

**Contact Report  
Gasoline Area Source**

**From:** Julia Cavalier, MACTEC Federal Programs

**Date:** August 24, 2004

**Contact:** Dennis Goodenaw

**Organization:** California Air Resources Board (CARB)

**Contact Summary:**

I contacted Mr. Goodenaw to request information on the cost of installing vapor balancing equipment at gasoline dispensing facilities. Mr. Goodenaw stated that the State of California has certified a number of vapor balance systems and that each certified system is documented and system components can be priced out. He estimated that the average list price of a California-certified vapor balance system was about \$2,000 - 2,500. He stated that this does not include the cost of installation, which could vary considerably depending on the age and location of the storage tanks. He also pointed out that his estimate does not account for any equipment discounts that might be available to large gasoline retailers with multiple locations. He further explained that certified systems must include a pressure vacuum vent valve.

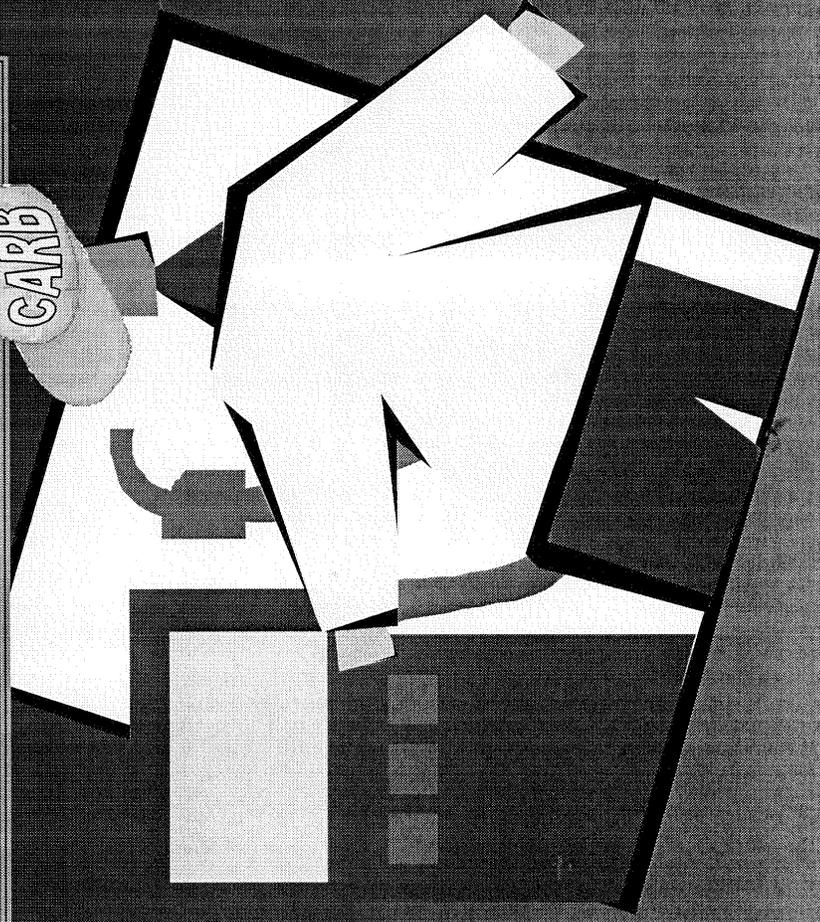
Additional information downloaded from the CARB website is attached.

