

# Callaway Response to NRC IN 2004-05 - SFP Leakage at Salem



# NRC Information Notice 04-05 – Background

- Sept 2002 – Salem RP discovered low-level radioactivity on shoes
  - “Calcium like substance” found adhering to west wall of 78’ Mechanical Penetration Room
    - Wall adjacent to Fuel Handling Building

# NRC Information Notice 04-05 Background

- “Calcium like substance” contained boron and various radionuclides
  - Consistent w/Unit 1 SFP
- Deposits removed
  - Later observed seepage of groundwater into room

# NRC Information Notice 04-05 Background

- Determination of Cause
  - Leakage is from Unit-1 SFP
  - Boric acid deposits obstructing normal drainage (telitale) paths

# NRC Information Notice 04-05 Background

- Previous Indications
  - SFP liner drains indicated leakage early in plant operation.
  - Leakage slowed to drips/day ~ 5 yrs. ago.
  - Decreased leakage unquestioned.

# NRC Information Notice 04-05 Background

- REMP Impact
  - Accumulation of H<sub>2</sub>O
    - Between SFP liner and concrete Fuel Handling building wall
  - Accumulated water migration
    - Mechanical Penetration Room wall
    - 6" seismic gap area between SFP Handling Building and Auxiliary Bldg.
  - Leakage through construction joints and penetrations
    - H-3 found in groundwater test locations near Unit-1 FHB
      - Wells In Restricted area
      - No additional radioisotopes found

# NRC Information Notice 04-05 Background

- REMP Impact
  - Elevated H-3 concentrations in monitoring wells below Unit-1
    - 10 – 15 million pCi/L in cofferdam area

# NRC Information Notice

## 04-05 Background

- REMP Impact

- Salem installed 21 permanent and 30 temporary groundwater monitoring wells to stabilize the situation over plant life
- 5 - 20K gallon holding tanks – for testing and removal of water
- Tanks to be processed by Radwaste treatment
- Four groundwater test wells in areas to prevent “groundwater discharge” – Range 1200 - 69,000 pCi/L



# NRC Information Notice 04-05

## Callaway Response

- Callaway Response
  - Immediate Actions
    - Sampling conducted on monitoring wells adjacent to SFP and Containment Bldgs.
      - 4 wells from Unit-1 Cofferdam
      - Positive H-3 results received from EIML
      - No gamma emitting nuclides found
      - H-3 conc. 164 – 427 pCi/L
        - ❖ LLD ~ 150 pCi/L

# NRC Information Notice 04-05

## Callaway Response

- Affected pathways
  - Wells sampled do not affect drinking water pathway
  - Water not used for irrigation
  - drinking water is from Deep Well #3
    - ❖ verified in sampling regimen
  - Reviewed Drinking water samples since 1989
    - ❖ 2 positive results – slightly above achieved LLDs  
~ 150 pCi/L

# NRC Information Notice 04-05

## Callaway Response

- Possible sources
  - Collaborative effort to determine sample regimen
  - Samples from numerous Callaway Plant aquifers/systems
  - Potential sources of H-3
    - ❖ RCS - 4.0E8 pCi/L
    - ❖ SFP - 6.0E7 pCi/L
    - ❖ Secondary - 5.0E5 pCi/L

Sample ( pCi/L)	5/14/04	6/2/04	6/16/04	7/2/04	7/29/04	7/30/04	8/2/04
Ground water sump:							399
936							429
937C							
937D							249
UHS Pond	443		349			479	
Clearwell	278		321				
Pond 12	<161			173		297	
Pond 13	<156						
Potable Water	<156		<157				
Unit 2 Pond	<161/224		229			215	
Oily Waste Effluent	329						
Oily Waste Ungrd Tk.	272						
Sludge Pit	308						
Supernatant Sump	272		170				
Settling Ponds 3/4	320		351				
Equalization Basin	<161		<157				
Raw water/WTP (river)	<161		<157				
Rainwater (5/13)	<161						
Cooling Tower Basin			642/562	<158	<154		
Settling Pond 1		<158					
Settling Pond 2		<158					
Parking lot drainage 6/17	<161		273/203				
(Unit 2 Pond effluent)							
S/G B/D NRHX				<158			
Service Water				<158			
CCW B				764			
SFP Leak Detection					4.7E+07		

