

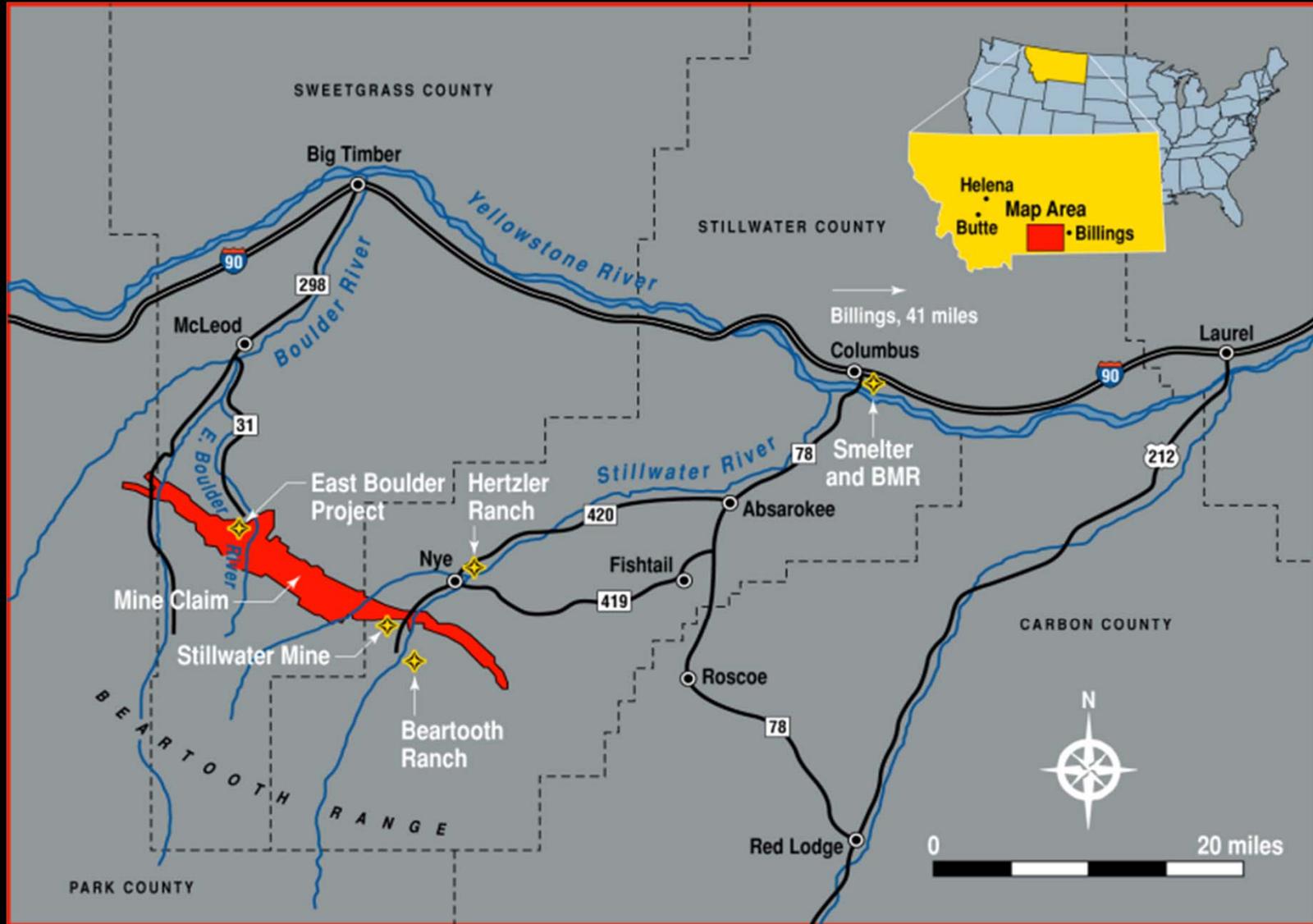


STILLWATER  
MINING COMPANY

# Recycling PGM's at Stillwater Mining Company Mine Design, Operations & Closure Conference

May 2015

# Location





# Stillwater Mining Company Metallurgical