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April 13, 1956

PRODUCTION TEST 224-B-5

LANTHANUM FLUORIDE BY-PRODUCT
PRECIPITATION TIME CYCLE REDUCTION

Objective:

To reduce the lanthanum fluoride by-product precipitation time cycle through process changes.

Basis:

It is deemed possible to reduce the time cycle of the lanthanum fluoride by-product precipitation through these process changes:

Process Change	Estimated Time Saving (hours) Individual	Cumulative
(1) Use the cake slurry of alternate runs as the source of lanthanum for the next run. Recycle is to be added as the source of lanthanum for the remaining runs with single reworks to	0.4	0.4

Process Change	Estimated Time Saving (hours) Individual	Cumulative
follow the runs using the cake slurry as the source of lanthanum. This change coupled with the use of the D-4 Tank as the precipitator tank for the rework results in further time saving.	1.7	2.0
(2) Decrease digestion times	1.0	3.0
(3) Increase centrifugation rate up to 110 lbs. per minute.	1.0	4.0
(4) Change from slurry to positive displacement type wash procedure.	1.2	4.6
(5) Reduce the cake slurry volume.	0.4	5.0

The bases of these changes are as follows:

(1) Cake Slurry as the Source of Lanthanum for the Next Run

This procedure is listed in the Hanford Engineer Works Technical Manual, Section C, p. 718, as a method for recovering product from the lanthanum fluoride by-product waste. If the cake slurry is returned to D-1 Tank for the next run, the resulting volume will dissolve 4.9 lbs. of lanthanum. Experience with routine waste reworking has indicated that complete cake solution is not necessary. Under present standards, Isolation Building recyc is added, as it becomes available, to runs in D Cell as the source of lanthanum. Recycle additions to D Cell contain from 6 to 9 lbs. of lanthanum and an average of 7% of a run in product. The suggested process change requires that recycle be added regularly to alternate runs. The following table summarizes the recycle conditions resulting from one run:

	Recycle received in the D-4 Tank per run				Recycle which can be added to the D-1 Tank for each run
	From Isolation Bldg.		From Concentration Bldg.	Total	
	Run RC	Miscellaneous RC			
Lanthanum (lbs)	4.4	0	0.1	4.5	9.0
Product (%)	4.0	0.4	0.6	5.0	5.0
Total Lbs.	500	25	25	550	1100

(Miscellaneous recycle from the Isolation Building consists of lab wastes, cleanouts, etc.)

(Recycle from the Concentration Building consists of F Cell flushes, Kitten Runs, etc.)

This table shows that all of the recycle can be used by additions to one-half of the runs.

(2) Decrease Precipitation and Oxidation Digestion Times

The standard digestion time for the precipitation is one hour for the run and one hour for the rework. On three runs the precipitation digestion times were inadvertently reduced to one-half hour. The results are shown below:

Run	D-4-BP%	LDF	
B-10-01-B-33	0.03	7.42	One-half hour precipitation digestion
B-34	0.04	7.45	One-half hour precipitation digestion
B-35	0.03	7.56	One-half hour precipitation digestion
Average of B-10-01-D-23 thru B-32 (ten runs)	0.03	7.40	Standard procedure

The standard digestion time for the oxidation is one-half hour for the run and one-half hour for the rework. The oxidation time for the rework was cut from one to one-half hour in the 10-02 series at B and T Plants. Average waste loss for 74 runs with the one-half hour digestion is 0.06% compared to an average of 0.06% for 50 runs previous to the change. Since each oxidation digestion period is followed by a cooling period of approximately one hour during which effective oxidation may continue, it may be possible to shorten the digestion period to 15 minutes.

(3) Centrifugation at 110 lbs/min

Standard centrifugation rate in D Cell is 70 lbs/min for the run and 55 to 60 lbs/min for the rework. A centrifugation rate of 110 lbs/min results in a time saving of 50 minutes on the run and up to 30 minutes on the rework. The 110 lbs/min rate allows a 5 minute bowl retention time. Less efficient decontamination of the effluent may result from the increased rate. At present the effluent is recontaminated by the rework centrifugation but this is adequately decontaminated in the lanthanum fluoride product precipitation.

(4) Change from Slurry to Positive Displacement Type Cake Wash Procedure

The standard slurry type wash procedure requires 2 hours, 15 minutes per run. The positive displacement type wash procedure using the same amount of wash solution would require 45 minutes per run. Positive displacement type washing was tested under Production Test SE-224-T-PA-5 in April, 1945. Waste losses did not appear to increase. The slurry type wash was thought to be more satisfactory for the 9 lbs. cake and was thus resumed as standard procedure after the test. Since D Cell losses in 1945

were approximately 0.70% compared to the present average of 0.06%, it is possible that losses will be increased. A satisfactory wash procedure may prove to be a compromise of slurry and positive displacement type washing.

