1 of 1

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UC-600

**ICPP WATER INVENTORY STUDY
PROGRESS REPORT**

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MASTER

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Acknowledgement

A special task team was developed to conduct an in-depth water inventory study for the ICPP. The Task Team operating under the direction of the U.S. Department of Energy, Idaho Field Office and the Westinghouse Idaho Nuclear Company. Participants on this team included personnel from those organizations cited on the title page and the USGS. The large scope of this project required that team members gather information from many different organizations at the ICPP. This required effort on the part of many WINCO plant personnel.

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Appendix A

WATER INVENTORY STUDY

1. INTRODUCTION

Recent data from the Idaho Chemical Processing Plant (ICPP) indicate that water is entering the sumps located in the bottom of Tank Farm Vaults in quantities that exceed expected levels. In addition, perched water body(s) exist beneath the northern portion of the ICPP. Questions have been raised concerning the origin of water entering the Tank Farm sumps and the recharge sources for the perched water bodies. Therefore, in an effort to determine the source of water, a project has been initiated to identify the source of water for Tank Farm sumps and the perched water bodies. In addition, an accurate water balance for the ICPP will be developed.

This project is being conducted by the U. S. Department of Energy (DOE) and the Westinghouse Idaho Nuclear Company (WINCO) with technical support from the U. S. Geological Survey (USGS), the State of Idaho INEL Oversight Program, and EG&G Idaho.

1.1 Purpose of Report

The purpose of this report is to present the specific results and conclusions for the ICPP water balance portion of the study. In addition, the status of the other activities being conducted as part of study, along with the associated action plans, is provided.

1.2 Background

ICPP is one of the principal facilities at the United States Department of Energy's Idaho National Engineering Laboratory (INEL) located near Idaho Falls, Idaho. ICPP's original mission was to receive, store, and process spent nuclear fuel from test and research reactors in the United States and foreign countries, and from the U. S. Navy's ship propulsion reactors. In 1992, ICPP's mission was changed to receive, store, and prepare spent fuel for final disposition. ICPP began operation in 1953. The facility consists of four process buildings and numerous support buildings. It covers an area of approximately 200 acres and where approximately 1800 people are employed. Figure 1 shows a map of the ICPP and major ICPP facilities. The facility names along with the respective building numbers are shown in Appendix A, Table A-1.

During the approximate 40 year history of the ICPP, water has entered the surficial alluvium underlying the plant via natural sources (i.e. rain and snowmelt) and artificial sources (i.e. percolation ponds and water distribution piping leaks). Once the water contacts the surficial alluvium, it either evaporates to the atmosphere or percolates downward to the Snake River Plain Aquifer (SRPA). It has been hypothesized that some combination of natural and artificial water sources is contributing to the water accumulation in the Tank Farm sumps and the recharge of the perched water bodies existing beneath the ground level at the ICPP.

Perched water occurs when a sufficient amount of water moves downward through a higher conductivity zone and encounters a lower conductivity zone. For the geological conditions at the ICPP, this lower conductivity zone can be a fine-grained sedimentary interbed, a massive basalt flow, or the upper surface of a basalt flow where the fractures and pores have been filled with fine-grained sediments and secondary minerals.

Therefore, "perching" of water often takes place within and above the interbeds where water is being recharged through the surface alluvium and basalt. Evidence indicates that the most significant perching layer at ICPP exists approximately 110 ft below ground surface. A generalized map displaying the postulated locations of perched water bodies, which occur on top of the 110 ft perching layer, is shown in Figure 2. The recharge source of the southern body has been determined to be the ICPP Percolation Ponds. The existence of a perched water body is expected in the northeastern portion of the ICPP resulting from the operation of the ICPP Sewage Treatment Plant. The recharge source of the northwestern body is presently being investigated.

Routine examination of ICPP data concerning water usage revealed discrepancies between recorded volumes of water pumped into the plant and measurements of water consumed and discharged from the plant. Historically, INWMIS (INEL Nonradiological Waste Management Information System) reports show a water imbalance of about 670,000 gallons of water per day. This imbalance had not been carefully studied until 1992. Plant records also revealed that more water than would be expected was accumulating in concrete vaults that contain high-level liquid waste tanks. An average of 2,400 gal/month were pumped from the concrete vaults during 1990, 1991, and 1992. In response to these findings, the water inventory project was initiated.

1.3 Project Description

The water inventory study was initiated to conduct the following activities. Each of these items is listed in the order of their overall priority in the project.

1. Identify the source of water for Tank Farm sumps and take appropriate action to reduce the amount of water entering the sumps.
2. Identify source of water for the perched water bodies existing beneath the northern portion of the ICPP.
3. Identify causes of measured water imbalance at the ICPP and develop capability to do real time water balance.

1.3.1 Task Description

Nine tasks have been defined by the task team to meet these project goals. These tasks are:

- 1a. Tank Farm Vaults, - Hypotheses concerning the source of water will be developed and evaluated using existing data.
- 1b. Additional data will be obtained based on the results of task 1a. This data will be compared to hypothesis. This data will include assessing lines in the Tank Farm region and gathering additional samples. Based on these results, the hypothesis will be modified, if necessary, and the resulting explanation for the occurrence water in the sumps will be documented in a report.
- 1c. Any necessary repairs and/or operational changes will be initiated.
- 2a. Identify Potential Leaks - Based on data collected from perched water and analyzed in the report *Hydrogeologic and Geochemical Assessment of Contaminated*

Figure 2. Location of the perched water on the 110 foot interbed.

