OTR Wheel Engineering

Tires and Wheels - Design and Delivery Solutions

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Green Carbon

THE REVOLUTION IN GREEN ENERGY
FROM WASTE

Green Carbon

A WASTE . . . RENEWED . . . FOR A BRIGHTER FUTURE

Manufacturer of Systems to process Tires, Rubber Tracks, and other Solid Hydrocarbons.

- Creating energy from solid carbon waste.
- Generating 6 times the Energy from waste than needed to process.
- Improving our environment with cleaner, energy positive, systems

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Green Carbon Advantage

- **Processes the whole tire**
- **Oil, Carbon Black and Steel, are separated** in the process by the reactor automatically.
- **Green Carbon system is able to process any size tire** – Earthmover, construction, mining, agricultural, and military.
- **Portable system design** so that the reactor system can be setup at a sight to process tires
- **The energy positive process** of taking waste and creation new products that provide more energy than consumed to process the waste.

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The Tire Problem

What to do with used Tires and Tracks?

300 Million Tires per year in North America

Current Solutions & Problems:

- **Landfill**
  - Negative Environmental Impact
  - Disposal Fee
  - Limited Sites that will take tires (few will take tracks)
- **Chipping & Crumbing**
  - Chemicals watershed into water sources and soil
  - Energy intensive
  - Labor intensive
- **Stockpile**
  - Aesthetic unpleasant (parcels of land with stacks of tires)
  - Environmentally Unfriendly
  - Insect breeding ground (Mosquitoes)
  - Fire hazard (Toxic Smoke)
- **Incineration**
  - Cement Kiln
  - Environmentally Unfriendly
  - Labor & Energy Intensive

Thermal Vacuum Recovery

300 Million Tires worth of MSW are scrapped each year in the USA. These tires have the potential to produce 360 million gallons of Renewable blendstock

Using the:

Green Carbon Reactor System

Mining Tire - 63”

Goodyear 53/80R63

Tire Weight: 9,802 Pounds

Renewable Blendstock: 588 Gallons (42%) = 4116Lbs

3,292 Lbs Nat Rubber	80%
823 Lbs Synthetic Rubber	20%

Carbon Black: 3,430 Pounds (35%)

Steel: 1,470 Pounds (15%)

Syn Gas: 3,267.333 cu ft. (7%)

Portable Green Carbon System

Green Carbon Products

Renewable Blendstock

Carbon Black

Steel Wire

Syn Gas

Green Carbon

Rubber Track In Reactor

13,500Lbs.

Rubber Tracks After Processing

7,620 Lbs Steel
257 Gals Oil
3,136 Lbs Carbon Black

Carbon Black

- New tire ~ 30% Carbon black by weight.
- Very large GHG contributor

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New tire ~ 40% Natural and Synthetic Rubber by weight.
Of this amount, 70% is natural in origin

- Imported from Brazil, Indonesia, SE Asia

CREATING GREEN ENERGY FROM WASTE

Green Carbon's TVR

Process 600,000 Lbs.
of Tires per month

- **Producing**

-36,000 Gallons of renewable blendstock
-210,000 Lbs. of carbon black
-72,000 Lbs of steel
-200,000 cu ft. Syn Gas:

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SMITHERS RAPRA

August 8, 2011

20% Green Carbon - Carbon Black Tire Test

TESTING:

APPROVED BY:
Jeff Marek
Test Engineer
Smithers Rapra, Inc.
Akron Laboratories

REVIEWED BY:
Bruce D. Lambillotte
General Manager
Smithers Rapra, Inc.
Akron Laboratories

Green Carbon Lab Refinery

During Distillation the renewable fuel feedstock is cut into multiple "fractions", by heating the sample.
(ex:gasoline, diesel, kerosene, heavy oil)

The vapor travels up the "column" and condenses at the top where each "fraction" falls to a different container at the side of the unit.

Distillation testing allows the laboratory to determine the volume of each grade of fuel is present in the sample.