Complex

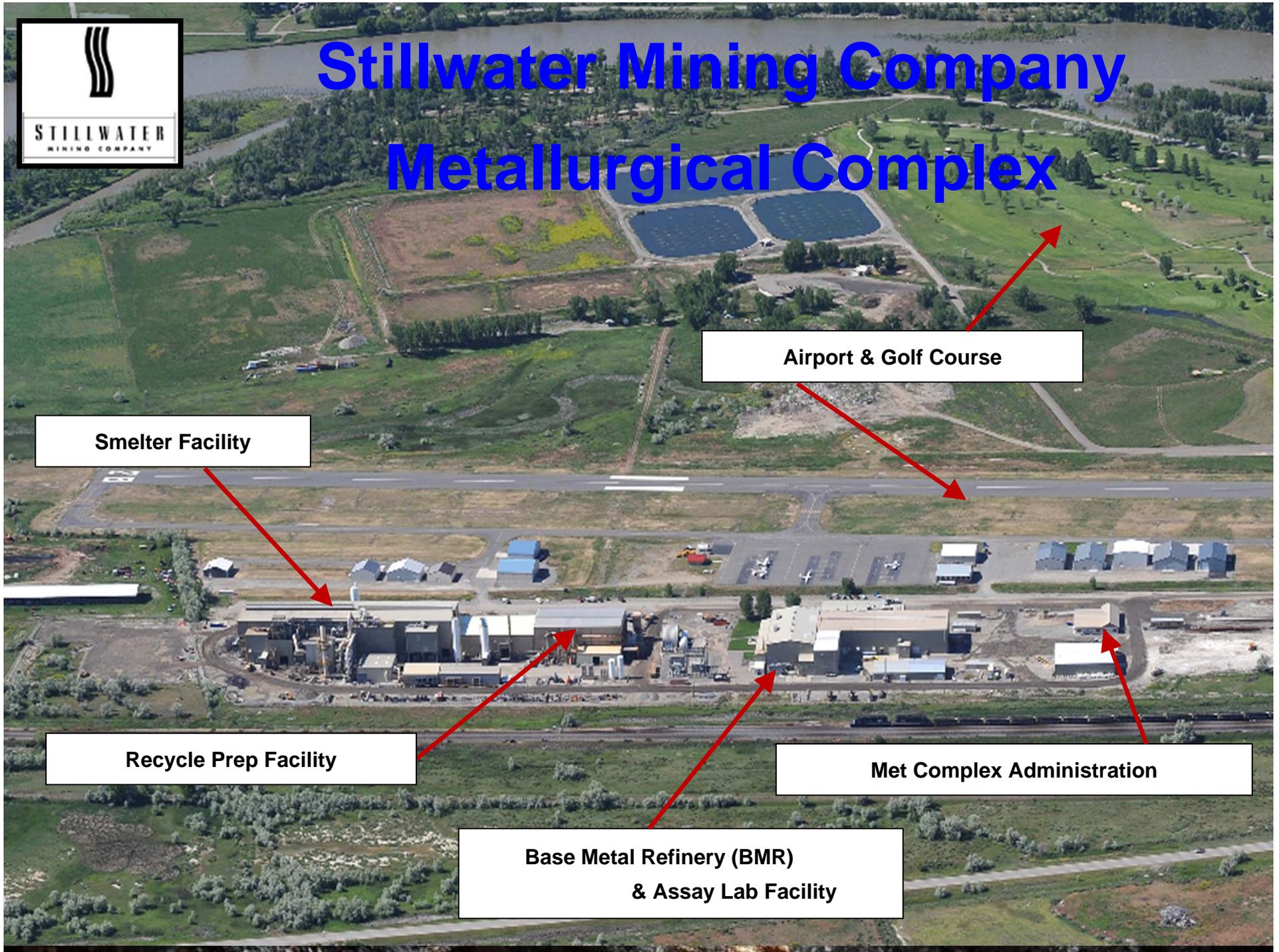
Airport & Golf Course

Smelter Facility

Recycle Prep Facility

Met Complex Administration

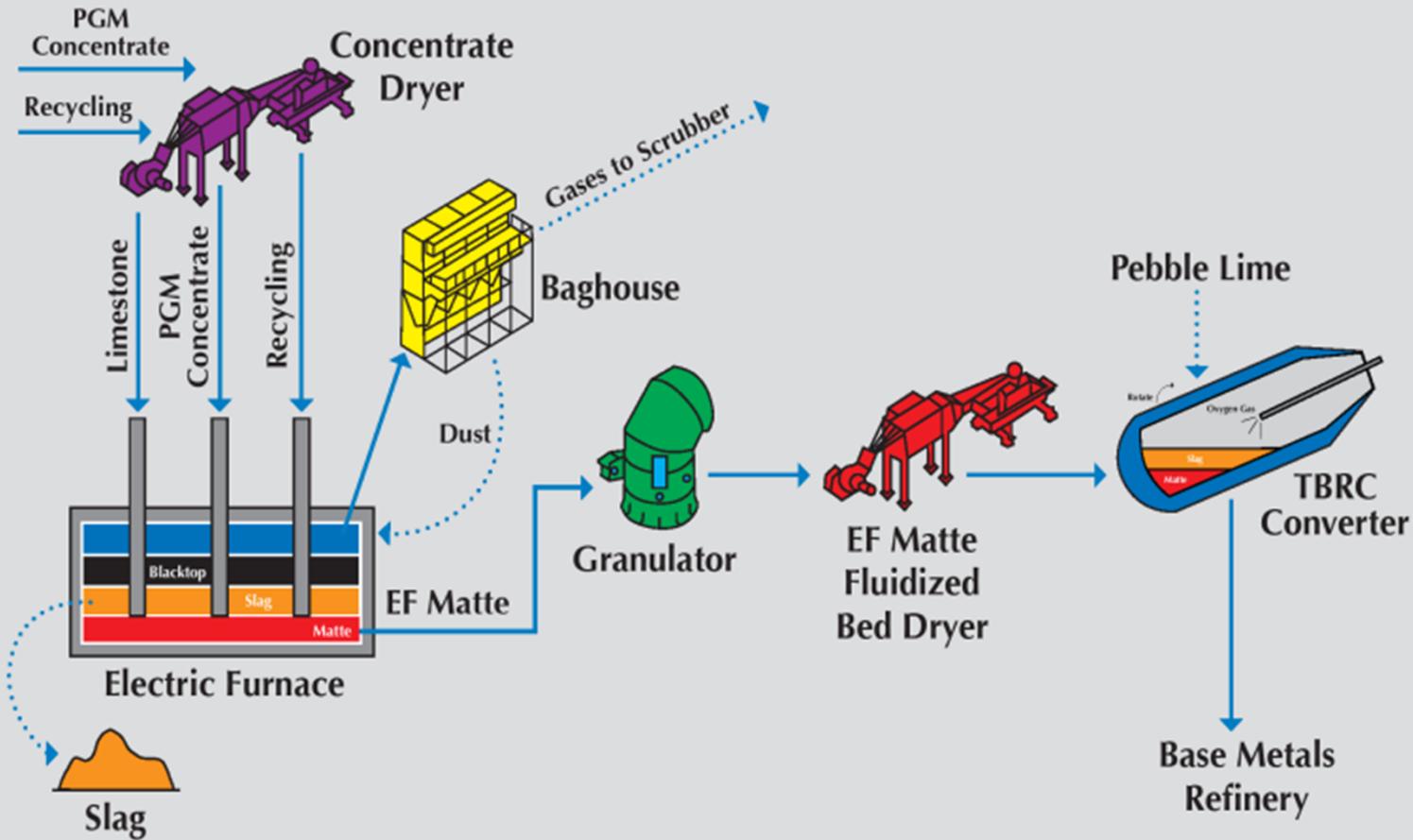
Base Metal Refinery (BMR)  
& Assay Lab Facility