Groundwater at the Idaho Chemical Processing Plant (in preparation), likely recharge sources will be identified for Tank Farm vaults and perched groundwater. Plant piping systems will be evaluated to develop a list of pipes to test. A workplan will be prepared to document the leak tests to be conducted. In addition, recommendations to upgrade the existing RCRA/DOE Order 5400.1 *Groundwater Monitoring Plan* in terms of parameters measured and frequency of measurements will be made.

- 2b. Pressure Leak Tests – Pressure leak tests will be conducted on selected waste and water lines suspected of leaking. A status report will be prepared at the end of this task.
- 2c. Tracer Study – The usefulness of a tracer test will be evaluated. If it is determined that the test is necessary, tracers will be injected into selected waste and water lines suspected of leaking and perched water wells will be monitored for the tracers. A report will then be prepared at the end of this task documenting all of the leak testing results.
- 3a. Evaluate the ICPP water system – This includes conducting a water balance on the raw water and potable water systems and identifying necessary metering upgrades. Volumes of water in unmetered systems need to be estimated. Results will be documented in a status report.
- 3b. Upgrade the ICPP water system – New meters will be installed and existing meters calibrated to bring the water distribution system into compliance with INWMIS reporting goals.
- 4a. Developed final report summarizing all activities conducted under the ICPP Water Inventory Study.

1.3.2 Schedule

Figure 3 shows a schedule for each of the eight tasks and milestones for project deliverables.

1.4 Report Organization

Section 2 of this report describes the ICPP water distribution and collection system. Section 3 provides the water balance conducted on the water system, estimation of flow in the unmetered portions of the water system, discussion of a system evaluation and the status of system upgrades, and the results of the overall water balance. Section 4 provides the status of the other tasks that are part of the water inventory study. Section 5 provide the results and conclusions based on the current progress.

2. WATER SYSTEM DESCRIPTION

ICPP uses approximately two million gallons of water per day. Water is supplied by three wells; two raw water wells, WEL-UTI-501 and -502 and one potable water well, WEL-UTI-504. The water is used for process cooling, equipment cooling, steam production, process solutions, decontamination, fuel storage basin makeup, chemical laboratory use, regeneration of ion exchange units, and for human use such as drinking, personnel showers, food preparation, restroom facilities, and fire protection. ICPP water systems include; raw water, fire water, treated water (softened), demineralized water, boiler feed water, and potable water. The systems are once through systems for the most part; water is used once

ICPP Water Inventory Project

Task Name	Start	Finish	Duration	1993																	Jan	Feb	Mar	Apr	May								
				Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec																
1. Tank farm infiltration	12/15/92	10/15/93	211d		▼											▼																	
1a. Compile existing information	12/15/92	6/10/93	122d		▼											▼																	
Sample sump 189C		12/15/92			◇	12/15																											
1b. Collect additional data	6/9/93	8/2/93	38d								▼			▼																			
Workplan completed		7/22/93										◇	7/22																				
1c. Analyze data and report	8/3/93	10/15/93	53d										▼			▼																	
Issue tank farm infiltration report		10/15/93														◇	10/15																
2. Deep perched water zone	2/1/93	3/1/94	272d			▼																	▼										
2a. Identify potential leaks & alt. sources	5/18/93	6/1/93	10d								▼	▼																					
Draft Geochem & Hydro Report to DOE		5/18/93									◇	5/18																					
2b. Pressure leak tests	5/10/93	12/13/93	151d								▼											▼											
Submit final test plan		7/28/93											◇	7/28																			
Issue pressure test report		12/13/93																◇	12/13														
Initiate necessary repairs	12/13/93																		◇	12/13													
2c. Tracer leak tests	2/1/93	3/1/94	272d			▼																	▼										
Decide Go/No Go on tracer test	6/30/93	6/30/93	0d									◇	6/30																				
Issue tracer test report	3/1/94	3/1/94	0d																		◇	3/1											
Initiate necessary repairs	3/1/94																					◇	3/1										
3. Water Balance	11/2/92	11/1/93	250d	▼																	▼												
3a. Evaluate distribution system	11/2/92	5/24/93	139d	▼											▼																		
Issue water balance report		5/24/93									◇	5/24																					

Date: 5/24/93

Summary task ▼ Milestone ◆

ICPP Water Inventory Project

Task Name	Start	Finish	Duration	1993																						
				Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May				
3b. Upgrade metering of distribution system	2/1/93	11/1/93	192d																							
Firewater meter operational	6/1/93																									
Sewage treatment plant meter operational	11/1/93																									
Potable water meter operational	11/1/93																									
INWMIS reporting meets accountability goal		11/1/93																								
4. Project summary report	3/2/94	4/19/94	35d																							
Issue project summary report		4/19/94																								

Date: 5/24/93

Summary task

Milestone

and then discharged to either the service waste system or the sewage waste system. A small amount of steam condensate (approximately 20%) is returned for boiler feed water and approximately 300 gpm of raw water, used for heat pumps in four office buildings, is recirculated back to the raw water storage tanks.

