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November 26, 2008

US NRC
Document Control Desk
MS T-2F8
Washington DC, 20555

Re: REQUEST FOR ADDITIONAL INFORMATION UNIVERSITY OF FLORIDA TRAINING REACTOR DOCKET NO. 50-83

Please find attached our responses to the RAI, Docket No. 50-83. Please inform me if you need other information.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on 11/26/08

Sincerely,

Alireza Haghighat, PhD
Professor and Chair
Interim Director of UFTR

Cc Mr. Alexander Adams, Project Manager, NRC
Mr. Duane Hardesty, Project Manager, NRC
Mr. Brian Shea, Reactor Manager, UF
Mr. Matt Berglund, SRO, UF
Dr. Ce Yi, UF

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NRR

**Responses**

**to**

**REQUEST FOR ADDITIONAL INFORMATION**
**UNIVERSITY OF FLORIDA TRAINING REACTOR**
**DOCKET NO. 50-83**

by

Alireza Haghighat, Interim Director of UFTR
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(November 26, 2008)

Responses to
REQUEST FOR ADDITIONAL INFORMATION
UNIVERSITY OF FLORIDA TRAINING REACTOR
DOCKET NO. 50-83

***Question 1:*** *Your letter dated April 7, 2008, states that the normal operating pressure for the secondary side is not monitored, but that secondary flow rate is about 4 times higher than the primary flow rate so the dynamic pressure of the secondary system is expected to be higher than the primary system pressure. Therefore, if a significant leak is developed on the primary/secondary boundary, the resistivity of the primary water is expected to change, which is constantly monitored and controlled. The technical specifications (TSs) limits on primary flow rate are greater than 36 gpm or 41 gpm depending on fuel coolant channel spacing tolerance, and the TSs limits on secondary flow rate are greater than 60 gpm when using a well system and 8 gpm when using city water.*

*Is the assumption that a significant leak would be detected in the primary water resistivity valid if the reactor is operating at the TS limit of 36 gpm or 41 gpm primary flow rate (or normal primary flow rate if it is in excess of the allowed TS limit) and 60 gpm or 8 gpm secondary flow rate? In your response, address how the primary and secondary pressures are affected by the flow characteristics in the heat exchanger.*

**Response 1:**

The resistivity of primary water is monitored. If some fission products leak into the primary coolant due to fuel failure, this will cause resistivity change in the primary water regardless of the flow rates.

The shell-tube type heat exchanger is one of the Type AHTR series, manufactured by AMETEK (Type 316 Stainless Steel, U-tube configuration), with one pass on the shell side for the secondary coolant, and two-pass on the tube side for the primary coolant.

Here we use the Kern method (Refs. 1 and 2) to estimate the shell-side and tube-side pressure drop.

The shell-side pressure drop can be estimated by the following equation.

$$\Delta p_s = \frac{f_S G_S^2 N_S \cdot D_S}{2\rho D_e \phi_S} \qquad (1)$$

Where

$f_s = \exp(0.576 - 0.19 * \ln(Re_s))$ is Fanning friction factor on shell side (Note the factor also takes entrance and exit pressure losses into account)

$D_s$= shell inner diameter

$G_s = \frac{m_s}{A_s}$ is the shell side mass velocity

$m_s$ = the shell side mass flow rate
$A_s = \frac{D_s CB}{P_T}$ is the shell side cross flow area
C = the distance between tubes (see Figure 1)
$P_T$ = tube pitch size ( see Figure 1)

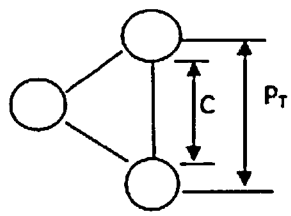



Figure 1 - Triangle pitch size parameters

$(Re_s = \frac{G_s D_e}{\mu_s})$ = shell-side Reynolds number (Eq. 1 is valid for $400 < Re < 1 \times 10^6$)

$[D_e = \frac{4 \times free\ flow\ area}{wetted\ perimeter} = \frac{4 \times (\frac{P_T^2 \cdot \sqrt{3}}{4} - \frac{\pi d_o^2}{8})}{\pi d_o / 2}]$ = Equivalent diameter of the shell side for triangular pitch.

$d_o$ = Tube outer diameter
ρ = shell side water density
$L_s$ = shell side length
B = baffle spacing
$N_s$ = number of times the shell side water passes across the tube bundle ($N_s = L_s/B$)
$\phi_s = (\frac{\mu_s}{\mu_w})^{0.14}$
$\mu_s$ = the shell side water viscosity at shell side water temperature

$\mu_w$ = the shell side water viscosity at tube wall temperature

The tube side pressure drop is calculated by the following equation

$$\Delta p_t = (4 f_t \times \frac{L N_p}{d_i} + 4 N_p) \frac{\rho V_t^2}{2} \qquad (2)$$

Where,

$[f_t = (1.58 \ln(Re) - 3.28)^{-2}]$ = the friction factor on the tube side
$N_p$ = the number of passes on the tube side
L = tube length.
$d_i$ = tube inner diameter
$V_t$ = the average flow speed (m/s)

The first part of Eq. 2 accounts for the pressure drop due to friction, and the second part accounts for pressure drop due to the change of direction of U-tubes.

In order to use Eqs 1 and 2, parameters given in Table 1 are considered.

Table 1 - Parameters used to evaluate pressure drop in the heat exchanger.

| Parameters | value |
|---|---|
| tube inner diameter | 5.35E-02 m |
| tube outer diameter | 6.35E-03 m |
| shell inner diameter | 2.06E-01 m |
| shell length | 1.10E+00 m |
| tube length | 1.00E+00 m |
| number of baffle | 10 |
| pitch size (Pt) | 1.27E-02 m |
| tube distance ( C ) | 6.35E-03 m |
| number of passes (tube side) | 2 |
| number of tubes | 126 |
| Average Primary Coolant Temp. | 86.5 °F |
| Average Secondary Coolant Temp. | 75.3 °F |

For reference, we use primary flow rate at 40 gpm, and secondary flow rate at 200 gpm (well water). The effects of different flow rates will be discussed later. In Table 2, the temperatures are the average measured values, and they are used to look up the viscosity values.

Table 2 - Pressure drop in the heat exchanger for the reference case (primary flow rate = 40 gpm, secondary flow rate = 200 gpm)

| | Flow rate (gpm) | Pressure Drop (psi) |
|---|---|---|
| Shell-side (Secondary) | 200 | 2.18 |
| Tube-Side (Primary) | 40 | 4.42 |

Above table indicates that the pressure drops in the primary and secondary sides are relatively small, and moreover the primary drop is larger than the secondary side.