Fuel feedstock is place in the a reservoir at base of the unit and heated

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Distillation Results

Light Naphtha
Used in the
Production of plastics

Naphtha – Used to produce
Reformates, added to Gas to
increase its octane

Gasoline

Kerosene / Light Diesel

Diesel

Heavy Gas Oil

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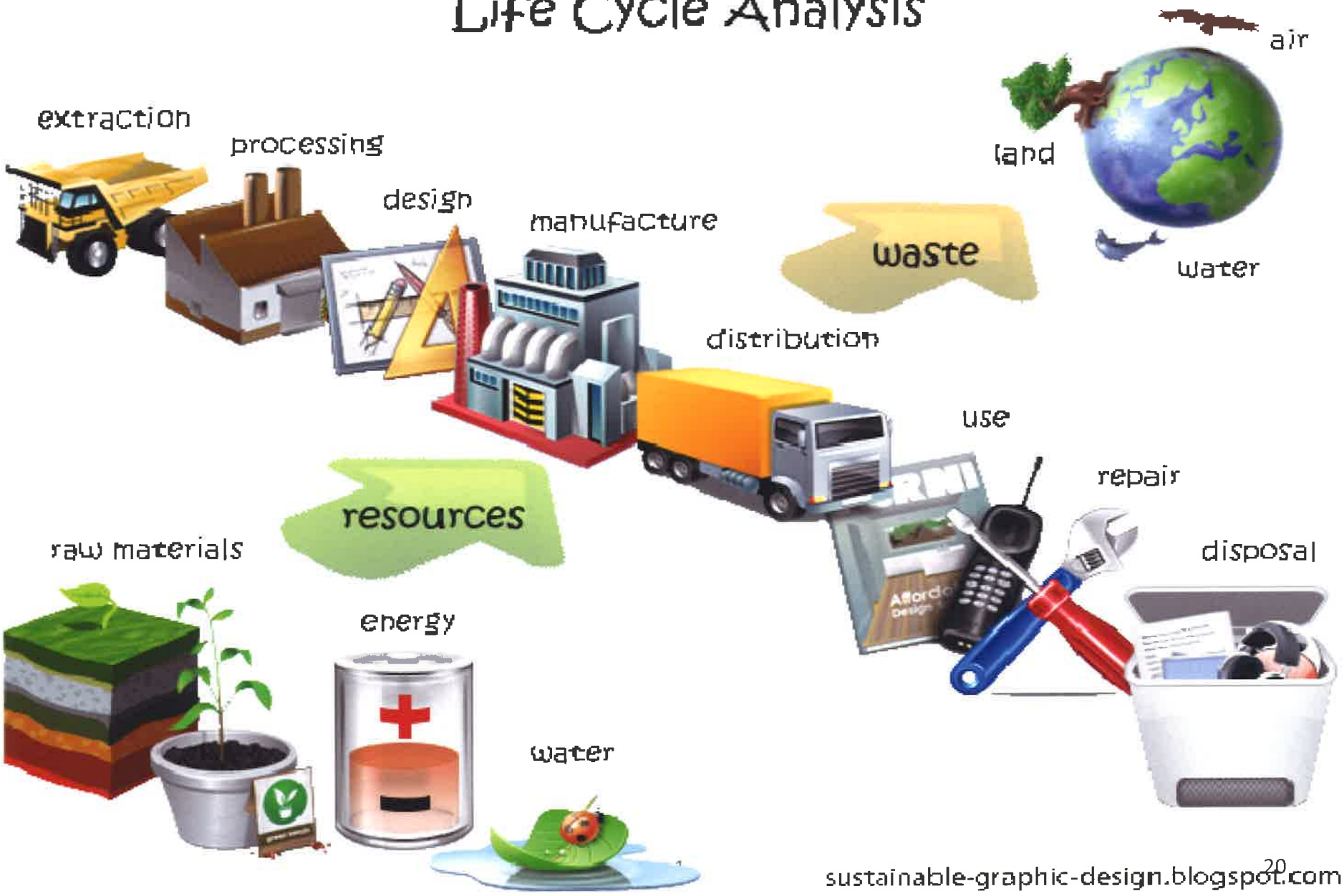
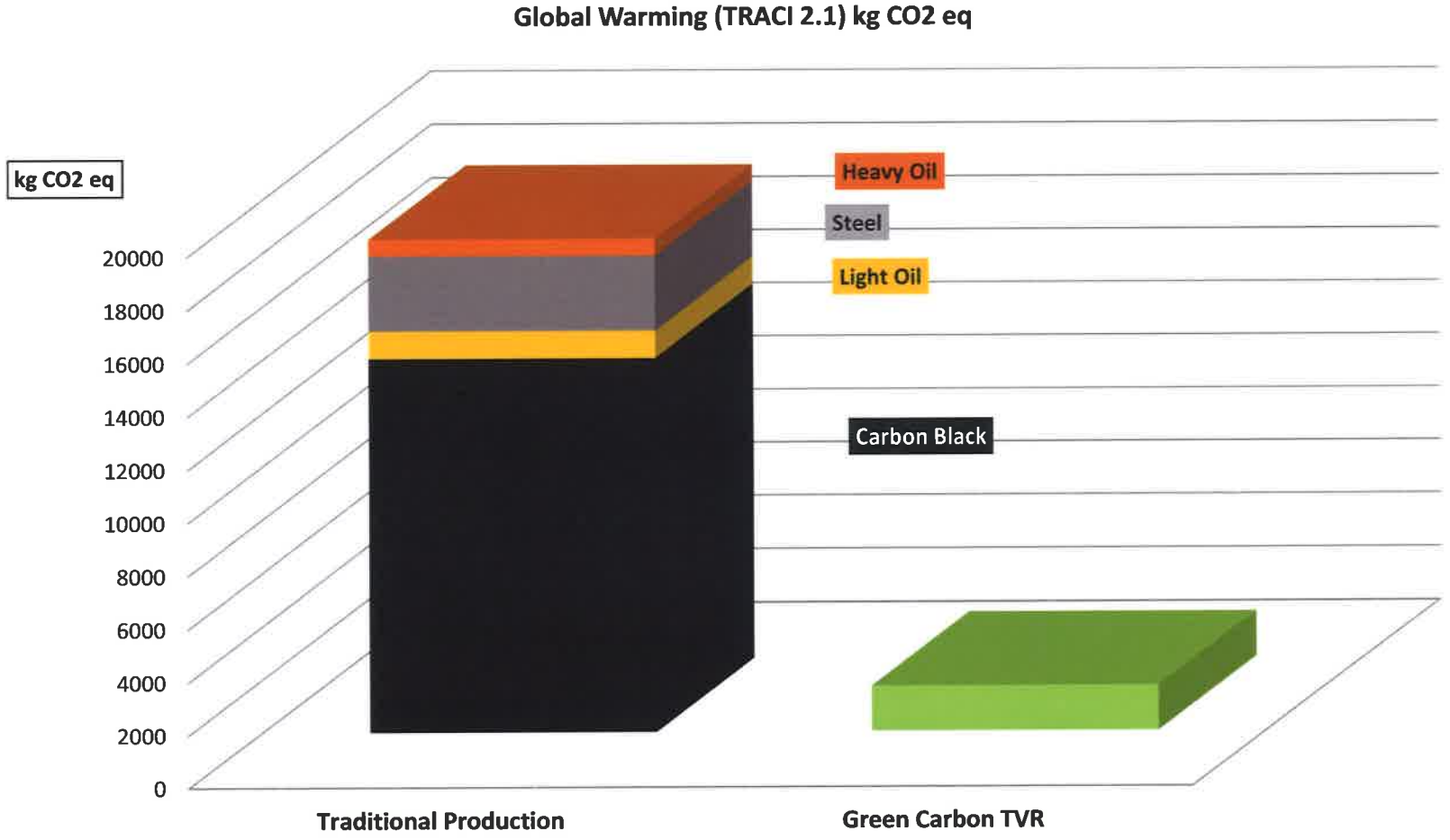
LCA

