



Reducing SF6 Emissions @ PPPL

DOE Fugitive Emissions Working Group

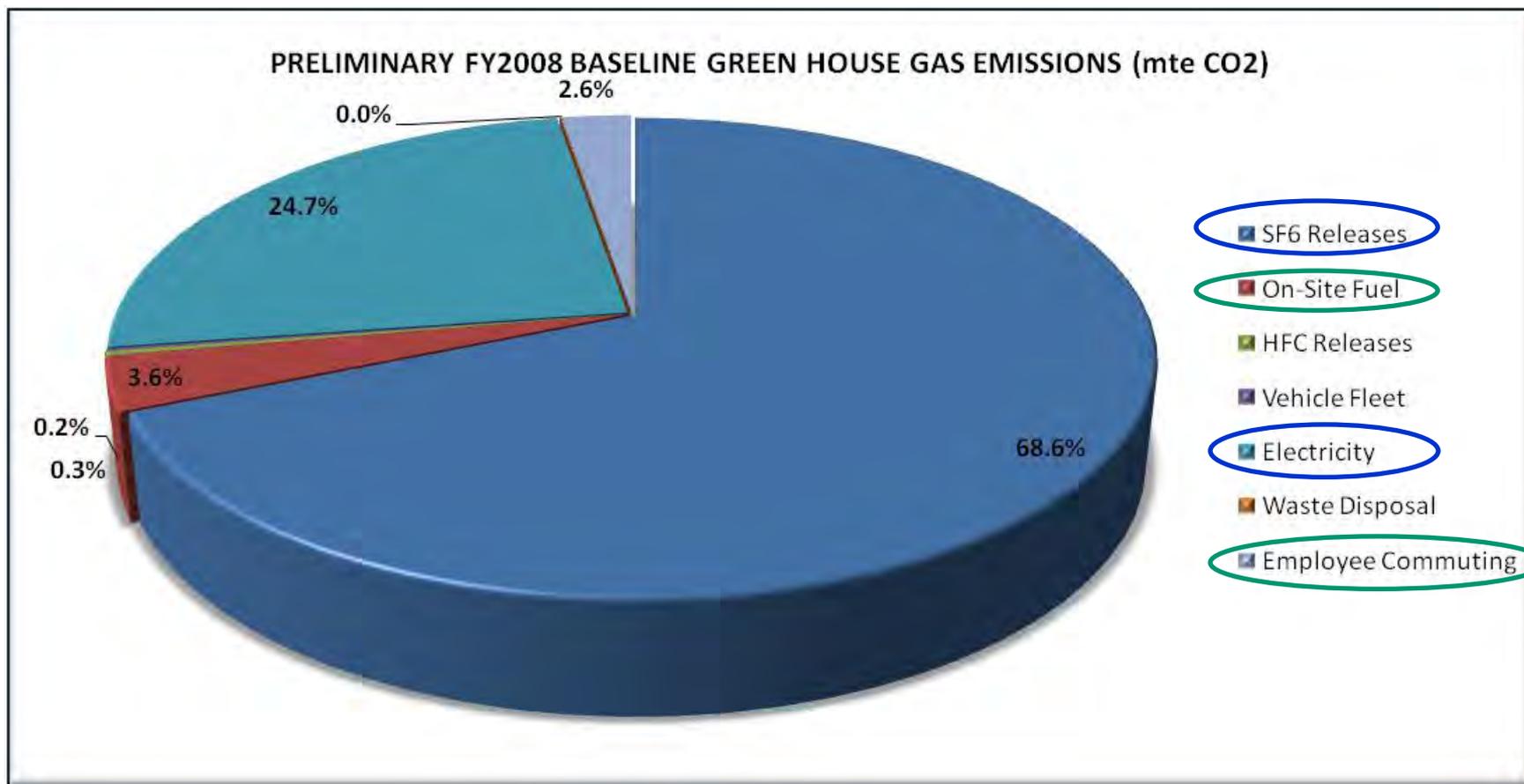
February 10, 2011



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Environment, Safety, Health & Security

