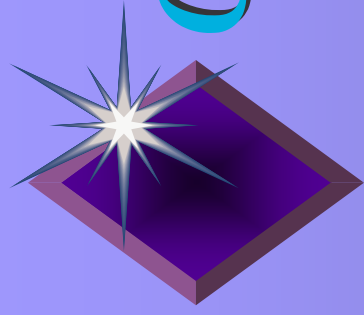


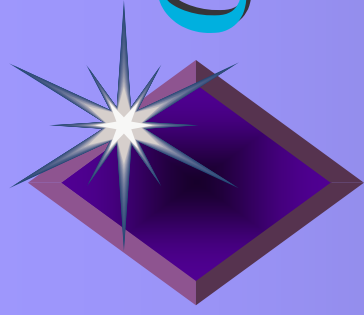
Containment Purge Accountability

Richard Conatser
Calvert Cliffs



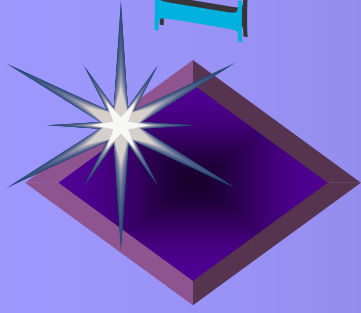
Objectives

- ◆ Anatomy of a containment purge
- ◆ RMS is a flow indicator
- ◆ RMS used for accountability
- ◆ Grab sample limitations
- ◆ Accountability methods



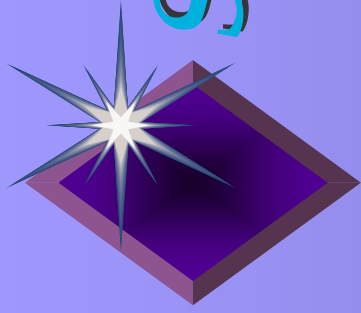
Overview of Topics

- ◆ Introduction
- ◆ Sampling
- ◆ Preliminary Release Permit
- ◆ Radiation Monitoring System
- ◆ Setpoints and the Ballistic Deficit
- ◆ Purge Fan Flow Rate
- ◆ “Reckoning” and Final Accountability



Introduction

- ◆ EMS is used for accountability
- ◆ Accountability based on grab samples
- ◆ Historical use of RMS at CCNPP
- ◆ Procedure somewhat non-specific
- ◆ New version of EMS at CCNPP
- ◆ New EMS worked differently
- ◆ Initiative to more clearly define process

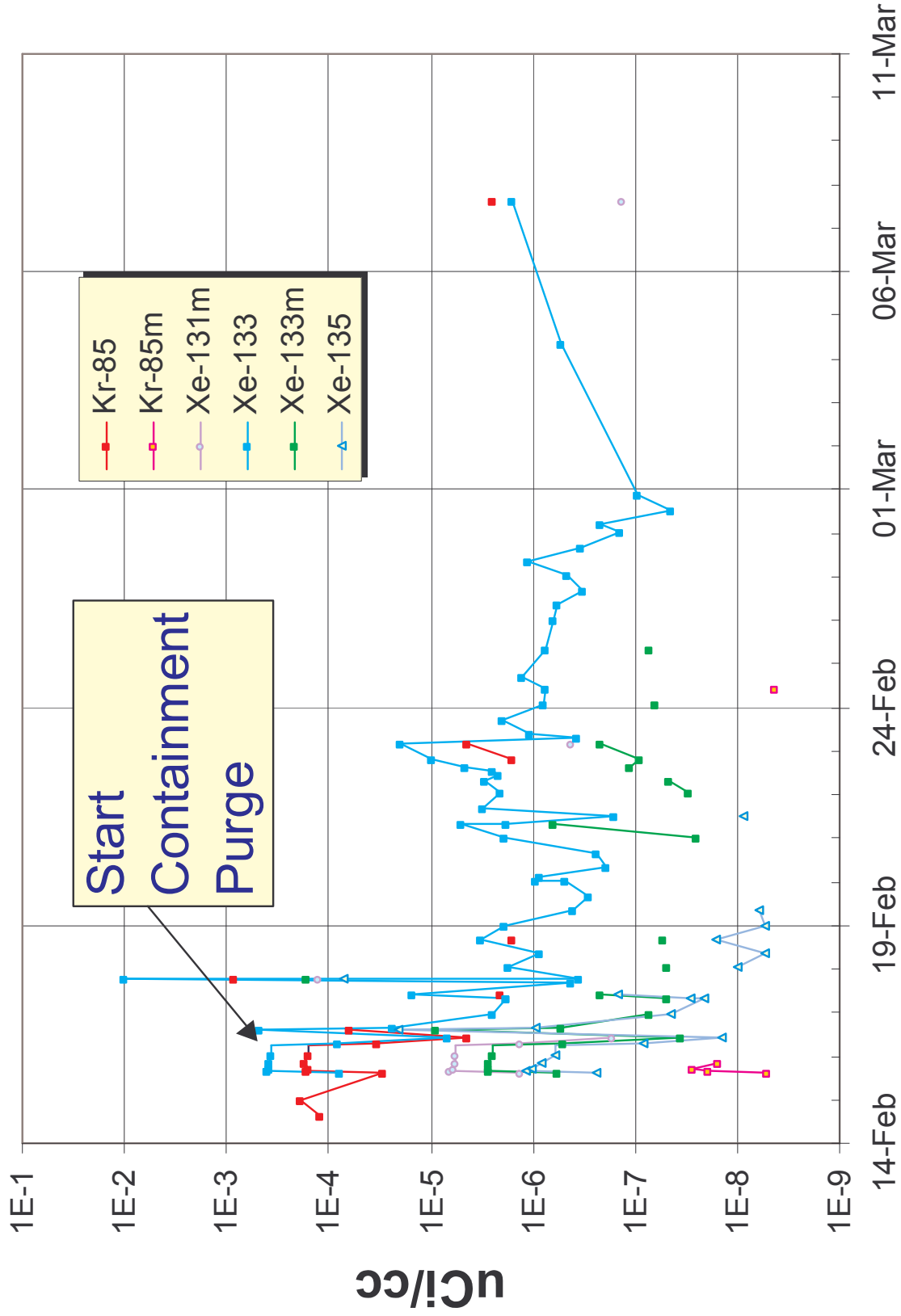


Sampling

- ◆ Sample containment atmosphere
- ◆ Multiple samples
- ◆ Preliminary release permit
- ◆ Containment samples every 8 hours
- ◆ 59 samples over 3 weeks