# Precious Metal Smelter



## Stillwater Mining Company PRECIOUS METAL SMELTER SMELTING PROCESS

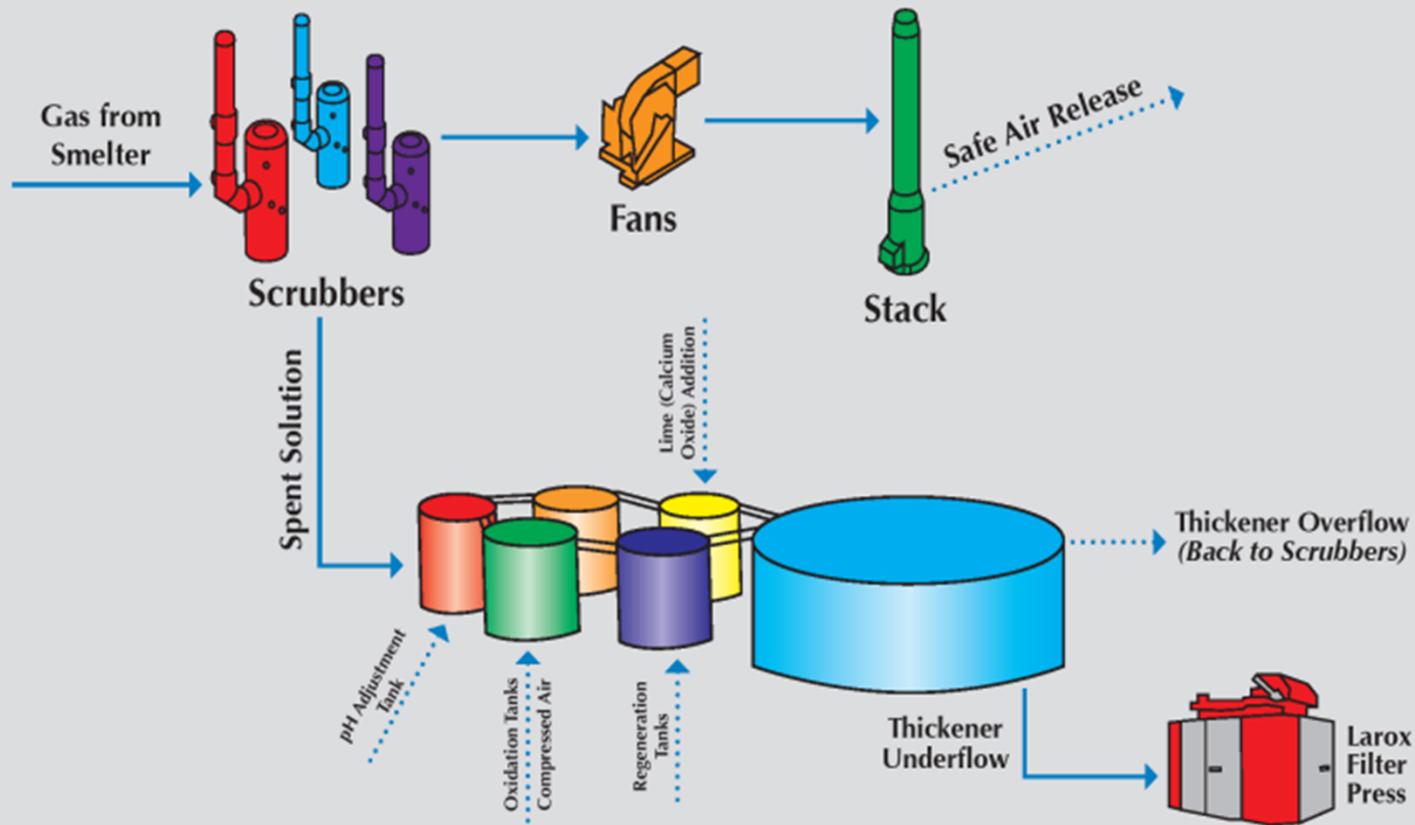


# Smelter – Gas Cleaning Process

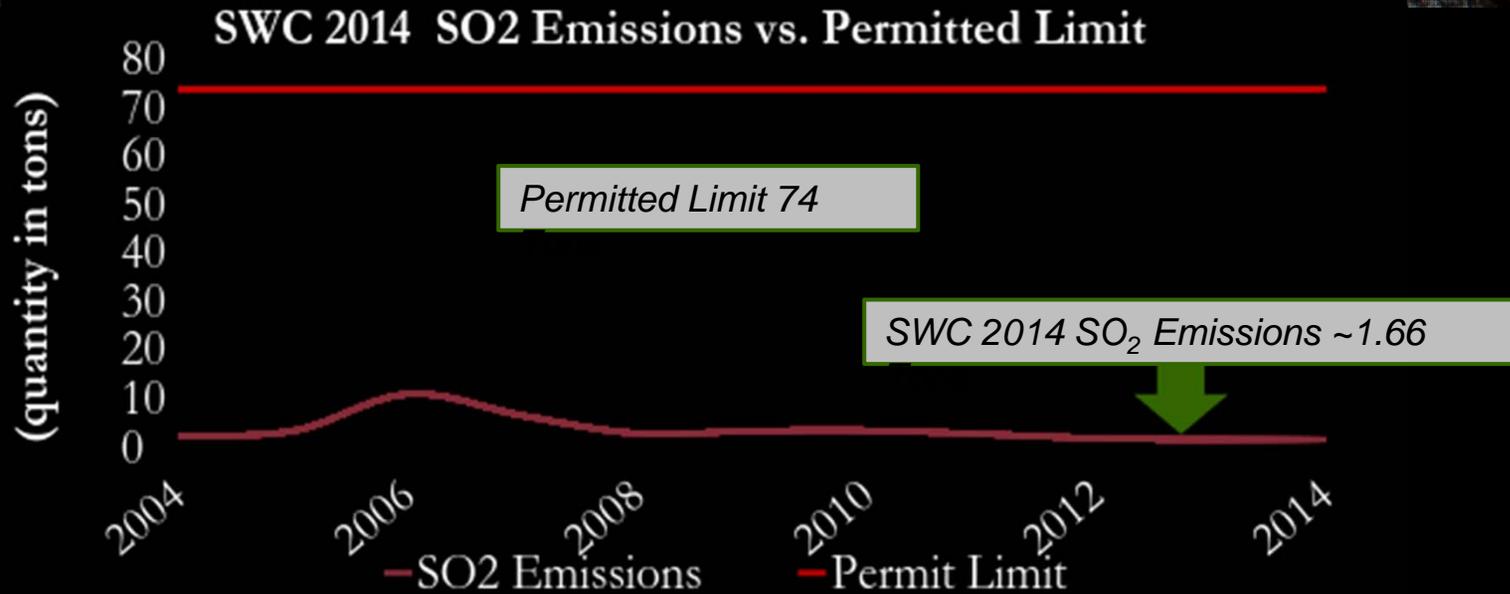


Stillwater Mining Company

## GAS CLEANING PROCESS



# SO<sub>2</sub> Emissions



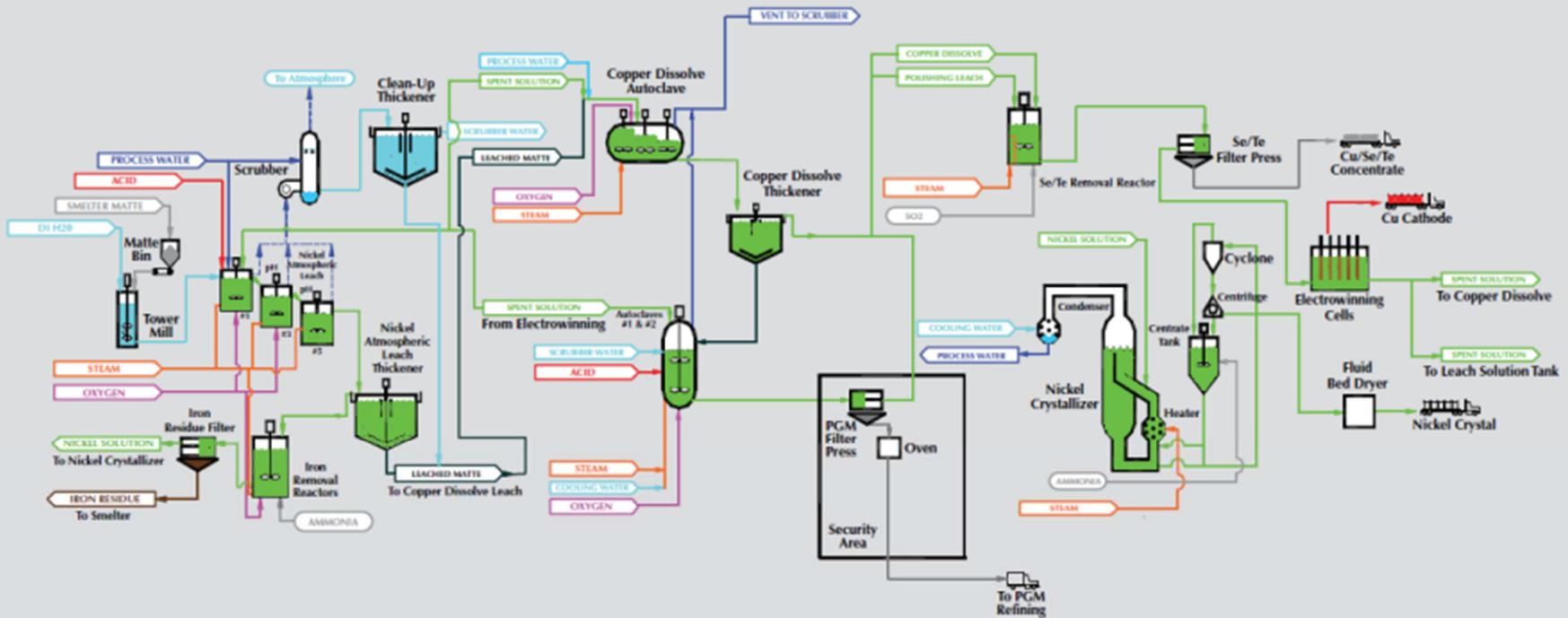
## 2013 SO<sub>2</sub> Emissions Comparison

	SO <sub>2</sub> Emissions Tons/Year	Pd+Pd Production Oz/Year	SO <sub>2</sub> Emissions Lbs/Oz Produced	Emission vs. SWC Factor
Stillwater <sup>1</sup>	1.7	1,094,000	0.003	n/a
Impala <sup>1</sup>	20,390	2,981,000	13.7	4,402
Anglo Platinum	21,120	3,761,000	11.2	3,614
Lonmin	4,778	1,030,000	9.3	2,985
Northam	4,660	291,000	32.0	10,305