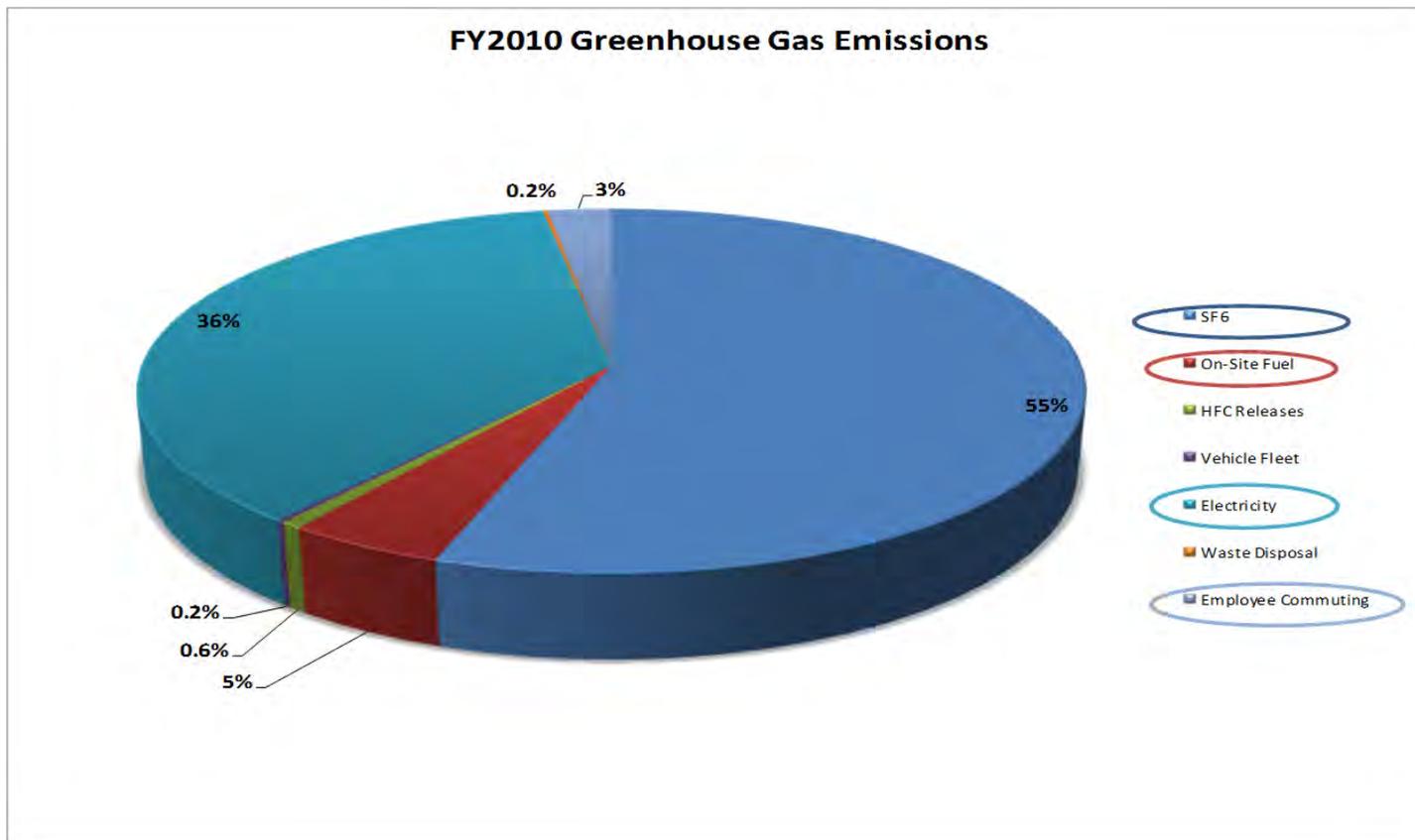


PPPL GHG Emissions 2008





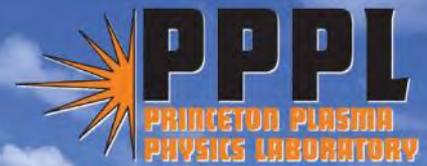
PPPL GHG Emissions 2010





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Greenhouse Gas Emissions Summary	Metric Tonnes CO2 Equivalent				
	2008		2010		
Scope 1 - Direct					
Vehicle Emissions	96.4		88.4		
Fuel Consumption Emissions	2015		1823.8		
Fugitive Emissions					
Refrigerant	160		241.2		
SF6	38360		21042.8		
Scope 2 - Indirect					
Electricity Purchase	13816		13855		
Scope 3 -					
Employee Commuting	992.8		945.5		
Product Use					
Production of Purchased Materials					
Contractor Vehicles					
T&D losses	902.5		905.6		
Waste Disposal	57	63	66		
Business Travel	586.1		711.2		
Sewer	31.7		33.1		
Total	57017.5		39712.6		
w/0 SF6	18657.5		18669.8		



Initial Progress to Reduce SF6

- Purchased new leak detectors (< \$200)
- Leak checked systems beginning Feb. 2010
- Tightened up systems
- Weighing cylinders
- Improved tracking of inventory





Improved SF6 Gas Cylinder Inventory

Cylinder #	Serial #	Date Initial Weight	Weight Full (lbs)	Date final weight	Weight "Empty" (lbs)	Amount used
1	CMC 911	4/23/2010	242	6/9/2010	122.5	119.5