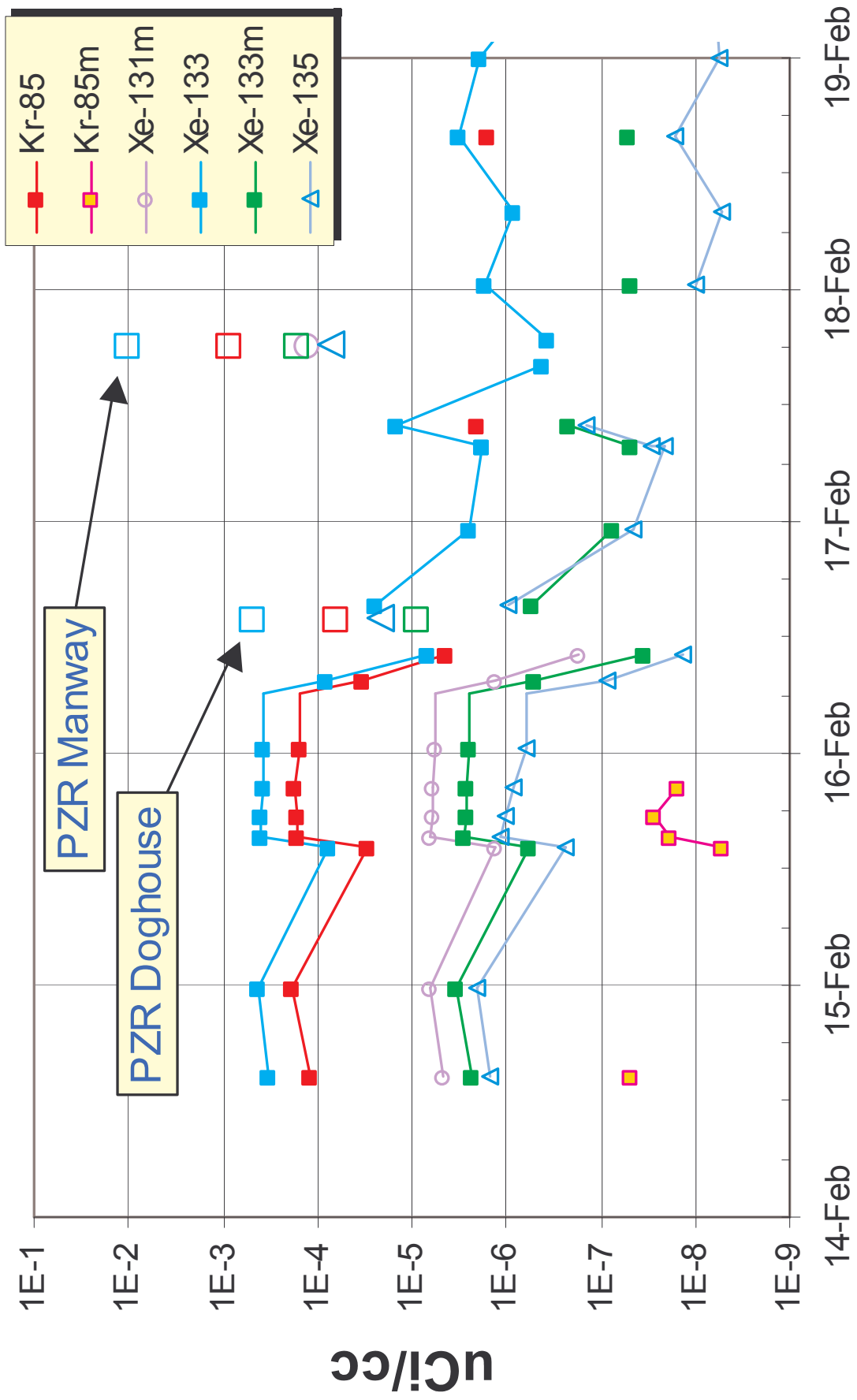
Samples of Containment Atmosphere

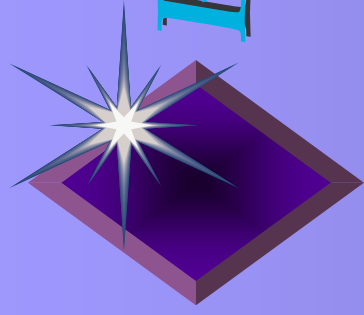
RFO 2003



Samples of Containment Atmosphere

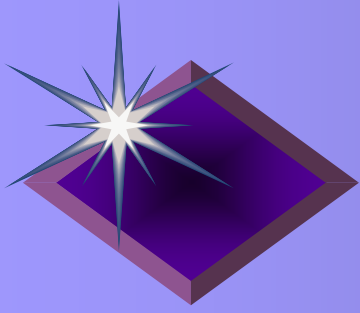
RFO 2003





Preliminary Permit

- ◆ Use EMS at CCNPP
- ◆ Method 1: $C_i = (\text{Ctmt Vol}) * (\text{Act})$
- ◆ Method 2: $C_i = (\text{Flow}) * (\text{Time}) * (\text{Act})$
- ◆ Other methodologies could be used
- ◆ Disadvantage of $(\text{Ctmt Vol}) * (\text{Act})$ is build-in
- ◆ Disadvantage of $(\text{Ctmt Vol}) * (\text{Act})$ is sample
- ◆ Continuous monitoring has advantages⁸