Norilsk	2,100,000	3,313,000	1268	407,912

# Base Metals Refinery

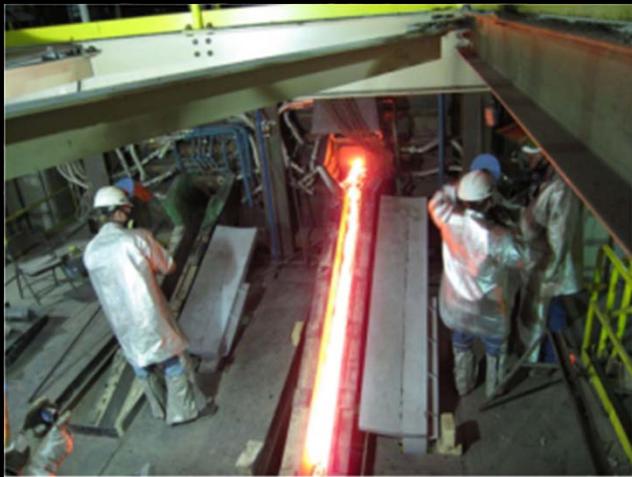


## Stillwater Mining Company Refinery CONDENSED FLOWSHEET





# Stillwater Mining Company



# Why Recycling at SMC?



- Base metal sulfides (copper, nickel, and iron) in mine concentrates are excellent collector metals for Platinum Group Metals (PGM's) from spent catalysts
- Recycle allows for efficient use of excess Smelter and BMR capacity with minimal impact to environmental or safety standards
- The additional PGM's from Recycling allow SMC to be a bigger player in the PGM industry resulting in better refining and marketing terms
- Prior to SMC entering the recycling business, most autocatalyst PGM's were sent overseas for processing