Life Cycle Analysis



GHG Benefits of Green Carbon Process

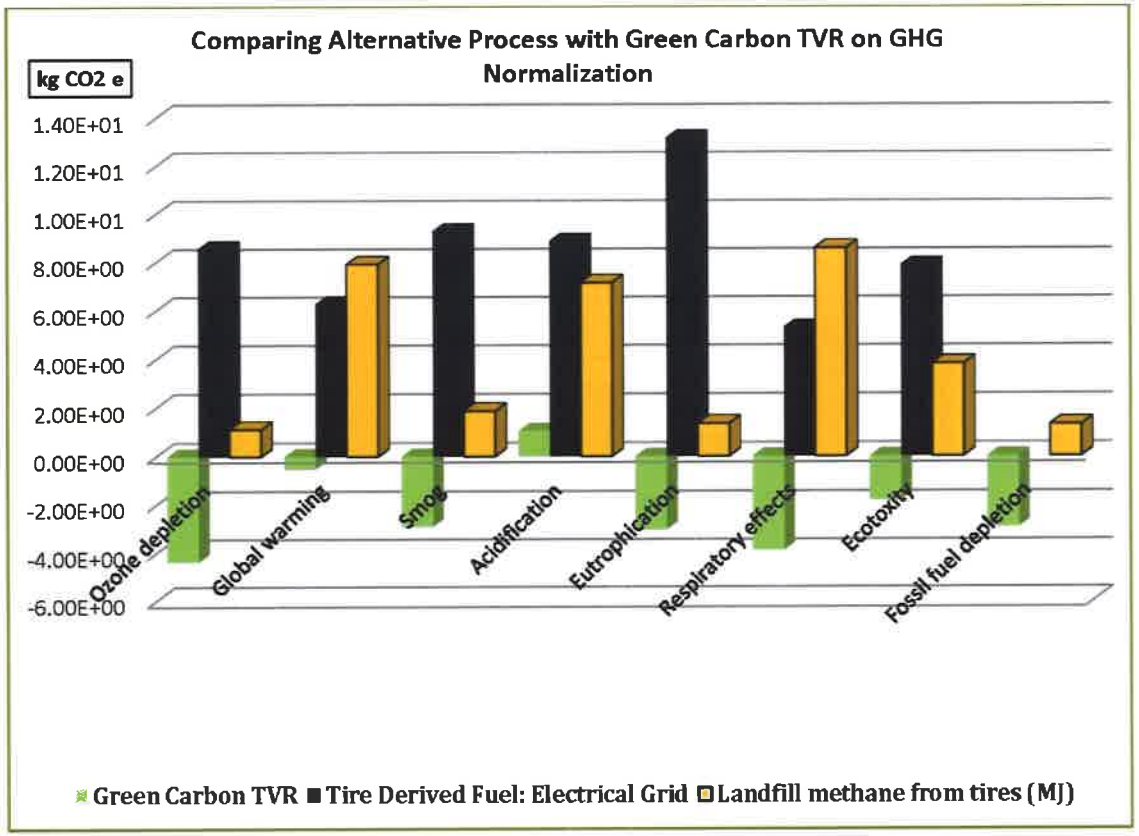


Impact Assessments for Green Carbon TVR GHG with comparison to Landfill; Tire Derived Fuel at Coal Plants / Electricity .

Figure ES-2. Has unit measure comparisons based on Green Carbons TVR processing an input of a 10,000 Lb. 63" Mining Tire.

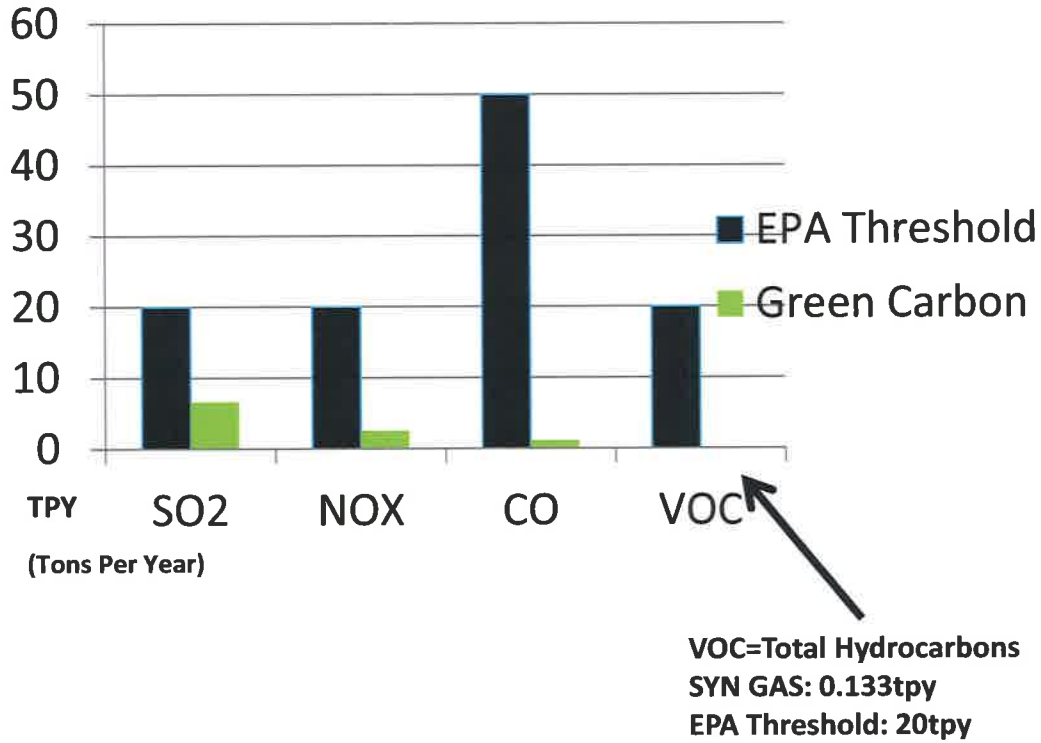
- Carbon Black = 3530 Lbs.
- Light Oil = 390.4 Gal (2732 Lbs.)
- Steel = 1570 Lbs.
- Heavy Oil = 256.2 Gal (1793 Lbs.)