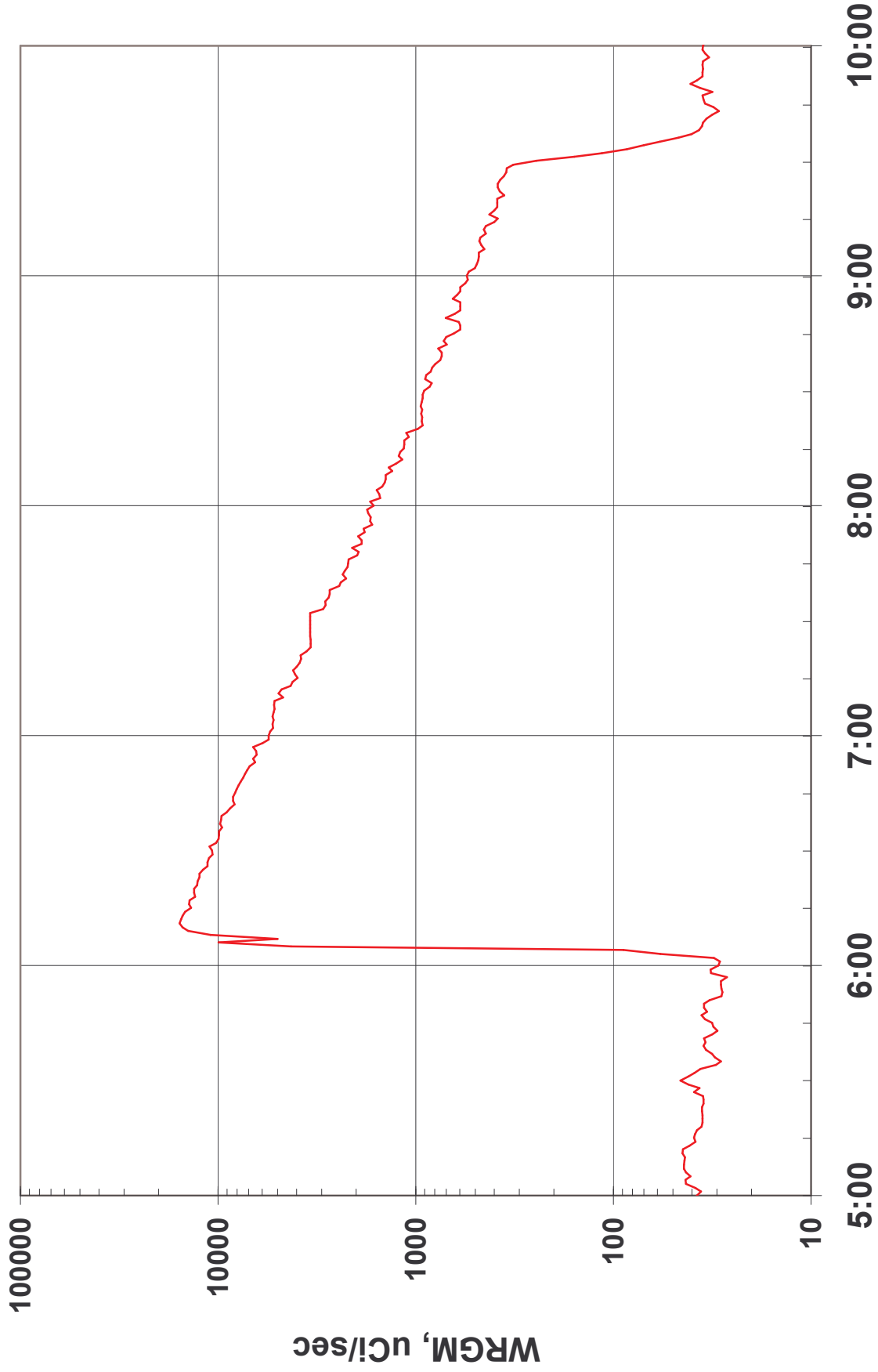


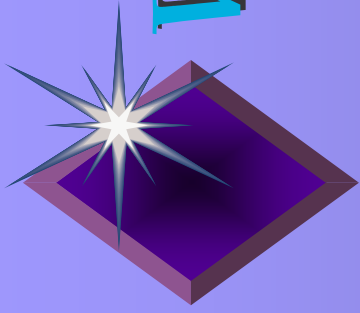
RMS

- ◆ Continuous monitoring
- ◆ WRGM is on Plant Vent Stack
- ◆ Typical bkg is 18-24 uCi/sec
- ◆ uCi/sec as Xe-133 equivalent activity
- ◆ Can convert to true uCi/sec
- ◆ Use grab samples to convert
- ◆ First, look at WRGM trace

U-2 Containment Purge

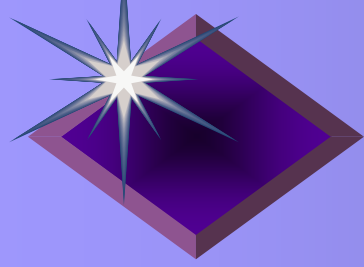
Initial Containment Purge: 16-Feb-2003





WRGM Setpoint

- ◆ $S = K_{sf} * c * \{ F_p * \sum A_i e_i + Bkg \}$
- ◆ $K_{sf} = 1.5$, safety factor
- ◆ $c = 1E6cc/m^3$
- ◆ F_p = purge fan flow rate
- ◆ A_i = Activity of nuclide in, uCi/cc
- ◆ e_i = Xe-133 equiv conversion factor

