

# Rare Earth Phosphor Crisis

July 2011



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# What are Rare Earth Metals?

- Rare Earth Metals are a group of 17 elements from the periodic table
- Rare Earth Metals are used in a vast array of products:
  - Hybrid Cars
  - Wind Turbines
  - Solar Panels
  - Military Weapons
  - Smart Phones
  - Computers
  - Flat Screens
  - Lighting
  - » Less than 10% of the industry's needs

**Periodic Table of the Elements**

1	Periodic Table of the Elements																18													
1 H 1.01	2 He 4.00											13 B 10.81	14 C 12.01	15 N 14.01	16 O 15.99	17 F 19.00	18 Ne 20.18													
3 Li 6.94	4 Be 9.01											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95													
11 Na 22.99	12 Mg 25.31	19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.87	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.41	31 Ga 69.72	32 Ge 72.64	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80											
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.60	53 I 126.90	54 Xe 131.29													
55 Cs 132.91	56 Ba 137.33	57 La 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.84	75 Re 186.21	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po (209)	85 At (210)	86 Rn (222)													
87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (266)	107 Bh (264)	108 Hs (270)	109 Mt (268)	110 Ds (281)	111 Rg (272)																				
																	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.97	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97
																	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)

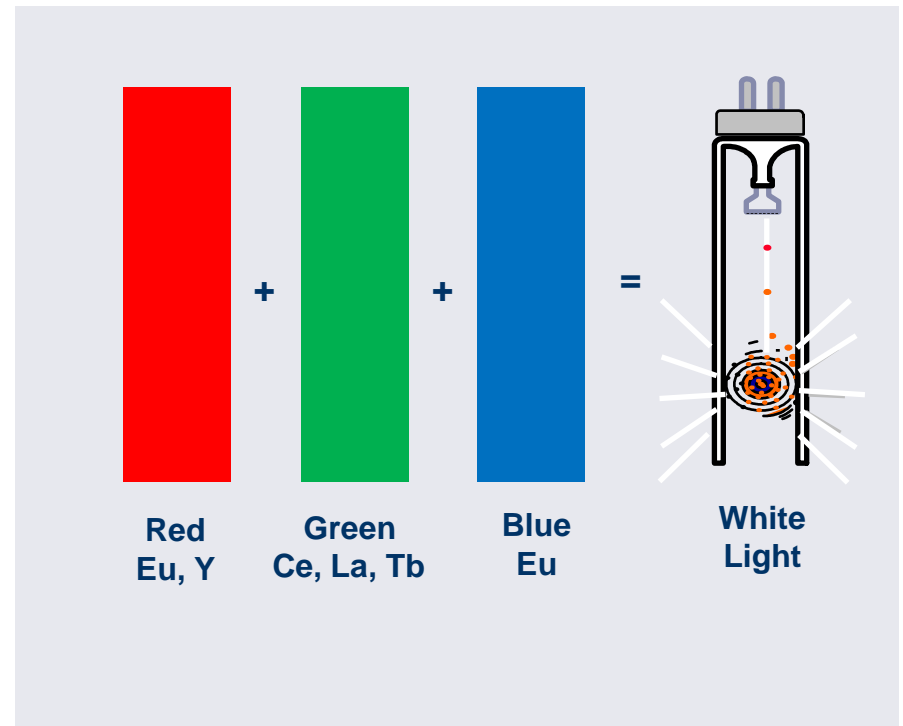
# Where are Rare Earth Elements (RE) used in Fluorescent Lighting?

