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NITROGEN ATMOSPHERE AT THE K PILES

The use of nitrogen as a pile atmosphere at the K Piles is being examined for current and future operating conditions. The preliminary results obtained by G. D. Joanou show that large economic gains are probable if the engineering problems are not too great. This letter recommends immediate evaluation of these problems so that a Production Test might be initiated at KE Pile before the I & E program begins.

- At equilibrium the net reactivity gain is expected to be 100-200 ih, for a K Pile operated at 1275 kw/tube, when compared to operation at or near 100% helium. If this reactivity gain - or part of it - is invested in equilibrium control rods, the scram time could become ten to twenty minutes longer directly. If the reactivity gain is used to reduce enrichment requirements and/or to repay losses for I & E charging, the scram time could be extended 5-10 minutes by a purge with CO₂ to sweep out the nitrogen poison but retain the high graphite temperatures; the change back to nitrogen could be made as soon as reactivity was available.

The cold pile reactivity loss would be about 260 ih; this could be removed by a CO₂ purge to permit a normal minimum length outage. The switch to nitrogen could be made shortly after start-up. Effectively, this procedure would act as a supplementary control method for a minimum outage. The start-up transient (turn-around) is not expected to be much higher than with 100% helium; graphite temperatures and gas expansion would not reach their maximum values at this time.

The conversion ratio for the production of plutonium is expected to increase with the higher neutron temperature; the fraction of Pu²⁴⁰ would also increase. These two effects have not yet been completely evaluated; more information will be included in a report to be issued late in November by G. D. Joanou.

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The potential economic advantages of the items listed above are large; the potential savings in gas costs, freedom from the limitations of a single source of supply, and the conservation of a rare natural resource add to the attractiveness of the idea. The Pile Physics Operation will initiate or be glad to cooperate in a Production Test to use nitrogen as a K Pile atmosphere as soon as there is assurance that the higher graphite temperatures* will not cause reduced pile life or create excessive engineering problems. Some of the effects that occur to me are:

1. Higher HCR Temperatures.
2. VSR temperatures and their gas seals.
3. Graphite thermocouple damage.
4. Longer cooling time following pile shutdown.
5. Water leaks.
6. Higher shield and aluminum baffle temperature.
7. Stack expansion
8. Side test hole cooling problems?
9. Graphite damage (D. H. Curtiss says there will be no problem on a test of 2-4 weeks).
10. Gas system - storing, pumping, drying, metering, analyzing, etc. °
11. Radiological problem of C^{14} .

°

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Recommendations Approved By

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* The graphite temperature assumed for our calculations was 730° C; this was estimated by D. H. Curtiss from data taken with Helium and CO₂ mixtures.