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PROJECT

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Richland, Washington 99352

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TITLE AND AUTHOR

MFC STUDY - KRYPTON AND XENON RECOVERY

H. P. Shaw

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PROPOSAL (MFC)

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It is proposed that a study be conducted to define processes and facilities for the economic recovery and purification of fission krypton and xenon from present and proposed separations facilities at Hanford. It is requested that \$75,000 be made available for a six-month study.

Major elements of the program are as follows:

- 3 Parts
- Market Survey
- Technology
- Engineering
1. Evaluate the commercial and Atomic Energy Commission markets for fission rare gases. Market information should be developed for krypton-85, stable xenon, and for specific krypton or xenon "cuts" which could be separated from the gases. A market analysis would establish the incentives for fission gas processing.
 2. Analyze recent developments in rare gas separation, in particular new low temperature distillation and molecular sieve techniques.
 3. Apply new technology to define processes and facilities for rare gas recovery and purification from Purex dissolver offgas and offgas from future power fuels reprocessing.

BASIS FOR PROPOSAL

As commercial fuels reprocessing develops, large quantities of radioactive and stable fission "rare" gases will become available. These gases pose both a problem and an opportunity. When efficient methods of control and recovery are developed, the cost of these materials will be greatly reduced. With increased availability and reduced costs, commercial and government applications would be accelerated. Thus the fission gases which present potential environmental problems, would become useful by-products.

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ECONOMICS

MFC Study - Krypton and Xenon Recovery

	<u>Krypton⁻⁸⁵</u>	<u>Stable Mixed Xenon</u>	<u>Nitric Acid</u>
Hanford Availability, FY-1968 ⁽³⁾	1,720,000 Ci/yr	114,000 liters/yr ⁽²⁾	1200 Ton
Power Fuels Availability, 500 T/yr at 25,000 MWD/T	3,000,000 Ci/yr	330,000 liters/yr	1200 Ton
Annual Consumption (1963)	5,000 - 7,000 Ci	31,000 liters (1963)	
Current Sales Price	\$22/Ci	\$13 to 35/liter	\$53/Ton make up nitric acid
Estimated Production Costs - Including Depreciation - 1958 Study ⁽⁴⁾	\$0.115/Ci	\$1.72/liter	
Selling Price	.20¢/Ci	\$3 /liter	\$53/Ton
Uses (43,000 Ci krypton over 11 years 1955 - 1966)	Light sources Radiation Sources Leak Detection Thermoelectric Generators for Space	Replace argon for Incandescent lamps High Intensity Lamps Battery Operated Devices	

(1) Gas containing 5% krypton⁻⁸⁵ with 95% inert krypton

(2) Liters gas at standard temperature and pressure

(3) Potential Hanford revenue of \$800,000/year for 90% recovery of krypton, xenon and HNO₃ at assumed prices of 20 cents/Ci., \$3/liter and \$53/ton, respectively. (\$385,000 operating cost/y
\$2,100,000
10-year
depreciation)

(4) Facility Capital Cost \$2,100,000

Commercially xenon is recovered from liquid oxygen in air separations plants. Since xenon content of atmospheric air is only one part in 12 million, tremendous quantities of air must be processed thus the high cost.

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INCENTIVES

MFC STUDY - Krypton and Xenon Recovery

1. Provide useful products for industry and government application.
2. Provide basic gas recovery technology for commercial fuels processing plants.
3. Provide supplemental Hanford revenue.
4. Reduce krypton-⁸⁵ and nitric acid atmospheric pollution.
5. Add to the knowledge and capabilities of Hanford personnel.

WORK ITEMS

MFC STUDY - Krypton and Xenon Recovery

1. Survey the market and evaluate the incentives for rare gas recovery.
2. Consult Battelle, Oak Ridge National Laboratory, Linde Air Reduction, Air Products, the Air Force and NASA for new technology.
3. Prepare process design for the Purex rare gas recovery facility.
4. Prepare process design for a commercial rare gas power fuels reprocessing plant.

DISCLAIMER

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SIX-MONTHS STUDY

<u>Estimated Study Cost</u>	<u>ISO</u>	<u>Technical Manpower</u>	
		<u>BNW</u>	<u>Other Consultants</u>
\$75,000	2	1/2	1

CONTRIBUTIONS TO MAINTENANCE OF FACILITY CAPABILITIES AT HANFORD

1. The study is directly related to important Commission objectives:
 - a) Recover and purify valuable fission products for industry and government use.
 - b) Reduce the emission of krypton-85 to the atmosphere, to reduce atmospheric pollution.
2. Studies of gaseous separations problems would add to the knowledge and capabilities of Hanford personnel in the fields of distillation, adsorption, cryogenics, thermal and mass diffusion.
3. The design program has a definite end date. If successful the work would lead to the detail design and construction of new facilities.

(Will Hanford benefit? Right now by initiating the study. Later - stimulation of commercial market - extend the environment for disposal of gaseous wastes.)
4. Hanford and/or the nuclear fuels reprocessing industry would benefit directly from the study. Capability would be installed when warranted for high volume low cost rare gas recovery in support of the Commission's peaceful applications program.
5. The work is an extension, rather than a substitute or duplication of established O2 process development work.
6. The studies will not interfere with established work patterns in O2 program work.

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