Comparing of Green Carbons TVR GHG Outputs with Alternative Process



Comparing Impacts on GHG between Green Carbons TVR GHG Outputs with Alternative Process
Comparison is in Units reflecting Normalization
Method: TRACI 2.1 V1.00
Data Base: US-EI 2.2 with Ecoinvent processes

Air Emission vs Permitted

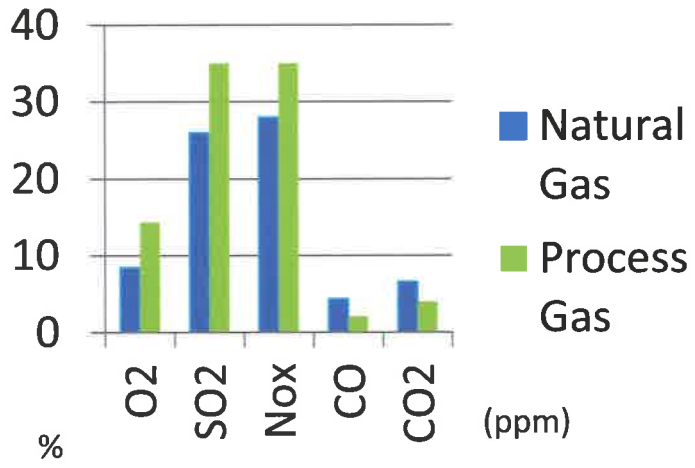


VOC=Total Hydrocarbons
SYN GAS: 0.133tpy
EPA Threshold: 20tpy

Air Emission Results

Natural Gas	O2 (%)		CO2 (%)		NOx (ppm)		CO (ppm)	
	Zero	Upscale	Zero	Upscale	Zero	Upscale	Zero	Upscale
Calibration Gas Conc.	0	11.1	0	8.8	0	150.0	0	150.0
Initial Bias Check Results	0.14	11.1	0.05	8.4	0.32	158.7	3.43	148.6
Final Bias Check Results	0.14	11.0	0.593	8.0	1.06	150.5	3.72	149.5
Average Bias Check Results	0.14	11.1	0.3215	8.2	0.69	154.6	3.575	149.1
Run Average	8.47		7.26		34.67		33.20	
Corrected Average	8.47		7.73		33.12		30.54	

Syn Gas	O2 (%)		CO2 (%)		NOx (ppm)		CO (ppm)	
	Zero	Upscale	Zero	Upscale	Zero	Upscale	Zero	Upscale
Calibration Gas Conc.	0	11.1	0	8.8	0	150.0	0	150.0
Initial Bias Check Results	0.12	11.1	0.087	8.6	0.320	149.1	1.270	148.0
Final Bias Check Results	0.12	11.2	0.160	9.1	0.320	148.3	1.170	143.5
Average Bias Check Results	0.12	11.1	0.124	8.9	0.320	148.7	1.220	145.7
Run Average	14.34		4.57		40.10		14.06	
Corrected Average	14.34		4.46		40.23		13.33	



Green Carbon Accomplishments

- US Patent - Jan 8, 2013
- South African Patent - April 4, 2014
- Canada Patent - July 8, 2013
- Europe Patent -Nov 15 2013

- TSCA Consent & Approval
  - Light Oil # P-12-0557 – Aug, 6, 2013
  - Heavy Oil # P-12-0558 – Aug, 6, 2013
  - Carbon Black # S-13-0006 – Sep, 26, 2013
- EPA RSF2 Application
- Screening LCA EarthShift – Oct, 2013

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TSCA Consent and Approval
Green Carbon Oil Products

UNITED STATES ENVIROMENTAL PROTECTION AGENCY

OFFICE OF POLLUTION AND TOXICS

REGULATION OF A NEW CHEMICAL SUSTANCE

PENDING DEVELOPMENT OF INFORMATION

In the matter of:	)	**Premanufacture Notice Numbers:**
	)	
	)	
	)	
	)	
Green Carbon	)	**P-12-0557 and P-12-0558**

This consent order precedes a final determination by EPA that these new chemical substance mat present an unreasonable risk and thus may be regulated by a 5 € consent order. Neither the general terms outlet nor speific conditions imposed should be construed to reperesnt a final EPA decision and represent only a possible outcome suggested by EPA staff.