# Enhanced Vapor Recovery Amendments Workshop

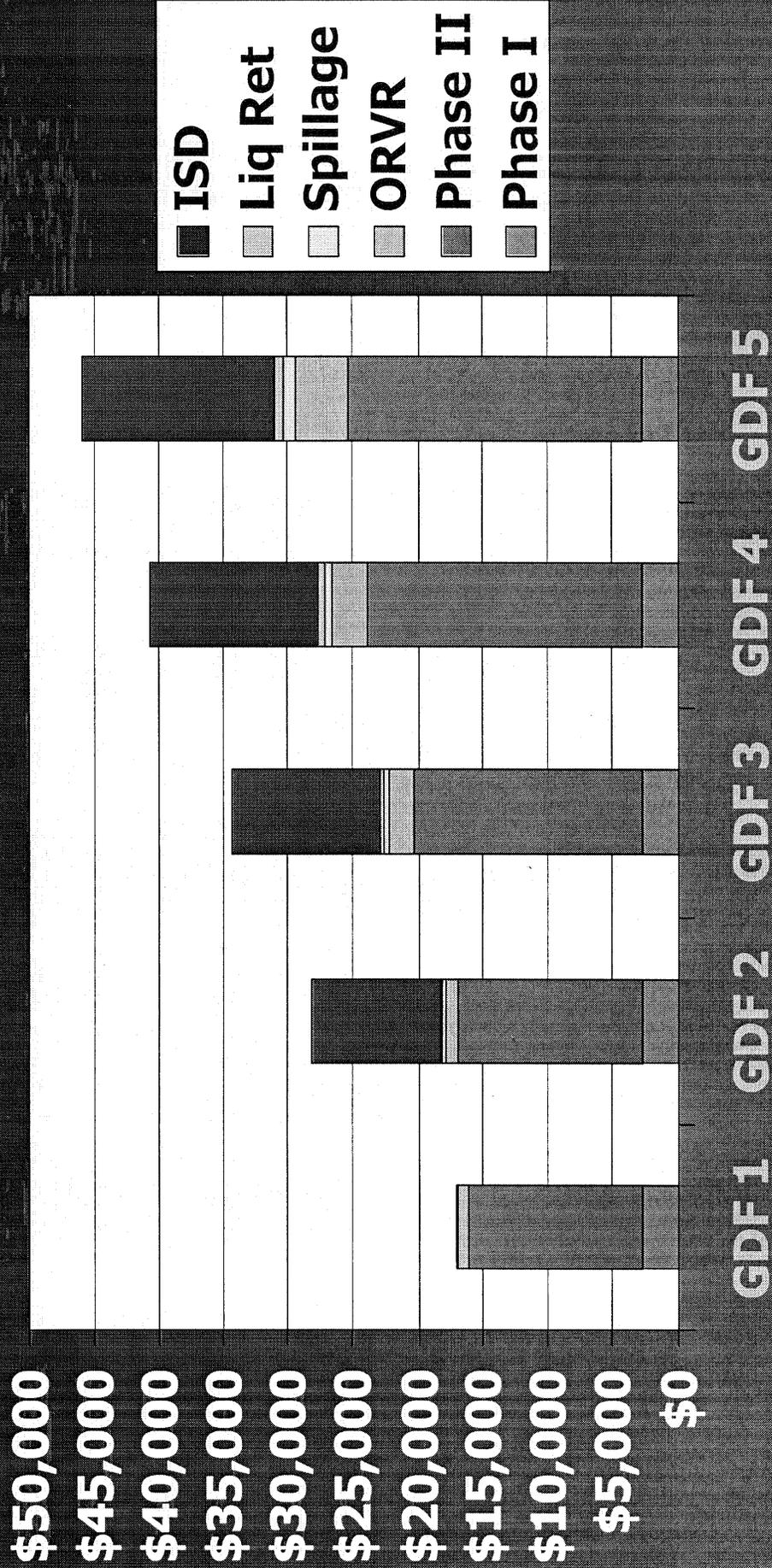
September 9, 2002

Air Resources Board

California Environmental  
Protection Agency



# EVR Total Equipment and Installation Costs



## Annual field test costs for balance systems

- Existing balance system Executive Orders require testing every 5 years
- EVR systems will require annual testing
- Added costs associated with balance system increased testing
- Estimated \$800 (SCAQMD rule)

## EVR COST ANALYSIS SPREADSHEET AS OF AUGUST 30, 2002

### CHANGES TO COST ANALYSIS SINCE MARCH 29TH TECH REVIEW REPORT

**1 Corrected Equipment Costs** by replacing 0.25 with 0.88 on Summary worksheet to correct error in original cost analysis. This change increased equipment costs by a factor of 3.5 as compared to the Feb. 2000 EVR staff report.