2.1 Raw Water System

Raw water is pumped from production wells, WEL-UTI-501 and -502 to fire water storage tanks, VES-UTI-111 and -112 (Appendix A, Figure A-1). The tanks supply water to fire water pumps P-UTI-672 and -673, which distribute fire water through a piping system to fire hydrants and other smaller uses. Raw water also overflows from the fire water tanks, through internal stand pipes, to two raw water tanks VES-UTI-600 and -608. The overflow stand pipes ensure that an adequate supply of fire water remains in storage at all times and allows flow through the tanks to prevent freezing. The raw water tanks supply water to three raw water distribution pumps P-UTI-502, -503, and -504, which distribute raw water through a piping system to the various ICPP facilities (Appendix A, Figure A-2). Raw water is also supplied to water softeners and demineralizers located in CPP-606, for the production of treated (softened) water (Appendix A, Figure A-3), demineralized water (Appendix A, Figure A-4), and boiler feed water. Almost all raw water, treated water, demineralized water, and steam condensate is eventually discharged to the service waste system. The service waste system discharges to the two percolation ponds located at the south end of the ICPP (Appendix A, Figure A-5). Service waste streams that could be contaminated are sent through service waste monitoring/diversion systems to check for radiological contamination. If radiological contamination is detected, the water is directed to a low level waste tank and stored for future processing. All water is monitored prior to discharge to the percolation ponds.

2.2 Potable Water System

Potable water is supplied by the potable water well WEL-UTI-504. The well pumps water to a potable water storage tank VES-UTI-696. Three distribution pumps P-UTI-662, -663 and -664 distribute the water to the various ICPP facilities (Appendix A, Figure A-6). The potable water system also includes a chlorination system to meet potable water system requirements. Almost all of the potable water is discharged to the sewage waste system (Appendix A, Figure A-7). Sanitary waste from the various building is collected in four lift stations. Each lift station has a sump and pump. The pumps transfer the sewage waste to the treatment lagoons. At the lagoons, sewage flows through two aeration lagoons where the bubbling action created by aeration blowers causes aerobic digestion of the sewage. The sewage then flows through two quiescent lagoons where anaerobic digestion takes place. From the quiescent lagoons, waste water flows to infiltration trenches where the water percolates into the ground.

3. WATER BALANCE

Historical data indicate that an imbalance exists between the water entering and exiting the ICPP water systems. Recent studies conducted to inventory water use at the ICPP include those of Makey (GLM-04-92, "Evaluation of the Plant Water Flow Monitoring Instrumentation," G. L. Makey to F. S. Ward, September 18, 1992) and Henderson (RRH-06-92, "Water Balance Study," R. R. Henderson to F. S. Ward, September 24, 1992). The Makey study identified that the raw water meter was not installed according to manufacturer recommendations due to limited space at the installation location. The uncertainty associated with specific flow rates are as follows: ± 24.0 gpm for raw water (measured at the tank), ± 52.0 gpm for raw water (as metered), and ± 36.9 gpm for service waste. For the potable water system, an uncertainty of ± 4.68 gpm was determined for the potable water inlet. No uncertainty

could be identified for the sewage waste system because the metering equipment on the sewage lines was inoperative. Makey recommended that the raw water meter be installed correctly and, if more accuracy is desired, to calibrate the meters for specific flow rates (the wider the range a meter is calibrated for, the less accurate it can be over the entire range).

The Henderson study investigated the possibility that the water softener brine pits were leaking. The conclusion of the Henderson study was that the brine pits were not leaking. The brine pits themselves were eliminated as sources of chlorides found in the perched water. It is possible, however, that leaks exist in the piping system leaving the brine pit.

INEL INWMIS reports indicate a water imbalance of approximately 670,000 gallons per day (gpd). This amount is arrived at by subtracting the water disposal to the percolation ponds and the sewage treatment plant from the total water produced. The INWMIS reports are monthly reports published by EG&G Idaho showing the water balance for each of the INEL sites. Table 1 shows the June, 1992 (30 days) INWMIS data for ICPP. An examination of these data by the water inventory study team, determined that the pumping rate does not take into account approximately 432,000 gpd of raw water recirculated to the raw water tanks. In addition, the INWMIS data does not take into account any of the unmetered water streams that exit the ICPP.

3.1 Metered Flows

To perform a more accurate water balance, the water inventory study team identified all water inputs and output streams and identified the location of all flow meters on the major input and output streams. Many of these flow meters were calibrated as part of the routine calibration program. The uncertainty associated with the raw water, potable water, and service waste water flow meters were identified.

Figure 4 shows a block diagram of all ICPP water input and significant exit streams. Three wells (two raw water and one potable water) supply water to ICPP. Water leaves in the service waste system, sewage waste, septic tanks, evaporation from pools and basins, vented steam, steam trap blowdown, lawn sprinklers, ash removal (from the coal-fired power plant), equipment washdown operations, and in the main stack.

3.2 Estimation of Unmetered Flows

A discussion of each significant stream that is not metered and the method of calculating its flow is presented below.

