

# Pilot Program for C-14 Sampling at Diablo Canyon Power Plant



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# Diablo Canyon C-14 Sampling

## Sampling Conducted:

- Liquid systems  
(primary systems)
  
- Gaseous systems + control  
(sampled similarly to Summer Station)



# Diablo Canyon C-14 Sampling

## Liquid Samples Locations

- Reactor Coolant System  
(RCS)
- Refueling Water Storage Tanks  
(RWST)
- Primary Water Storage Tanks  
(PWST)
- Spent Fuel Pools (SFP)
- Liquid Holdup Tanks (LHUT)
- Liquid Radwaste (LRW)

# Diablo Canyon C-14 Sampling

System	Unit 1 $\mu\text{Ci/ml}$	Unit 2 $\mu\text{Ci/ml}$
RCS	2.24E-04	1.78E-04
LHUT	1.91E-04	----
RWST	1.31E-06	2.26E-06
SFP	2.78E-07	3.26E-07
PWST	3.93E-07	2.24E-07
LRW	1.36E-06	----

- Detection limit  $\sim 4.5\text{E-}08 \mu\text{Ci/ml}$
- Samples shipped to GEL; full bottles, no preservation, no refrigeration



# Diablo Canyon C-14 Sampling

## Estimated C-14 Discharge In LRW

(Two Operating Units)

3-year avg. LRW volume = 1.5E6  
gallons

LRW C-14 conc. = 1.36E-6 $\mu$ Ci/ml

~ 8 millicuries C-14 discharge  
estimated

~ 43 millicuries total discharged in 2009  
(not including H-3, NG, GAlpha)



# Diablo Canyon C-14 Sampling

## Gaseous Sample Locations

- Plant Vent (PV)
- Containment Atmosphere (CNT)
- Waste Gas Header  
(WGH)
- Waste Gas Decay Tanks  
(GDT)

# Diablo Canyon C-14 Sampling

## DCPP C-14 gaseous sampling conducted April 26-28, 2010

Location	CO2 Result pCi/Liter	CO2 MDC pCi/Liter	Methane Result pCi/Liter	Methane MDC pCi/Liter	Methane to CO2 ratio
U-1 CTMT Atmosphere	39.60	0.20	440.40	0.66	11.1
U-2 CTMT Atmosphere	41.20	0.20	1,538.80	1.34	37.3
U-1 Plant Vent	0.18	0.08	2.12	0.08	11.8
U-2 Plant Vent	1.31	0.08	0.74	0.08	0.56
U-1 Waste Gas Header	3,810	40,500	2,736,190	35,600	718.2
U-2 Waste Gas Header	4,700	18,900	435,300	20,300	92.6
Gas Decay Tank 2-1	20,600	19,000	1,839,400	18,700	89.3
Control Sample	0.07	0.09	0.09	0.09	1.29

Plant C-14 in particulate form was < mdc of 0.08 pCi/Liter



# Diablo Canyon C-14 Sampling

## Plant Vent Results

- Total C-14 =  $2.15\text{E-}09$   $\mu\text{Ci/ml}$
- C-14 as  $\text{CO}_2$  =  $7.45\text{E-}10$   $\mu\text{Ci/ml}$
- $\text{CO}_2$  accounts for ~35% of C-14





# Diablo Canyon C-14 Sampling

## Containment Atmosphere Results

- Total C-14 =  $1.03\text{E-}06$   $\mu\text{Ci/ml}$
- C-14 as  $\text{CO}_2$  =  $4.04\text{E-}8$   $\mu\text{Ci/ml}$
- $\text{CO}_2$  accounts for ~4% of C-14



# Diablo Canyon C-14 Sampling

## Gas Decay Tank Results

- Total C-14 =  $1.86\text{E-}03$   $\mu\text{Ci/ml}$
- C-14 as  $\text{CO}_2$  =  $2.06\text{E-}05$   $\mu\text{Ci/ml}$
- $\text{CO}_2$  accounts for  $\sim 1\%$  of C-14

# Diablo Canyon C-14 Sampling Critical Receptor Locations

Sector	Receptor	Distance (miles)	X/Q	D/Q	Comments
ESE	Oat Hay, Sugar Bean Fields	3.3	1.7E-07	1.1E-09	Ingestion pathway
NW	Site Boundary	0.5	5.0E-06	1.8E-08	Release Rate, HASPs calcs
NNW	Full Time Residence	1.5	6.3E-07	2.0E-09	Inhalation pathway

# Diablo Canyon C-14 Sampling



Looking Northwest

# Diablo Canyon C-14 Sampling



Looking Southwest

# Diablo Canyon C-14 Sampling

## Gaseous C-14 Discharge Per Operating Unit

- Spreadsheet = 5.41 curies total  
= 1.08 as CO<sub>2</sub> (~20%)
- Observed
  - Plant Vent = 5.4 curies
  - Containment = 0.2 curies
  - GDT = 1.2 curies
  - Total = 6.8 curies total  
= 1.9 curies as CO<sub>2</sub>  
(~28%)



# Diablo Canyon C-14 Sampling

Dose Comparison  
(mrem/yr)

Spreadsheet Observed Data	Spreadsheet Model Plant	Typical DCPD Dose, Including Ingestion Pathway
4.57E-02	2.62E-02	2.00E-2



Questions?