# Cooling Tower Blowdown vs Monitoring Well sample results

Sample - pCi/L	4/1	5/18	5/21	6/16	7/2	7/9	7/29	8/2	9/1	9/24	10/1	10/6	10/11
GWS	366	363				2512		399					<158
936	368	406				176		429					411
937C	164	<156				<162							199
937D	427	304				<162		249					<158
Cooling Tower Basin			<165	642 /562	<158		<154		304	1107 /1204	<172	<172	

# NRC Information Notice 04-05

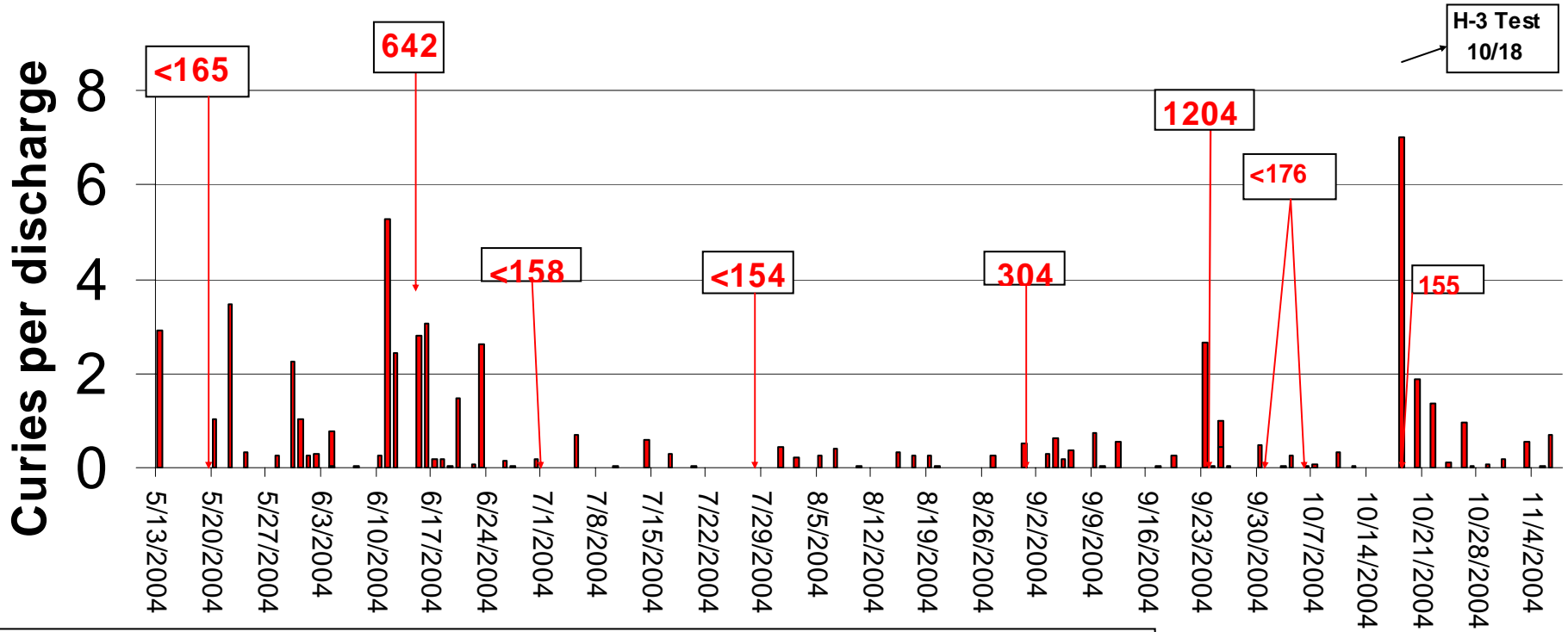
## Callaway Response

- Engineering Investigation of Possible sources
  - SFP Leakage – leakage system functioning properly
    - ❖ Leakrate
    - ❖ evaporation
  - Component Cooling Water
  - S/G Blowdown
  - Ultimate Heat Sink
  - Unit 2 Pond
  - Etc.