The heat exchanger shell-side and tube-side inlet/outlet pressures are not monitored in UFTR. However, we can estimate the pressures based on the piping layout and pump characteristics. Figure 5-5 in UFTR SAR shows the schematic of UFR secondary coolant system. The figure is also attached in this document (Appendix A). A simplified version of Figure 5-5 in SAR is used here to estimate the primary outlet and secondary inlet pressures as shown in Figure 2

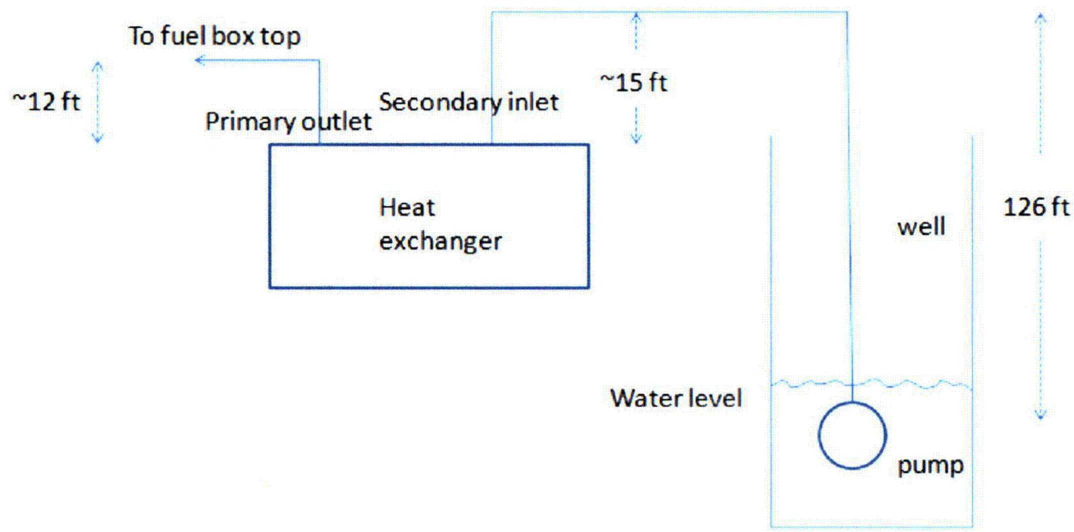



Figure 2 schematic of UFTR secondary coolant system used for determination of heat exchanger inlet/outlet pressures.

The well pump, model *150H10* is manufactured by Goulds Pumps, ITT Industry. The specifications of the pump are given in Appendix B. According to the data given in the Appendix, the pump at 10 hp, for 200 gpm, has a dynamic head of 163 ft. In Figure 3, the height difference between the pump and heat exchanger is ~111 ft (126 ft minus 15 ft). Assuming no significant pressure loss in the pipes, the secondary inlet pressure is about 50 ft (163 ft minus 111 ft) water above the atmosphere pressure. While on the primary side, the height from the heat exchanger to the top of fuel box (where the pressure is atmosphere) is ~12 ft. The primary outlet pressure is about 12 ft water above the atmosphere pressure. Considering 1 psi is equal to 2.306 ft water, then the inlet pressure for the secondary is ~36.4 psi, and the outlet pressure for the primary is ~19.9 psi. Considering the expected pressure drop in the heat exchanger give in Table 2, the secondary outlet pressure is ~34.2 psi, which is ~72% higher than the primary outlet pressure. This difference increases as the secondary flow rate decreases, e.g., at 100 gpm with a dynamic head of 238 ft, the pressure difference is ~251%. This means that there is always a negative pressure which prevents any leak from the primary loop to the secondary loop.

Figures 3 and 4 show the pressure drop as a function of flow rate for the primary and secondary sides, respectively.

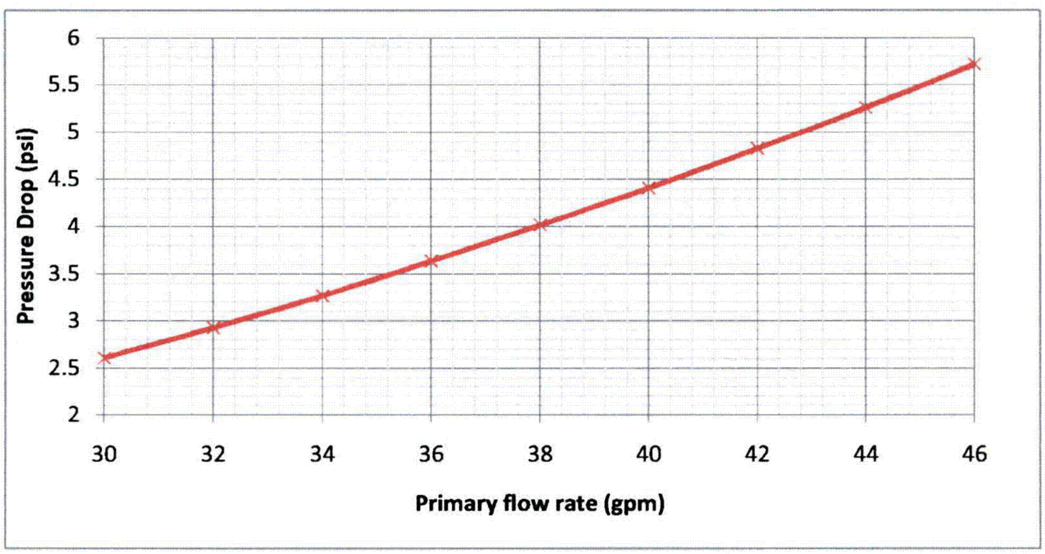



Figure 3 - Primary pressure drop in the heat exchanger for different flow rates

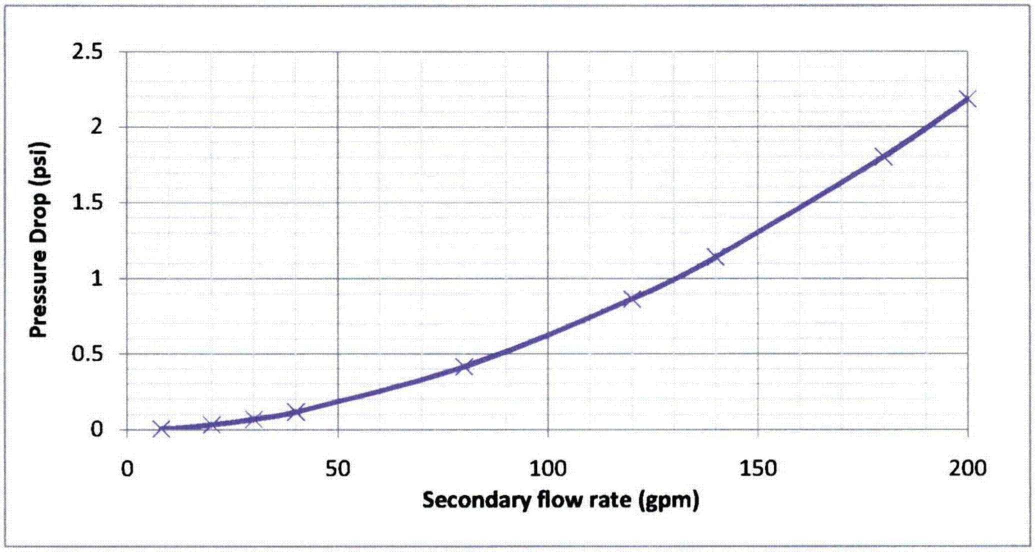



Figure 4 - Secondary pressure drop in the heat exchanger for different flow rates

Above figures show that the primary pressure drop ranges from 2.61 psi to 5.72 psi for a flow rate from 30 gpm to 46 gpm. While the secondary pressure drop is below 2.18 psi for a flow rate up to 200 gpm.

In conclusion, the secondary pressure remains higher than the primary pressure in the heat exchanger when operating on the well water. For city water, the primary pressure drop is still larger than the secondary pressure drop. The primary heat exchanger inlet pressure is likely higher than the secondary inlet pressure. So it is not valid to assume that the secondary pressure is always higher than the primary pressure. However, the activity release is limited even if there is leakage in the heat exchanger (See analysis in Question 2).