	Present Value	
	Annualized Costs (AC)	
Year 1	(AC)	= (AC)
Year 2	(AC)(1/[1+ i])	= (AC)(0.91)
Year 3	(AC)(1/[1+ i] <sup>2</sup> )	= (AC)(0.83)
Year 4	(AC)(1/[1+ i] <sup>3</sup> )	= (AC)(0.75)

Assume 25% of stations upgrade to EVR in each year

$$\begin{aligned} \text{Total Annual Equipment cost} &= (0.25)(AC) + (0.25)(AC)(0.91) + (0.25)(AC)(0.83) + (0.25)(AC)(0.75) \\ &= (0.25)(AC) + (0.23)(AC) + (0.21)(AC) + (0.19)(AC) \\ &= (0.88)(AC) \end{aligned}$$

**2 Reduced R&D and certification costs** by halving the number of expected certified systems:

Phase I	was 14	now 7
Phase II	was 64	now 32
ISD	was 16	now 8

**3 Increased ISD "worst-case" equipment costs** based on 6/13/02 Veeder-Root e-mail

	tech rev	now
TLS-350ISD	\$4,500	\$3,995
Dispenser Interface		\$670
Pressure sensor	\$750	\$595
Flow sensor	\$900	\$885
Inventory sensor	not incl	\$1,095

	GDF1	GDF2	GDF3	GDF4	GDF5
EVR Tech Review	\$6,150	\$6,600	\$7,950	\$9,300	\$10,650
Now	\$8,883	\$9,625	\$10,656	\$11,980	\$13,308

**4 Reduced ISD installation costs** based on 4/15/02 Veeder-Root comment letter

EVR ISOR was \$1230 per dispenser  
 EVR Tech Review doubled cost to \$\$2560 per dispenser

Veeder-Root costs based on experience in installing ISD at nine sites (\$55/hr):  
 Two line items: Base install per facility and per-dispenser install

	Base	Per Dispenser	Example: GDF 3
New	\$250	\$125	\$250 + 3 x \$125 = \$625

Retrofit            \$300            \$200            \$300 + 3 x \$200 = \$900

The higher retrofit costs were used for the cost analysis.

**5 Revised ISD maintenance/calibration/repair costs**

EVR ISOR did not include these costs  
 EVR Tech Review assumed \$1200/yr as suggested by Glenn Co. APCD

Veeder-Root suggests costs depend on number of ISD components

	Unit Cost				
A/L sensor	\$300				
Pressure sensor	\$200				
Datalogger	\$50	TOTAL	GDF1	GDF2	GDF3
			\$550	\$700	\$1,150
					GDF4
					\$1,600
					GDF5
					\$2,050

**6 Revised ISD emission reductions from 6.6 to 8.5 tons/day as calculated in tech review report.**

**7 Revise ORVR emission reductions from 6.3 to 4.5 tons/day as calculated in tech review report.**

**8 Adjust ISD costs to 1999 Dollars**

The original EVR cost analysis was in terms of 1999 dollars. The ISD costs are in terms of 2001 dollars. The ISD costs have been adjusted to 1999 values by 0.94.

This is the ratio of the 1999 Consumer Price Index (CPI) to the 2001 CPI (166.6/177.1 = 0.941).

**9 Update to 1999 Gasoline Throughput**

The original EVR cost analysis used the 1997 total CA Gasoline throughput of 13.5 billion gallons. The throughput has been updated to the 1999 total CA gasoline throughput of 14.5 billion gallons

**10 Added costs for annual balance station field testing**

Currently, balance systems are required in most districts to be tested every five years. EVR will require annual testing of balance systems as part of ISD maintenance & calibration. Costs are estimated at \$800 annually, as estimated by the SCAQMD vapor recovery rule staff report.