## Fluorescent lamps contain Halo and Triphosphors

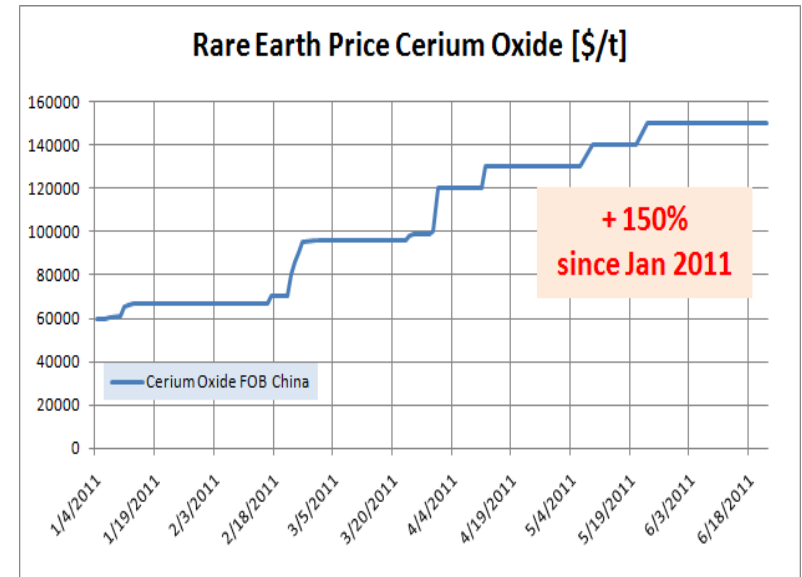
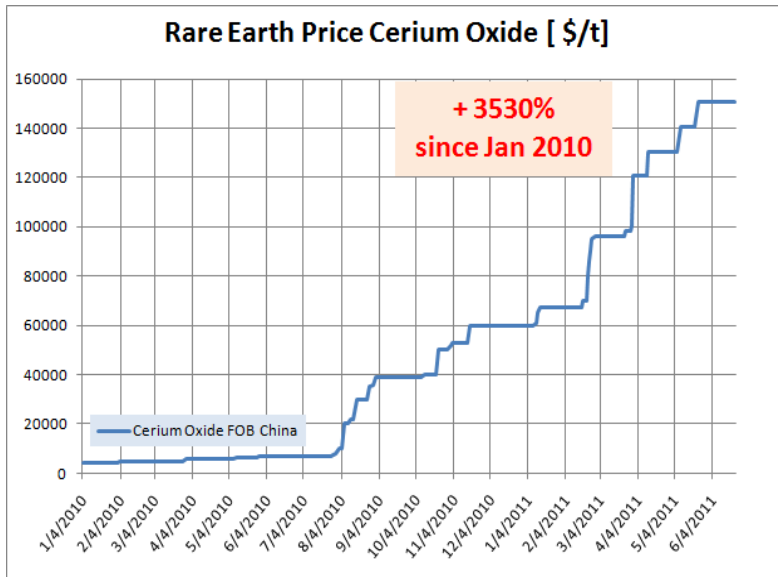
- Tri-Phosphors use Rare Earth oxides in their phosphor mix
- Rare Earth oxides are vital component in our energy efficient fluorescent lamps
- Cerium, Europium, Terbium, Yttrium are examples of RE oxides contained in fluorescent lamps