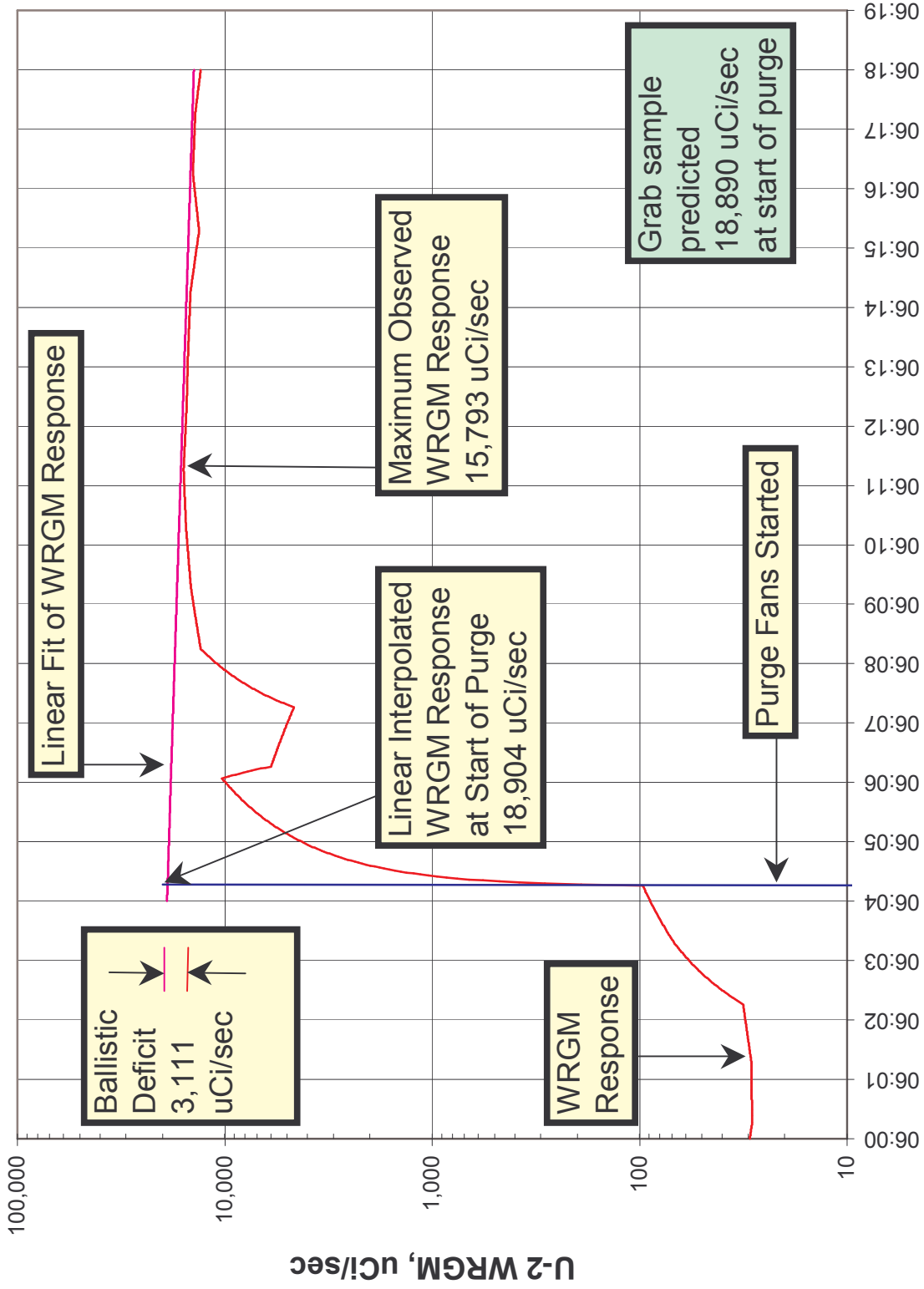


Expected WRGM Reading

- ◆ Use sample results
- ◆ plug into formula (without Ksf)
- ◆ Expected 18,890 uCi/sec Xe-Equiv
- ◆ Observed 15,793 uCi/sec Xe-Equiv
- ◆ -19.6% difference
- ◆ There appears to be a deficit