***Question 2:*** *Your letter dated April 7, 2008, states that "with conservative assumptions on sodium in the primary coolant system, irradiation time, neutron flux level, cross section, primary-to-secondary leakage and secondary diluting flow, the following values are determined for a 1 liter/hr undetected leak rate continuing for 1 hour with 1 ppm sodium assumed in the primary coolant system. Activation for 10 hours yields ~54 mCi Na-24 in the primary coolant tank at a concentration of ~0.0895 μCi/ml before dilution by the secondary flow. For a 1 liter/hour leak rate undetected for an hour, the concentration assuming 140 gpm well water flow (minimum based on well water flow without flow warning light), the concentration becomes ~2.8E-06 μCi/ml. Public release is allowed at 5E-3 μCi/ml so we conclude that this unlikely event would not be a problem in this regard."*

***Question 2a:*** *What is the basis for the 'assumptions of 1 ppm sodium in the primary coolant, activation for 10 hours, and 1 liter/hour leak rate for 1 hour?*

**Response 2a:**

The activity release is calculated by the following equation.

$$AR = \phi \sigma_a N(1 - e^{-\lambda t}) \times \frac{LR}{FR} \quad (3)$$

Where,

$AR$ = Activity release in the unit of $\mu Ci/ml$
$\phi = 2.0 \times 10^{12}$ $neutrons/cm^2sec$ is the core total (fast + thermal) flux at 100 kW
$\sigma_a$= Microscopic absorption cross section for Na-23
$N$ = Number of Na atoms in 1 ml primary coolant (Sodium concentration)
$\lambda$ = Decay coefficient of Na-24 ($T_{1/2}$=15.02 hrs)
t = Activation time
LR = Primary to secondary leakage rate
FR = Secondary flow rate

**A. Estimation of activity for different operation times and sodium concentration**

The reason for considering a sodium concentration of 1ppm sodium is based on the measurement results by UF Extension Soil Testing Library. (See attachment). Two water samples are filtered primary coolant and the unfiltered city water (before entering the primary system). Results show that the primary coolant sodium concentration is 0.7 ppm. As a conservative measure, we have considered an operation time of 10 hrs, while the current operation time of the UFTR by the Technical Specifications is 6 hrs. We will further examine the effects of operation time and sodium concentration.

Here, in order to examine the effect of higher Na concentration and longer operation times, we evaluate the activity release for concentrations in a range of 1-10 ppm for operation hours of 10 to 100 hrs. Figure 1 compares the activity release for different hours of operation as a function of Na concentration in the primary coolant. Note that these calculations are based on 1 liter/hr leakage rate, and 60 gpm secondary flow rate.

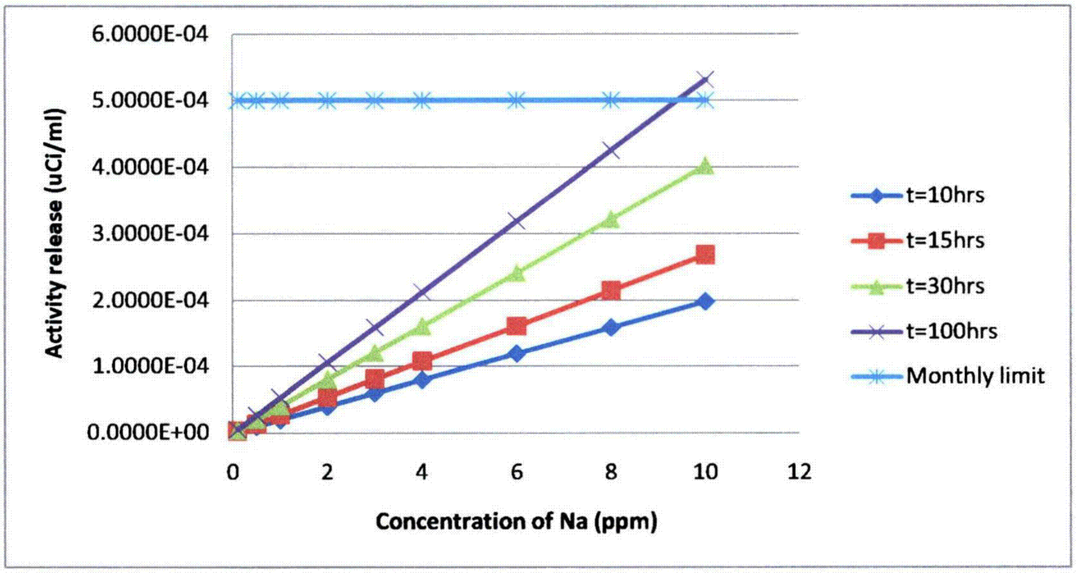



Figure 1 - Comparison of the activity release for different operation time as a function of sodium concentration (100 kW, 1 liter/hr, 60 gpm)

Above figure indicates that the activity is less than the monthly limit if sodium concentration is less 9 ppm even at an unrealistic case of 100 hrs of operation. Only, for cases with concentrations between 9 ppm and 10 ppm the concentration exceeds the limit for the 100 hrs operation case. Further, this diagram indicates at a more realistic value of Na concentration of 1 ppm and operation time of 10 hrs, the activity release is less than the limit by a factor of ~25.

### B. Estimation of activity release for different leakage rates

Figure 2 compares the activity leakage for different coolant Leakage Rate (LR) as a function the Na concentration in the primary coolant for 10 hrs operation time and 60 gpm secondary flow rate, at 100 kW.

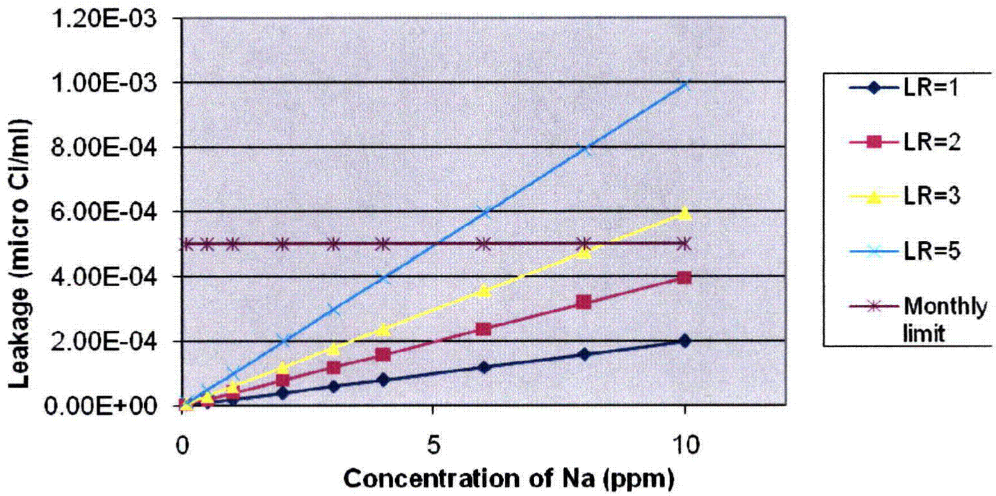



Figure 2 - Comparison of the activity release for different primary to secondary leakage rate as a function of sodium concentration (100 kW, operation time of 10 hrs, and 60 gpm secondary flow rate)

As expected, Fig. 2 shows that activity leakage increases linearly as the primary coolant leakage rate increases. Further, Figure 1 demonstrates that for more realistic values of Na concentration of ≤ 1 ppm even at a leakage rate of 5 liter/hr, the activity leakage is less than the limit by a factor of ~5.