2	CMC909	4/23/2010	242	in use	120	122
3	CMC447	4/23/2010	247	10/16/2010	134.5	112.5
4	BVR028	4/23/2010	239	in use	120	119
5	BVR094	4/23/2010	231	in use	120	111
6	BVU307	4/23/2010	241	in use	120	121
7	CXP534 w/t	4/23/2010	238	9/14/2010	126	112
8	CXP536 w/t	4/23/2010	238	8/16/2010	125	113
9	CXP545 w/t	4/23/2010	252	9/14/2010	140	112
10	CXP538 w/t	4/23/2010	228	9/14/2010	116	112
11	CXP535 w/t	4/23/2010	234	8/16/2010	121	113
12	CXP540 w/t	4/27/2010	230	8/16/2010	119	111
13	CXP539 w/t	4/27/2010	230	8/16/2010	119	111
14	CXP537 w/t	4/27/2010	255	9/14/2010	141	114
15	CMD917 w/	4/27/2010	236	8/16/2010	117	119
16	CXP541 wtu	4/27/2010	230	9/14/2010	117	113
17	1702 PraxAi	-----	240	7/27/2010	138	102
		Purchased	4053			
		FY10 actual used	4053		2116	1937



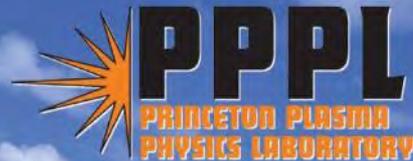
Systems Re-engineering – FY2010/11

- Leaks repaired – Ion Source gauge & sieve canister, radio frequency seals. Periodic leak checks
- Pressure relief valves – vent to bladder, monitor bladder, process with portable cart.
- Re-design components
 - High voltage switch tubes – helmet
 - Valves and tubing for molecular sieve cans
- Purchase high capacity recovery cart
 - Possible repair of existing (30 years old)



