NINE MILE LAKE

DOCKET NO. 40-8721

ALTERNATIVE ANALYSIS

OF

PROCESS WASTE DISPOSAL OPTIONS

Prepared July 16, 1980

by

ROCKY MOUNTAIN ENERGY COMPANY

NINE MILE LAKE

July 14, 1980

11.8 ALTERNATIVE WASTE DISPOSAL

The various process waste disposal systems discussed in this section have been evaluated from the perspective of impact on the environment, energy consumption, and economic feasibility. Both acid and carbonate lixiviants have been considered each with a base case and alternatives to the base cases.

The acid and carbonate base cases provide for permanent disposal of all deposited solids in the evaporation reservoirs. All reservoir embankments will be constructed with the native clay from the reservoir subgrade excavation. The clays within the proposed reservoir construction area have been characterized as being competent, extremely impermeable materials; therefore, impacts due to seepage would be negligible and minimal long term maintenance would be required.

The criteria pertinent to the base cases and the alternatives are listed as follows:

- Process waste volumes are based on plant operations 24 hours/day, 345 days/year for 13 years with restoration terminating 1.5 years after uranium production.

- Inclusion of a 20 ft. buffer zone, measured from the outside toe of the embankment and fence, on all sides of the evaporation reservoirs and 300 ft. for all permanent deposition sites.

- A buffer zone perimeter with sheep tight fence enclosing all evaporation reservoirs and final deposition sites.

- Reservoir embankments with shallow (4 to 1) slopes which require no slope protection or riprap.

- Reservoir freeboard is designed as follows:
  Maximum storm precipitation level: 2 ft. of freeboard
  Maximum operating level: 3 ft. of freeboard
  Normal operating level: 5 ft. of freeboard

- A net evaporation rate of 2.14 ft. per year including all precipitation.

- All suitable topsoil will be stripped from the disturbed areas and stockpiled for final reclamation.

- Monitor wells around all reservoirs and final deposition sites.

- Seven feet of appropriate cover material over all permanently deposited process waste solids.

- Final reclamation to include grading to suitable contours, replacement of topsoil and revegetation of all disturbed areas.

- A haul distance of 90 miles for all off-site disposal options.

11.8.1 BASE CASE DISPOSAL

11.8.1.1 Acid Lixiviant - Base Case

Process effluents (described in detail in sections 3.3 & 3.4) are discharged to a permanent on-site disposal system consisting of four reservoirs depicted on drawing 086-03-G-223. The reservoirs are sized to contain effluents produced at the rate of 1,510 lbs/min of which about 1,360 lbs/min will be evaporated. At the end of the project life liquid and solids consisting of heavy metal hydroxides, gypsum, and calcite forming a fine grained slime like residue are estimated to occupy 14 million cubic feet, based on 74% solids by weight and a bulk density of 70 lbs/ft^3.

After the liquids have evaporated from the two smaller reservoirs, all deposited solids and an additional three inches of clay will be removed from them and deposited in the larger reservoirs. The solid wastes would then be covered with 7 ft. of protective cover material prior to final reclamation.

11.8.1.2 Carbonate Lixiviant - Base Case

Process effluents are discharged to a permanent on-site disposal system consisting of two reservoirs depicted on drawing 086-03-G-227. The reservoirs are sized to contain effluents produced at the rate of 670 lbs/min of which approximately 660 lbs/min will be evaporated. At the end of the project life, a crystalline residue containing mixtures of carbonate and sulfate salts with sodium and calcium cations will occupy an estimated volume of 1.7 million cubic feet based on 83% solids by weight and a bulk density of 45 lbs/ft^3.

The large reservoir will have a sloped bottom allowing all deposited solids in both reservoirs to be placed in the deep area of this large reservoir along with up to three inches of affected clay liner material. This will minimize the surface area required to permanently dispose of the affected solids. The solids would then be covered with 7 ft. of appropriate material and reclaimed.

11.8.1.3 Advantages/Disadvantages

The principal advantages of the acid and carbonate base case disposal systems result from not having to handle the residual process wastes twice. Thus, there would be substantially less reclamation worker exposure, less energy consumption, less capital cost, and less general populace exposure than future on and off-site d sposal options.