### C. Estimation of activity release for different secondary flow rates

UFTR has two secondary water supplies: i) well water; ii) city water. UFTR operates on the well water, and city water is used as a temporary backup for normal shutdown. Based on the current UFTR Technical Specifications, the nominal well water flow rate is ~200 gpm. A warning is triggered if flow drops to 140 gpm or less, and the reactor is tripped if the flow rate drops to 60 gpm or less. The nominal city water flow rate is ~30 gpm, and reactor is shutdown if the flow rate drops to 8 gpm or less. In order to examine the effect of secondary flow rate for both well and city waters, in Figure 3, we compare the leakage rate for different Na concentrations as a function of different flow rates for operation time of 10 hrs and leakage rate (primary to secondary) of 1 liter/hr at 100 kW.

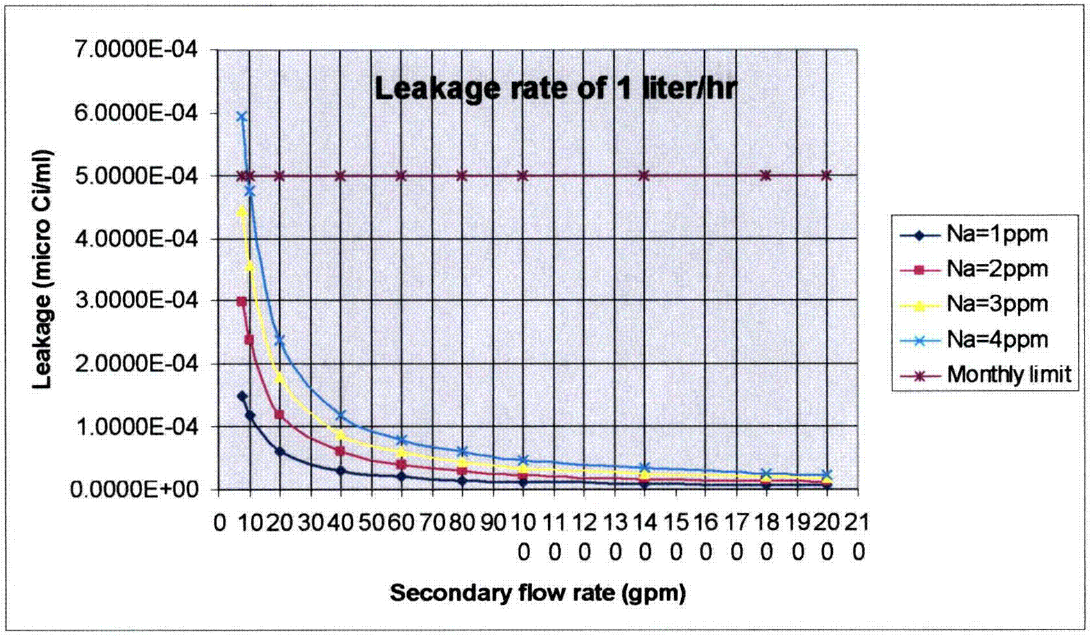



Figure 3 - Comparison of the activity release for different sodium concentrations as a function of secondary flow rate for 1 liter/hr leakage (operation time of 10 hrs, 100 kW).

Above figure indicates even if the secondary flow is as low as 8 gpm, the leakage activity is less than the limit for Na concentrations of up 3 ppm. If the secondary flow rate between 100 gpm to 200 gpm, where the latter is the nominal value, for a more realistic Na concentration of 1 ppm, the leakage activity varies in the range of $1.2 \times 10^{-5}$ to $6 \times 10^{-5}$ which is significantly smaller than the limit by a factor of ~40 to ~100.

Figs. 4 to 7 show the leakage activity as a function of secondary flow rate for different Na concentration for leakage rates of 2, 3, 4, and 5 liter/hr, respectively.

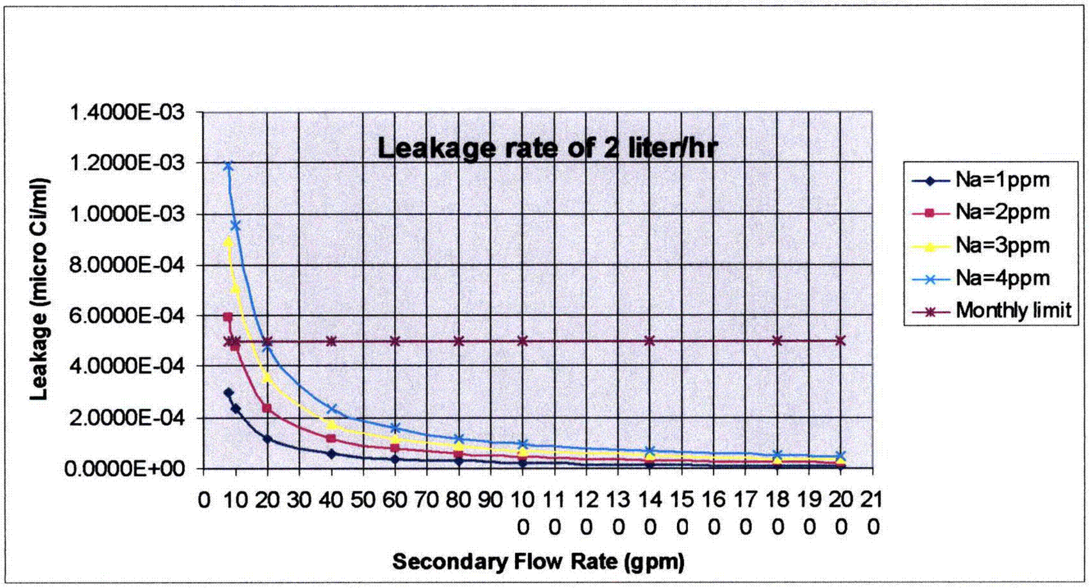



Figure 4 - Comparison of the activity release for different sodium concentrations as a function of secondary flow rate for 2 liter/hr leakage (operation time of 10 hrs, 100 kW).

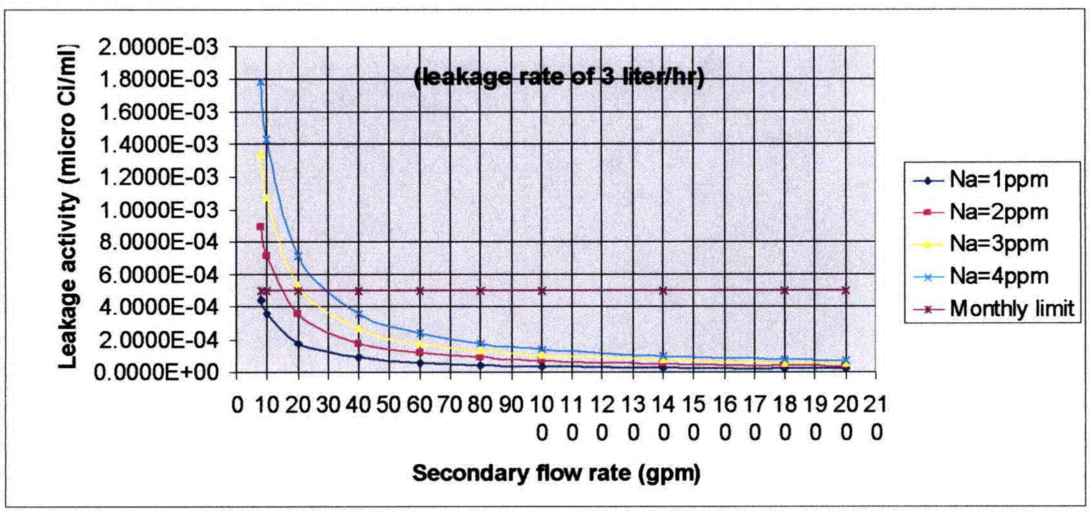



Figure 5 - Comparison of the activity release for different sodium concentrations as a function of secondary flow rate for 3 liter/hr leakage (operation time of 10 hrs, 100 kW).

