

Fate of Mercury in Synthetic Gypsum Used for Wallboard Production

Agricultural and Industrial Uses of FGD Gypsum Workshop



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Presentation Outline

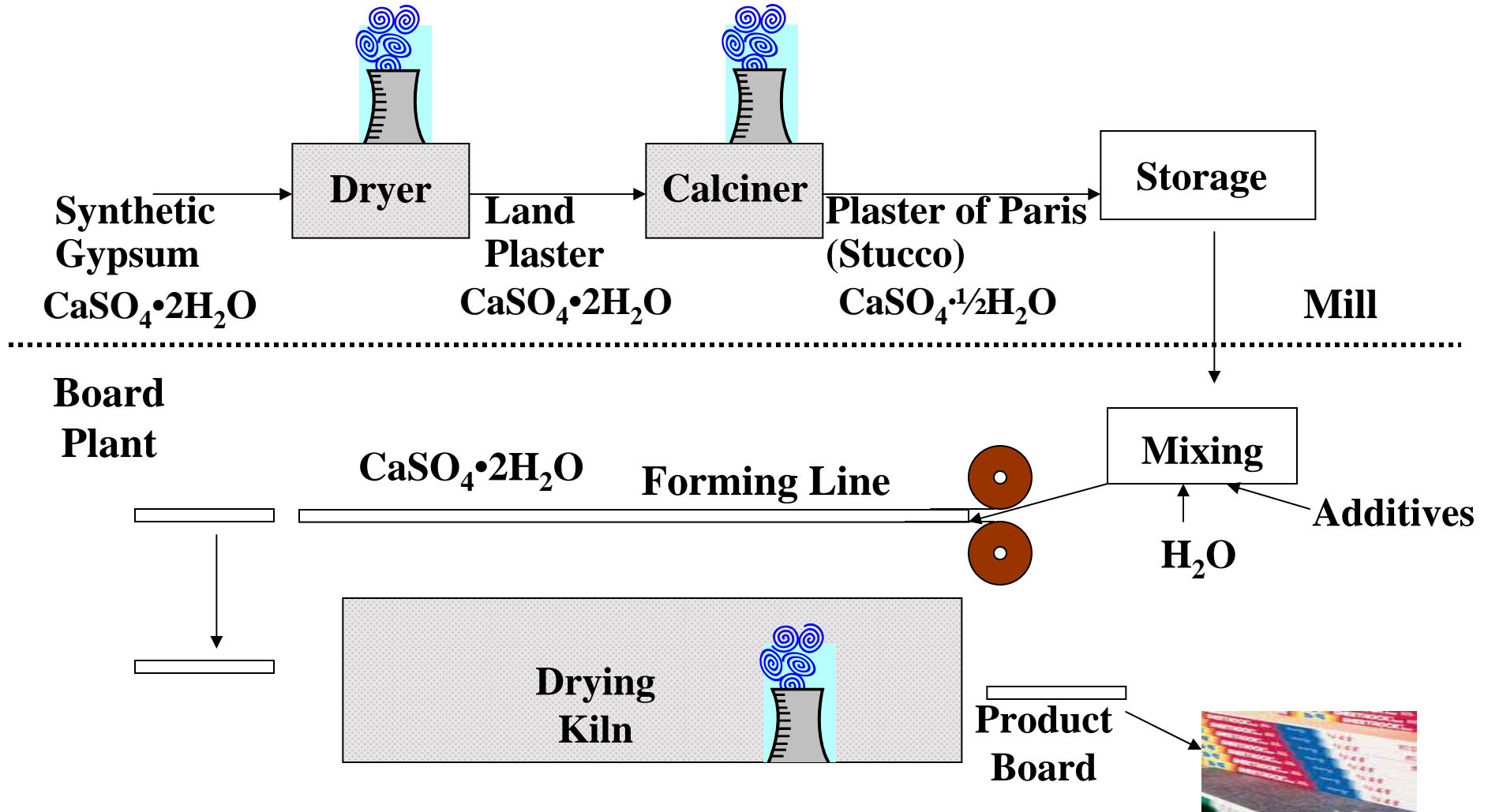
- **Project Test Matrix** (what synthetic gypsum sources, why)
- **Wallboard Production Process**
- **Sample Collection Sites** (where in the process)
- **Ontario Hydro Results** (% Hg Released)
- **Bulk Samples Results** (% Hg Loss)
- **Wallboard Industry Estimates**
(Based on project results and annual wallboard industry usages)
- **Extrapolated Industry Estimates**
(Compared to national mercury emissions)