# NRC Information Notice 04-05 Callaway Response

- Variable Cooling tower H-3 levels!?!?!?
  - Primary source – Missouri River
    - Investigation of previous REMP surface water (Missouri River) sample results (control location)
    - Positive results prior to 1998 @ control location
      - ❖ Surface water sample line (control) moved to upstream side of Intake

# Effluent H-3 Releases per batch



**NOTE: Red numbers indicate cooling tower blowdown sample results.**

**Date**



# NRC Information Notice 04-05

## Callaway Response

- Iowa Institute of Hydraulic Research Study conducted @ Intake structure (1999)
  - Recirculation of liquid effluents to the plant @ low river stages
    - Slugs of H-3 in service water – returned ~ 5 miles to the cooling tower.
  - Propose underwater weir / discharge line move

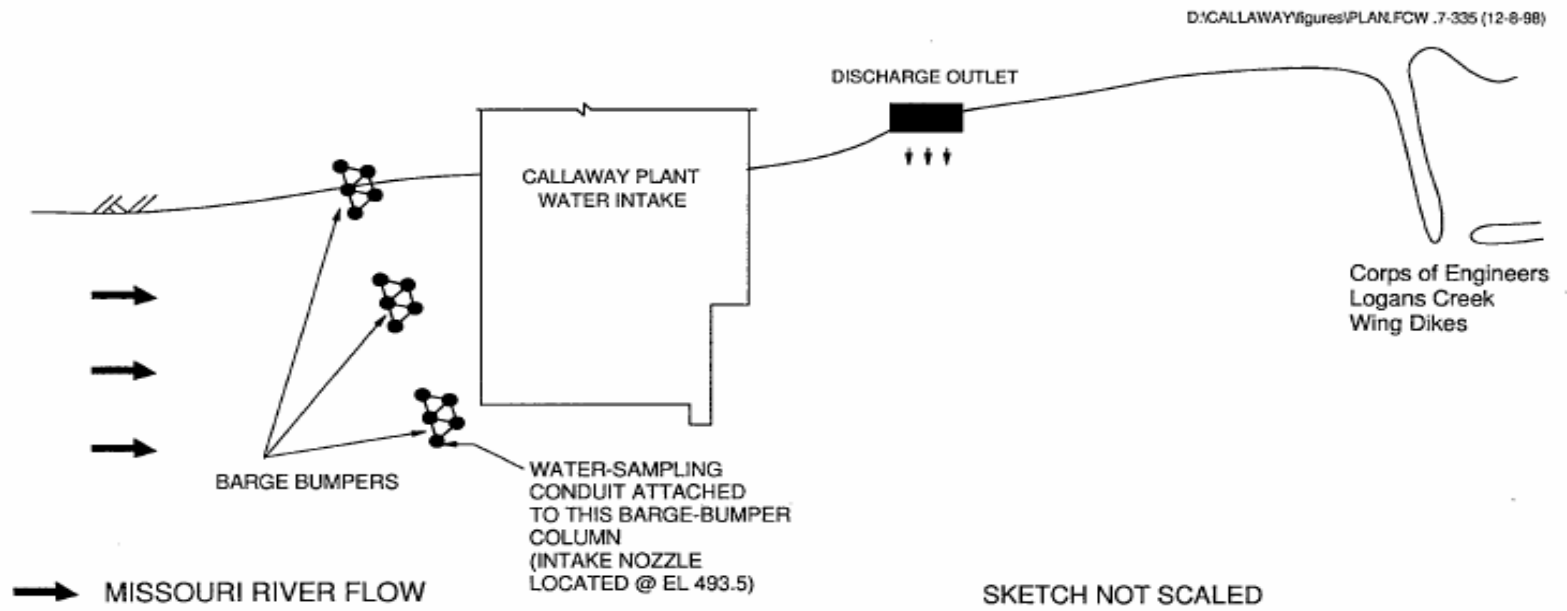


Figure 1 General plan of the Callaway Plant intake and discharge structures

# EXTREMELY LOW RIVER STAGE WITH DEBRIS ACCUMULATION ON BARGE BUMPERS

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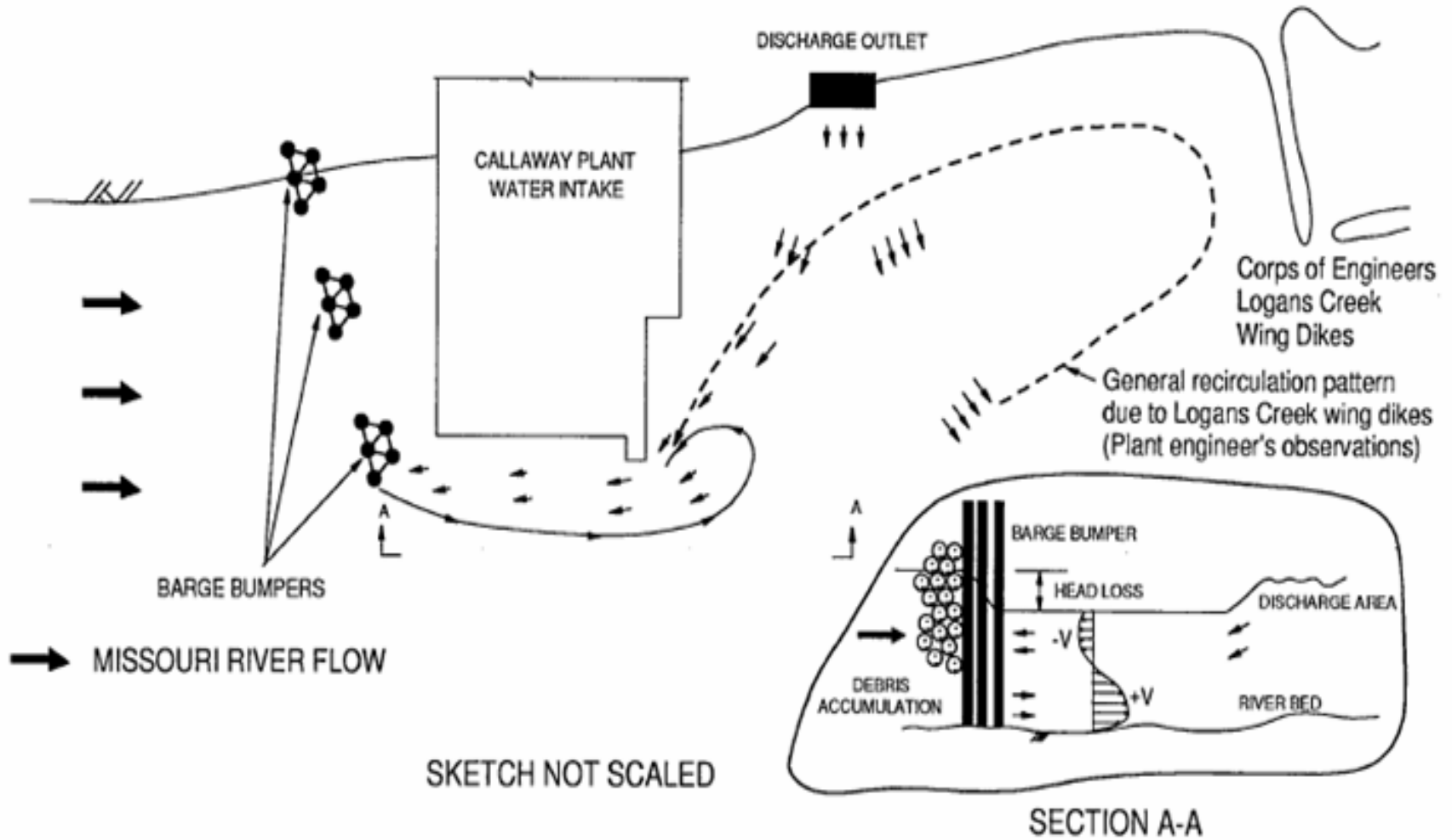


Figure 10 General flow patterns surrounding the proposed submerged weir during very low river stages