# Recycling History at SMC

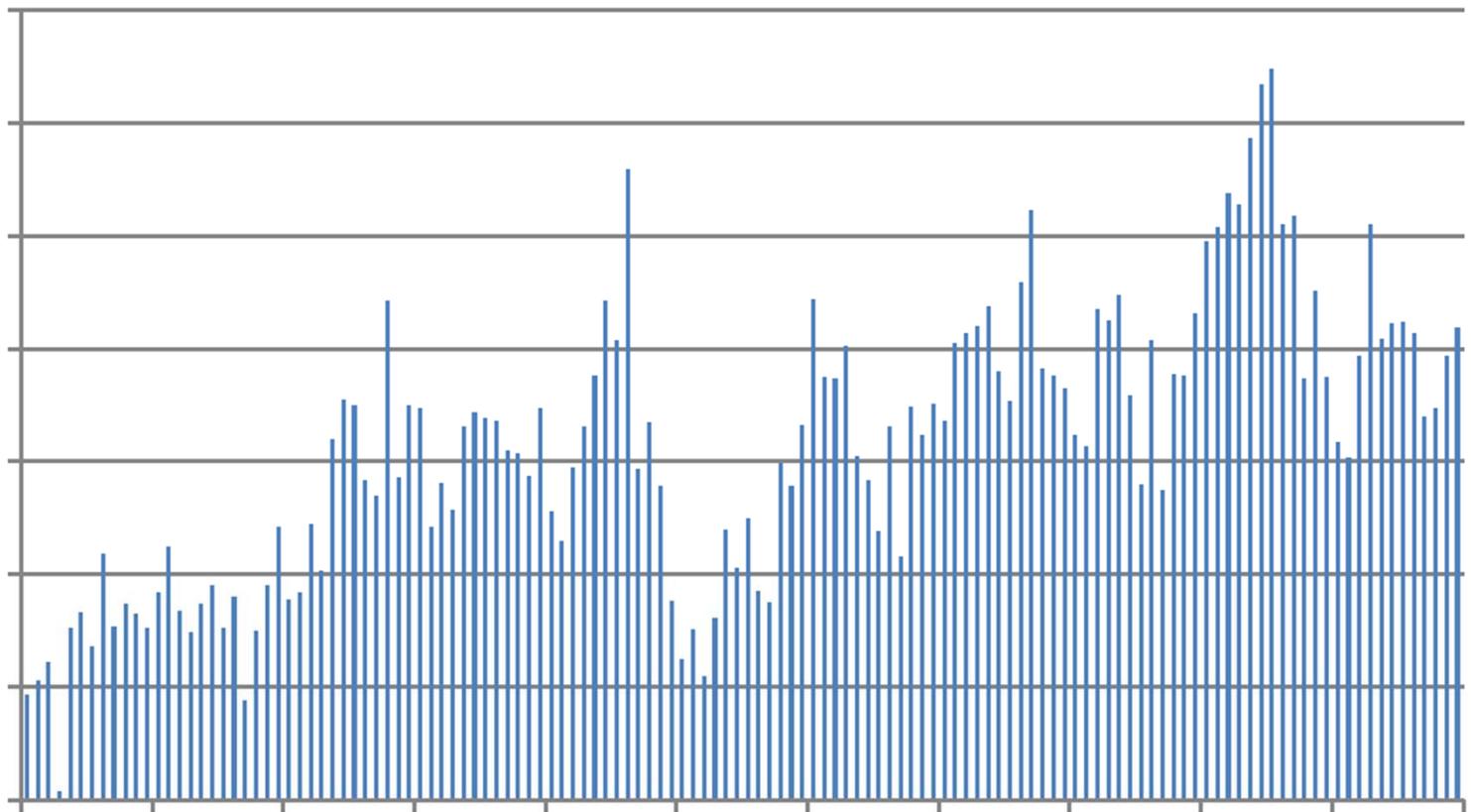


- 1990 – Commissioned Smelter – 30 tpd
- 1994 – Evaluated potential for recycling, tested small quantities
- 1996 – Commissioned Base Metals Refinery
- 1997 – Commissioned Sampling Facility
- 1999 – Commissioned new Smelter – 100 tpd
- 2003 – Entered into long term autocatalyst supply agreement
- 2009 – Commissioned new 150 tpd Smelting Furnace
- 2010 – Commissioned new Sampling Facility (August 2010)
- 2011 – Commissioned new Automated X-Ray Lab (March 2011)

# Growing Recycling Business



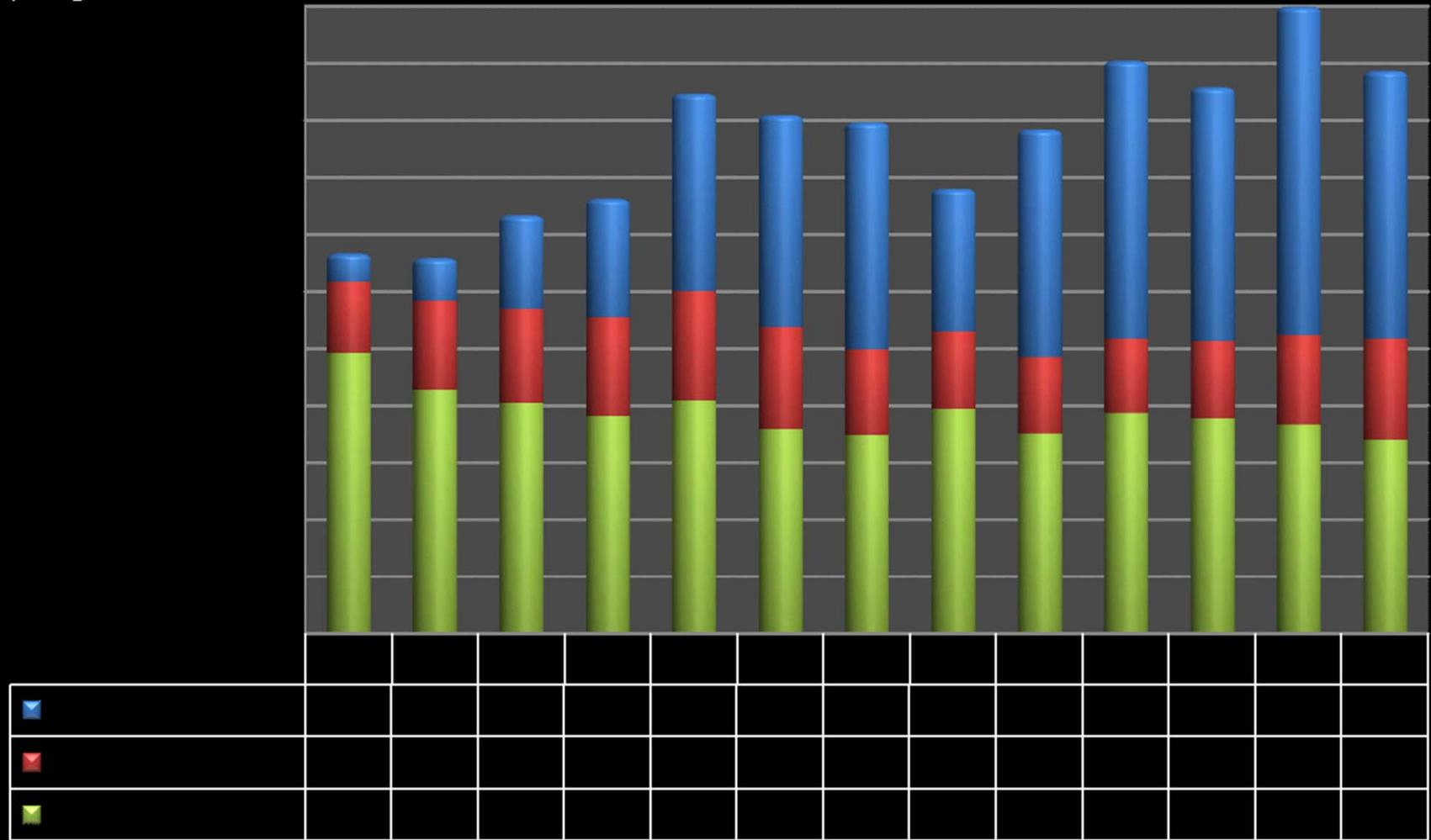
10,000 Monthly ounces produced and annual recycled volume