3.2.1 Basin Evaporation

Buildings CPP-603 and CPP-666 have water basins for storing nuclear materials. The water in these basins needs to be periodically replenished to account for evaporation and/or potential seepage in the basins. It has been estimated that CPP-603 requires approximately 500 gpd of makeup water. CPP-666 requires approximately 400 gpd of make-up water. The majority of the makeup water requirements by these fuel storage basins is due to evaporation. However, a detailed breakdown of water lost through different pathways has not been completed. Together, these basins have a total loss rate of 900 gpd (0.6 gpm).

Table 1 INWMIS Data from June, 1992

FORM ID-136 IDM 0511		UNITED STATES DEPARTMENT OF ENERGY IDAHO OPERATIONS OFFICE INDUSTRIAL WASTE FORM					
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DATE												AREA OF ORIGIN		PAGE		N-NEW A-AMENDED D-DELETE		Prepared By: <u>John K. Neff</u>		Date: <u>7-13-92</u>		Phone: <u>3900</u>	
M	M	D	D	Y	Y	8	9	10	11	12													
2	3	4	5	6	7	8	9	10	11	12													
0	6	3	0	9	2	0	6	3	0	9	2												

SECTION 0
ON ALL CARDS

SECTION 1: FUEL OIL AND WELL WATER SUMMARY

CARD TYPE	FUEL OIL USED					WELL WATER		NOT USED
	GROSS VOLUME GALLONS	NOx #/Gal	%S	PARTICULATE #/Gal	WATER PUMPED GALLONS	WELL OR BUILDING NUMBER		
0	+2.6 E+04	0.0	0.94	0.0	+6.5 E+07	616		
0	+ . E +	0.0	0.0	0.0	+ . E +			
0	+ . E +	0.0	0.0	0.0	+ . E +			
0	+ . E +	0.0	0.0	0.0	+ . E +			
0	+ . E +	0.0	0.0	0.0	+ . E +			

SECTION 2: WATER DISPOSAL

CARD TYPE	WATER DISPOSED			SEWAGE								
	AIR	SURFACE	SUBSURFACE	GROSS VOLUME GALLONS	DO PPM		PH	BOD PPM		SETTLABLE COLIDS - ml/l		BUILDING NUMBER
	GROSS VOLUME GALLONS	GROSS VOLUME GALLONS	GROSS VOLUME GALLONS		RAW	FINAL		RAW	FINAL	RAW	FINAL	
1	+ . E +	+4.36 E+07	+ . E +	+1.26 E+06	0.3	3.7	9	19.4	0	12.0		615
0	+ . E +			+ . E +								

SECTION 3: INDUSTRIAL WASTE SUMMARY

CARD TYPE	F-FL ³ P-Pounds L-Liters VOLUME OR WEIGHT	Y-Yds ³ G-Grams K-Kg UNITS	D-DISPOSED S-STORED L-LIQUID S-SOLID	DESCRIPTION OF WASTE		DISPOSAL OR STORAGE LOCATION	
				AREA	WITHIN AREA		
1							
2							
3							
4							
5							
6							
7							
8							
9							

SECTION 4: LIQUID AND AIRBORNE RELEASE POINTS

CARD TYPE	RELEASE POINT SUMMARY				SUBSTANCE SUMMARY			
	RELEASE POINT DESCRIPTION	A-ATMOSPHERE B-SURFACE C-SUBSURFACE	K-Gal. L-Liters P-Pounds F-F ³ M-Cubic Meters GROSS VOLUME	PH	SUBSTANCE	BOD PPM		UNITS
						RAW	FINAL	
4	5. Percolation Pond		+4.36 E+07	6	Chloride	+8.25 E+02		
4			+ . E +		Fluoride	+2.67 E+01		
4			+ . E +		Nitrate	+7.67 E+00		
4			+ . E +		Sulfate	+2.63 E+01		
4			+ . E +		Chromium	+2.62 E+02		
4			+ . E +		Sodium	+1.4 E+02		
4			+ . E +			+ . E		
4	5. Stock Ponds		+1.42 E+07	4	Nitrogen Dioxide	+0.00 E+00		
4			+ . E +		Nitric Oxide	+0.00 E+00		
4			+ . E +			+ . E		
4			+ . E +			+ . E		
4			+ . E +			+ . E		
4			+ . E +			+ . E		
4			+ . E +			+ . E		
4			+ . E +			+ . E		
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4			+ . E +			+ . E		
4			+ . E +			+ . E		
4			+ . E +			+ . E		
4			+ . E +			+ . E		

Figure 4

3.2.2 Steam Output

The ICPP operates several systems on steam (e.g. HVAC and transfer jets). Steam use increases with heating load. Steam use was 18, 19, 31, and 39 million pounds for September through December 1992, respectively. The steam is generated at both CPP 606 and the Coal Fired Steam Plant. The steam entering CPP 669, 637, 668, 645, 652, 640, 601 (Process Make-up Area), 620, and FPR is returned to CPP 606 for reuse. All other buildings discharge their used steam to service waste unless it is vented and or disposed directly to the ground. Steam condensate from the steam lines in the utility tunnel is also discharged to the ground. These lines are inspected for leaks by utilities personnel once per week. Steam is vented to the atmosphere via (1) condensate return tanks (each heating unit has one) and (2) pressure relief valves (each heating unit has one). The relief valve at the Coal Fired Steam Plant that regulates the pressure of the entire steam system releases the largest quantity of water to the atmosphere. There are a few cases where small amounts of steam condensate are discharged directly to the ground.