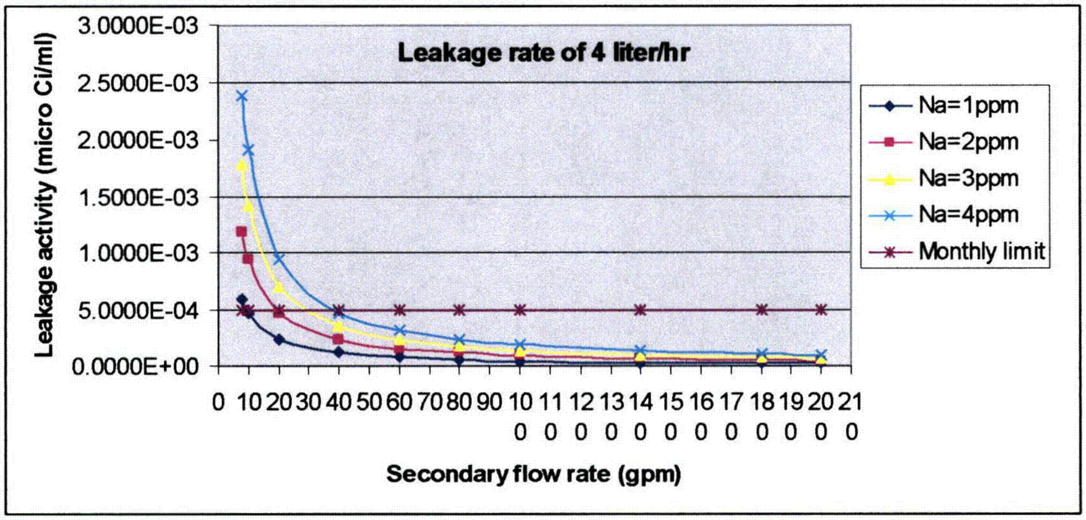



Figure 6 - Comparison of the activity release for different sodium concentrations as a function of secondary flow rate for 4 liter/hr leakage (operation time of 10 hrs, 100 kW).

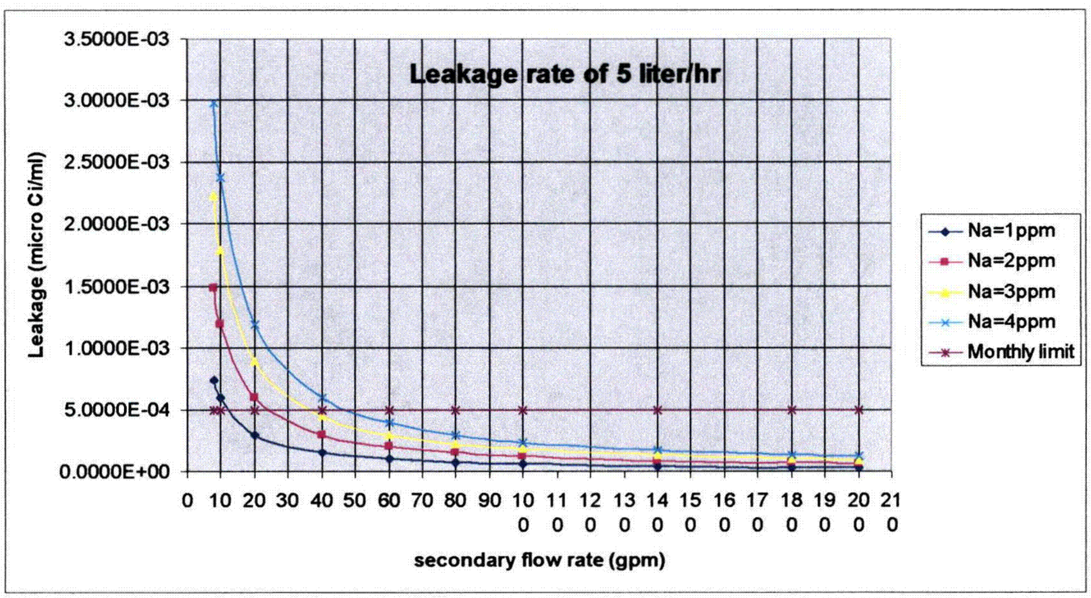



Figure 7 - Comparison of the activity release for different sodium concentrations as a function of secondary flow rate for 5 liter/hr leakage (operation time of 10 hrs, 100 kW).

Above figure shows that as long as secondary flow rate is more than 60 gpm even for 5 liter/hr leakage rate, for a realistic Na concentration of 1 ppm, and 10 hrs of operation time at 100 kW, leakage activity is significantly less than the limit by a factor of ~5.

In conclusion, above analysis demonstrates that considering highly conservative parameters including operation time of 10 hrs, total flux level of $2x10^{12}$, leakage rate of 5 liter/hr, power of 100 kW, and Na concentration of 1 ppm, leakage activity will remain significantly below (by a factor of 5) the monthly limit if the secondary flow rate is above 60 gpm.

Since the city water is not meant to be used for normal operation, and reactor does not need cooling in case of loss of coolant, we intend to modify the Technical Specification by removing the use of city water and increasing the secondary flow trip setpoint to 100 gpm. For this situation even for the leakage rate of 5 liter/hr, the activity leakage is less than the limit by a factor of 10.

***Question 2b:*** *How is the public release limit (5E-3 μCi/ml) derived? Appendix B to 10 CFR Part 20, Table 2, Column 2, lists an average yearly concentration release limit of 5E-5 μCi/mi for water effluents, and Table 3 list a monthly average concentration release limit to sewers as 5E-4 μCi/ml.*

**Response 2b:**
The release limit has been updated to the monthly limit *5E-4 μCi/ml*

***Question 2c.*** *As discussed previously, the TS limit on secondary flow rate is 60 gpm when using well water and 8 gpm using city water. Therefore, provide an estimated effluent concentration assuming the allowed TS limits for secondary flow.*