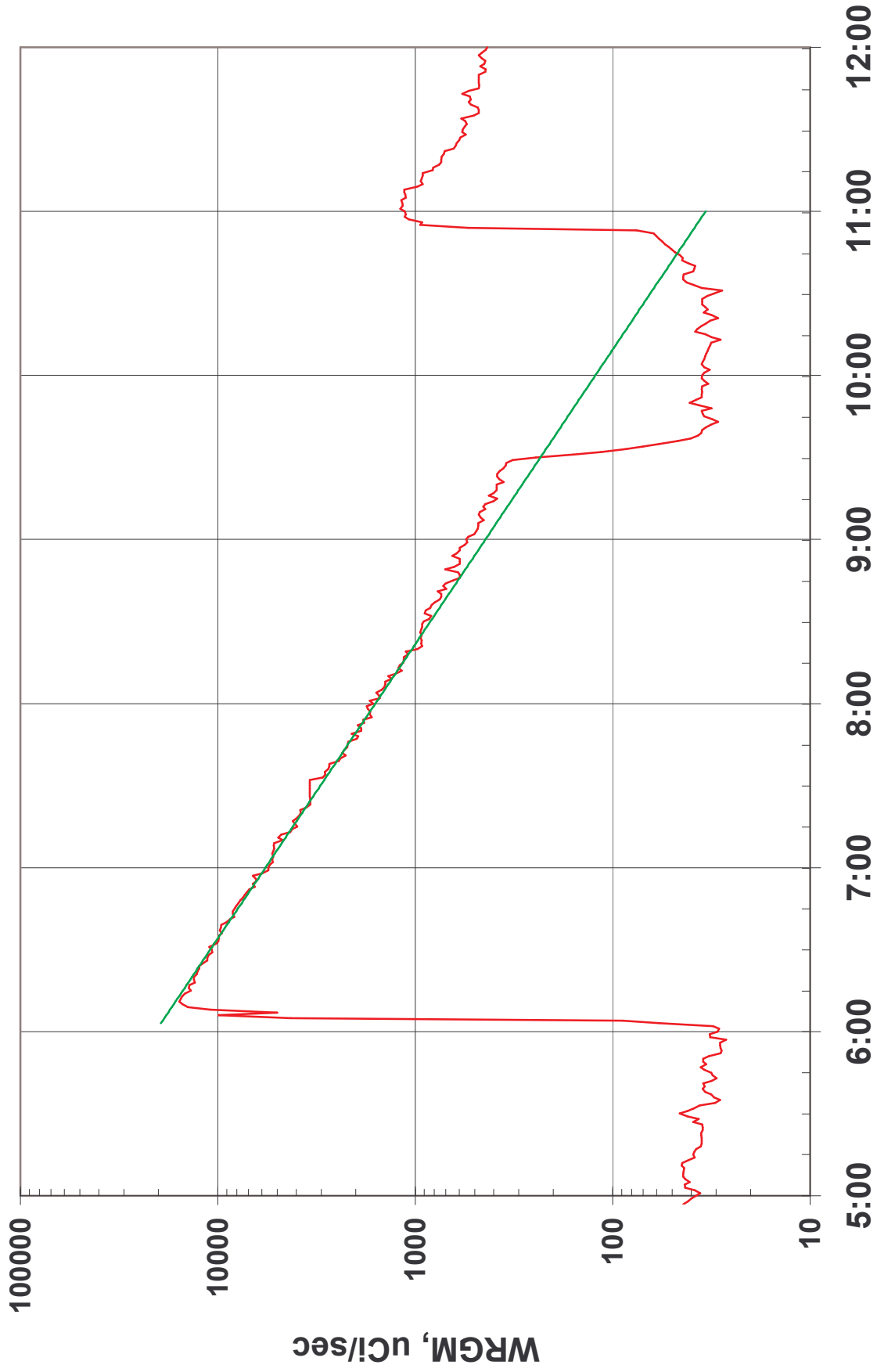
Ballistic Deficit

Initial Containment Purge 16-Feb-2003 RFO



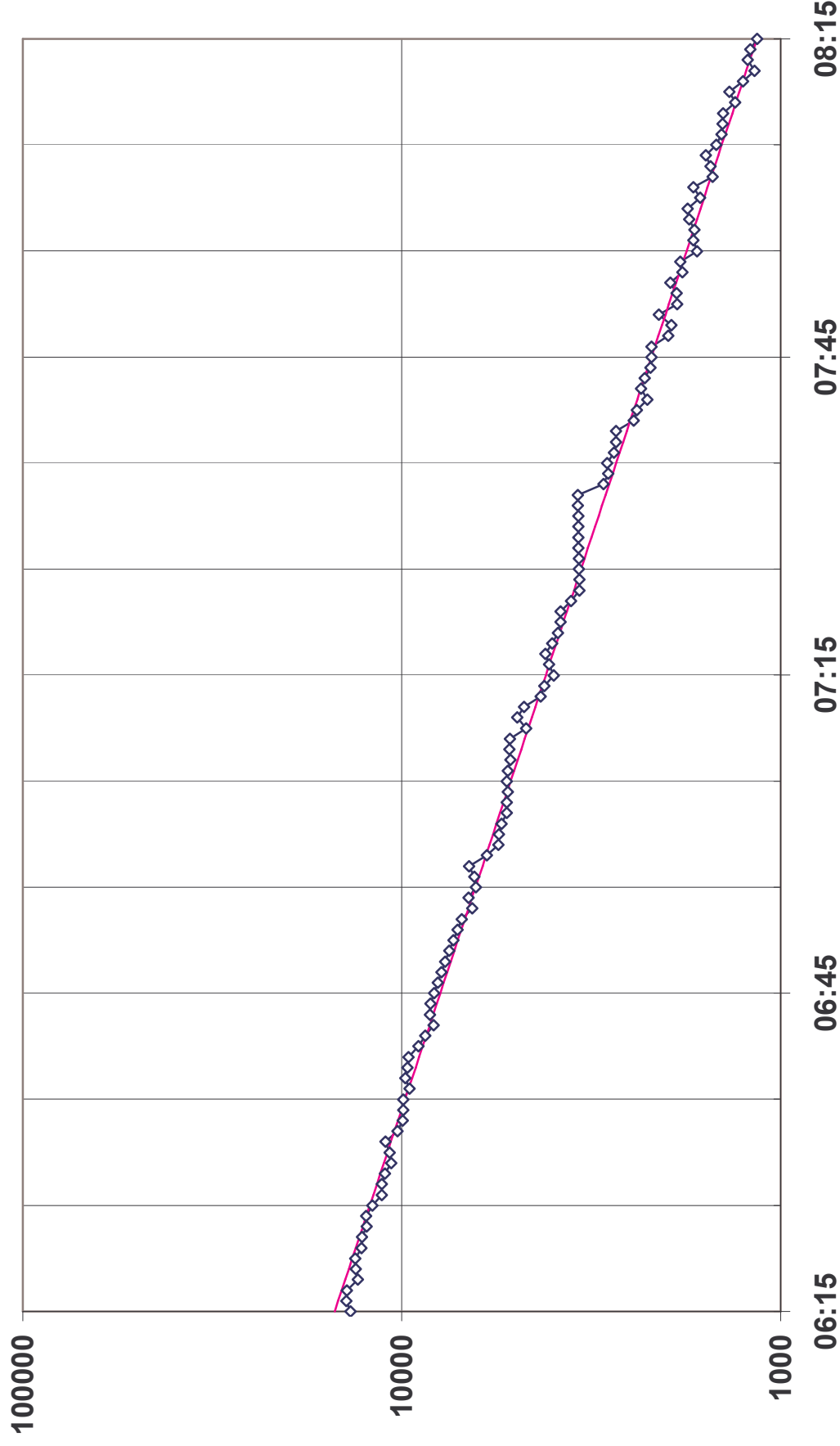
U-2 Containment Purge

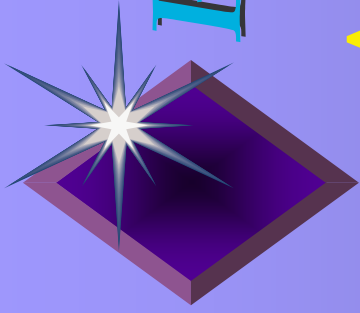
Initial Containment Purge: 16-Feb-2003



U-2 WRGM

16-Feb-03, U2 RFO Initial Purge, Linear Fit of Data