The principal disadvantages of the base case disposal systems are listed as follows:

1) A greater surface area than that required by the other options would be subjected to long-term disposal.

2) The disposal site is in closer proximity to residential dwellings than the off-site disposal site discussed in Options 2 and 3.

11.8.2 FUTURE ON-SITE DISPOSAL (OPTION 1)

11.8.2.1 General

Option 1 is a variation of the carbonate and acid base cases that provides for the recovery of deposited solids after evaporation has been completed and permanently depositing them in a nearby Lewis Shale out-cropping (see RMEC drawings number 086-03-G-224 and 228). The Lewis Shale, being a very thick impermeable material, should provide insurance against potential ground water contamination. The location of this out-crop would be within the permit boundary. Selection of the exact site will require detailed geotechnical analysis to determine the optimum location, hence the locations shown on the drawings are approximate. Trucks would be used for the transfer of the waste material which would be a distance of about one mile.

After all of the liquids are evaporated in either the acid or carbonate systems, the waste solids will be collected along with up to three inches of affected reservoir bottom clay for final deposition in the Lewis Shale excavation. The only difference between the acid and carbonate waste handling procedures for this option will be the total volume of solids produced. After all solids are removed, the reservoir site will be restored by pushing the embankments into the reservoir excavation. The excavated Lewis Shale will then be deposited over the solids providing 7 ft. of cover and all disturbed areas will then be reclaimed.

11.8.2.2 Advantages/Disadvantages

The principal advantages of Option 1 (Lewis Shale excavation) are:

1) Small surface area subjected to long-term disposal.

2) Geologically stable waste disposal environment.

3) Reduced potential of ground water seepage occurrence.

The disadvantages of Option 1 result from having to handle the process residue twice and are listed as follows:

1) Greater exposure to reclamation workers.

2) Substantially higher energy consumption and capital cost in the acid case.

3) Higher energy consumption in the carbonate case.

11.8.3 CONTINUOUS OFF-SITE DISPOSAL (OPTION 2)

11.8.3.1 General

This option was only considered for the acid system because the large amounts of liquid in the carbonate system would not provide an economically effective disposal solution.

For the acid system, the filter belt solids containing all of the heavy metals and a majority of the radionuclides will be separated from the reverse osmosis (R.O.) brine wastes which contain most of the liquids. The filter belt solids will be stored in a surge tank and conveyed on a continuous basis by truck to an existing waste disposal site such as the Bear Creek Uranium facility (see RMEC drawing number 086-03-G-225). The filter belt solids will be produced in the form of a slurry at 15 gpm and will contain 50% solids by weight (see acid lixiviant flow sheet).

R.O. brine wastes will be produced at 165 gpm and will contain approximately 30,000 ppm of total dissolved solids. These wastes, containing background levels of radioactivity, will be deposited into the evaporation reservoirs and the precipitated solids along with a maximum of three inches of clay liner will be covered by the normal reservoir reclamation backfill.

11.8.3.2 Advantages/Disadvantages

The principal advantage of Option 2 is the disposal of process wastes in a more remote site.

The principal disadvantages of this option involve the increased energy and capital expenditures required to transport the waste as well as the increased safety risk incurred during transport.

Because of the high volume of water which would need to be transported with the process residue, it is estimated that over 1,000,000 gallons of diesel fuel and a capital expenditure of more than $12,000,000 (1980 dollars) greater than the base case would be required.

With more than 5,000,000 haul truck miles required to transport the waste material to a future disposal site such as Bear Creek, the probability of accident occurrence is extremely high. Such an accident could result in spillage of waste material and possible contamination of surrounding areas. The waste would likely be hauled through the cities of Casper and Glenrock, often during inclement weather, creating a significant high accident risk and general populace exposure factor.