USG/DOE Fate of Mercury in Synthetic Gypsum Used for Wallboard Production – Project Test Matrix

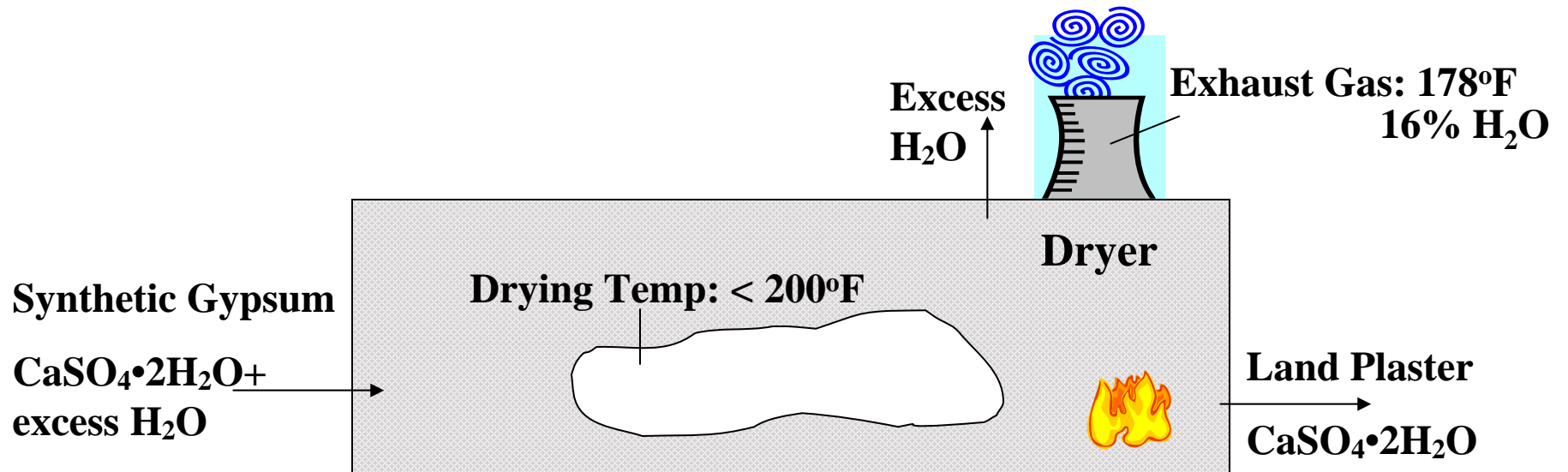
Task	1	2	3	4	5	6	7
Power Plant	A	A	B	C	D	D	E
Coal Type	HS Bit	HS Bit	HS Bit	TX lignite	HS Bit	HS Bit	PRB
FGD Reagent	Limestone	Limestone	Limestone	Limestone	Limestone	Limestone	Limestone
Forced Oxidation Mode	In Situ	In Situ	In Situ	In Situ	In Situ	In Situ	In Situ
Gypsum Fines Blow Down?	Low	Low	High	None	High	High	None
SCR Status	On Line	Bypassed	On Line	No SCR	Bypassed	On Line	On Line
USG Plant	1	1	2	3	4	4	5
FGD Hg Control Additive?	No	No	No	No	No	Yes TMT-15	No

*HS Bit – High Sulfur Bituminous; TX Lignite – Texas Lignite; PRB – Powder River Basin