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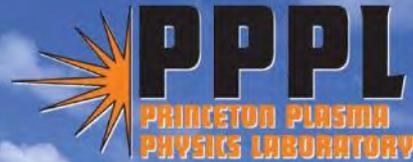
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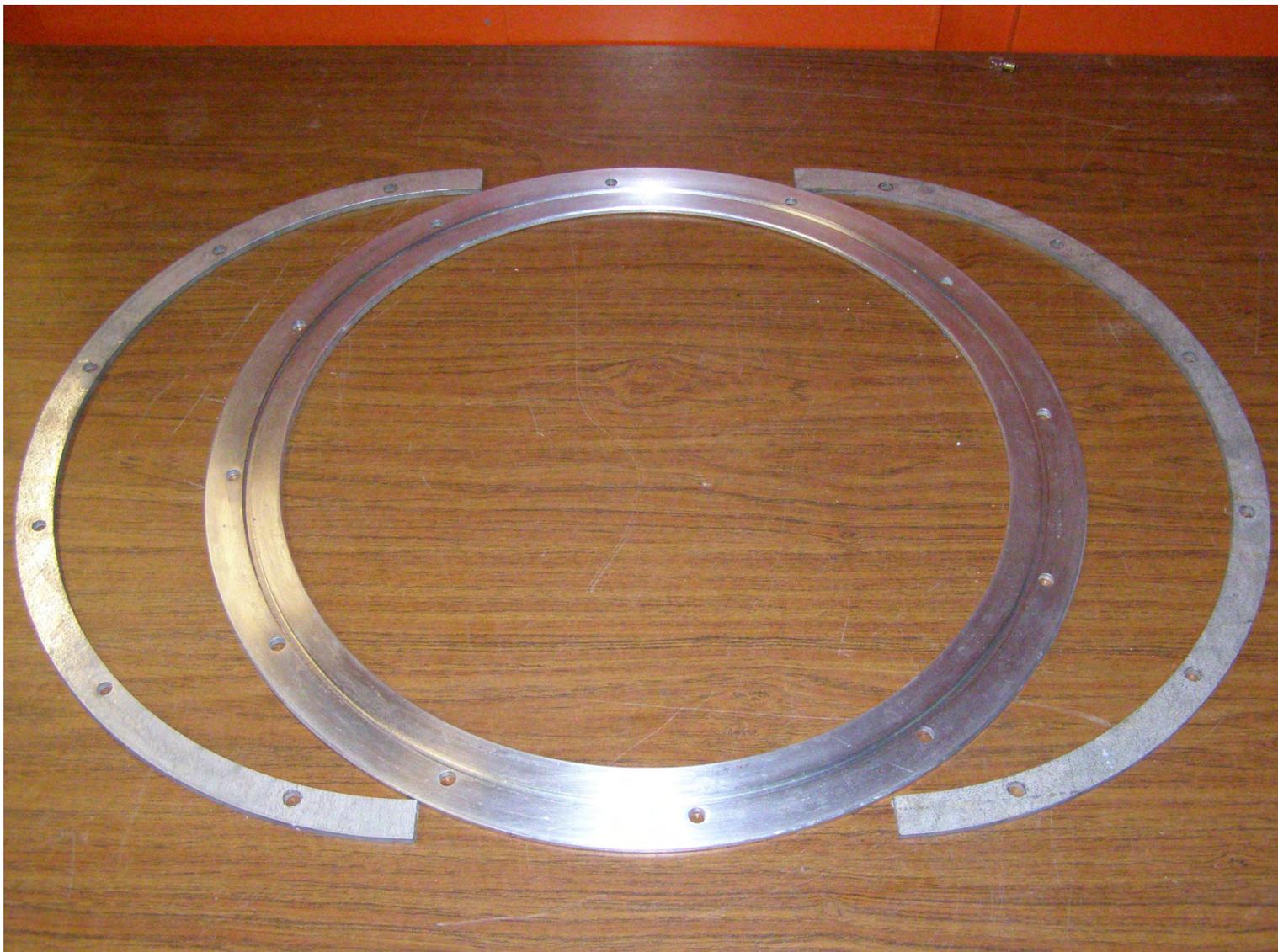
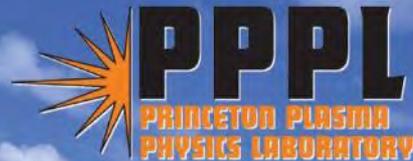
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Dilo Mini Plus D-320 Portable Recovery Cart