**Response 2c:**
The analysis on the secondary flow rate is discussed in Section D in the answer to question 2.a

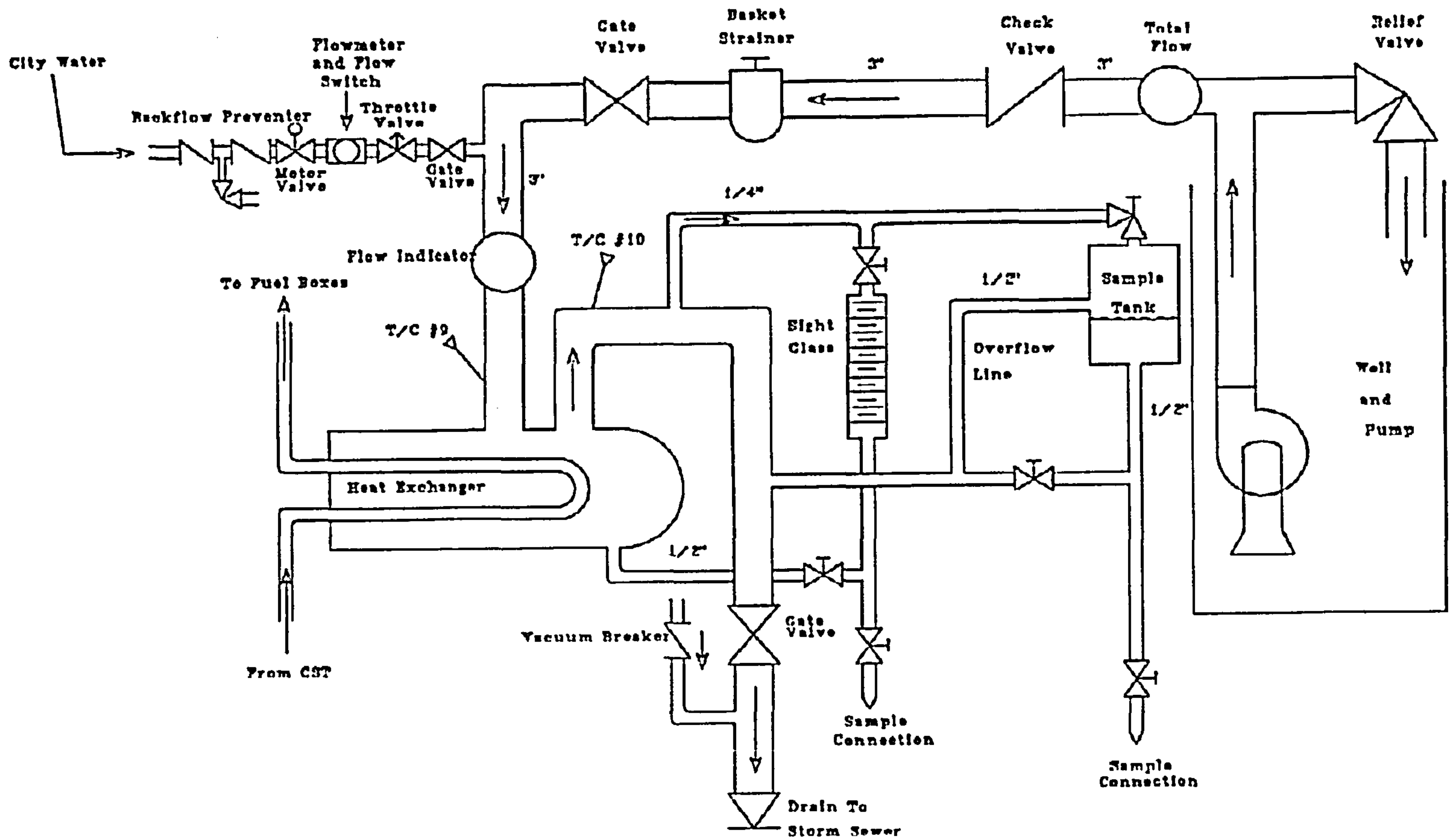
***Question 2d:*** *What is the basis for your conclusion that a primary to secondary leak is unlikely?*

**Response 2d:**
The statement is based on the analysis (See the answers to Question 1) of the pressure drop in the heat exchanger for the primary and secondary sides.

## References


1. Kern, D.Q., *Process Heat Transfer*, McGraw-Hill, New York 1950.
2. Kakac, Sadik and Liu, Hongtan, Heat Exchanger Selection, Rating and Thermal Design, CRC Press, Boca Raton, Florida, 2002

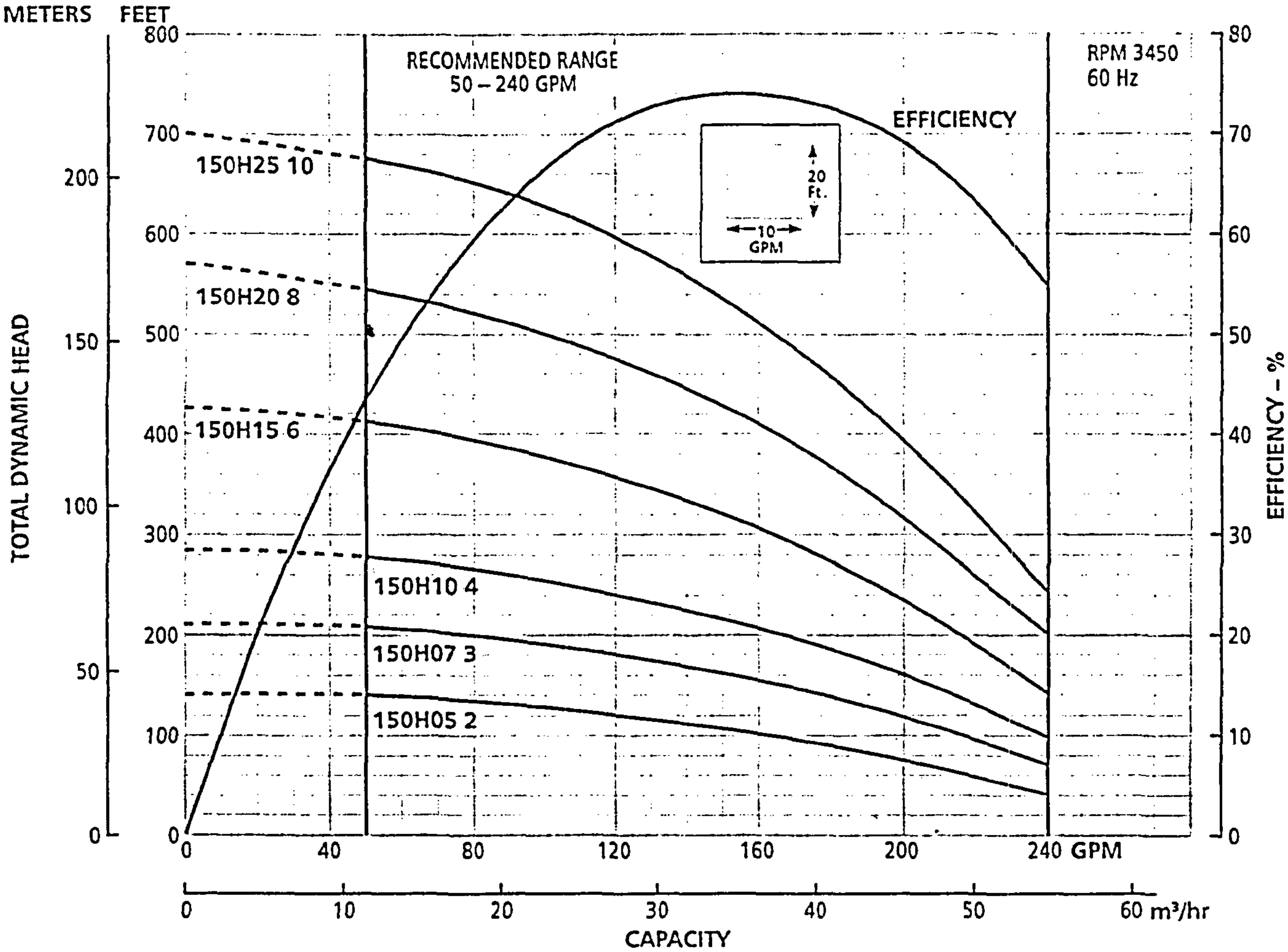
## Appendix A - Schematic of UFTR secondary coolant system (From SAR Figure 5-5)