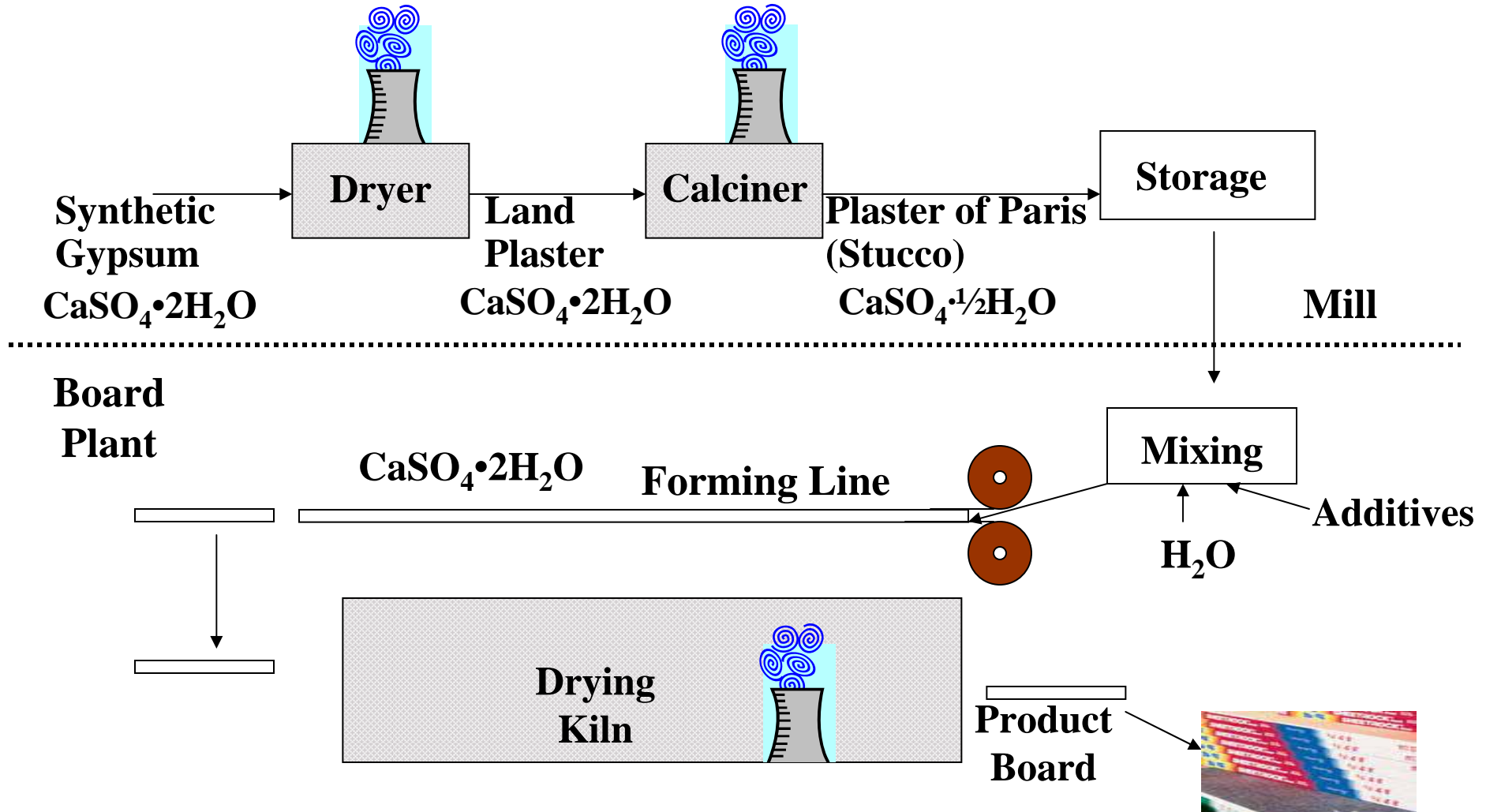
Simplified Flow Diagram of Synthetic Gypsum used for Wallboard Production