# EXTREMELY LOW RIVER STAGE WITH DEBRIS ACCUMULATION ON BARGE BUMPERS WITH SUBMERGED WEIR

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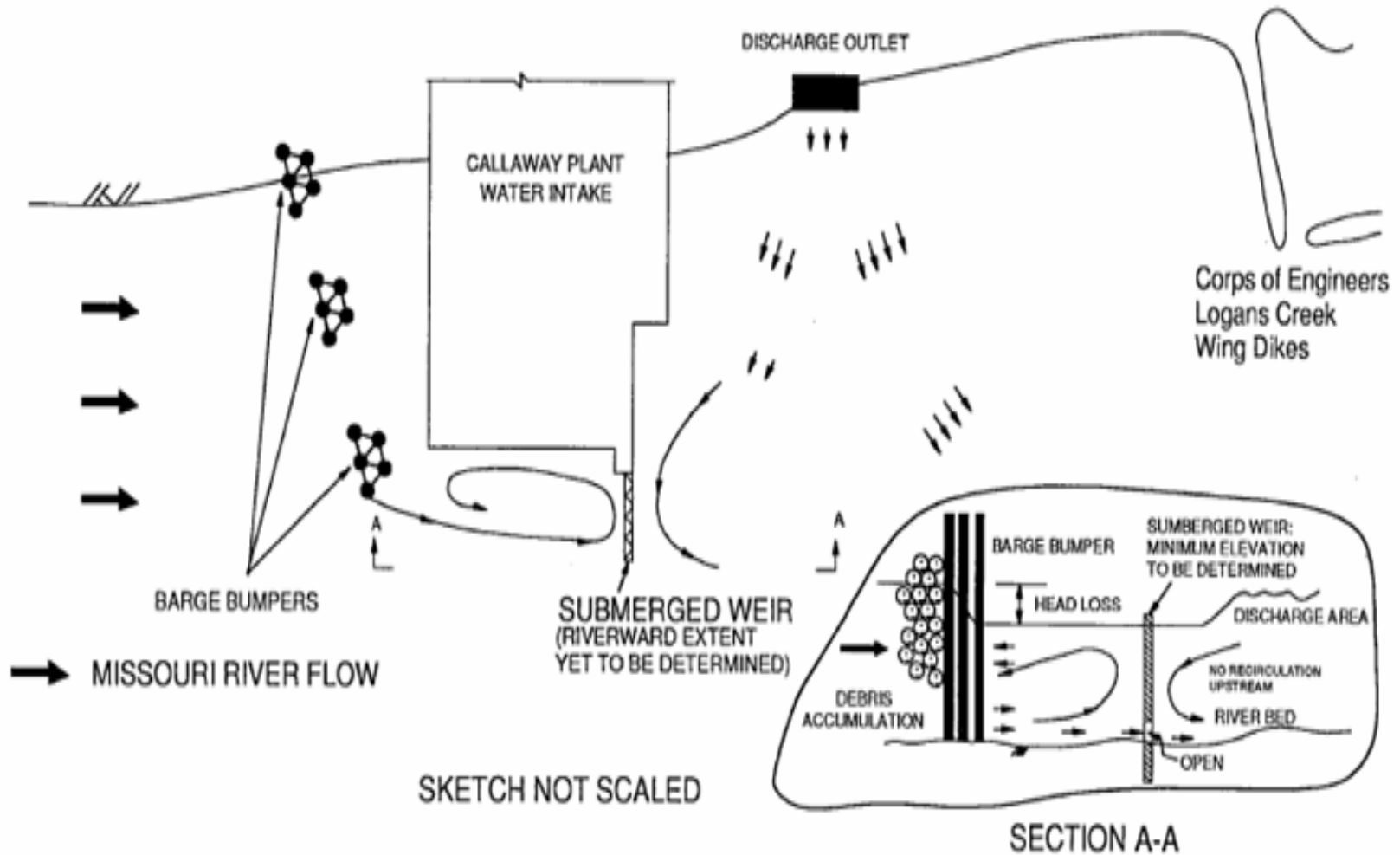


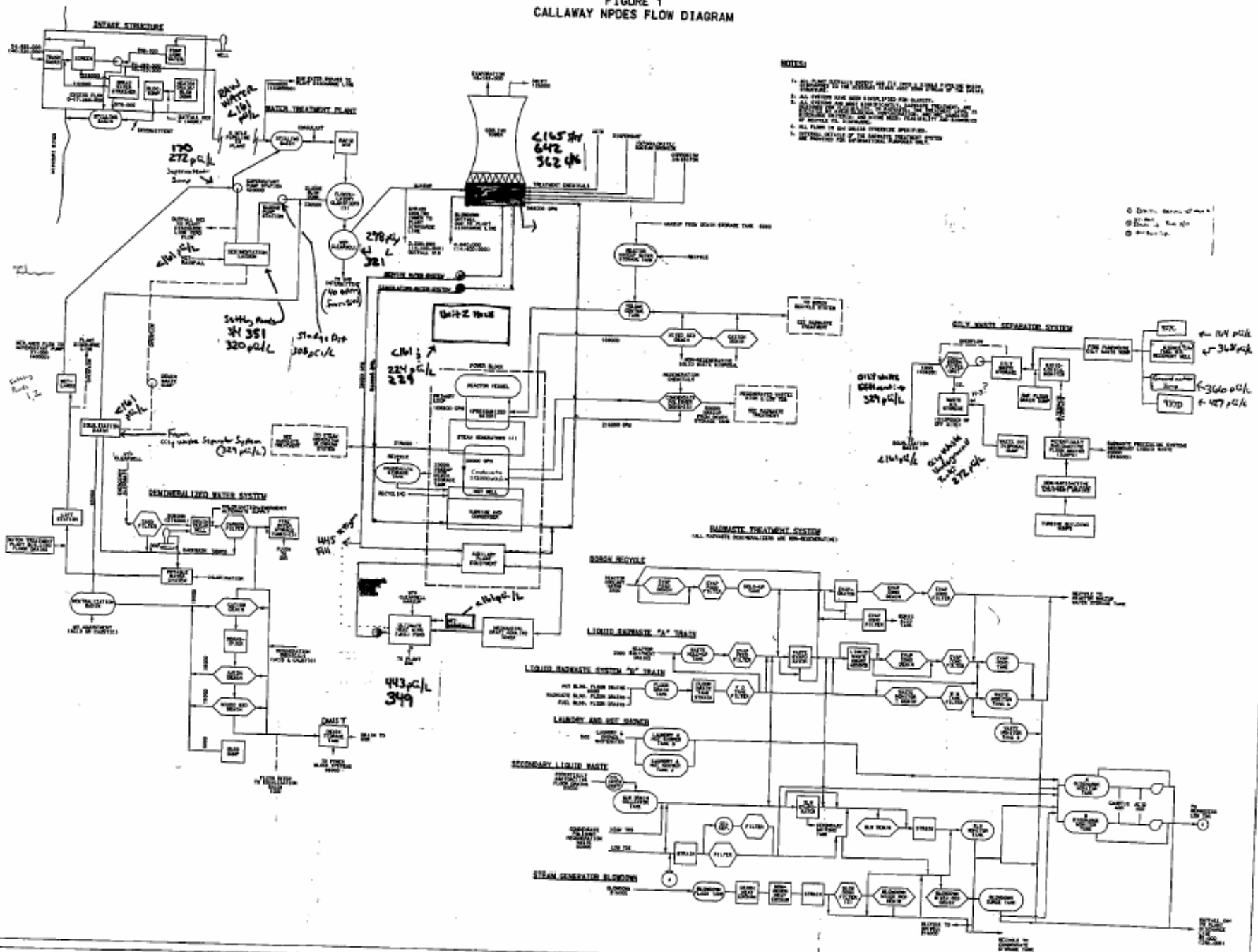
Figure 11 General flow patterns surrounding the proposed submerged weir during very low river stages