Purge Fan Flow Rate

$$A_t = A_0 e^{-\beta \Delta t}$$

A_t = WRGM response at time, t (uCi/sec)

A_0 = Initial WRGM response (uCi/sec)

Δt = elapsed time

$$\beta = F_p / V_c$$

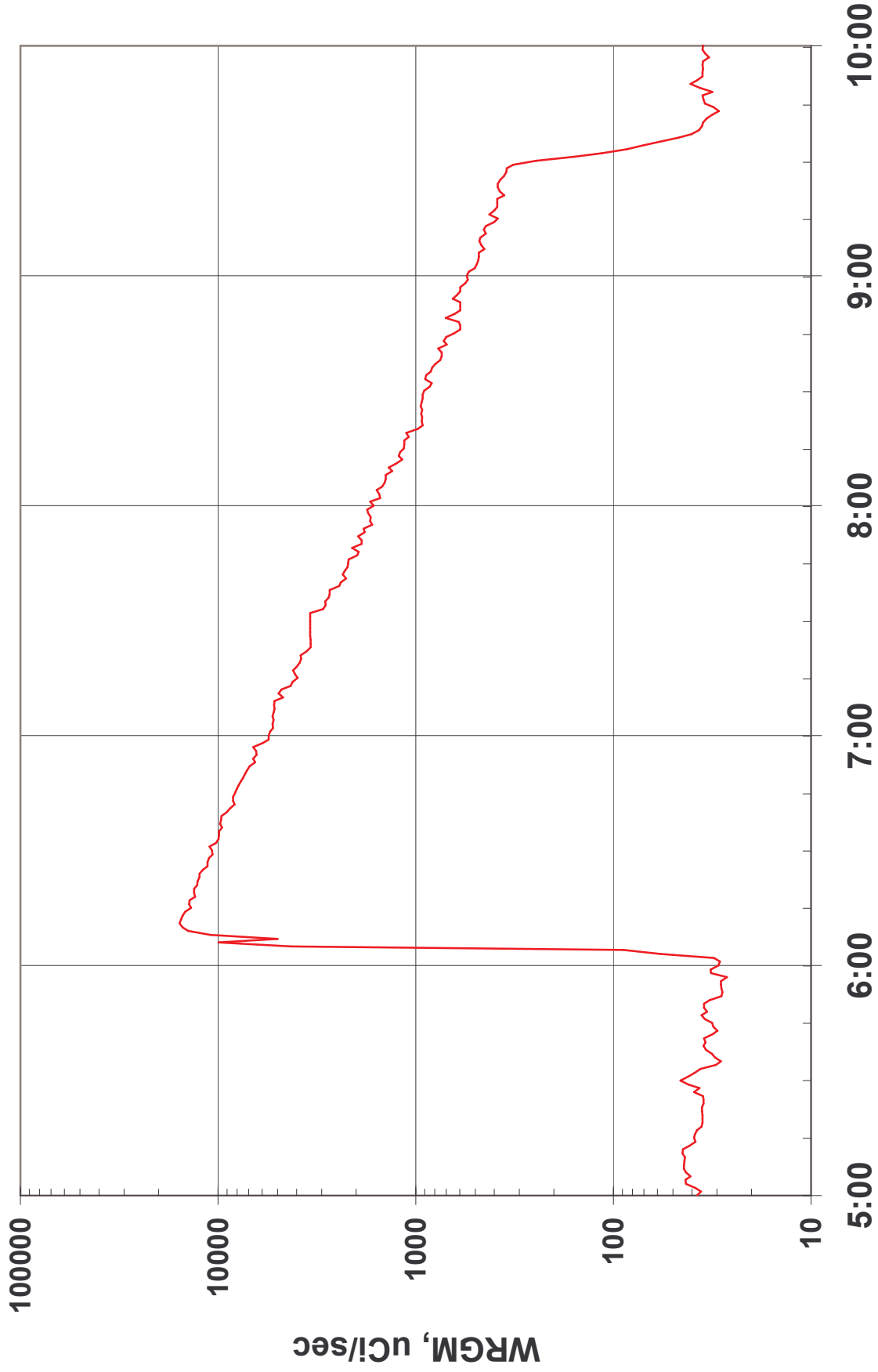
β = purification rate constant, (sec^{-1})

