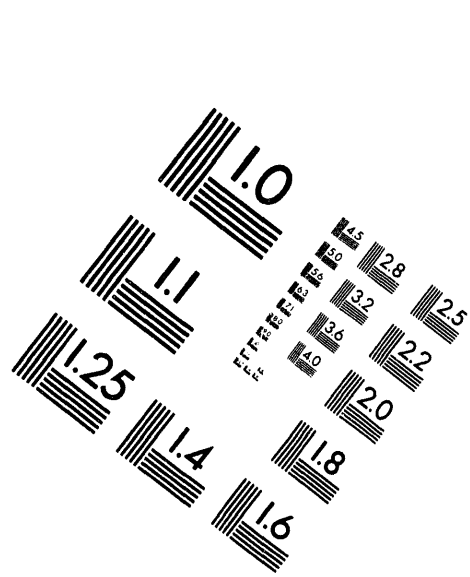

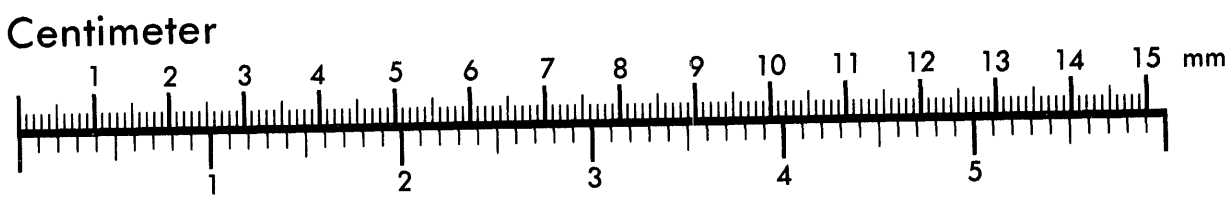

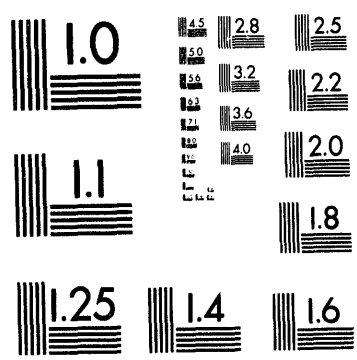

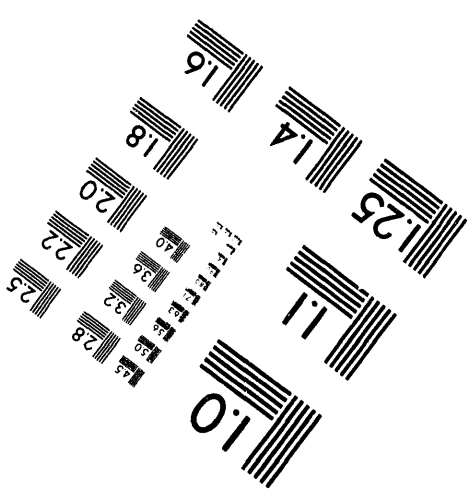

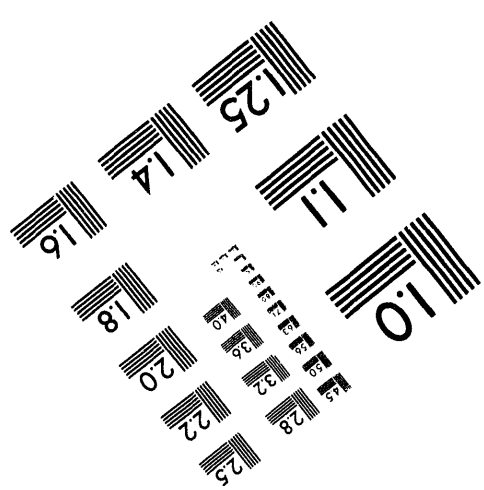

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DATE
January 30, 1961

GENERAL ELECTRIC

HANFORD ATOMIC PRODUCTS OPERATION - RICHLAND, WASHINGTON

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INTERIM REPORT GENERAL ELECTRIC PROJECT - CONSULTANT AGREEMENT CA-264

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C. J. Vinton, United States Chemical Milling Corp., Manhattan Beach, Calif.