11.8.4 FUTURE OFF-SITE WASTE DISPOSAL (OPTION 3)

11.8.4.1 General

Option 3 provides for the recovery of deposited solids (both acid and carbonate systems) from the evaporation reservoirs at the end of the project and permanently depositing them in an existing waste disposal site such as the Bear Creek installation (see RMEC drawings number 086-03-G-226 and 229). Final disposition of evaporation reservoirs for both the acid and carbonate systems will be identical. As in Option 1, the volume of material, including up to three inches of affected clay liner, will be trucked to a site such as Bear Creek for disposal. Reclamation will consist of pushing the embankments into the reservoir excavation and revegetating the disturbed area.

11.8.4.2 Advantages/Disadvantages

The principal advantage of Option 3 (which is the same for Option 2) is disposal of process wastes in a more remote location.

The principal disadvantages of Option 3 are similar to those described in Option 2; however, the magnitude of the energy, human exposure, and capital differences are lower. This option has the second highest general populace exposure and accident risk factor associated with transporting the process wastes. In addition, Option 3 requires the following energy and capital over the respective acid and carbonate base cases:

	Additional Energy	Additional Capital
Acid Lixiviant	800,000 gallons diesel	$9,360,000
Carbonate Lixiviant	94,000 gallons diesel	$ 708,000

Table II.8-I

NINE MILE LAKE

ALTERNATIVE WASTE DISPOSAL STUDY SUMMARY

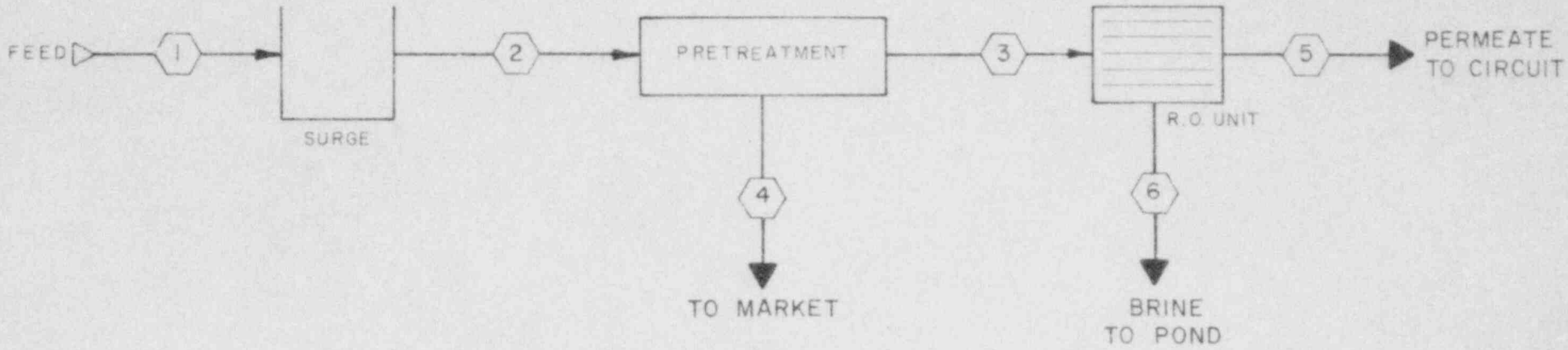
Acid

	Cost Increase Over Base Case	Areas Affected: Disposal Site	Areas Affected: Restricted Use (including 300 ft. Buffer Zone)
Base Case	--	88.2 acres	213 acres
Option 1	$1,470,000	16.6 acres	50 acres
Option 2	12,500,000	*	*
Option 3	9,360,000	*	*

Carbonate

	Cost Increase Over Base Case	Areas Affected: Disposal Site	Areas Affected: Restricted Use (including 300 ft. Buffer Zone)
Base Case	0	9.9 a es	51 acres
Option 1	(-75,000)	4 acres	24 acres
Option 2	N/A	N/A	N/A
Option 3	708,000	*	*

* No land will be permanently affected at Nine Mile Lake. However, this option will require a small waste area increase at the off-site disposal facility.