3.2.2.1 Vented Steam. Most of the steam generated at the ICPP is condensed and recycled or routed to the service waste. It is assumed (based on interviews with plant personnel) that approximately 10% of the 39.4 million lb of steam produced in December 1992 (~4.7 million gallons) is not recycled or routed to service waste. This steam is released to the atmosphere or discharged to the ground as condensate and accounts for approximately 15,200 gpd (10.6 gpm). It is assumed that 7600 gpd of this steam is vented to the atmosphere and 7,600 gpd is discharged to the ground as condensate.

3.2.2.2 Steam Trap Blowdown In Utility Tunnel. Condensate within steam lines is collected in steam traps. This water is removed from the lines and is discharged to the ground. Currently, the amount of water involved in this balance is unknown but it is estimated that the amount is negligible when compared to other water streams being considered.

3.2.3 Lawn Sprinklers

Lawn sprinklers are used only during the summer months. This study was conducted during the winter and this quantity was considered to be zero for the period of this study. For future water inventory calculations, the sprinkler flow rates will be estimated based on known usage.

3.2.4 Stack Losses

It is estimated that less than 1000 gpd is exhausted by the main stack. This amounts to 0.69 gpm. When the LET&D is brought on line, the amount of water exiting the stack will increase. The water entering the LET&D and thus being evaporated will be metered and factored into future inventories.

3.2.5 Wash Down Use

The amount of water discharged to the ground during wash-down operations is estimated to be minimal compared to other water streams and is considered as zero for this study.

3.2.6 Coal Fired Steam Generator Facility Ash Removal

Fly ash from the coal fired steam generator facility (CFSGF) is mixed with water for disposal to an ash pit. This is a batch type process that uses 500 gallons per tanker truck. Between 5 and 20 tank trucks are used every two days. Therefore, based on the maximum water usage, it is estimated that 5000 gallons of raw water per day (3.5 gpm) are used for ash removal.

3.2.7 Sewage Waste

There are two main headers that feed into the Sewage Treatment Plant. One of the headers has a flow meter installed on it at the lift station. However, it is not believed to be accurate. The second header does not have a flow meter. A new meter to measure the entire flow entering the Sewage Treatment Plant is planned to be installed as part of a upgrade project currently in progress. To gain a more accurate estimate of the sewage being disposed in the Sewage Treatment Plant, temporary weir-type meters were installed in April 1991 on the discharge to the sewage lagoons ("ICPP Sewage Treatment Plant Evaluation," report to Westinghouse Idaho Nuclear Company, Inc. by Alpha Engineers, Inc. and DMJM, May 1991). Measured flow rate for weekdays was 47,290 gpd and 27,410 gpd for weekends. Because of the type of meter used, an error of $\pm 10\%$ was estimated for this measurement.

3.2.8 Septic Tanks

An estimate on the septic tank use was generated. There are 10 septic tanks, each with 1,000 gallon capacity. Assuming than each tank supports 15 people and each person generates approximately 20 gallons of sewage per day, it is estimated that the total flow of sewage through the 10 tanks is 3,000 gpd or (2.1 gpm).

3.2.9 Personnel Showers

The water used for personnel showers originates from the potable water system. The large majority of the showers discharge to the ICPP sewage system. The remaining showers (used for decontamination) discharge to the service waste system. The small volume of water resulting from this crossover from the potable water system to the raw water system (service waste) was considered insignificant for the purposes of conducting a plant wide water inventory.

3.3 System Evaluation

The ICPP water systems were evaluated to determine the adequacy of their metering systems for the purpose of performing accurate monthly water balances. It was concluded that a highly accurate monthly water balances cannot currently be performed because:

1. The potable water meter is located in CPP-606 approximately 2,200 ft from the well head and down stream of the potable water storage tank. As a result the meter does not account for potential water losses from the storage tank or interconnecting piping.
2. Not all of the sewage waste water discharge to the sewage treatment plant is metered.
3. Fire water usage is not metered.
4. The raw water meter is located in CPP-606 approximately 750 ft from the well head and downstream of the fire water and raw water storage tanks. As a result the meter does not account for potential water losses from the fire water tanks, raw water tanks, or interconnecting piping. The raw water tanks and interconnecting piping between the fire water tanks and raw water tanks are approximately 30 years old and are considered one of the most likely leak sources.
5. Not all of the raw water recirculated through the raw water tank is metered. This prevents an accurate measurement of the total raw water pumped.

6. Not all of the water discharges from ICPP were metered.

Current projects to upgrade the potable water well, upgrade the sewage treatment plant, and separate the fire water/raw water systems will address items 1, 2, and 3. These projects will add new meters near the potable water well head, at the inlet to the sewage treatment plant, and at the outlet to the fire water booster pumps in CPP-606. A separate project is presently underway to add flow meters near the raw water well heads to address item 4. A flow meter has been installed, as part of this project, in building CPP-1650 to address item 5. Estimates described in Section 3.2 will be included in future INWMIS reporting to address item 6. The locations of the new meters are identified in Figure 4.