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UNITED STATES CHEMICAL MILLING CORPORATION

MEMORANDUM

[redacted] January 30, 1961

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TO: DON C. ATKINS, JR. Page 1 of 2 pages

FROM: CHARLES J. VINTON

SUBJECT: INTERIM REPORT
GENERAL ELECTRIC PROJECT

The tentative plans for investigation arrived at during the last trip to Hanford were soon interrupted. The special request was to investigate the high uranium concentration region. In particular, it was desired to find out whether gross tolerance faults occurred at high uranium concentrations; also to establish a practical top limit. In order to observe this specific feature, the first test series was continued to the absolute top limit of uranium content without variance of other components. During this series, there were occasional runs to test the effect of variation of nitrates or sulfates - so as to have a basis for further planning.

Temperature variations were also studied as a special feature. The conclusion is that the most promising temperature range with present mixtures is 160° - 165° F. At higher temperatures tolerance faults are increased, and at lower temperatures there was a slope toward the center. In general, tolerance seemed to be closely related to etch rate - the slower the etch rate the better the tolerance, up to the point where the tendency to form a slope becomes evident.

The reason for the slope is probably a matter of thermal heat distribution due to etching, and the relatively greater part this plays in a more cool etchant. It is evident that the center portion has less Zircaloy as a cooling body than the outer portion and this may become a factor in slope formation to cause faster etching toward the center in cooler etchant mixtures.

The general problem of ridge formation is also very likely related to the cooling effect of the Zircaloy. Actually, this is a dishing tendency more than a ridge formation.

A significant observation was that the problem of pit formation was entirely eliminated by decreasing nitrates to 1000 lbs./M gallons and increasing sulfates to 5500 lbs./M gallons. The tolerance problem remained about the same. The larger parts always tended to pit more than the smaller parts in the same mixtures.

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TO: DON C. ATKINS, JR.

January 30, 1961

One significant point is that there was no tolerance variation attributable to the uranium concentration all the way from 0-1200 lbs./M gallons. The practical top limit for uranium ion concentration has been established at 1200 lbs./M gallons. It is very inadvisable to go beyond this limit for if precipitation of uranium salts starts there is no practical way to re-dissolve them in this media.

Etch rate is related directly to nitrate concentration and temperature, and inversely to sulfate concentration above limits of about 4200 lbs./M gallons.

The tolerance limits sought seem to be very optimistic, since there are so many factors working against tolerance. The Zircaloy tubing cooling effect, the deep 300 mil cut, the desired fast etch rate, and the requirement for vertical milling are examples. In view of all of these factors, it seems that the tolerance requirements or the etch rate must be reduced. The tolerance requirements have been met with one mixture in the 1.0 msm region.

Whether or not to increase copper has been a point of great concern. Mixtures have been tested at 160, 186, 229 and 320 lbs./M gallons. The mixtures at 229 and 320 lbs./M gallons were problematic in that the copper salts would precipitate out on cooling and re-dissolve with difficulty. There was no noticeable difference between 160 and 186 other than the greater tendency toward copper salt precipitation. The tests at 229 and 320 were made before the rotating mechanism was available and tolerance measurements could not be made. The next variable to be studied is copper ion increase.