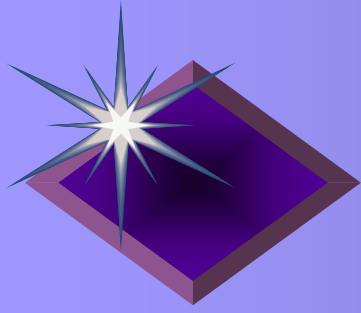
F_p = containment purge fan flow rate (m^3/sec)

V_c = containment volume, $5.66\text{E}4 \text{ m}^3$

U-2 Containment Purge

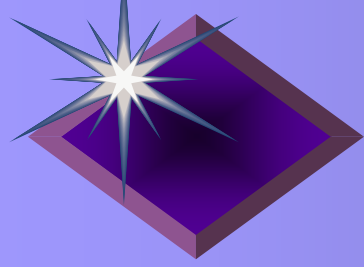
Initial Containment Purge: 16-Feb-2003





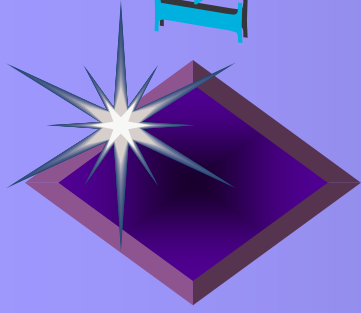
Xe-133 Equivalents

- ◆ 1 uCi Kr-85 = 3.3 uCi Xe-133
- ◆ 1 uCi Xe-135 = 3.6 uCi Xe-133
- ◆ 1 uCi Xe-133m = 0.15 uCi Xe-133
- ◆ From the 15-Feb 15:30 sample,
5.66 E-4 uCi/cc is
= 9.34E-4 uCi/sec as Xe-133 Equiv.
- ◆ 49 Ci Xe-Eq * (5.66/9.34) = 29.8 Ci



Total Activity *Discharged*

- ◆ 29.8 Ci = Area under WRGM trace
- ◆ 32.0 Ci = Vol * Act for 15:30 sample
- ◆ 30.2 Ci = Vol * Act for 00:34 sample
- ◆ Good agreement between WRGM integration and Vol*Act

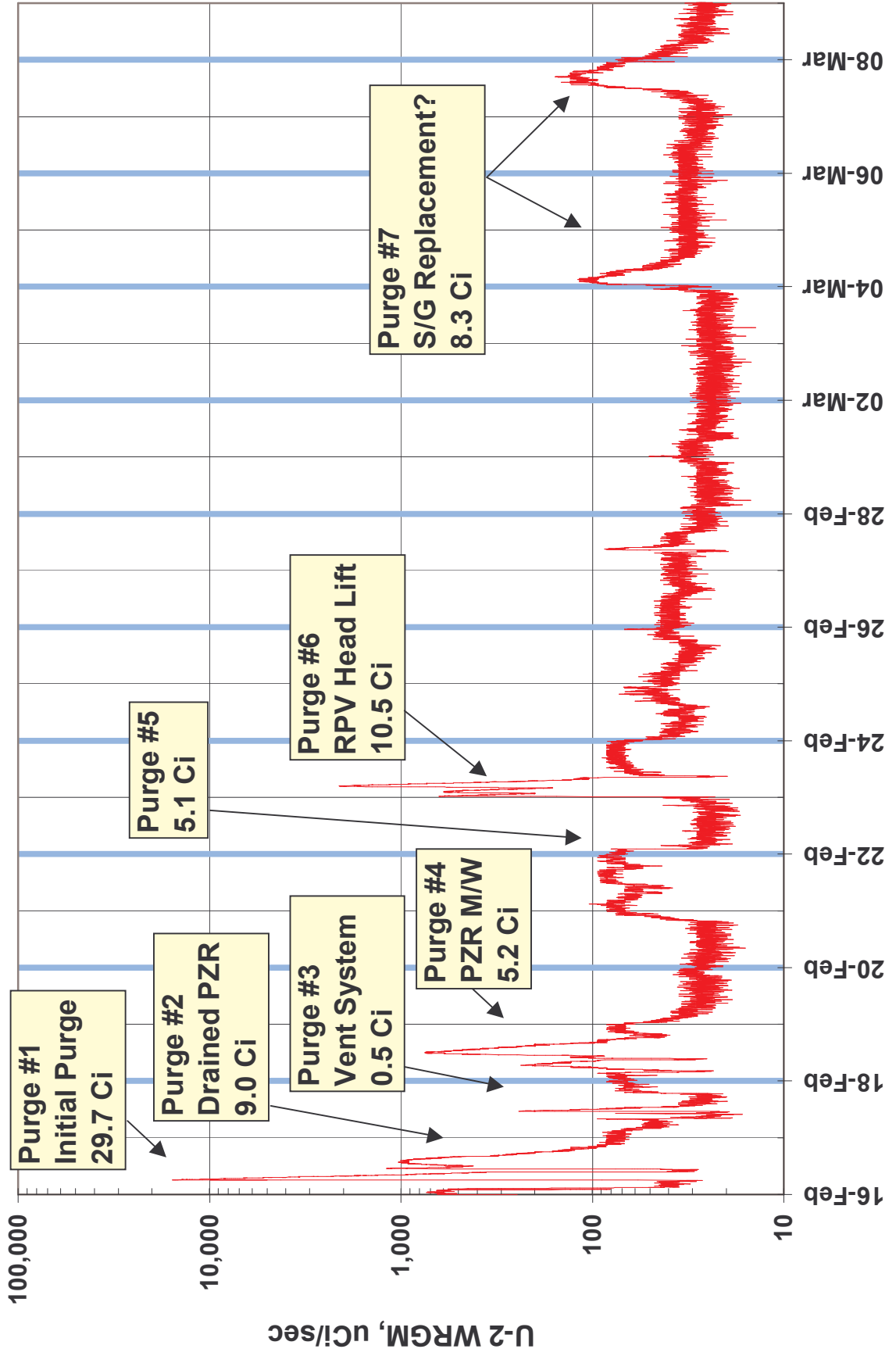


Reckoning

- ◆ We used WRGM to calculate curies discharged
- ◆ WRGM Ci agree well with sample curies
- ◆ We used WRGM to check setpoint
- ◆ Setpoint agreed well with sample
- ◆ We have a lot of confidence with WRGM
- ◆ Can use WRGM for subsequent