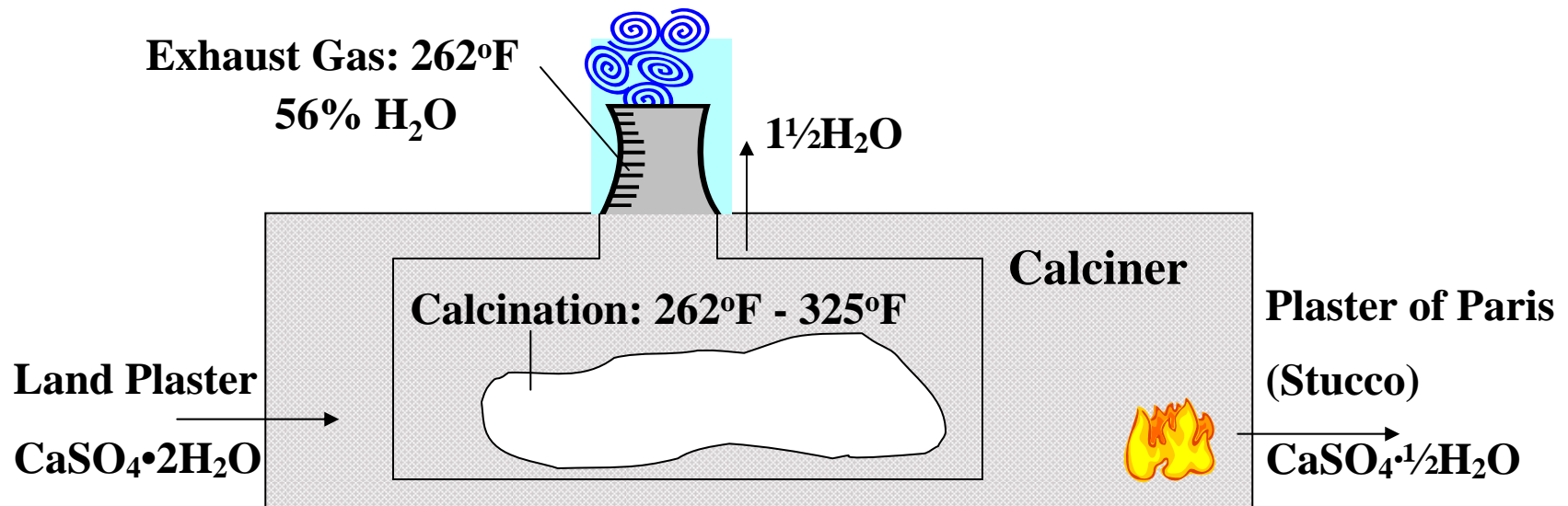
Mill Dryer



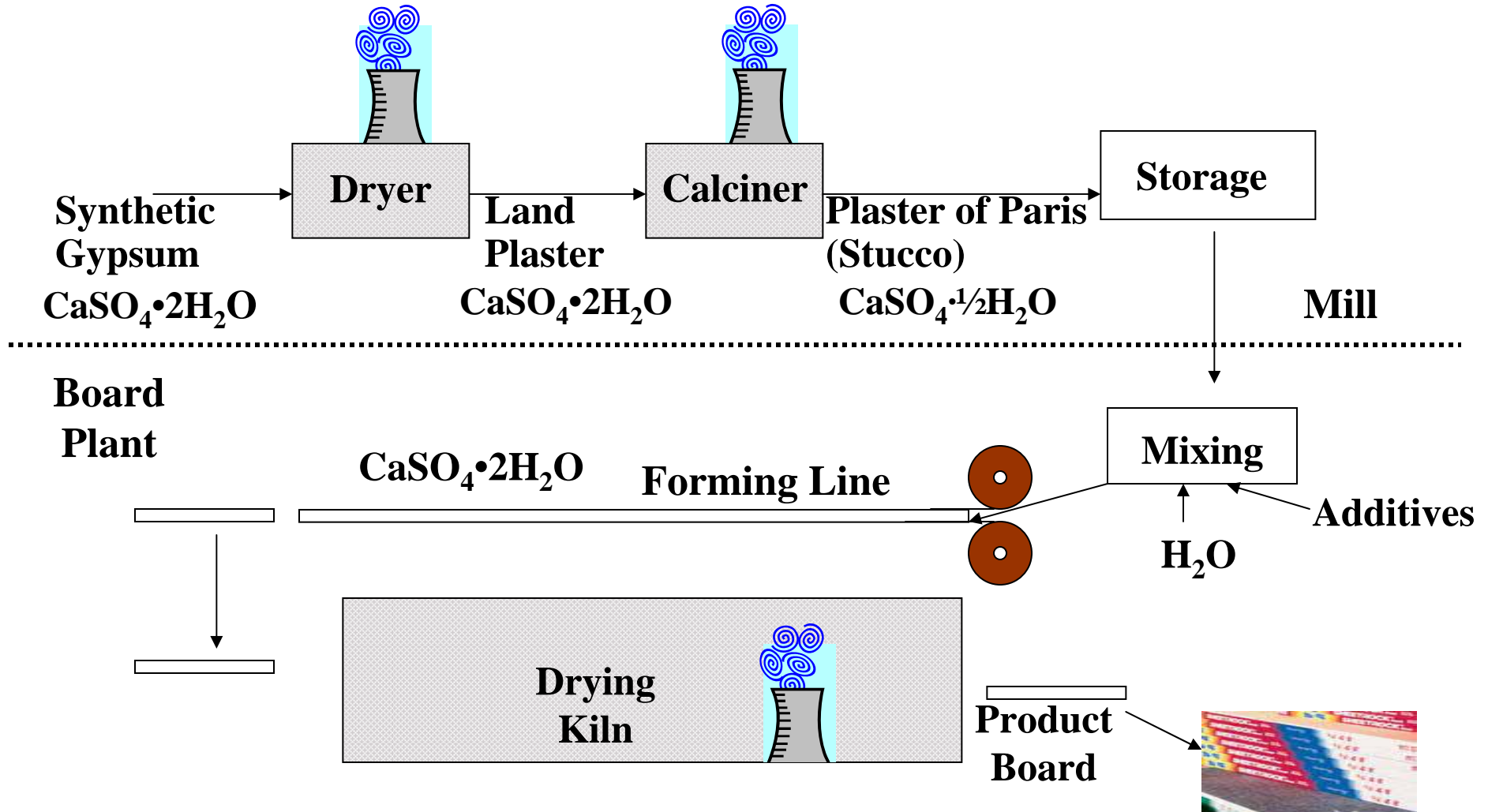
Simplified Flow Diagram of Synthetic Gypsum used for Wallboard Production