3.4 Results

The water balance for the raw water system determined for December 1992 is shown in Table 2. There was a net loss of -92 ± 93 gpm (-185 to 1 gpm). Table 3 is a balance on the potable water system. Data are from April 1991 (when the most recent metering of flow rate to the sewage lagoon was obtained). The potable water balance shows a net loss of -30 ± 9 gpm (-39 to -21 gpm). This net loss for the potable water system could be due to a leak that was identified in the potable water system during November 1992. This leak, which has been fixed, was estimated to be approximately 20 gpm. Combining the water balance from the two systems to give an overall plant estimate gives an estimated -122 gpm ($-175,680$ gpd) of water unaccounted for in the ICPP water distribution system. Considering the uncertainties in the estimated numbers, this imbalance could range from a net loss of 20 gpm (28,800 gpd) to a net loss of -224 gpm ($-322,560$ gpd). The imbalance in the inputs and outputs amounts to approximately 7% of the total flow through the plant. This deviation is within the INWMIS goal of 10%. Nearly all of the water used at the ICPP (both potable and raw water) is diverted to percolation ponds after being used. A total of 1.9 million gpd of water (for December 1992) is routed to percolation ponds. This water either evaporates or percolates to recharge the underground aquifer. The results of the water balance (a loss of 175,680 gpd) suggest that the ICPP water system could be the source of recharge water for the northern perched water bodies.

4. STATUS OF ADDITIONAL INVESTIGATIONS

In addition to bringing the measurement of water production and use within the INWMIS goal, there are two other objectives of this study. Work on these additional objectives is just getting under way (see Figure 3), and so only brief updates on these projects can be presented at this time.

4.1 Tank Farm Infiltration

The High Level Liquid Waste Tank Farm (HLLWTF), shown in Figure 1, has been used to store high level radioactive liquid wastes from the reprocessing of spent nuclear fuel since 1954. It provides the interim storage capacity for radioactive liquid wastes until these wastes can be processed at the waste calciner facility. The tank farm consist of 18 stainless steel underground storage tanks with capacities ranging from 18,400 to 320,000 gallons. The objects of this investigation are the 11 largest storage tanks. Tanks WM-180 and -181 have capacities of 320,000 gallons. Tanks WM-182 through -190 have a capacity of 300,000 gallons. The stainless steel tanks are contained in concrete vaults. The 11 vaults and tanks are numbered WM-180 through WM-190 (Figure 5). The tops of the largest tanks are approximately 10 ft below ground surface (bgs), with their bases located approximately 50 ft bgs. In 1977, the tank farm was graded to promote drainage and covered with a synthetic membrane to inhibit

Table 2 ICPP Raw Water Balance, December 1992.

RAW WATER SYSTEM	Flow Rate (gpm)	Meter Accuracy (gpm)
INPUTS		
Raw water input	1,729(a)	± 53 (b)
Recirculated water	-300(c)	
Total	1,429	± 53
OUTPUTS		
Service waste	1,327(d)	± 35 (e)
Basin evaporation	0.6(f)	± 0.3 (g)
Vented steam	5.3(h)	± 2.6 (g)
Steam trap blowdown	0	
Lawn sprinklers	0	
Stack losses	1(i)	± 0.5 (g)
Wash down use	0	
CFSGF ash removal	3.5(j)	± 1.8 (g)
Total	1,337.4	± 40.2
RAW WATER BALANCE	-92	± 93

- a. December 1992 Utilities Monthly Production and Consumption Report.
- b. Flow meter F-UTI-621 has a full scale (3500 gpm) uncertainty of 1.48% as identified in the manufacture's data.
- c. Estimate based on design of heat pumps located in CPP-1604, -1605, -1631, and 1650.
- d. Measured with flow meter F-YDA-797-3.
- e. Flow meter F-YDA-797-3 has an a full scale (3000 gpm) uncertainty of 1.23% as identified in the manufacture's data.
- f. See section 3.2.1.
- g. The uncertainty for estimates is 50% of the reported flow.
- h. See section 3.2.2.1.

Table 2 (cont.) **ICPP Raw Water Balance, December 1992.**

- i. Main stack losses include an estimated of 0.69 for the main stack general operation and 0.27 for the operation of LET&D during the month of December 1992.
- j. See section 3.6.

Table 3 ICPP Potable Water Balance, April 1991.

POTABLE WATER SYSTEM	Flow Rate (gpm)	Meter Accuracy (gpm)
INPUTS		
Potable water input	60.7(a)	± 2.3 (b)
OUTPUTS		
Sewage waste	29(c)	± 2.9 (d)
Septic tank use	2.1(e)	± 1 (f)
Total	31.1	± 10.8
POTABLE WATER BALANCE	-30	± 9

- a. April 1991 Utilities Production and Consumption Report.
- b. Flow meter FI-UTI-699 has a full scale (300 gpm) uncertainty of 1.56 as identified in the manufacture's data.
- c. Measured using ISCO 90-degree notch weir-type flow meter April 1991 by DMJM of Salt Lake City, monthly average calculated from weekday and weekend readings. "ICPP Sewage Treatment Plant Evaluation, Report of Sewage Wastewater Sampling Sampling and Flow Monitoring Program," May 1991, Alpha Engineers, Inc., Pocatello, ID and DMJM, Salt Lake City, UT.
- d. Meter accuracy of $\pm 10\%$ given in report referenced in c.
- e. See section 3.2.8.
- f. The uncertainty for estimates is 50% of the reported flow.