CARBONATE LIXIVIANT
PROCESS & RESTORATION-WATER TREATMENT
FLOWSHEET

	1	2	3	4	5	6		
GPM SLURRY						80		
TPH SOLIDS						0.3		
TPH SOLUTION						19.8		
GPM SOLUTION						79.1		

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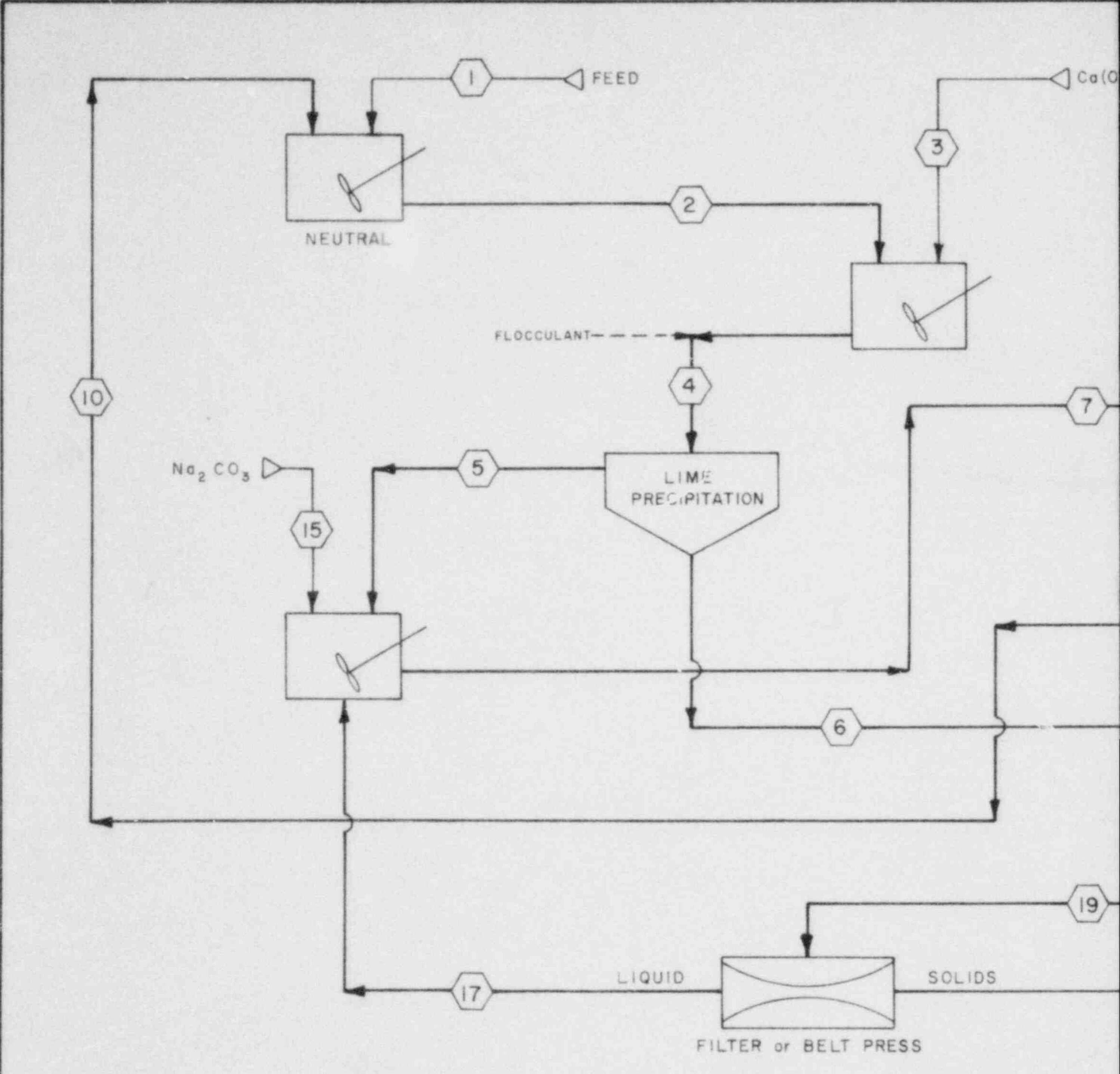
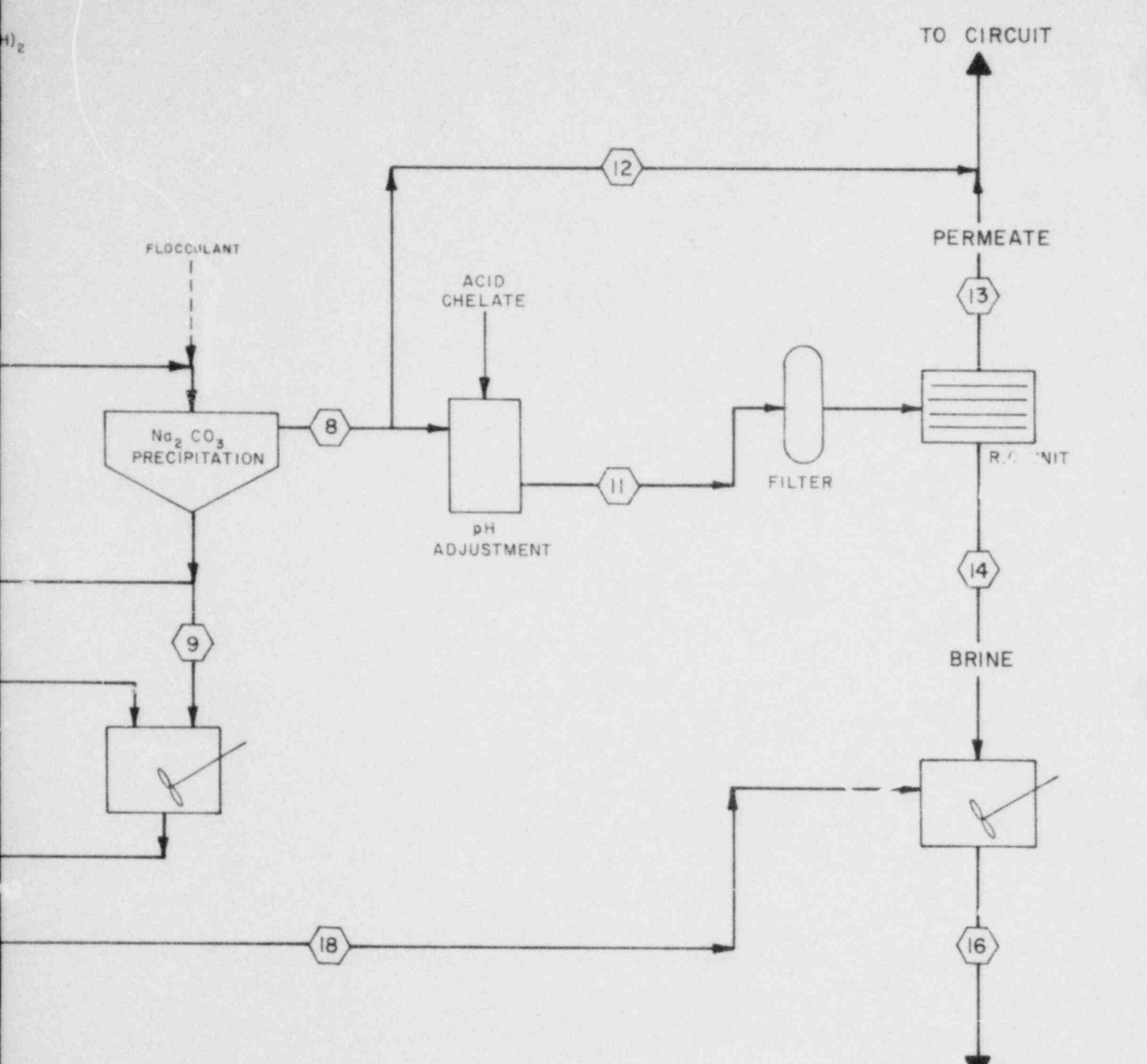


ACID L
PROCESS & RESTORAT
FLOW

	1	2	3	4	5	6	7	8	9	10
GPM SLURRY										
TPH SOLIDS										
TPH SOLUTION										
GPM SOLUTION										



LIXIVIANT
TION-WATER TREATMENT
VSHEET

	11	12	13	14	15	16	17	18	19				
						180		15					
						3.3		2.1					
						43.38		2.1					
						173.4		8.4					

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