**11 Clarified number of dispensers vs. number of fueling points for input variable table on summary page.**

For example, the original table denoted 2 dispensers for GDF1, but this is intended to be 1 dispenser with two fueling points as denoted in Table 2-12 of ISOR reference 26, USEPA Phase II Technical Guidance

**COST-EFFECTIVENESS SUMMARY**

**Input Values Used in Cost Analysis**

Input variable used in Cost Analysis	Input value for each Model GDF				
	1	2	3	4	5
Nominal Monthly Average Sales per GDF, gals/month-GDF	13,233	37,500	75,000	150,000	300,000
Population Distribution (EPA, 1991 adjusted to fit current po	4.7%	14.1%	45.7%	31.3%	4.2%
Estimated Number of GDFs (11,250 total)	531	1,586	5,136	3,522	475
Total Annual Sales, million gals/yr	84	769	4,981	6,830	1,843
Number of Processors per GDF (when applicable)	1	1	1	1	1
Number of Drop Tubes & Spill Buckets per GDF	2.5	2.5	2.5	2.5	2.5
Wtd-Avg Number of Nozzles per GDF (EPA, 1991)	2.5	3.25	6.5	9.75	16.25
Number of Fueling Points per GDF (EPA, 1991)	2	3	6	9	12

Est. population-wtd average gallons per month using popula 99,779 Total 1999 CA gasoline sales = 14,514,435,002 gals  
 Actual population-wtd average gallons per month 99,865 Total GDFs in CA in 1998 = 11,250

**Emission Reductions per Model GDF**

Module	Description	2010 ROG Reductions Statewide, tons/day	Emission Reductions by Model GDF and Module, tons/day				
			1	2	3	4	5
1	Phase I	5.5	0.03	0.29	1.89	2.59	0.70
2	Phase II	3.1	0.02	0.16	1.06	1.46	0.39
3	ORVR Compatibility	4.5	0.03	0.24	1.54	2.12	0.57
4	Liquid Retention	0.2	0.00	0.01	0.07	0.09	0.03
5	Spillage/Dripleless Nozzle	3.9	0.02	0.21	1.34	1.84	0.50
6	In-Station Diagnostics	8.5	0.05	0.45	2.92	4.00	1.08
	<b>Total</b>	<b>25.7</b>	<b>0.15</b>	<b>1.36</b>	<b>8.82</b>	<b>12.10</b>	<b>3.27</b>