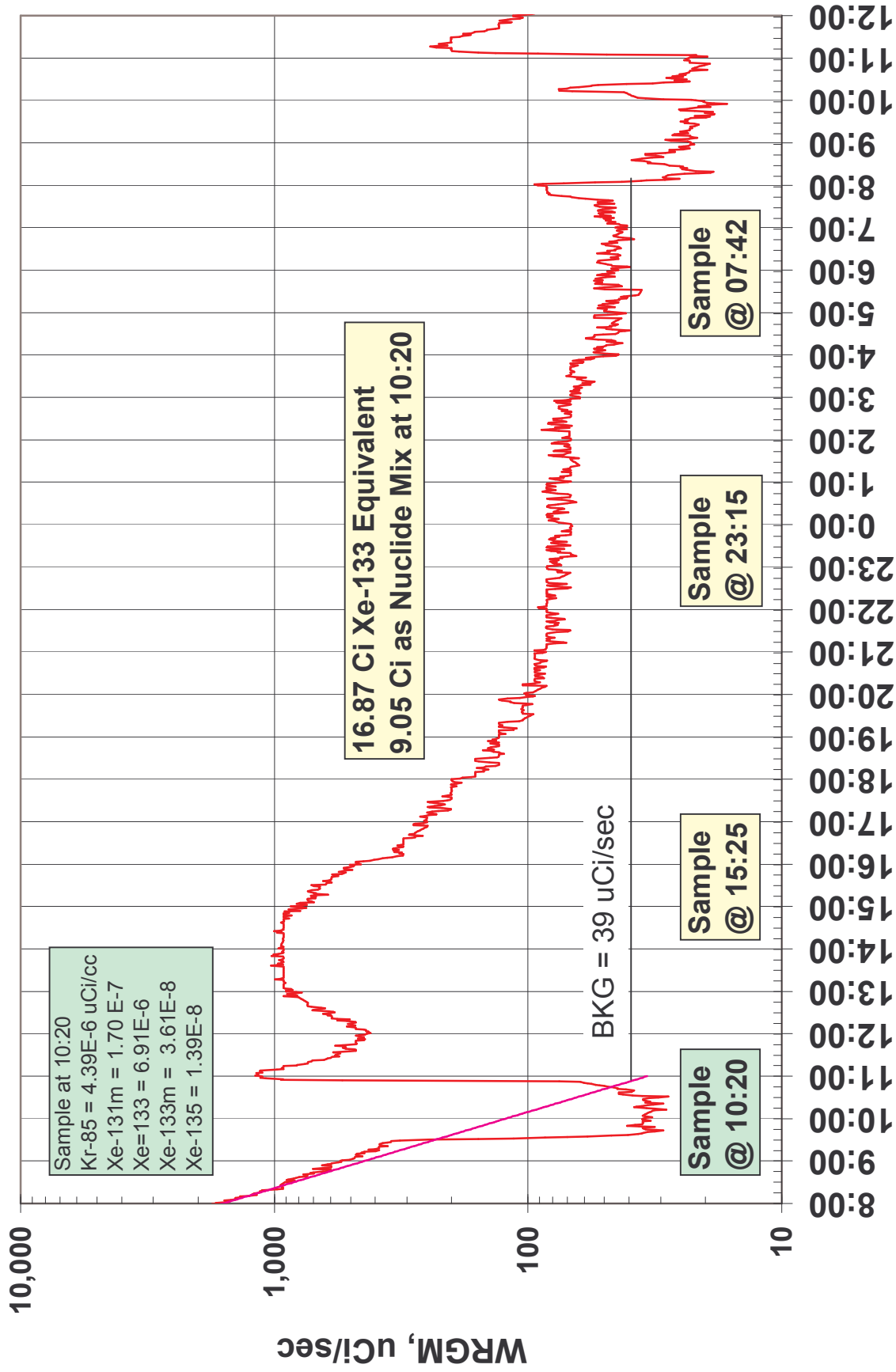
Containment Purge

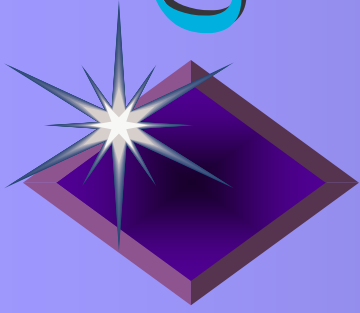
U-2 RFO 2003



U-2 Containment Purge

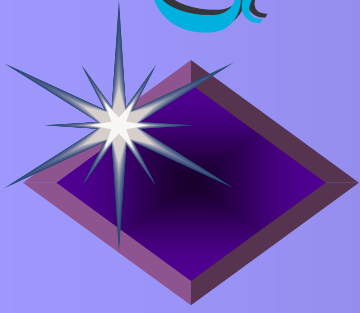
Purge #2, 16-Feb to 17-Feb-2003





Conclusion

- ◆ Cmtt purge accountability can be challenging
- ◆ Use all the tools at your disposal to accurately account for discharges
- ◆ Use RMS to their fullest capability
- ◆ Have high confidence in effluent control program



Questions?