## Triphosphors are used in the following products:

- All T8's
- All T5's
- Deluxe T12's
- All CFL pin and self-ballasted



# Rare Earth Oxide Continue To Climb...Cerium

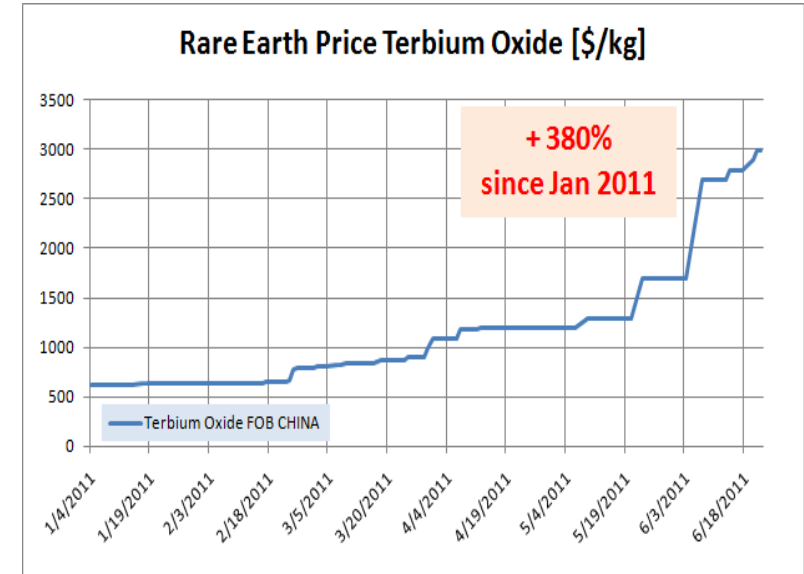
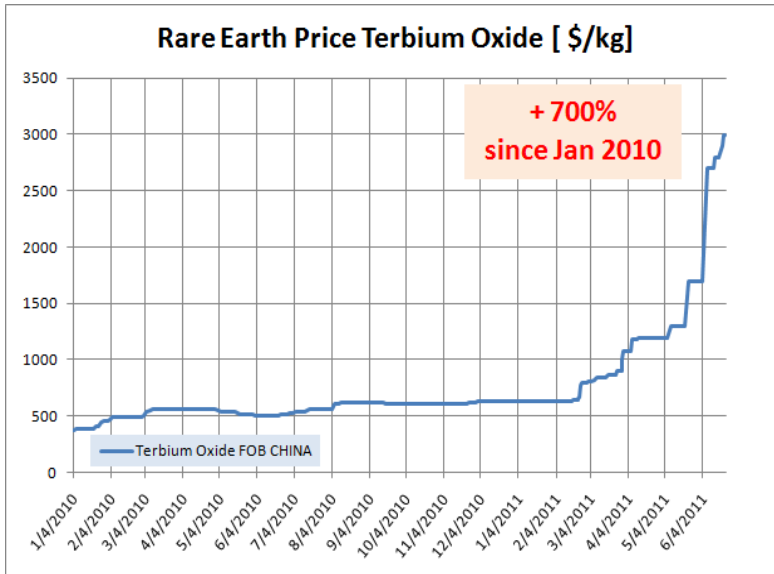


Source: [www.asianmetal.com](http://www.asianmetal.com)

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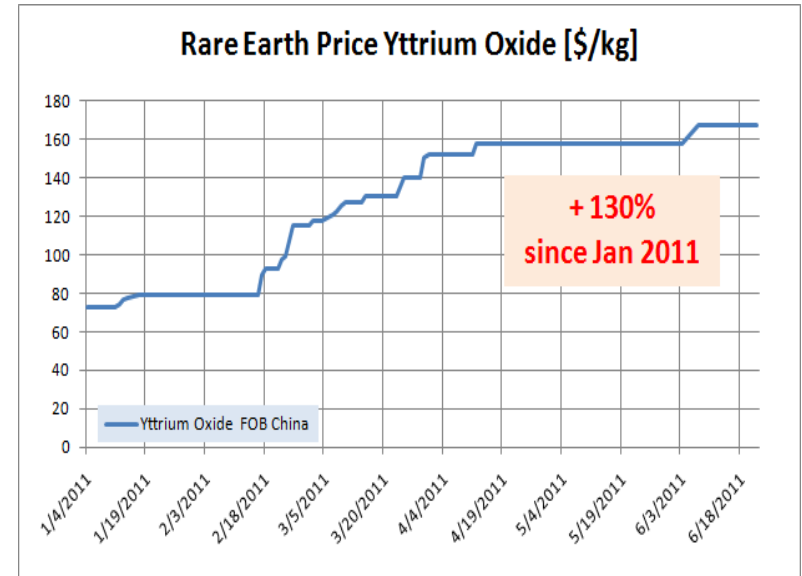
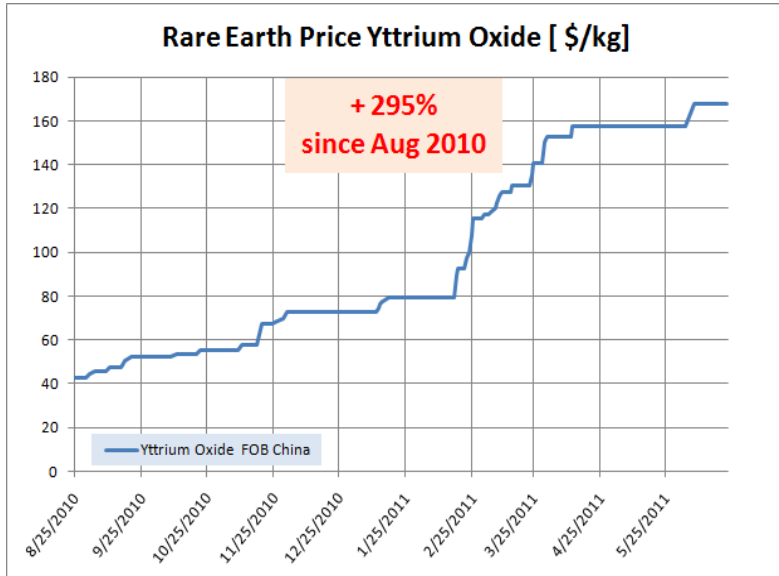
# Rare Earth Oxide Continue To Climb...Terbium