**Cost-Effectiveness (C.E.) & Impacts to GDFs and Consumers**

Module	Description	Cost-Effectiveness by Model GDF and Module 1999 Dollars per Pound ROG Reduced					Overall Cost-Effectiveness by Module only
		1	2	3	4	5	
1	Phase I C.E. (Annual Costs/Annual Reductions)	\$12.54	\$3.94	\$1.84	\$0.81	\$0.28	\$1.33
	Annualized Equip Costs (assumes 25%/yr conve	\$270,908.86	\$809,282.83	\$2,620,239.69	\$1,796,722.67	\$242,440.47	
	Annualized R&D Costs (assume 5% of Total R&	\$16,580.38	\$49,530.38	\$160,366.04	\$109,964.48	\$13,998.15	
	Annualized Cert & Testing (assume 5% of Total	\$11,015.31	\$32,905.92	\$106,540.49	\$73,055.80	\$9,299.79	
	Annual Gasoline Recovery Credit	(\$5,889.43)	(\$53,721.55)	(\$347,871.82)	(\$450,073.46)	(\$121,461.18)	
2	Phase II C.E. (Annual Costs/Annual Reductions)	\$105.93	\$36.80	\$23.21	\$13.95	\$8.09	\$18.13
	Annualized Equip Costs (assumes 25%/yr conve	\$1,120,673.38	\$3,621,113.67	\$15,559,187.07	\$13,298,771.89	\$2,151,227.21	
	Annualized R&D Costs (assume 50% of Total R	\$165,803.84	\$495,303.84	\$1,603,660.35	\$1,099,644.78	\$148,380.38	
	Annualized Cert & Testing (assume 50% of Total	\$110,153.14	\$329,059.17	\$1,065,404.92	\$730,558.04	\$98,577.73	
	Annual Gasoline Recovery Credit	(\$3,319.50)	(\$30,279.42)	(\$196,073.21)	(\$268,898.44)	(\$72,567.53)	
3	ORVR Compatibility (Annual Costs/Annual Reduct	\$6.92	\$2.66	\$2.20	\$1.46	\$0.96	\$1.74
	Annualized Equip Costs (assumes 25%/yr conve	\$81,712.63	\$342,102.01	\$2,215,268.25	\$2,278,544.99	\$456,764.76	
	Annualized R&D Costs (assume 10% of Total R	\$33,160.77	\$99,060.77	\$320,732.07	\$219,928.96	\$29,676.08	
	Annualized Cert & Testing (assume 10% of Total	\$22,030.63	\$65,811.83	\$213,080.98	\$146,111.61	\$19,715.55	
	Annual Gasoline Recovery Credit	(\$4,818.63)	(\$43,954.00)	(\$268,511.70)	(\$390,336.44)	(\$105,339.96)	
4	Liquid Retention (Annual Costs/Annual Reductions)	\$62.19	\$23.14	\$17.81	\$11.96	\$9.04	\$14.49
	Annualized Equip Costs (assumes 25%/yr conve	\$25,391.78	\$98,608.32	\$638,534.33	\$656,773.37	\$147,702.67	
	Annualized R&D Costs (assume 5% of Total R	\$16,580.38	\$49,530.38	\$160,366.04	\$109,964.48	\$14,838.04	
	Annualized Cert & Testing (assume 5% of Total	\$11,015.31	\$32,905.92	\$106,540.49	\$73,055.80	\$9,857.77	
	Annual Gasoline Recovery Credit	(\$214.16)	(\$1,953.51)	(\$12,649.88)	(\$17,348.29)	(\$4,681.78)	
5	Spillage/Dripleless Nozzle (Annual Costs/Annual Red	\$2.95	\$0.95	\$0.67	\$0.37	\$0.22	\$0.50
	Annualized Equip Costs (assumes 25%/yr conve	\$25,391.78	\$98,608.32	\$638,534.33	\$656,773.37	\$147,702.67	
	Annualized R&D Costs (assume 5% of Total R	\$16,580.38	\$49,530.38	\$160,366.04	\$109,964.48	\$14,838.04	
	Annualized Cert & Testing (assume 5% of Total	\$11,015.31	\$32,905.92	\$106,540.49	\$73,055.80	\$9,857.77	
	Annual Gasoline Recovery Credit	(\$4,176.14)	(\$38,093.46)	(\$246,672.75)	(\$338,291.58)	(\$91,294.64)	
6	In-Station Diagnostics (Annual Costs/Annual Redu	\$34.15	\$12.17	\$7.39	\$4.29	\$2.38	\$5.71
	Annualized Equip Costs (assumes 25%/yr conve	\$1,109,949.41	\$3,694,016.46	\$14,999,331.94	\$12,366,277.05	\$1,949,645.78	
	Annualized R&D Costs (assume 25% of Total R	\$78,209.36	\$233,633.89	\$756,443.56	\$518,700.37	\$69,990.75	
	Annualized Cert & Testing (assume 25% of Total	\$51,959.03	\$155,216.59	\$502,549.49	\$344,602.85	\$46,498.93	
	Annual Gasoline Recovery Credit	(\$8,586.65)	(\$78,324.73)	(\$507,188.76)	(\$695,568.08)	(\$187,712.73)	
	<b>Total Annual Costs by Model GDF Category</b>	<b>\$3,151,127.19</b>	<b>\$10,042,799.94</b>	<b>\$40,354,718.45</b>	<b>\$32,501,954.51</b>	<b>\$4,997,954.73</b>	<b>\$91,048,555</b>
	<b>Total Annual Costs per each GDF in a Model GDF</b>	<b>\$5,934.33</b>	<b>\$6,331.16</b>	<b>\$7,857.46</b>	<b>\$9,229.05</b>	<b>\$10,517.58</b>	<b>overall annual cost</b>
	Per-gallon cost increase for consumers, cents/gal	<b>3.74</b>	<b>1.31</b>	<b>0.81</b>	<b>0.48</b>	<b>0.27</b>	<b>0.63</b>
	Non-Wtd Cost-Effectiveness for All Modules by M	<b>\$28.90</b>	<b>\$10.10</b>	<b>\$6.27</b>	<b>\$3.68</b>	<b>\$2.10</b>	<b>vg. per-gal increas</b>
	Cost-Effectiveness without ISD	<b>\$17.60</b>					