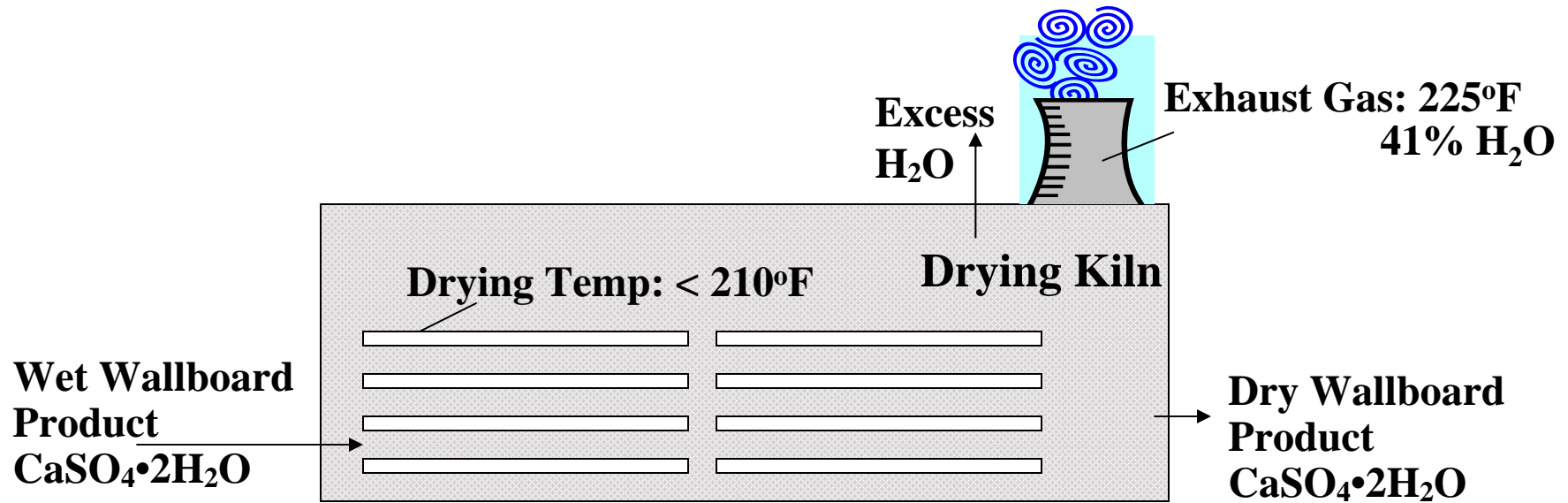
Mill Calciner



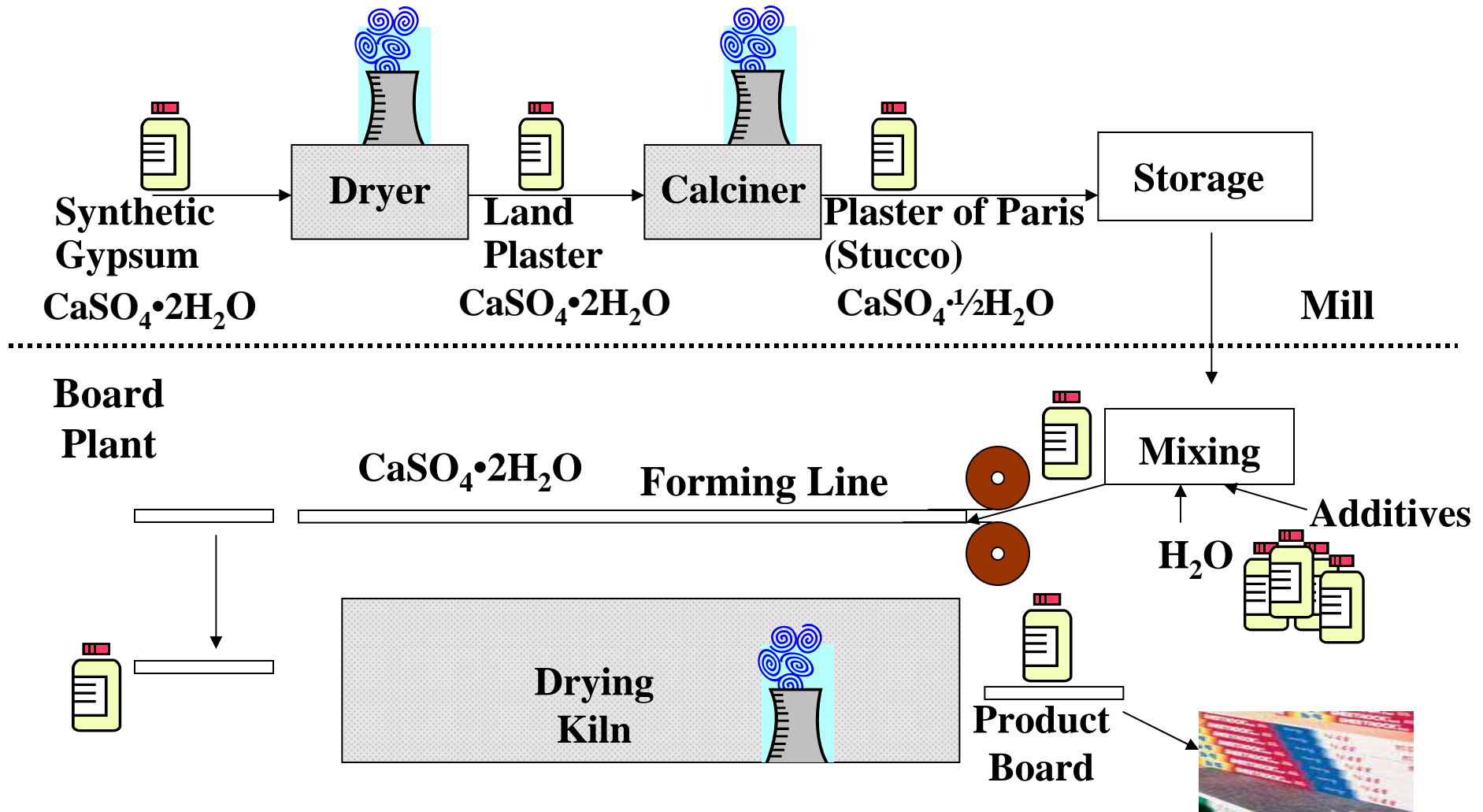
Simplified Flow Diagram of Synthetic Gypsum used for Wallboard Production



Board Plant Dryer (Kiln)



Sample Collection Sites



USG/ DOE Fate of Mercury in Synthetic Gypsum Used for Wallboard Production Results

