Contract No:

This document was prepared in conjunction with work accomplished under Contract No. DE-AC09-08SR22470 with the U.S. Department of Energy (DOE) Office of Environmental Management (EM).

Disclaimer:

SUMMARY

Iodine is released to the off-gas during uranium dissolution in the annular dissolvers in F-Canyon. The iodine is currently removed by reaction with silver nitrate coated Berl saddles. Iodine removal has been adequate but the average life of the iodine reactor bed has been less than expected.[1] Failure of the iodine reactor is usually indicated by a high reactor differential pressure. Pluggage of the reactor is due primarily to entrainment of dissolver solution into the reactor and degradation of the Berl saddles. In addition to frequent replacements, it has become more difficult to obtain Berl saddles coated with silver nitrate at SRP.

This TA authorizes the use of silver mordenite for iodine adsorption instead of the Berl saddles. Silver mordenite is a commercially available iodine adsorbent that is more stable chemically and thermally than silver nitrate coated Berl saddles.[2] Silver mordenite has a higher capacity for iodine and should increase bed life by a factor of 2 or 3.

DISCUSSION

The F-Canyon iodine reactor consists of a reactor shell which contains a cartridge loaded with 20 cubic feet of 1/2 inch Berl saddles coated with silver nitrate. The cylindrical cartridge is about two feet in diameter and is packed to a depth of eight feet. It has an open top and a bottom perforated with 3/8 inch diameter holes. The off-gas stream enters the top of the reactor, is heated as it goes through tubes coiled around the cartridge, and enters the cartridge from the bottom. The reactor is maintained at 170-190°C by high pressure steam in the reactor shell. The average cartridge life has been about nine months.

Cartridge failure is usually indicated by a high differential pressure across the reactor caused by pluggage. Pluggage is probably due to entrainment of dissolver solution into the reactor and degradation of the Berl saddles. Degradation is probably due to alternate exposure to base and acid vapors during the decladding and dissolution cycles. It is also possible to exceed the melting point of silver nitrate (212 °C). The melted material would seep to the bottom of the cartridge and plugs the holes.

Mordenite is a molecular sieve material with a silica/alumina mole ratio of 10/1 which gives the material good chemical and thermal stability. Silver mordenite is made by ion exchange of either the sodium or hydrogen form of Zeolon 900. After exchange, the silver is reduced to the metallic state by heating in the presence of hydrogen. Thus, no silver nitrate is present and there is no problem with melting because silver melts at 960°C.

The silver concentration in silver mordenite is much higher than in silver nitrate coated Berl saddles, therefore, a smaller quantity of silver mordenite is required in the bed. About 2.6 cubic feet of silver mordenite will collect about the same amount of iodine as the present 20 cubic feet of silver nitrate coated Berl saddles.

TEST DETAILS

Silver mordenite will be tested in F-Canyon using an existing reactor cartridge. The bottom 24 inches of the cartridge will be packed with stainless steel wool to act as a demister. About 150 pounds of silver mordenite will be placed on a No. 7 or 8 mesh screen on top of the steel wool. The initial pressure drop across the reactor is expected to be 5 to 10 inches of water column which is higher than with Berl saddles. The higher pressure drop is due to the smaller particle size (1/8 inch extrudate) of the mordenite. However, the higher initial pressure drop should cause no problems during dissolver operation. The reactor operating temperature will continue to be 170 to 190°C. The existing stack iodine monitor will be used to determine if iodine releases change during the test.

SAFETY

No safety problems associated with this test have been recognized. Radiation exposure to personnel might be slightly reduced since less time should be required to load and unload the reactor cartridge.

RISKS

Failure of the silver mordenite to remove a sufficient amount of iodine from the dissolver off-gas is the only recognized risk associated with this test. However, there is no evidence to indicate that iodine releases will increase when using silver mordenite as the adsorbent. Iodine releases are constantly monitored at the 195 foot F-area stack and any significant increase in iodine will be detected immediately.

A typical F-Canyon dissolver charge of 200 days cooled 3% ^{240}Pu Mark 31 targets contains about 75 mCi of ^{131}I. If all of the iodine in a dissolver charge was released to the atmosphere, the annual guide (250 mCi) for ^{131}I released to the atmosphere would not likely be exceeded.