Source: [www.asianmetal.com](http://www.asianmetal.com)

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# Rare Earth Oxide Continue To Climb...Yttrium



Source: [www.asianmetal.com](http://www.asianmetal.com)

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# Rare Earth Mineral Mining

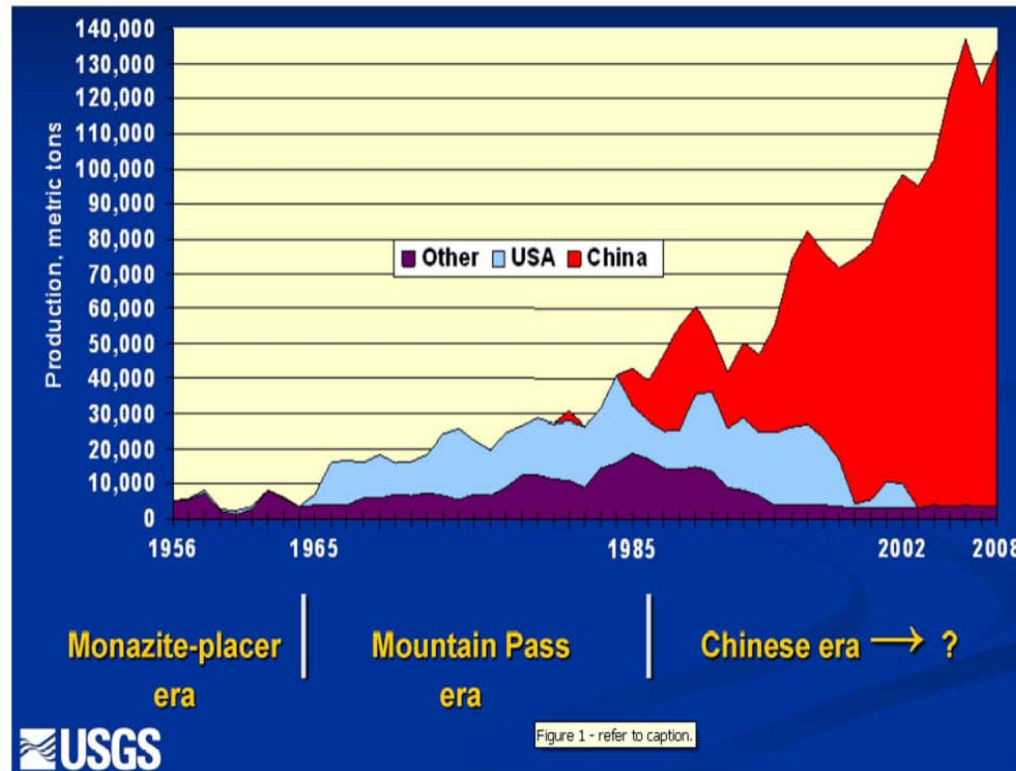


Figure 1. Global rare-earth-oxide production trends. The Mountain Pass deposit is in California, U.S.A. Graph from D.J. Cordier (U.S. Geological Survey, written commun., 2011) was updated from Haxel and others (2002, fig. 1).