# PGM Process Volumes – Pt+Pd+Rh

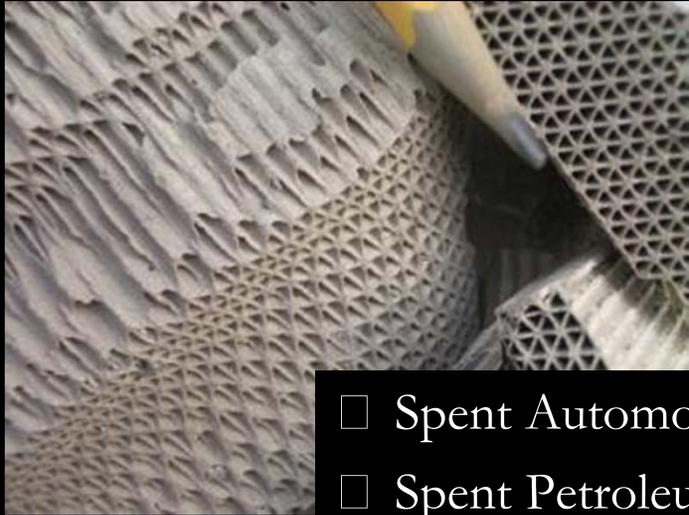


Direct Mine '000 Ounces



Note: Recycle numbers include Rh

# Materials Recycled



- Spent Automobile Catalysts
- Spent Petroleum Catalysts
- Spent Industrial Catalysts
- Refinery Sweeps/Cuttings



# Recycling Highlights



## □ Sources of Spent Catalysts:

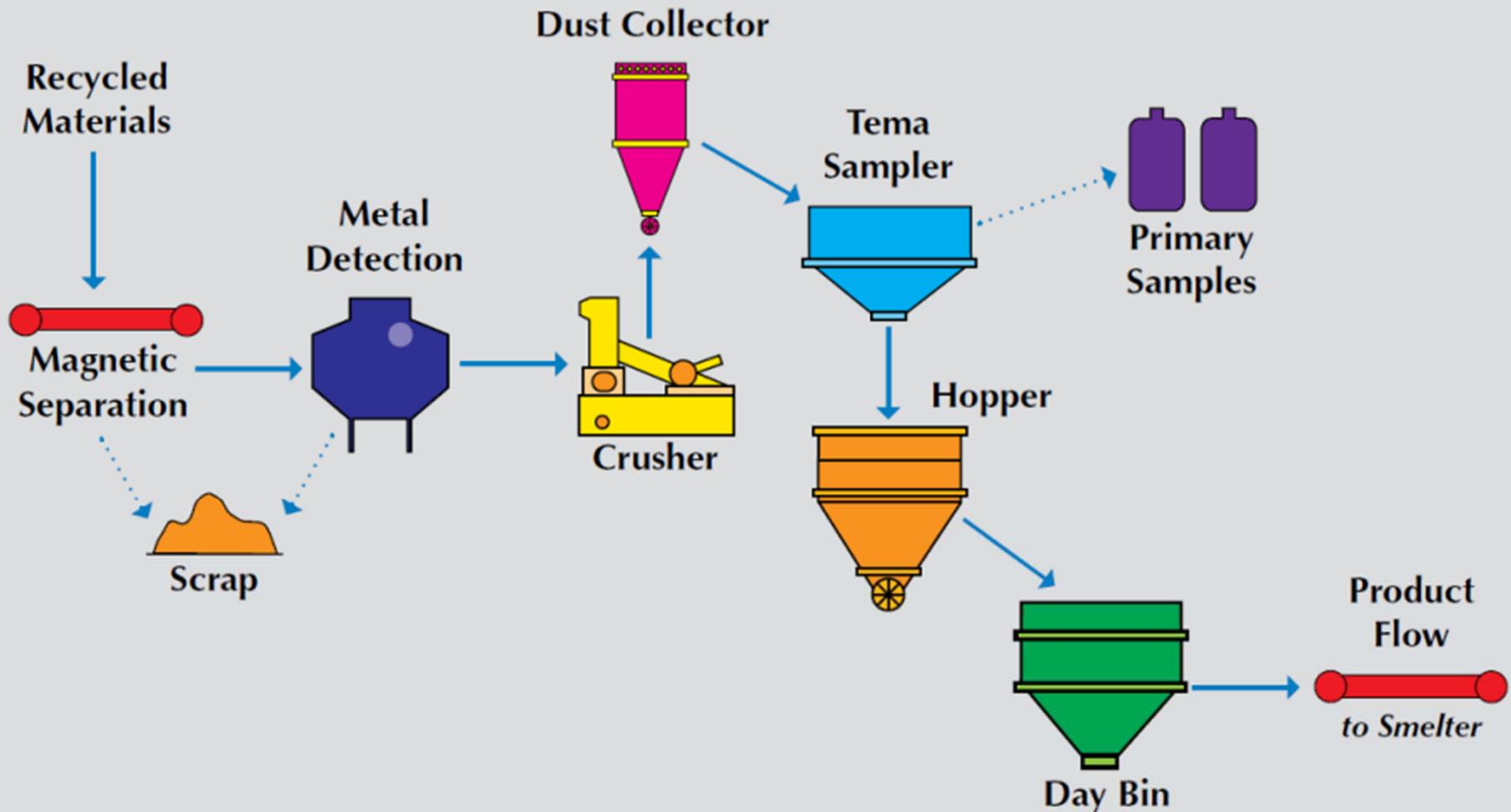
- North America
- Europe
- China
- Australia
- South America