Notes: (cents per gallon)  
 Gasoline price/gal assu \$1.50  
 Per-gallon increase for consumers assumes all costs passed on to consumers  
 Gasoline density, lb/gal 6.3

**OVERALL COST EFFECTIVENESS: Total costs/ Total Emission Benefits**  

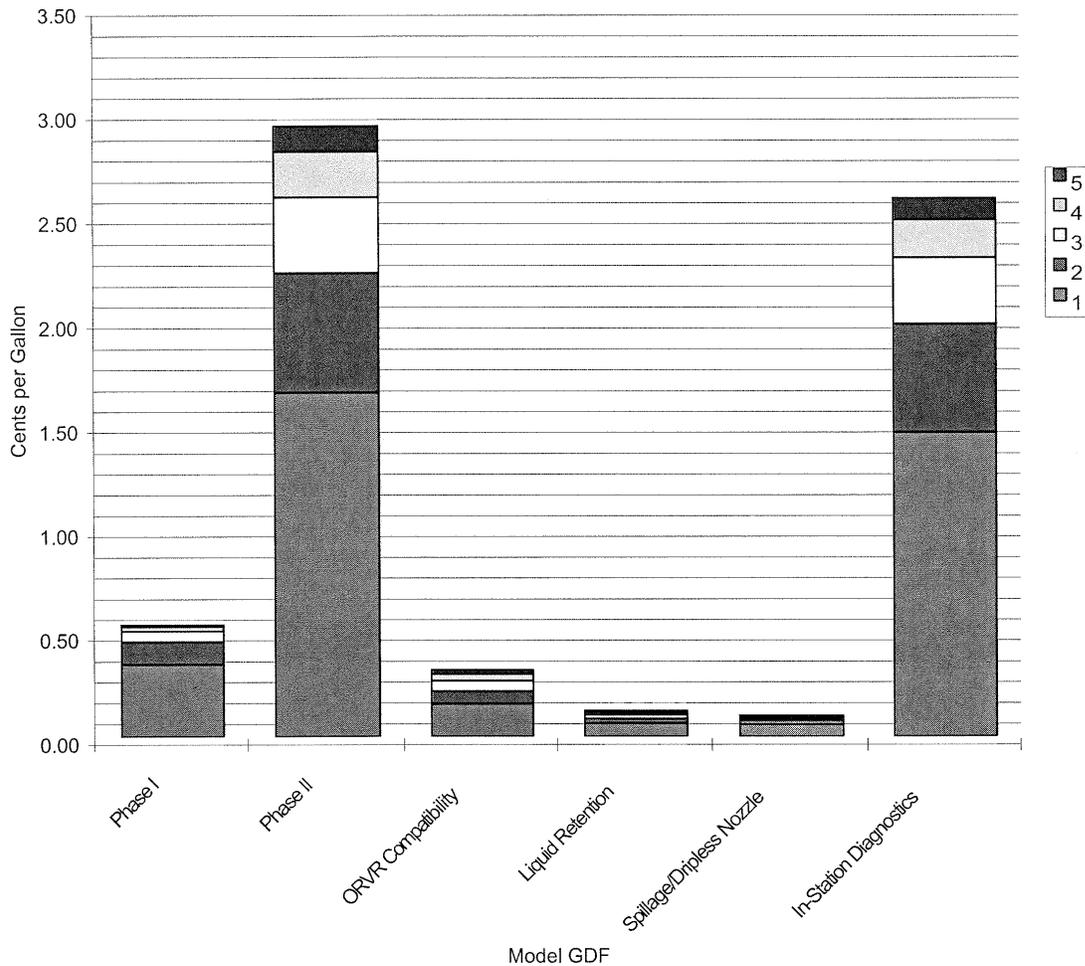
$$= (\text{costs } [\$/\text{yr}]) / (\text{emissions} [\text{tons}/\text{day}] \{1\text{ton}/2000\text{lb}\} \{1\text{yr}/365\text{days}\})$$