# Appendix B - UFTR Secondary Coolant Pump (well pump) Specifications

# Model 150H

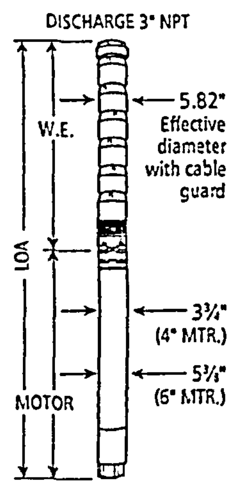





Curve Reference SU 507

## DIMENSIONS AND WEIGHTS

| HP | Stages | W.E. Order No. | Motor Order No. | PH | Motor Volts | Motor Lgth. | W.E. Lgth. | LOA | Wt. (lbs.) |
|---|---|---|---|---|---|---|---|---|---|
| 5 | 2 | 150H05 2 | S10940 | 1 | 230 | 28.2 | 18.0 | 46.2 | 95 |
| | | | S10978<br>S10970<br>S10975<br>S10979 | 3 | 200<br>230<br>460<br>575 | 22.2 | 18.0 | 40.2 | 95 |
| 7.5 | 3 | 150H07 3 | S11970 | 1 | 230 | 28.0 | 24.3 | 52.3 | 185 |
| | | | S11978<br>S11971<br>S11972<br>*S11979 | 3 | 200<br>230<br>460<br>575 | 24.2 | 24.3 | 48.5 | 160 |
| 10 | 4 | 150H10 4 | S12970 | 1 | 230 | 30.6 | 29.3 | 59.9 | 215 |
| | | | S12978<br>S12971<br>S12972<br>*S12979 | 3 | 200<br>230<br>460<br>575 | 25.5 | 29.3 | 54.8 | 185 |
| 15 | 6 | 150H15 6 | S13970 | 1 | 230 | 33.1 | 39.3 | 72.4 | 255 |
| | | | S13978<br>S13971<br>S13972<br>*S13979 | 3 | 200<br>230<br>460<br>575 | 28.0 | 39.3 | 67.3 | 229 |
| 20 | 8 | 150H20 8 | S14978<br>S14971<br>S14972<br>*S14979 | 3 | 200<br>230<br>460<br>575 | 30.6 | 49.3 | 79.9 | 274 |
| 25 | 10 | 150H25 10 | S15978<br>S15971<br>S15972<br>*S15979 | 3 | 200<br>230<br>460<br>575 | 33.2 | 59.3 | 92.5 | 316 |




(All dimensions are in inches and weights in lbs. Do not use for construction purposes.)
**Non-stock motors have a six (6) week lead time.*

Water end and motor must be ordered separately and are packaged separately.

## SELECTION CHART

Horsepower Range 5 – 25, Recommended Range 50 – 240 GPM, 60 Hz, 3450 RPM

| Pump Model | Depth to Water in Feet/Ratings in GPM (Gallons per Minute) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HP | PSI | 25 | 50 | 75 | 100 | 125 | 150 | 175 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 600 |
| 150H05 2<br>2 Stages | 5 | 0 | 254 | 230 | 200 | 164 | 102 | | | | | | | | | | |
| | | 20 | 206 | 172 | 120 | | | | | | | | | | | | |
| | | 30 | 174 | 122 | | | | | | | | | | | | | |
| | | 40 | 126 | | | | | | | | | | | | | | |
| | | 50 | | | | | | | | | | | | | | | |
| | | 60 | | | | | | | | | | | | | | | |
| 150H07 3<br>3 Stages | 7.5 | 0 | | 250 | 234 | 215 | 192 | 164 | 126 | | | | | | | | |
| | | 20 | 237 | 220 | 194 | 170 | 130 | 78 | | | | | | | | | |
| | | 30 | 220 | 197 | 174 | 134 | 78 | | | | | | | | | | |
| | | 40 | 200 | 174 | 140 | 84 | | | | | | | | | | | |
| | | 50 | 176 | 142 | 90 | | | | | | | | | | | | |
| | | 60 | 144 | 100 | | | | | | | | | | | | | |
| 150H10 4<br>4 Stages | 10 | 0 | | | 251 | 238 | 223 | 205 | 186 | 163 | 92 | | | | | | |
| | | 20 | 253 | 240 | 225 | 210 | 190 | 168 | 140 | 104 | | | | | | | |
| | | 30 | 240 | 226 | 210 | 190 | 170 | 140 | 104 | | | | | | | | |
| | | 40 | 228 | 212 | 193 | 172 | 146 | 108 | | | | | | | | | |
| | | 50 | 213 | 193 | 172 | 147 | 111 | | | | | | | | | | |
| | | 60 | 194 | 176 | 148 | 116 | | | | | | | | | | | |
| 150H15 6<br>6 Stages | 15 | 0 | | | | 255 | 246 | 236 | 226 | 216 | 192 | 164 | 122 | | | | |
| | | 20 | | 257 | 248 | 238 | 228 | 218 | 206 | 194 | 167 | 128 | | | | | |
| | | 30 | 258 | 248 | 238 | 228 | 218 | 206 | 194 | 181 | 150 | 100 | | | | | |
| | | 40 | 248 | 240 | 230 | 220 | 208 | 196 | 184 | 168 | 130 | | | | | | |
| | | 50 | 240 | 230 | 220 | 209 | 196 | 184 | 170 | 154 | 107 | | | | | | |
| | | 60 | 234 | 220 | 210 | 198 | 185 | 172 | 154 | 136 | 78 | | | | | | |
| 150H20 8<br>8 Stages | 20 | 0 | | | | | 259 | 252 | 244 | 237 | 221 | 204 | 183 | 163 | 134 | 95 | |
| | | 20 | | | 260 | 253 | 246 | 238 | 230 | 223 | 206 | 187 | 166 | 138 | 100 | | |
| | | 30 | | 260 | 253 | 246 | 239 | 231 | 223 | 214 | 197 | 177 | 154 | 120 | | | |
| | | 40 | | 254 | 247 | 240 | 232 | 224 | 216 | 208 | 188 | 168 | 140 | 102 | | | |
| | | 50 | 255 | 247 | 240 | 232 | 224 | 216 | 208 | 199 | 180 | 156 | 125 | 80 | | | |
| | | 60 | 247 | 240 | 232 | 225 | 216 | 209 | 199 | 190 | 170 | 142 | 106 | | | | |
| 150H25 10<br>10 Stages | 25 | 0 | | | | | | | 258 | 252 | 240 | 226 | 212 | 198 | 182 | 165 | 113 |
| | | 20 | | | | | 259 | 253 | 247 | 240 | 227 | 213 | 199 | 183 | 166 | 144 | 78 |
| | | 30 | | | | 260 | 253 | 247 | 240 | 234 | 220 | 207 | 192 | 175 | 156 | 132 | 100 |
| | | 40 | | | 260 | 254 | 247 | 241 | 234 | 228 | 214 | 200 | 184 | 168 | 146 | 118 | |
| | | 50 | | 260 | 254 | 248 | 242 | 235 | 229 | 222 | 208 | 193 | 177 | 158 | 134 | 104 | |
| | | 60 | 260 | 254 | 248 | 242 | 235 | 230 | 222 | 216 | 201 | 186 | 169 | 148 | 120 | 84 | |