## □ Employment at SMC from Recycling Operations

- 5 Salaried Positions
- 10 Hourly Positions
- 4 Accounting/Marketing Support Positions

# Block Flow Diagram

## RECYCLING PROCESS



# Recycling Sampling Plant



## Stillwater Metals Company - PGM Recycling



# Recycling Sampling Plant

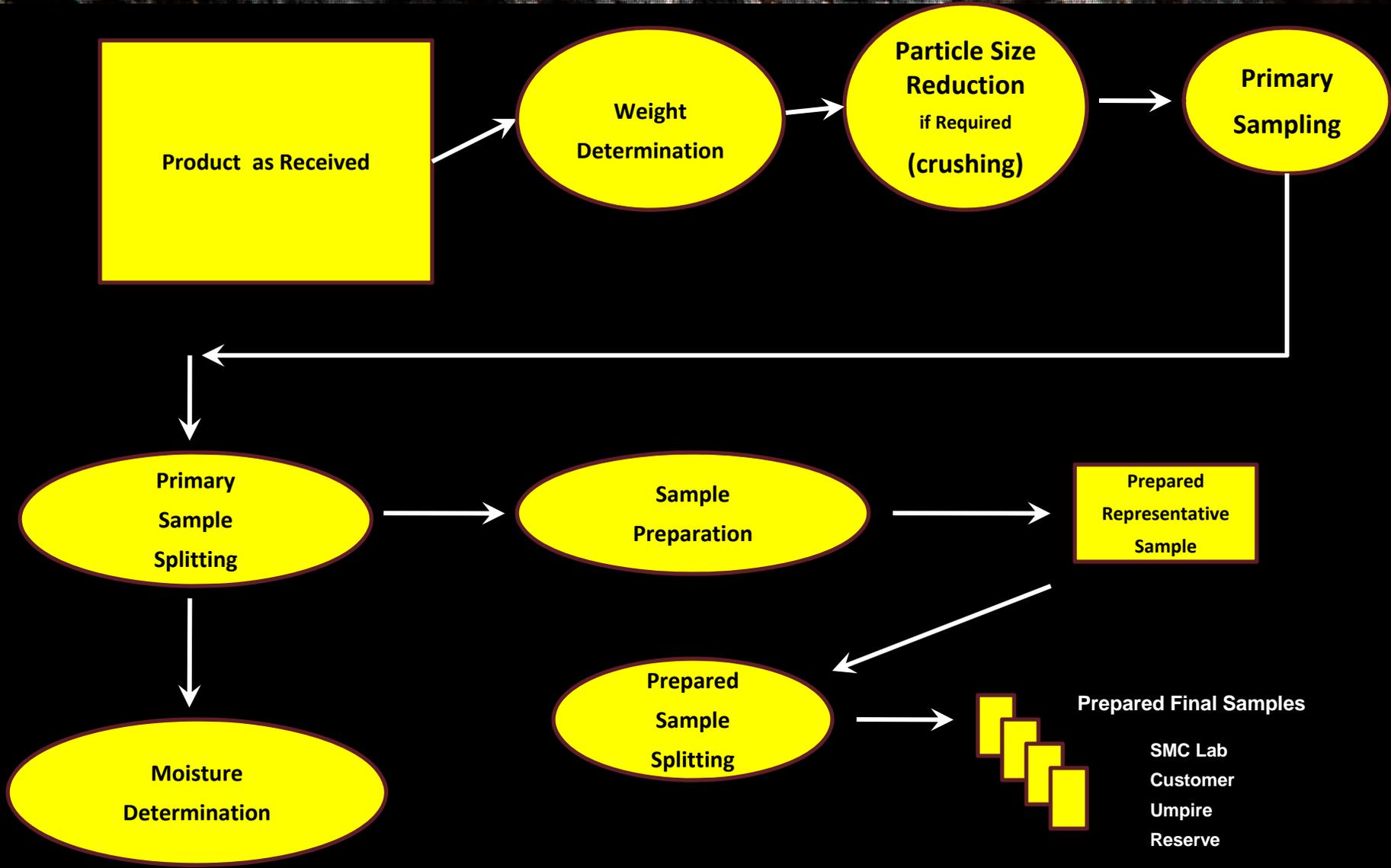


# Sampling Philosophy



- Use of Interpenetrating (Interleaving) samples.
- Requires the ability to obtain at least two samples and/or assays at each sampling and assaying step.
- Allows for:
  - the ability to measure the precision and accuracy of each step.
  - the detection of bias.
  - the calculation of the total sampling/assaying system performance.
  - **detection of system degradation.**