$$= \quad \quad \quad \mathbf{\$4.85 \text{ dollars}/\text{lb}}$$

**Per-Gallon Cost Increase by Module and Model GDF**

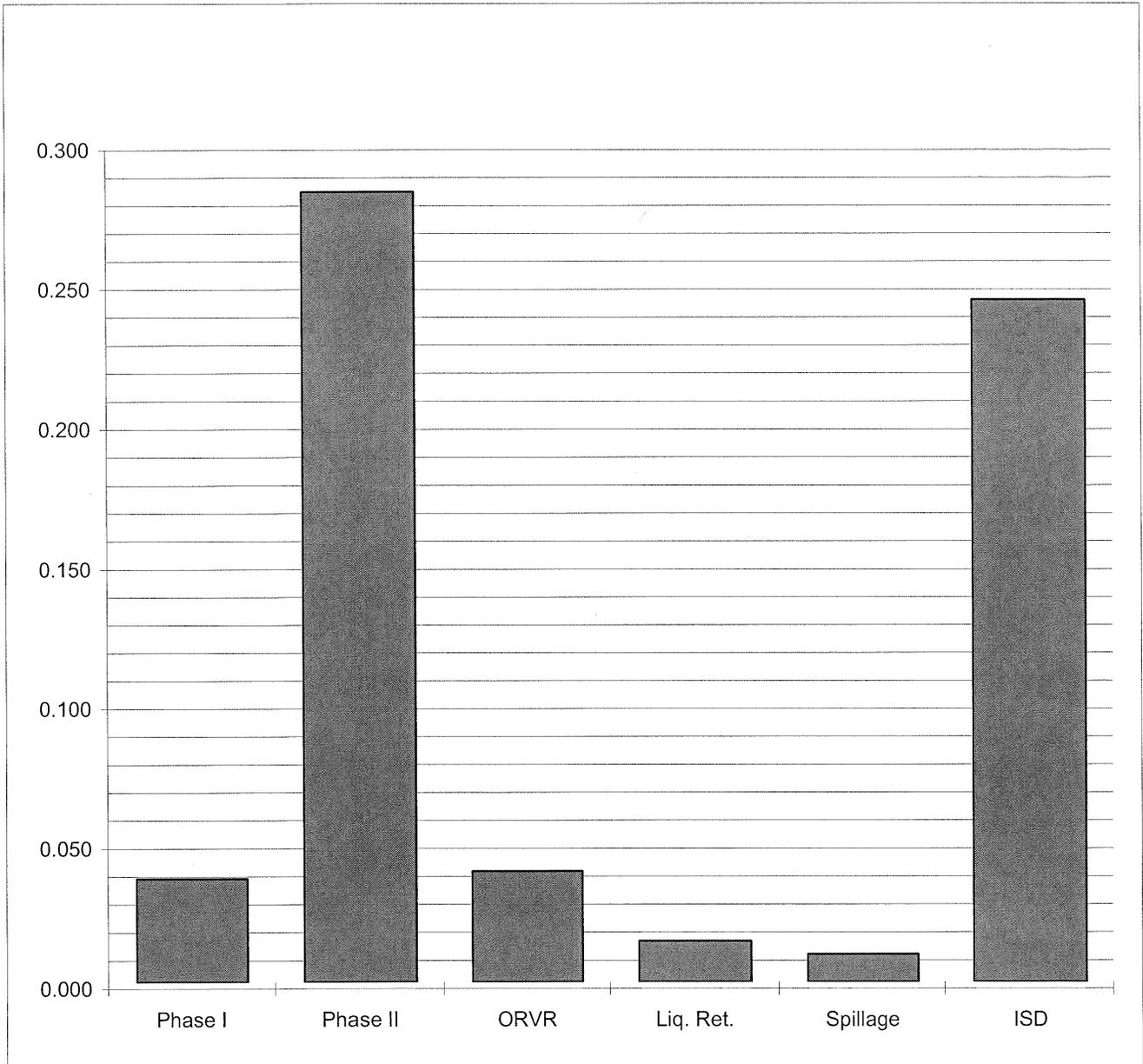
		Per-Gallon Cost Increase by Module and Model GDF, cents per gallon				
Model GDF		1	2	3	4	5
Module	Per-GDF Throughput, g	13,233	37,500	75,000	150,000	300,000
1	Phase I	0.35	0.11	0.05	0.02	0.01
2	Phase II	1.65	0.57	0.36	0.22	0.13
3	ORVR Compatibility	0.16	0.06	0.05	0.03	0.02
4	Liquid Retention	0.06	0.02	0.02	0.01	0.01
5	Spillage/Dripless Nozzle	0.06	0.02	0.01	0.01	0.00
6	In-Station Diagnostics	1.46	0.52	0.32	0.18	0.10
Total Cents per Gal Increase by		3.74	1.31	0.81	0.48	0.27