The most promising mixture thus far has the following composition:

Cu^{++}	187
U^{++++}	536
NO_3^{--}	981
SO_4^{----}	5508

	%	Lbs.	Gals.
H_2O	34.3	4002	479.6
HNO_3 42° Be	12.3	1439	122.0
$CuSO_4 \cdot 5H_2O$	6.3	735	
H_2SO_4 · 66° Be	47.1	5511	360.0

CJV:er

Charles J. Vinton

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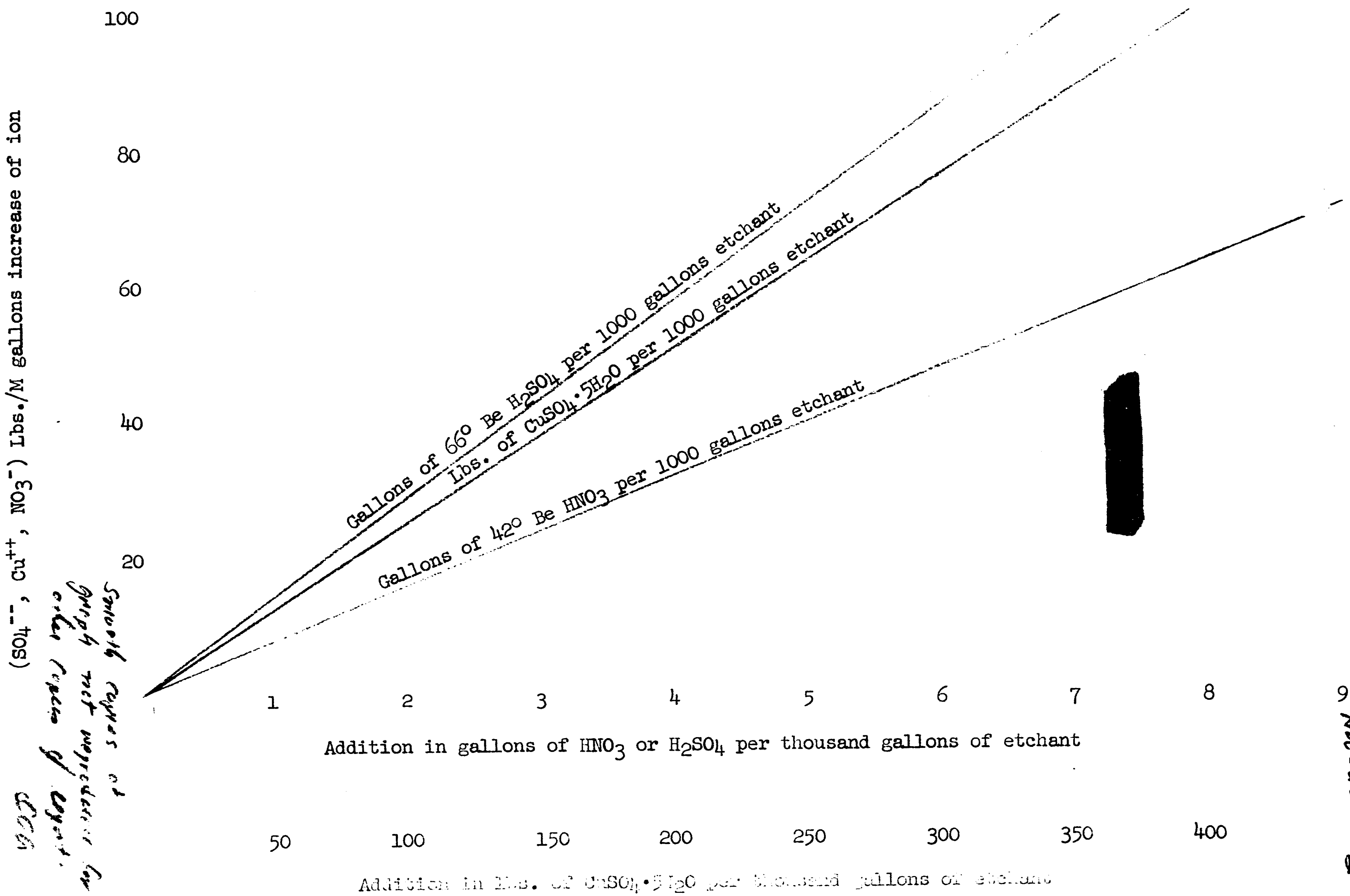
GENERAL ELECTRIC PROJECT

Effect of additions to 1000 gallons of uranium etchant



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