# NRC Information Notice 04-05

## Callaway Response

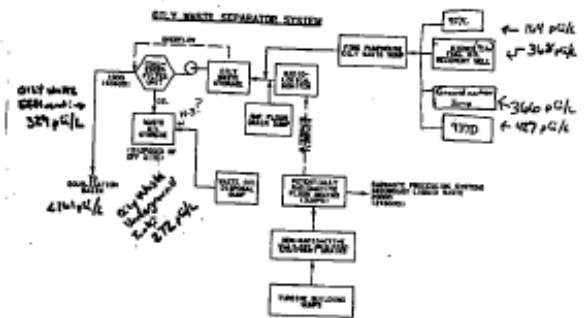
- Explanation for H-3 in plant aquifers
  - Documented Service water leaks
    - Leakage collects in cofferdam below Unit-1
      - ⇒ Leakage to Unit-2 hole
      - ⇒ Oily waste system removes water
      - ⇒ Construction runoff ponds receive water
      - ⇒ Supernatant sump/clearwell return water to cooling tower basin
      - ⇒ SFP leak detection adequate as per system Engineer evaluation
      - ⇒ UHS is filled at 40 gpm by service water and turns over ~ 11 months

FIGURE 1  
CALLAWAY NPOES FLOW DIAGRAM



- NOTES
1. FLOW RATES ARE TO BE CHECKED AGAINST THE DATA SHEETS.
  2. ALL SYSTEMS ARE TO BE CHECKED AGAINST THE DATA SHEETS.
  3. ALL SYSTEMS ARE TO BE CHECKED AGAINST THE DATA SHEETS.
  4. ALL SYSTEMS ARE TO BE CHECKED AGAINST THE DATA SHEETS.
  5. ALL SYSTEMS ARE TO BE CHECKED AGAINST THE DATA SHEETS.
  6. ALL SYSTEMS ARE TO BE CHECKED AGAINST THE DATA SHEETS.

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# NRC Information Notice 04-05

## Callaway Response

- Additional considerations
  - Dose from an elevated release – cooling tower – added to MEMPUB dose
    - Callaway ODCM assumes ground level releases
  - 50.75G Decommissioning Records
  - Resolution:
    - Engineering evaluating construction of a weir or discharge line move
      - Near field dilution factor!?!

# NRC Information Notice 04-05 Callaway Response

- Thanks
  - Environmental Inc. – Midwest Labs (EIML)
    - Expediting processing to meet needs
    - Adjusting count times as necessary – lower LLDs
  - Salem personnel for information
  - NRC Region IV
  - RETS/REMP Users Group