Appendix C – UFTR Coolant Sample Test Results

Sample number : CW1 - unfiltered (city water)

Sample number : DI1 - filtered (primary coolant)

UF UNIVERSITY of FLORIDA
IFAS

# UF/IFAS Analytical Services Laboratories
## Extension Soil Testing Laboratory

**Wallace Building 631 PO Box 110740 Gainesville, FL 32611-0740**

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## Water Test

To: Nuclear Engineering/Berglund, Matt
PO Box 118300
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Tel: 352-392-1429 x318

Set: 1852
Report Date: 18-Nov-08

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| Lab No | Sample Identification | Parts per million (ppm or mg/L) | | | | | | | | pH | Electrical Conductivity in mmho/cm or dS/m | Total carbonates in meq/liter |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Calcium Ca | Magnesium Mg | Hardness | Iron Fe | Manganese Mn | Sodium Na | Chloride Cl | Suspended Solids | | | |
| 22987 | CW 1 | 30.1 | 21.5 | 163.4 | 0.00 | 0.00 | 10.5 | 27.6 | 0.0 | 7.60 | 0.35 | 0.80 |
| 22988 | DI 1 | 0.0 | 0.0 | 0.0 | 0.00 | 0.00 | 0.7 | -0.3 | 0.0 | 5.70 | 0.00 | N/A |

## REPORT OF WATER TEST RESULTS

The reported values have different meanings depending upon the planned uses of the water. The following interpretations are divided into Household Uses and Irrigation sections. Please read the applicable section to better understand these water test results.

## HOUSEHOLD USES INTERPRETATIONS

The physical and chemical determinations made by the Extension Soil Testing Laboratory can be effectively used to diagnose potential problems in water. However the lab does not test a water's suitability for human consumption. Bacteriological tests may be available from the County Health Department or from selected commercial laboratories.

**Hardness** is calculated according to the following equation:

Hardness = (ppm Ca x 2.5) + (ppm Mg x 4.1)
(parts per million, ppm)

The following table will assist in classification of water hardness:

| Interpretation | Hardness ppm | Hardness grains per gallon |
|---|---|---|
| soft | 0 to 17 | 0 to 1 |
| relatively soft | 17 to 50 | 1 to 3 |
| moderately hard | 50 to 120 | 3 to 7 |
| hard | 120 to 170 | 7 to 10 |
| vary hard | > 170 | >10 |

**Iron and Mn can impart a metallic taste to water as well as stain clothes and plumbing fixtures. Staining can be caused by as little as 0.3 ppm Fe or Mn.**

**Electrical Conductivity of water is related to the amount of dissolved salts in the water. Higher salinity results in higher electrical conductivity.** ***Increases in electrical conductivity with*** **time may mean that the aquifer is turning brackish or that salt water intrusion is occuring.**

This data report has been issued on the authority of
Dr. Rao Mylavarapu, Laboratory Director, and Mr. Pete Straub, QA Officer,
in support of Florida Cooperative Extension Services.

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**Sodium** and **Chloride** levels are used to define the type of salts contributing to the electrical conductivity of the water. Electrical conductivity measures the presence of all dissolved salts. If the electrical conductivity reading is elevated, the presence of sodium and chloride indicatethat the water source is a brackish or that saltwater may have intruded into the water source.

**pH** is a measurement which determines the level of acidity of the water. The pH of water can change rapidly for a number of reasons. If the reading is lower than 6.5, treatement of water may be necessary to preclude damage to metallic plumbing.

Additional information on interpretation of these results can be found in IFAS Circular 703, "Home Water Quality and Safety."

## IRRIGATION AND MICROIRRIGATION INTERPRETATIONS

Interpretation of water quality for irrigation purposes must be crop specific. Crops respond differently to the quality of water with which they are irrigated. Use the following information as a guideline to determine if a possible problem exists. If there is a possible problem indicated, consult with your county extension agent and/or refer to the additional publications cited in the following text.

**Electrical conductivity** of water is related to the amount of dissolved salts in the water. Higher salinity results in higher electrical conductivity. As the electrical conductivity increases, the plant must expend more energy to take in nutrients dissolved in the water from fertilizer and the soil. Some plants are very sensitive to salinity, while others can tolerate a wide range. Use the following table to make general interpretations. Refer to IFAS Circular 817, "Soil, Container Media, and Water Testing Interpretations and IFAS Standardized Fertilization Recommendations." A reference copy of the circular is maintained at your county extension office.

| Class of water | Electrical conductivity |
|---|---|
| | dS/m or mmhos/om* |
| Excellent | 0.25 |
| Good | 0.25 to 0.75 |
| Permissible | 0.75 to 2.00 |
| Doubtful | 2.00 to 3.00 |
| Unsuitable | > 3.00 |

*Conversion
ppm soluble salts = EC x 700

**pH** is a measurement which derminnes made the level of the acidity or alkalinity of the water. Much of the Florida's well waters are alkaline (pH 7.6 to 6.5). The high pH results from the calcium carbonate aquifer in which the water has been in contact. Use of such water in effect causes liming of the crop. Some crops, blueberry or pine seedings will grow poorly if exposed to water containing appreciable amounts of lime. Surface waters are usually lower in pH.

**Total Carbonates and Bicarbonates** are a direct measure of the liming potential of the water. For many crops, use of water with an appreciable liming potential is not of concern and may lower the need for agricultural lime additions. However, as noted above, some crops will be adversely affected. Neutralization of the liming potential can be economically accomplished in some situations by treatement of water with acid. Refer to Notes in Soil Science No. 18, "Neutralizing excess bicarbonates from irrigation water" and Notes in Soil Science No. 25, Quick-test method for pH and bicarbonates in water."

**Ca** and **Mg** are used to calculate **Hardness** described in the Hosehold Uses described above.

**Na** and **Cl** can be used to determine the type of salts present and to diagnose the possibility of saltwater intrusion.

**Fe** and **Mn** can cause plant tissue staining. Overhead irrigation with water containing levels above 0.3 ppm may cause staining to foliage. Additionally such levels indicate that the water should be treated to prevent microirrigation plugging due to enhanced microbial growth or iron encrustations.

**Suspended solids** are used to predict the amount of undissolved material that is in the water. High suspended solids indicate that plugging problems are likely to occur if the water is used for microirrigation without adequate filtration.

Criteria for estimating plugging potential of microirrigation water sources.

| | | ---------Plugging potential--------- | | |
|---|---|---|---|---|
| Factor | Units | Sight | Moderate | Severe |
| pH | | 7.0 | 7.0 to 7.5 | 7.5 |
| Suspended solids | ppm | 50 | 50 to 100 | 100 |
| Mn, Fe | ppm | 0.1 | 0.1 to 1.5 | 1.5 |
| Hardness | ppm | 150 | 150 to 300 | 300 |
| Electrical conductivity | dS/m | 0.7 | 0.7 to 2.9 | 2.9 |

Adopted from IFAS Bulletin 258, "Causes and prevention of emitter plugging in microirrigation systems"

Dr. Ce Yi, UF