(5) Reduce the Cake Slurry Volume

The standard cake removal from D Cell uses 2100 lbs. of water delivered through the bowl sprays. Beckman data (see Table I) indicate that the cake can be satisfactorily removed with 1000 lbs. of water. On slurries to be returned to the next run, this weight reduction would save ten minutes per run centrifugation time in D Cell and an additional one-half hour in E Cell. This weight reduction can be used on slurries to be reworked only when the D-4 Tank is used as the precipitator. In March, 1947, water used for the rework was reduced 33% to the present standard. Waste losses were unaffected by this reduction. Further reductions were not made at that time because of the volume required to reach the agitator in the D-1 Tank. If increased waste losses occur, higher nitric acid and permanganate concentrations will be tried.

Table I. D-2 Centrifuge Beckman Readings (Amp x 10^{14}) During First Cake Removal

Run Number	Full	1st. 700 lbs.	2nd 700 lbs.	3rd 700 lbs.
T-10-03-F-1	78	10	7	6
D-2	void	7	6	6
D-3	84	10	8	8
D-4	44	5	5	5
D-5	82	8	6	6
D-6	53	5	5	5
D-7	100	11	8	8
D-8	47	9	8	8
D-9	76	7	7	7
D-10	39	7	7	7
Average	67	8	7	7

Beckman Limit is 10 x 10^{-14} amps.

Procedure:

(1) A series of twenty runs will be processed as follows: On alternate runs the lanthanum fluoride by-product cake slurry will be used as the source of lanthanum for the next run. Isolation Building recycle will be used as the source of lanthanum on the remaining (alternate) runs. One thousand lbs. of water will be used for the cake slurry to be added to the first run. Single lanthanum fluoride by-product reworks will follow runs using the cake slurry as the source of lanthanum.

(2) Ten runs will be processed under the present standard as control runs.

(3) Ten runs will be processed using the procedures of Item 1 which proved satisfactory. In addition, the digestion time for oxidation will be decreased to 15 minutes, and for precipitation to 30 minutes.

(4) One run will be processed using the procedures of Item 3 which proved satisfactory. In addition, this run will maintain a centrifugation rate of 90 lbs. per minute. Standard procedure will be employed in subsequent runs until the final decontamination of this run is determined. If the waste loss and decontamination factor of this run are satisfactory, one run will be processed using the procedures selected in Item 3. In addition, this run will maintain a centrifugation rate of 110 lbs. per minute. Standard procedure will be employed in subsequent runs until the final decontamination factor of this run is determined. If the waste loss and decontamination factor of this run are satisfactory, ten runs will be processed using the procedures selected in Item 3. In addition, this series of runs will maintain a centrifugation rate of 110 lbs. per minute.

(5) Ten runs will be processed using the procedures of Item 4 which proved satisfactory. In addition, the cake wash will be accomplished by the positive displacement type of wash. Cake wash volumes will remain standard. If necessary a series of runs will be processed to determine the best compromise of the slurry and positive displacement type wash procedures.

(6) Ten runs will be processed under the present standard as control runs.

(7) When the necessary fabrication for the use of the D-4 Tank as the precipitator for the rework is completed, ten runs will be processed using the procedures of Item 5 which proved satisfactory. In addition, the cake slurry for the rework will be reduced to 1500 lbs. of water. If waste losses and decontamination of this series of runs is satisfactory, an additional ten runs will be processed using the procedures of Item 5 which proved satisfactory. In addition, the cake slurry for the rework will be reduced to 1000 lbs. of water.

Data:

A D-4-BP sample of the cake slurry of each run will be required in addition to routine samples.

Equipment:

New equipment required will be: Process line, jet and gang valve assembly, D-4 to D-2 Tanks.

Chemical addition line, D-1-B to D-4 Tank
D-1-A to D-4 Tank
D-1-Y to D-4 Tank

Responsibility

Responsibility for the preparation of operating procedure will be assigned to B. E. Kirkendall. Operations will be under supervision of the "S" Division.

Conclusions will be drawn jointly by the "S" and Technical Divisions from process and operational considerations.

Estimated Completion:

Testing should be completed by September 1, 1950.

200 AREAS PROGRAM COMMITTEE

C A Bissett by VRC "S" Division 4-19-50 Date

J Swink Separations Technology Division 4/13/50 Date

200 AREAS STEERING COMMITTEE

VR Cheyney "S" Division 4-19-50 Date

RH Beaton Separations Technology Division 4/19/50 Date

MANAGEMENT

[illegible] Production Divisions 4-21-50 Date