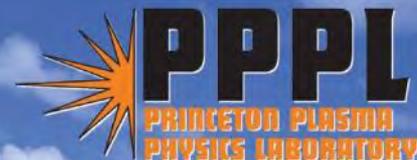
- Recover SF₆ gas when servicing gas-filled apparatus
- Store SF₆ in liquid form in on-board cylinders or fill external cylinders
- Purify recovered SF₆ gas twice during regular routine.
- Evacuate air and moisture from apparatus after servicing
- Refill apparatus with reclaimed gas controlling fill pressure
- Transfer SF₆ between cylinders partial to liquid, liquid to liquid
- Simultaneous execution of functions





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DILO Unit Comparison Sheet



d-300	D-300	D-310	MINI Plus	Compact	Economy	Performance	MEGA
Feature							
Description	Cylinder consolidation unit.	Light-weight, hand-carryable recovery system	Dolly mounted recovery system	Manual full-sized recovery system	Automatic full-sized recovery system	Automatic full-sized recovery system	Ultra fast-recovery system, fastest made by DILO
Filters (including particle filter)	None	1	2	3	3	3	3
Regulator (Range in PSIG)	None	0-160	0-160	0-360	0-145	0-145	0-145
Vacuum pump ¹	None	External (optional)	Integrated, 10 CFM	Integrated, various sizes	Integrated, various sizes	Integrated, various sizes	Integrated, various sizes
Max. discharge pressure (PSIG)	725	725	725 PSIG	725	725	725	725
Final suction pressure ²	0 PSIG	0 PSIG	10 mmHg	35 mmHg	35 mmHg	35 mmHg, (1 mmHG) [*]	1 mmHg
Cylinder consolidation	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Weight scale	External (optional)	External (optional)	External (optional)	Integrated	Integrated	Integrated	Integrated
Evaporator	None	None	None	Yes	Yes	Yes	Yes
Compression ratio ³	50:1	50:1	1000:1	1000:1	1000:1	1000:1 (unlimited)	unlimited
Control system	Manual	Manual	manual	Manual	Automatic	Automatic	Automatic
Power	120 VAC, 60	120 VAC, 60	120 VAC, 60	208-240 VAC, 1 or 3 phase	208-240 VAC, 1 or 3 phase	208-240 VAC, 1 or 3 phase	208-240 VAC, 1 or 3 phase
Weight (lbs.) ⁴	95	45	240	1,050	1,050	1,300	1,500
Capacity (storage) ⁵	Variable	Variable	Variable (2 cylinder standard)	Variable	Variable	Variable	Variable
Throughput (lbs./hr. est.)	60	30	60	100	100	200	500 (800 w/upgrade)
Delivery	6-8 weeks	6-8 weeks	8-10 weeks	12-14 weeks	12-14 weeks	12-14 weeks	14-16 weeks
Budgetary Cost	\$7,000	\$9,000	\$18,000 [†]	\$62,000 [†]	\$88,000 [†]	\$87,000 [†]	\$ 159,000 [†] (\$ 187,000) [†]

¹ Vacuum pump sizes range from 24 CFM to customer specified.

² Final suction pressure is under worst case scenario (725 PSIG discharge pressure).

³ Compression ratio is determined using the attached formula sheet.

⁴ Dry weight of processing unit (no storage cylinders or trailer).

⁵ Capacity is unlimited, and is determined only by number of available cylinders.

^{*} Using optional scroll pump upgrade.

[†] Budgetary pricing includes components necessary for operation (storage, trailer, etc.)



Stationary Dilo MEGA Series Processing System

- Process up to 800 pounds per hour
- Built-in tank scale displays weight of gas in storage cylinders.
- 100% oil-less and refrigeration-less.
- No manual valves – simple operation.
- Fully automatic – no operator supervision.
- Multi-port design allows simultaneous recovery, filling, and evacuation.
- 99.99% Recovery – Highest Available

