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IRVIN STEWART, Executive Secretary

June 10, 1942

Dr. C. C. Furnas
Division B
National Defense Research Committee
1703 32nd Street NW
Washington, D. C.

Dear Furnas:

We are beginning to obtain some results on the glass life-activity test units that were suggested by Mr. Stevenson. The units as we have constructed them involve a glass tube, 1/2" i.d. containing 10 grams of the absorbent. This tube is connected through small glass tubing to a mercury manometer and a glass bulb reservoir of 200 cc. capacity. Only the short section of 1/2" tube containing the absorbent is subjected to the temperature changes, the remainder of the apparatus being at room temperature. The 200 cc. bulb was introduced as a reservoir to reduce the period of about 7 minutes and a steam heating period of approximately 5 minutes. The total cycle time is 12-1/2 minutes; the extra time being consumed in the intermediate periods during changeover.

Five such units were assembled as follows:

Unit A - pure oxygen - with silica gel drying

Unit B - similar to Unit A but at higher pressure abs.

Unit C - Oxygen with about 3% carbon dioxide - with silica gel drying

Unit D - pure oxygen - liquid water in reservoir bulb

Unit E - pure oxygen - concentrated hydrochloric acid in reservoir bulb

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These units have had somewhat of a tough life. They were initially heated at 100°C. for two days while the automatic timer was not in operation. During this period in which they were held at 100°C., they all showed a small consumption of oxygen. We are certain that this was not due to leaks due to the fact that Unit A was actually pulling a vacuum. The decrease in volume during this heating period corresponded to about one mol of gas per 50-100 mols of absorbent. The oxygen takeup may have been greater due to the fact that other gases were probably evolved. At the end of this heating period, the units were allowed to stand at room temperature for about a week without any cycles being carried out. Following these treatments the units were placed on test and have been operating on the cycle indicated above for the past seven days. The results are plotted in the attached figure. The activities given in this accompanying figure are based on dividing the difference in the pressures at the end of the heating period and at the end of the cooling period by the maximum observed difference.

Unit A appears to have deteriorated more rapidly than Unit B. These two units are presumably identical with the exception that Unit B is at the higher pressure. We would therefore have expected Unit B to have deteriorated more rapidly. The difference may be due to the inaccuracies obtained with Unit A, since the change of the manometer level during the cycle is very small under the vacuum conditions. All of the units except C showed the initial increase in absorption capacity. This initial rise in the case of Units A and B, i.e., the ones with dry gas, is very rapid. While in the case of Units D and E the initial rise is somewhat slower. In all of the last four units the absolute amount of oxygen absorbed per cycle had about the same initial value. It will be noted that Units B, D, and E all deteriorate at about the same rate, i.e., oxygen saturated with water vapor or hydrochloric acid is as good as dry oxygen. Unit C appears to have gone bad very rapidly and in fact all the units appear to be deteriorating at a relatively rapid rate.

After studying the results, we are not too clear just what they imply due to the fact that the gas phase is no longer pure oxygen but probably contains either carbon dioxide or carbon monoxide or both. This decrease in oxygen concentration may account for the apparent rapid deterioration. After a few hundred more cycles, we are planning to remove the gas and attempt an analysis. We plan to add pure oxygen to the units and see whether this will give higher apparent activities. It may be that such tests are an ideal method of concentrating the product gases, but it probably obscures the activity results.

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In all of the units, the pressure continues to decrease indicating that the oxygen permanently absorbed exceeded the volume of gases evolved. This would also make the apparent drop off in activity greater than the true deterioration. If CO_2 were evolved, the volume of the CO_2 would obviously equal the volume of the oxygen associated with the dioxide. Water vapor would probably result in a volume decrease due to the fact that it would either condense or be absorbed by the silica gel. Carbon monoxide would result in a volume increase. In other words, it appears that oxygen must be actually tied up with the compound to account for the decrease in pressure. This would be in line with the analytical results on the previous deactivated material. Quantitative calculations of the oxygen takeup in this manner do not signify very much due to the fact that if other gases are evolved, the oxygen consumption may be much higher than the pressure figures indicate.