ENVIRONMENTAL IMPACT

Except for the unlikely possibility that iodine releases could increase, this test has no recognized environmental impact.

REFERENCES

1. Letter, J. B. Starks, to J. T. Buckner, "Iodine Reactor 7.1 Pluggage Problem", May 15, 1969.

2. DPST-82-348, "Iodine Removal From SRP Dissolver Off-Gas", M. C. Thompson, February 26, 1982.

OSR 14-347

NEPA, SAFETY ANALYSIS AND PERMITS CHECKLIST

ACTIVITY TITLE	ACTIVITY NUMBER
Iodine Removal Using Silver Mordenite	TA 2-1102
CUSTODIAN (NAME AND ORGANIZATION)	**DATE**
D. C. Witt, Separations	July 18, 1985
LOCATION	**PHONE NUMBER**
221-F	74123

ACTIVITY DESCRIPTION: INCLUDE PURPOSE, NEED, LOCATION (PROVIDE MAP OR FIGURE IF APPLICABLE), SCHEDULE, COST, ETC. (USE ADDITIONAL SHEETS IF NECESSARY)

Silver mordenite will be tested as the iodine adsorbent in the 221-F off-gas reactors instead of silver nitrate coated Berl saddles. The reactor life should be increased and the iodine adsorption efficiency should be unchanged. If any decrease in adsorption efficiency does occur, the iodine release will be detected by the F-Area stack iodine monitor. Even if all the iodine-131 (75 mCi) in a typical dissolver escaped to the atmosphere, the annual release guide (250 mCi) would not likely be exceeded. Except for the unlikely possibility that iodine releases could increase, this test has no recognized environmental impact.

INSTRUCTIONS

1. If the activity results in all NO's being checked or is a direct replacement which will have equal or less impacts (indicate this in the project description), attach completed checklist to project approval papers and send copies of checklist to:

SRP NEPA Coordinator	703-34A
SRL NEPA Coordinator	773-18A
SRL Safety Analysis Coordinator	773-26A

2. If any item is checked YES, and activity is not replacement action, contact EAD NEPA Coordinator, ext: 2457 and/or Safety Analysis Coordinator, ext: 1359, to discuss providing supplemental information so that SRL-EAD can coordinate the appropriate environmental or safety analysis documentation. Send copies of the completed check list and supplemental information to the coordinators listed in (1) above.

3. For permit requirements, contact the SRP Environmental Coordinator's Office, ext: 2568.

NEPA, SAFETY ANALYSIS AND PERMITS CHECKLIST

Checklist Instructions: Place an X in the appropriate column for the activity under evaluation

	NO	YES
ENVIRONMENTAL EVALUATION		
Air Emissions (except uncontaminated ventilation air)	X	
Liquid Releases to Streams, Seepage Basins, Storm Drains, Process Sewers, Wetlands, Groundwater, Ponds, Lakes	X	
Solid or Liquid Waste Burial or Storage	X	
Storage of Chemicals or Petroleum Products	X	
Site Clearing, Excavation, Filling or Draining, Wetlands/Floodplains, Borrow Pits, etc.	X	
Increased use of groundwater or river water	X	
SAFETY ANALYSIS (This section not required for Test Authorizations)		
Part of Existing Designated Facility (DF)		
Alters any section of the Safety Analysis Report for the DF		
New Facility		
Involves the use, handling or storage of		
— fissionable materials		
— fission products		
— special nuclear materials		
Has potential for radiation exposure to		
— operating personnel		
— personnel outside the facility		
Uses or produces toxic or cerrosive materials that could result in exposure to		
— operating personnel		
— personnel outside the facility		
Involves flammable or explosive materials that could impact adversely on		
— operating personnel		
— adjacent facilities		
PERMITS REQUIRED		
Air Emissions	X	
Liquid Releases (NPDES modification)	X	
Spill potential (oil, chemicals, etc.)	X	
Construction	X	
Wetlands Impact (Env. Coord. and EAD review)	X	
Hazardous Waste — RCRA (storage, handling, treatment, etc.)	X	
Other	X	

If the activity is a direct replacement or will have equal or less environmental or safety impact than already exists, please sign and date here.

Name _____ Date 7-19-85

(If signed and dated, no additional action on this checklist is required)