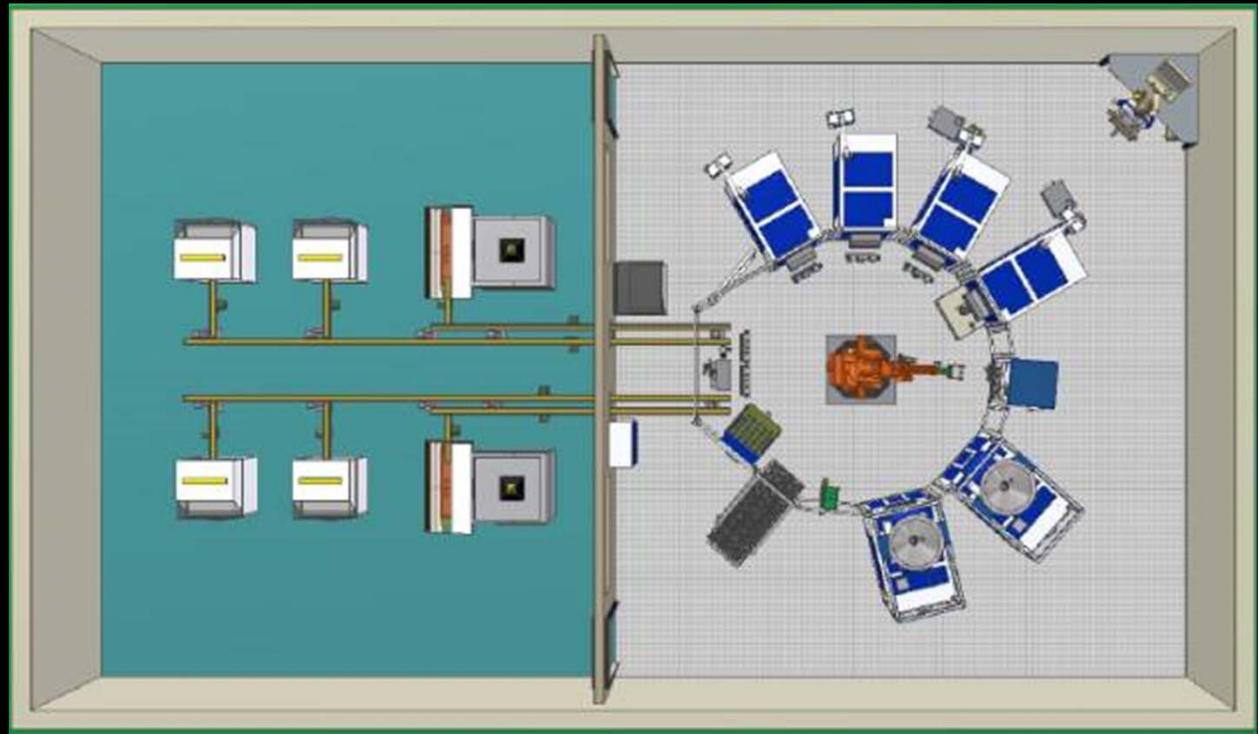
# Sampling Flowchart



# Automated Recycle Lab



## Stillwater Metals Company - PGM Recycling



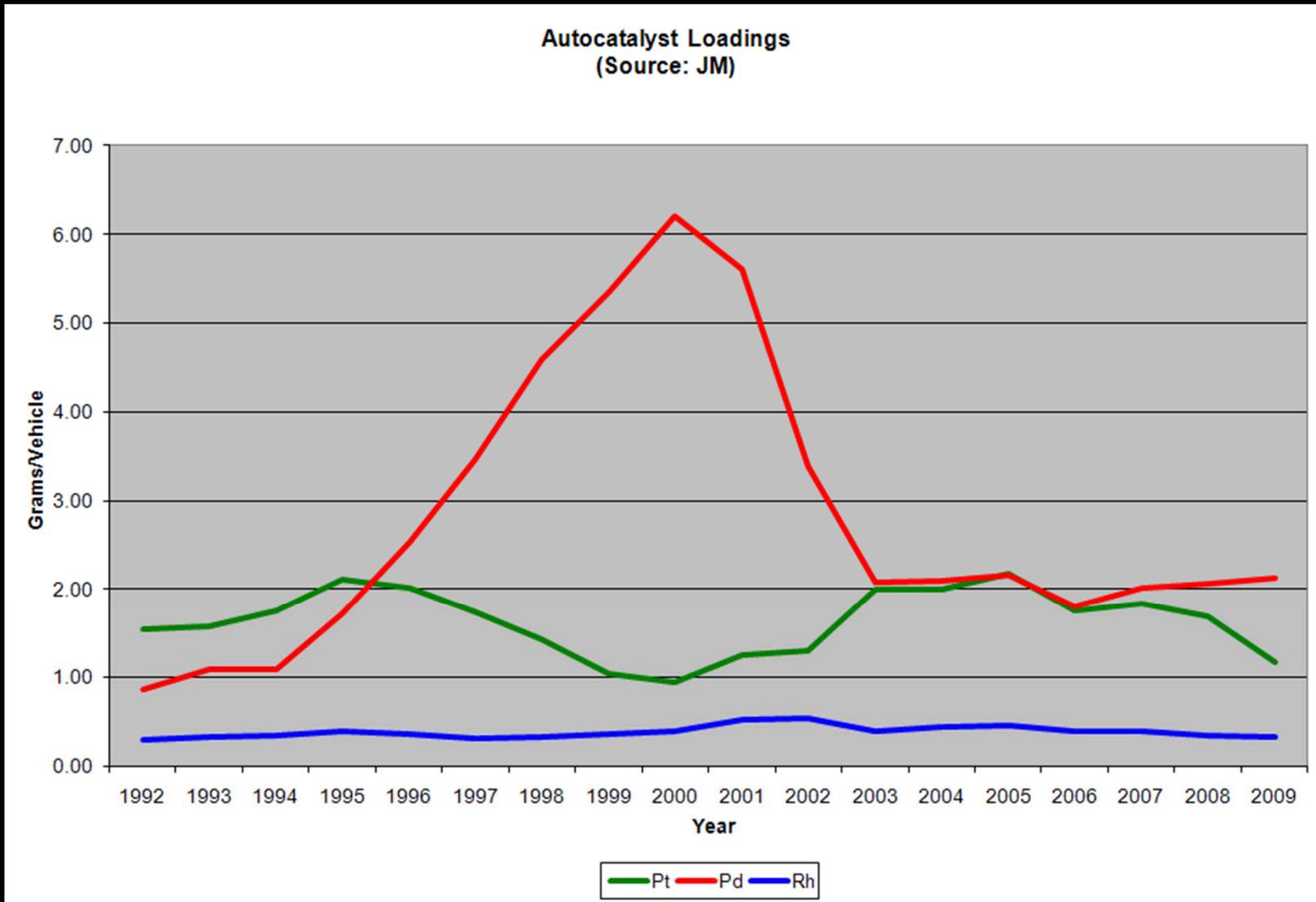
Schematic of X-Ray



# Recycling Analytical Laboratory



# This is why sampling matters!



# Conclusion



SMC has successfully demonstrated that recycling spent catalysts:

- Is a profitable, low risk core business
- Provides synergies with the Company's mining operations
- Improves the long term sustainability of the Company's operations
- Closes the recovery loop for key metals that are needed for a cleaner environment