As indicated above, we are not too clear as to the value of these tests due to the difficulty of evaluating what actually takes place. We would like to have your reactions on these units

Very truly yours,

E. R. Gilliland

cc: Messrs. Dr. C.C. Furnas
Mr. E.P. Stevenson
Mr. George Roberts
Dr. D.B. Curll, Jr.

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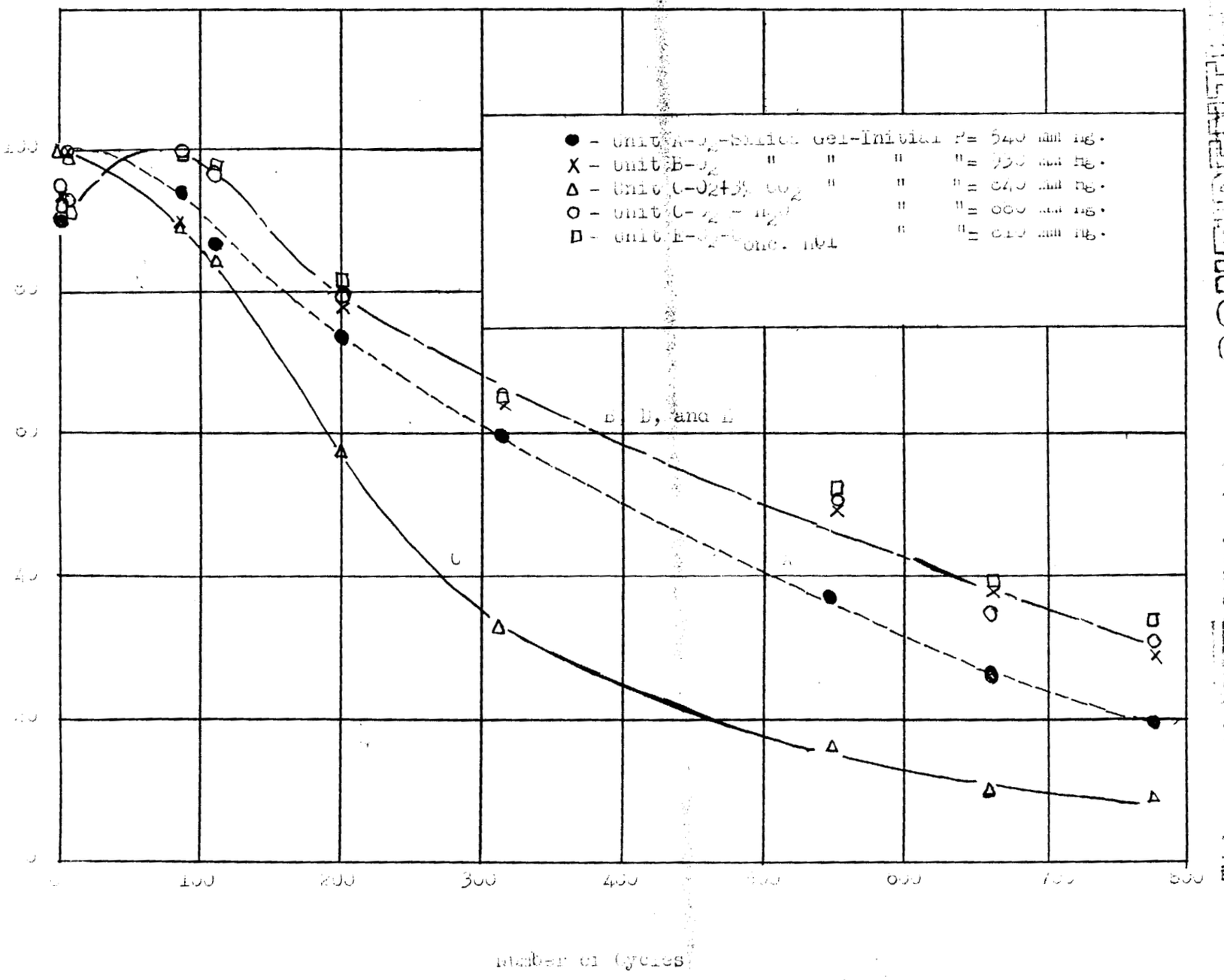

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