Since 2002 China controls 95% of the world's rare earth oxide production

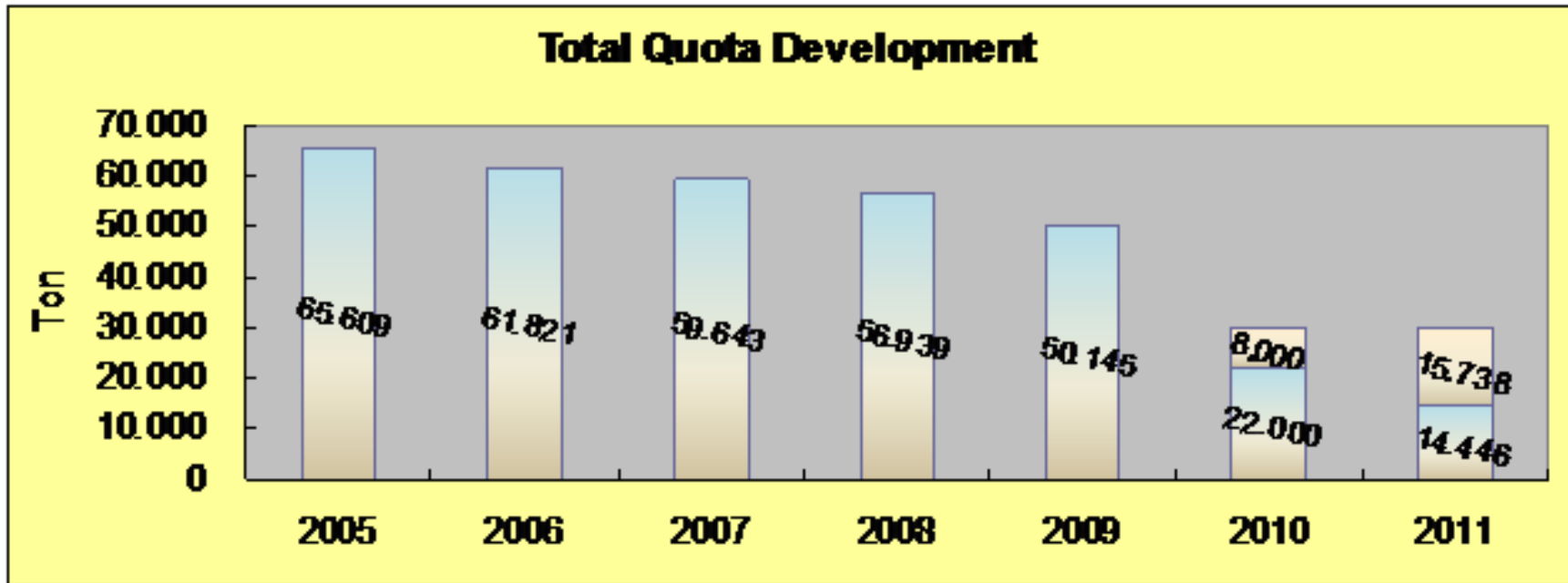


# Why are the prices for RE from China rising?

- Imposed new taxes and tariffs from Chinese government
- Enforced new mining rules and regulations from Chinese government
- Control of the amount of Rare Earth available to the market through administrating export quotas from Chinese government



# Rare Earth Export Quota History



- Over the years export quotas have been reduced as demand for these materials has grown
  - ~40% reduction from 2009 to 2010
  - 1<sup>st</sup> half 2011 vs. 1<sup>st</sup> half 2010 saw a reduction of >35%
  - Latest releases keep 2011 quota same as 2010 overall due to pressure from World Trade Organization (WTO)

# SYLVANIA's Targeted Actions

## Government Activities

- United States Congress has several pieces of legislation in process to address strategy and supply chain for RE Materials
  - United States Trade Representative (USTR) investigating policies and practices of the Chinese government through World Trade Organization (WTO)
- NEMA engagement
  - Meeting with USTR to cite impact of RE crisis on lighting industry
  - Pursuing postponement of implementation of lighting legislation (DOE2012)
- Pursuing re-opening of previously closed mines

## What are we doing?

- Continue to strengthen our supply chain
- Drive development innovation:
  - Options to optimize powder weight
  - Evaluate alternative substitutes
  - Ways to reclaim and recycle materials
- Raising prices
- Create tools and materials to help educate and communicate this issue to the market

**Thank you for your  
attention.**

**OSRAM  
SYLVANIA**