Ontario Hydro Results Percent of Total Mercury Released



Task Parameters (Incoming Hg content)	Dryer	Calciner	Kiln	Plant Emissions (g/hr)
Task 1 HS Bit w/SCR (0.96 ppm Hg)	1%	2%	2%	4.1
Task 2 HS Bit w/o SCR (1.1 ppm Hg)	<1%	3%	5%*	7.8 *
Task 3 High Fines BD (0.21 ppm Hg)	1%	41%	14%*	8.2 *
Task 4 TX Lignite (0.53 ppm Hg)	<1%	<1%	<1%	0.3
Task 5 High Fines BD (0.20 ppm Hg)	<2%	50%	<2%	2.0
Task 6 High Fines Blow Down w/TMT-15 (0.13 ppm Hg)	4%	45%	6%	1.4

* Losses in the Dryer Kiln for Tasks 2 &3 are estimated based on solids analysis

USG/ DOE Fate of Mercury in Synthetic Gypsum Used for Wallboard Production Results

Ontario Hydro Results – Speciation



	Dryer			Calciner (%)			Kiln (%)		
	Hg ^P	Hg ⁺²	Hg ⁰	Hg ^P	Hg ⁺²	Hg ⁰	Hg ^P	Hg ⁺²	Hg ⁰
Task 1	3	--	97	5	3	92	2	7	91
Task 2	5	--	95	1	10	89	NA	NA	NA
Task 3	1	68	31	0	1	99	NA	NA	NA
Task 4	4	11	86	28	10	62	0	35	65
Task 5	2	22	79	0	1	99	1	23	84
Task 6	2	44	55	3	2	96	--	--	100

USG/ DOE Fate of Mercury in Synthetic Gypsum Used for Wallboard Production Results

Bulk Samples Results Percent of Total Mercury Loss average of 3 samples \pm 95% confidence interval			
	Dryer	Calciner	Kiln
Task 1	1.3 \pm 4.0	1.4 \pm 2.5	-0.9 \pm 6.8
Task 2	3.7 \pm 1.3	8.4 \pm 1.4	5.5 \pm 2.4
Task 3	-1.5 \pm 13	43 \pm 3	14 \pm 6
Task 4	-2.3 \pm 6.1	6.6; 3.6	4.6; 6.1
Task 5	12.6 \pm 5.5	30 \pm 6	-3.4 \pm 2.3
Task 6	0.0 \pm 3.2	35 \pm 5	-0.1 \pm 4.9



USG/ DOE Fate of Mercury in Synthetic Gypsum Used for Wallboard Production Results

Bulk Samples Results Percent of Total Mercury Loss average of 3 samples \pm 95% confidence interval			
	Dryer (OH)	Calciner (OH)	Kiln (OH)
Task 1	1.3 \pm 4.0 (1%)	1.4 \pm 2.5 (2%)	-0.9 \pm 6.8 (2%)
Task 2	3.7 \pm 1.3 (<1%)	8.4 \pm 1.4 (3%)	5.5 \pm 2.4 (N/A)
Task 3	-1.5 \pm 13 (1%)	43 \pm 3 (41%)	14 \pm 6 (N/A)
Task 4	-2.3 \pm 6.1 (<1 %)	6.6; 3.6 (<1 %)	4.6; 6.1 (<1 %)
Task 5	13 \pm 6 (<2 %)	30 \pm 6 (50 %)	-3.4 \pm 2.3 (<2 %)
Task 6	0.0 \pm 3.2 (4%)	35 \pm 5 (45%)	-0.1 \pm 4.9 (6%)