Fig. VI-2  
Per-Gallon Increase per Model GDF



**Per-Gallon Cost Increase by Module**

Module	Description	Annual Costs, \$Million/yr	Cents per Gallon
1	Phase I	\$5.3	0.037
2	Phase II	\$41.0	0.283
3	ORVR	\$5.7	0.039
4	Liq. Ret.	\$2.1	0.015
5	Spillage	\$1.4	0.010
6	ISD	\$35.4	0.244
Total		\$91.0	0.627



**Estimated Equipment Costs for a Model GDF 1 Facility per Proposed Module**

Proposed Module	Unit Cost 1999 Dollars	Number of Components in Model GDF				
		Bal-1	Bal-2	Hybrid	Assist-1	Assist-2
<b>Module 1 (Phase I)</b>						
Phase I Components						
Pressure/Vacuum (P/V) valve	\$65	2.5	2.5	2.5	2.5	2.5
Low-emission spill containment and cov	\$351	2.5	2.5	2.5	2.5	2.5
Drop tube & overflow protection	\$178	2.5	2.5	2.5	2.5	2.5
Rotatable adaptor	\$55	2.5	2.5	2.5	2.5	2.5
Installation Costs						
Pressure/Vacuum (P/V) Valve	\$80	2.5	2.5	2.5	2.5	2.5
Low-emission spill containment and cov	\$160	2.5	2.5	2.5	2.5	2.5
Drop tube & overflow protection	\$160	2.5	2.5	2.5	2.5	2.5
Rotatable adaptor	\$80	2.5	2.5	2.5	2.5	2.5
<b>Module 1 -- Total Fixed Cost (All Equipment)</b>		\$2,823	\$2,823	\$2,823	\$2,823	\$2,823
<b>Module 1 -- Total Annualized Cost = Total Fixed Cost x CRF</b>		\$580	\$580	\$580	\$580	\$580
<b>Avg Fixed</b>		\$2,823	Avg Annual		\$580	\$580

**Module 2 (Phase II w/pressure-related fugitives)**

Dispenser Components						
Nozzle -- Balance	\$200	2.5	2.5	2.5	2.5	2.5
Nozzle -- Hybrid	\$231					
Nozzle -- Assist Type 1	\$209					
Nozzle -- Assist Type 2	\$225					
Modified Equipment (Dispenser-related)	\$382					
Modified Equipment (Dispenser-related)	\$468					
Modified Equipment (Dispenser-related)	\$400					