Figure 5 Tank Farm Schematic

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water infiltration. The membrane is covered by an additional 6 in. of sand and then topped with a small amount of soil.

4.1.1 Vault and Tank Construction

The vaults vary in details of design and construction. The general configuration of the vaults and tanks, however, share many similarities. A general drawing of the vault and tank construction details is shown in Figure 6. The vaults enclosing tanks WM-180 and WM-181 are made of cast-in-place concrete and are octagonal in shape. The vaults enclosing five of the tanks, WM-182 through WM-186, are constructed of pre-cast concrete columns and panels. The seams between the columns and panels, and the panels and the floor, are sealed with grout. The remaining tanks, WM-187 through WM-190, are enclosed with a single, rectangular, continuous pour concrete vault with partitions separating the tanks. All of the tanks are constructed on 2.5- to 3-ft thick concrete slabs placed directly on bedrock. The walls range in thickness from 6 in. for the pillar and panel vaults, to 42 in. for the rectangular continuous-pour concrete vault. The roofs of the vaults consist of concrete panels resting on concrete beams which extend across the vault.

The liquid waste tanks are 50 ft across by 32 ft high. All the tanks are built of stainless steel. Tanks contain cooling coils to carry away the heat generated by radioactive decay within the tanks. Waste inside the tanks consists of solutions remaining from the dissolution of spent nuclear fuel. The solutions are very acidic and contain high concentrations of fission products (particularly Cs-137 and Sr-90), uranium isotopes, and transuranics (plutonium, neptunium, and americium). Solutions also contain heavy metals, such as mercury and cadmium.

Each vault has from one to three sumps to collect any free liquid in the vault. The sumps are identified as North (N), South (S), or Cold (C). The N and S identifiers indicate the location of the sump in the vault. The C identifier indicates that the vault has a cold sump. This basically means that the bottom of the sump has a dike separating the area directly under the tank from the area adjacent to the vault wall. The area adjacent to the vault is identified as the cold sump. Water levels in the sumps are monitored. If the water level rises too high within the sump, the water is removed by jetting with a steam jet. This aspirates the water out of the sump. There are a total of 22 sumps within the 11 vaults.

4.1.2 Completed Activities

Plant records indicating the volume water pumped from the 22 Tank Farm sumps over the past three years have been compiled and plotted. A summary of this data is presented in Table 4 and Figure 7. It is apparent from the evaluation of the data presented in Table 4 that the vaults on the eastside of the Tank Farm receive the most water. The seasonal effects are recognizable in the data presented in Figure 7. One sample of water was collected from the cold sump in vault WM-189. Results of this sample are shown in Table 5. The results indicate that the water is not high-level liquid waste.

4.1.3 Planned Activities

Based on the construction and other properties of the vaults and tanks, hypotheses for paths and sources of Tank Farm Vault water infiltration will be developed and tested against existing data obtained from sampling activities. The results on this comparison will be used to develop conclusions for a final report. If necessary, the conclusions will be factored into a line isolation activity which is discussed below.

Figure 6 Typical Tank Schematic

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(8 86)

Table 4. Volume of water pumped from tank farm sumps between June 1990 and April 1993.

Sump	Gallons
180 S	0
181 S	0
182 N	0
182 S	2,900
183 N	0
183 S	0
184 N	0
184 S	0
185 N	0
185 S	4,092
186 N	0
186 S	4,791
187 N	0
187 S	15,090
188 N	15,253
188 S	0
189 C	12,707
189 N	1,695
189 S	16,479
190 C	11,186
190 N	2,156
190 S	200
Total	86,549

Figure 7. Total volume of water pumped per month from tank farm sumps WM-180 through WM-190.

Table 5 Chemical and radiological analysis of a water sample collected from the WM-189 cold sump

FINAL report for WM-189 SUMP
(Customer copy)

** EPA Log **

Report for :WCF
Address :MS 5230

Log Number : 92-121510
Phone number : 6-3697

Date received :12/15/92
Time received :15:16

Date completed: 01/28/93
Time completed: 18:56

GWA charged :13120-200-001

Reviewed by C.J. MILLER

MSR mR/hr :<0.1

Signature C. J. Miller

Hazard Index :<E4

Lab QC/QA reviewed by

Quality Level :

Signature Cindy R. Whitman

COMMENTS: (sorted by Analysis)

See Attached report for additional information

Indicates the reported result was adjusted for low spike recovery.