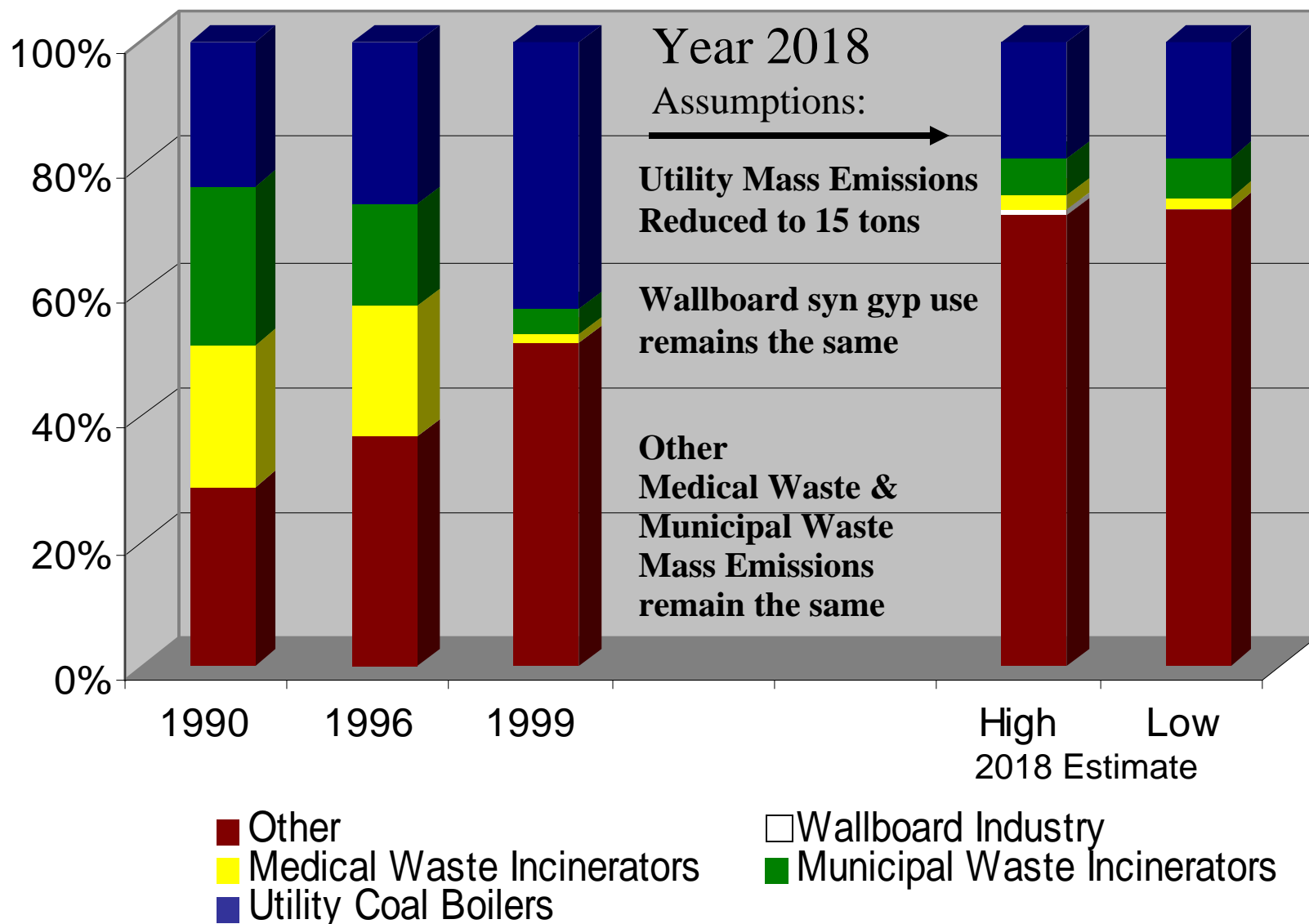
Wallboard Industry Estimates based on USG/DOE Study

Mercury Emitted per Ton Dry Gypsum Processed	Times	Industry Use [#]	Potential Estimated Emissions Wallboard Industry Total
Task 1: 0.045 grams/ton	*	7,579,187 tons	= 800 pounds
Task 2: 0.08 grams/ton	*	7,579,187 tons	= 1300 pounds
Task 3: 0.09 grams/ton	*	7,579,187 tons	= 1500 pounds
Task 4: 0.01 grams/ton	*	7,579,187 tons	= 200 pounds
Task 5: 0.09 grams/ton	*	7,579,187 tons	= 1500 pounds
Task 6: 0.06 grams/ton	*	7,579,187 tons	= 1000 pounds

[#]Based on ACAA 2006 Coal Combustion Product (CCP) Production and Use Survey – 7,579,187 short tons used in wallboard production



Percent of Total U.S. Human Caused Direct Mercury Emissions by Year by Industry – A Future Estimate



*1990, 1996 EPA NTI & 1999 NEI