This draft is being provided for discussion purposes only.

Consent Order and Determinations Supporting Consent Order

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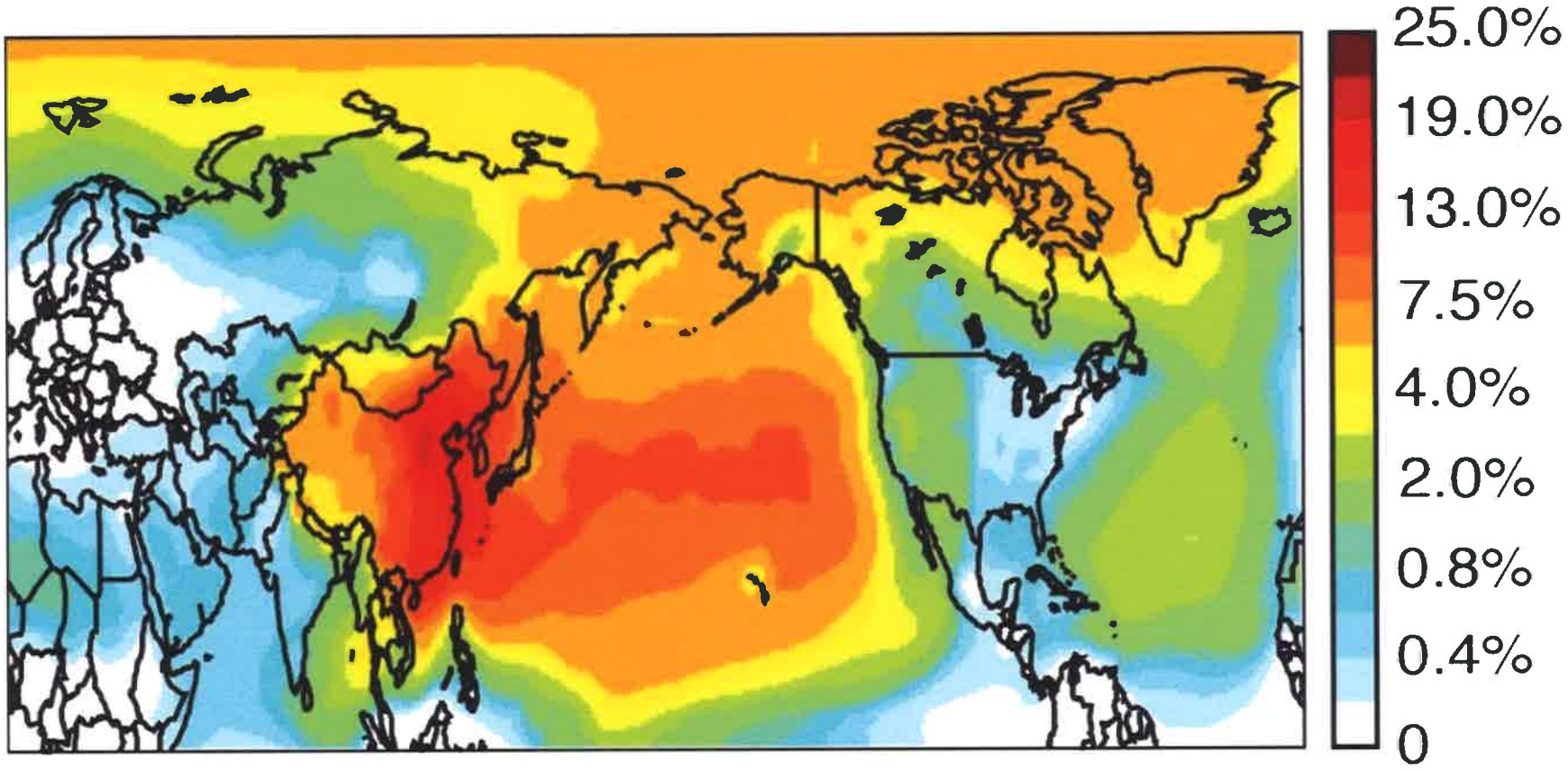
Pollution from China



Annual average percent of black carbon pollution related to Chinese exports.