Index	Analysis	Sample	Method	Analyst	Result(s) for log 121510
247	1,1,1-TCE	WM-189SUMP	7306	BCS	< 5.11569E-03 MG/L
235	ARSENIC	WM-189SUMP	7901	SDN	< 1.40797E-01 mg/L
236	BARIUM	WM-189SUMP	7902	SDN	< 1.78124E-01 mg/L
245	BENZENE	WM-189SUMP	7304	BCS	< 2.19873E-02 MG/L
237	CADMIUM	WM-189SUMP	7903	SDN	< 2.44293E-01 mg/L
251	CARBON TET	WM-189SUMP	7310	BCS	< 5.60999E-03 MG/L
244	CH2CL2	WM-189SUMP	7302	BCS	< 1.93411E-01 MG/L
250	CHLOROFORM	WM-189SUMP	7309	BCS	< 6.87583E-03 MG/L
238	CHROMIUM	WM-189SUMP	7904	SDN	2.04E-01+-7.5E-02 mg/L
	CO-60	WM-189SUMP	83993	DAO	3.4E-02+-1.5E-02 D/S/ML
	CS-137	WM-189SUMP	83993	DAO	1.36E-01+-1.5E-02 D/S/ML
	FLASHPOINT	WM-189SUMP	7985	BCS	NO Flash @ 60.0 deg C corrected
	GROSS ALPH	WM-189SUMP	7005	SDN	< 3.26995E-01 A/S/mL
	GROSS BETA	WM-189SUMP	77970	SDN	< 7.98513E+02 B/MIN/ML
	I-129	WM-189SUMP	23536	BJS	< 2.31378E-01 D/S/ML
239	LEAD	WM-189SUMP	7905	SDN	< 1.79575E-01 mg/L
	MERCURY	WM-189SUMP	7802	CBG	< 1.66140E-02 UG/ML
242	NICKEL	WM-189SUMP	7908	SDN	< 2.27451E-01 mg/L
249	PER-CL-E	WM-189SUMP	7308	BCS	< 2.81689E-03 MG/L
	PH	WM-189SUMP	67017	SDN	6.735E+00+-3.8E-02 pH
240	SELENIUM	WM-189SUMP	7906	SDN	< 2.24325E-01 mg/L
241	SILVER	WM-189SUMP	7907	SDN	< 2.05477E-01 mg/L
248	TCETHYLENE	WM-189SUMP	7307	BCS	< 4.00000E-03 MG/L
246	TOLUENE	WM-189SUMP	7305	BCS	< 2.00000E-02 MG/L
	TOTAL SR	WM-189SUMP	23381	BJS	< 2.28083E-05 UCI/ML

4.2 Deep Perched Water Zone

There is at least one, if not several, perched water zones on top of the 110 ft perching layer near the Tank Farm. This perched water contains dissolved concentrations of radionuclides suggesting contamination from past releases at ICPP. The origin of this perched water zone is not well understood. Because the perched water zone represents a potential pathway for the migration of contaminants to the Snake River Plain Aquifer, it is important to understand the perched water zone to assess the risk posed to the aquifer.

A previous project has initiated the study of the perched water zone at ICPP. A final report from that project describing the hydrology and geochemistry of the perched water is currently being prepared. One objective of this report is to identify potential sources of perched water based on the configuration of the perched water table and geochemical signatures in the perched water that can be traced back to sources within the facility. The results of this study will be used to identify potential sources within the facility. Once possible sources have been identified, leak tests will be conducted to determine if the possible sources are leaking. This evaluation is complicated by historical releases, which might contribute contaminants to the perched water, while the actual water is coming from another source.

4.2.1 Completed Activities

Data loggers used to measure the water levels in three of the perched water wells located near the Tank Farm were installed. Quarterly water sampling of the perched water wells continued. Pump tests were conducted on the perched water wells in an effort to obtain hydraulic conductivity data. A tracer test plan has been developed. The intent of the plan, if conducted, is to inject different tracers into various water systems at the ICPP and monitor for the tracers in the perched water zones. Interpretation of available water quality and hydrology/geology data has been documented in a draft report titled *Hydrogeologic and Geochemical Assessment of Contaminated Groundwater at the Idaho Chemical Processing Plant* which is nearing completion.

Two water lines which had developed leaks have been identified. During November 1992, a potable water line was observed to be leaking. This leak (estimated at approximately 20 GPM) was repaired resulting in a water level decrease in an adjacent perched water well in the northern portion of the ICPP. During May 1993 a service waste line was observed to be leaking. The line was repaired on May 13, 1993. At the time this report was prepared, the evaluation of the impact to the perched water body had not been conducted.

4.2.2 Planned Activities

Results of the hydrogeologic and geochemical analysis will be reviewed, along with the water balance and other facility information, to develop a list of potential sources within the facility for water in the perched water zone. A workplan will be prepared for testing the potential sources for leaks. In addition, if it is determined that a tracer test is necessary, it will be conducted. Finally, the occurrence of the perched water and associated contaminants will continue to be investigated under a parallel project being conducted under the Federal Facility Agreement / Consent Order.

5. SUMMARY AND CONCLUSIONS

The results of the water balance indicate that the unaccounted for water at the ICPP is smaller than originally believed. Based on the results of this study, over 90% of the water entering the ICPP is accounted for and thus the INWMIS goal is achieved.

Locations for new flow meters have been identified which will enhance the ICPP water metering system. Some of these meters have been installed. The remaining meters are being installed under ongoing projects.

Pumpage data have been obtained from Tank Farm sumps which indicate that sumps on the eastside of the Tank Farm receive the largest amount of water. A sample of water from one sump has been obtained. The results of the sample analysis indicate that the water is not high-level liquid waste.

Appendix A

ICPP WATER SUPPLY

Figure A-1

RAW WATER DISTRIBUTION

Figure A-2

ICPP Service Waste Flow Diagram

POTABLE WATER DISTRIBUTION

Figure A-6

Figure A-7

Figure A-8

DATE

FILMED

4 / 18 / 94

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