

# MARKET SURVEY OF CHEMICAL CHARACTERISTICS OF SMOKELESS TOBACCO PRODUCTS SOLD IN CANADA

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62nd Tobacco Science Research Conference  
September 21-24, 2008  
Nashville, Tennessee, USA

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# Background

## Estimated Canadian Usage (2007)



### Cigarettes

- 28,704,713,382 units reported to Health Canada



### Smokeless Tobacco

- 279,415 kilograms ( $\approx$  372,500,000 cigarettes)

## Health Expert Concerns Regarding Use of Smokeless Tobacco Products

1. Uncertainty in the composition
2. Lack of governmental regulations
3. Uncertainty that any smokeless tobacco product is a safe alternative to smoking

# Objectives

1. Determine the content of target compounds in smokeless tobacco products sold in Canada.
2. Examine possible relationships.
3. Examine alternative methods for expressing contents.
4. Compare levels to the GothiaTek<sup>®</sup> standard\*.

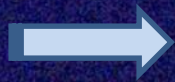
\* <http://www.swedishmatch.com/en/Snus-and-health/Our-quality-standard-GothiaTek/GothiaTek-standards/>

# Smokeless Tobacco Products Available in the Canadian Market Place\*



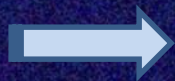
## Long Cut Moist Snuff

- 13 Brands
- Code: LCMSN



## Fine Cut Moist Snuff

- 2 Brands
- Code: FCMSN

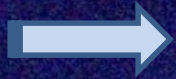


## Pouched Moist Snuff

- 4 Brands
- Code: PMSN

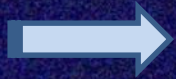
\*A total of 31 products were purchased at retail by Health Canada between November 2007 and January 2008 and stored at 4° centigrade upon receipt.

# Smokeless Tobacco Products Available in the Canadian Market Place



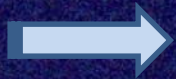
## Low-moisture Snuff

- 6 Brands
- Code: LMSN



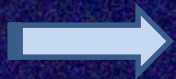
## US Style Chewing Tobacco

- 2 Brands
- Code: CTUS



## Imported Chewing Tobacco

- 2 Brands
- Code: CTIM



## Swedish-type Snus

- 2 Brands
- Code: SWSU

# Sample Preparation\*

## Selection

- 100 grams of sample pooled
- Pouches included where present

## Grinding

- Plug/pouch products ground @2000rpm
- Sieved to 4mm particle size

## Storage

- Homogenous sample bagged
- Stored at 4° prior to analysis

\*T-402, Health Canada Official Method entitled "Preparation of Cigarettes, Cigarette Tobacco, Cigars, Kreteks, Bidis, Packaged Leaf Tobacco, Pipe Tobacco and Smokeless Tobacco for Testing"

# Methods and Analytes

Method	Analytes
TWT-324*	Nicotine
T-302	Ammonia
T-304	Glycerol, propylene glycol, triethylene glycol
T-306	Ni, Pb, Cd, Cr, As, Se, Hg
T-307	Benzo[a]pyrene
T-308	Nitrate
T-309	NNK, NNN, NAT, NAB
T-311	Triacetin
T-312	Sodium propionate
T-313	Sorbic acid
AOAC 966.02	Moisture in tobacco, gravimetric method

\*Protocol to Measure the Quantity of Nicotine contained in Smokeless Tobacco Products manufactured, imported or packaged in the United States. Federal Register/Vol. 62, No. 85/Friday, May 2, 1997

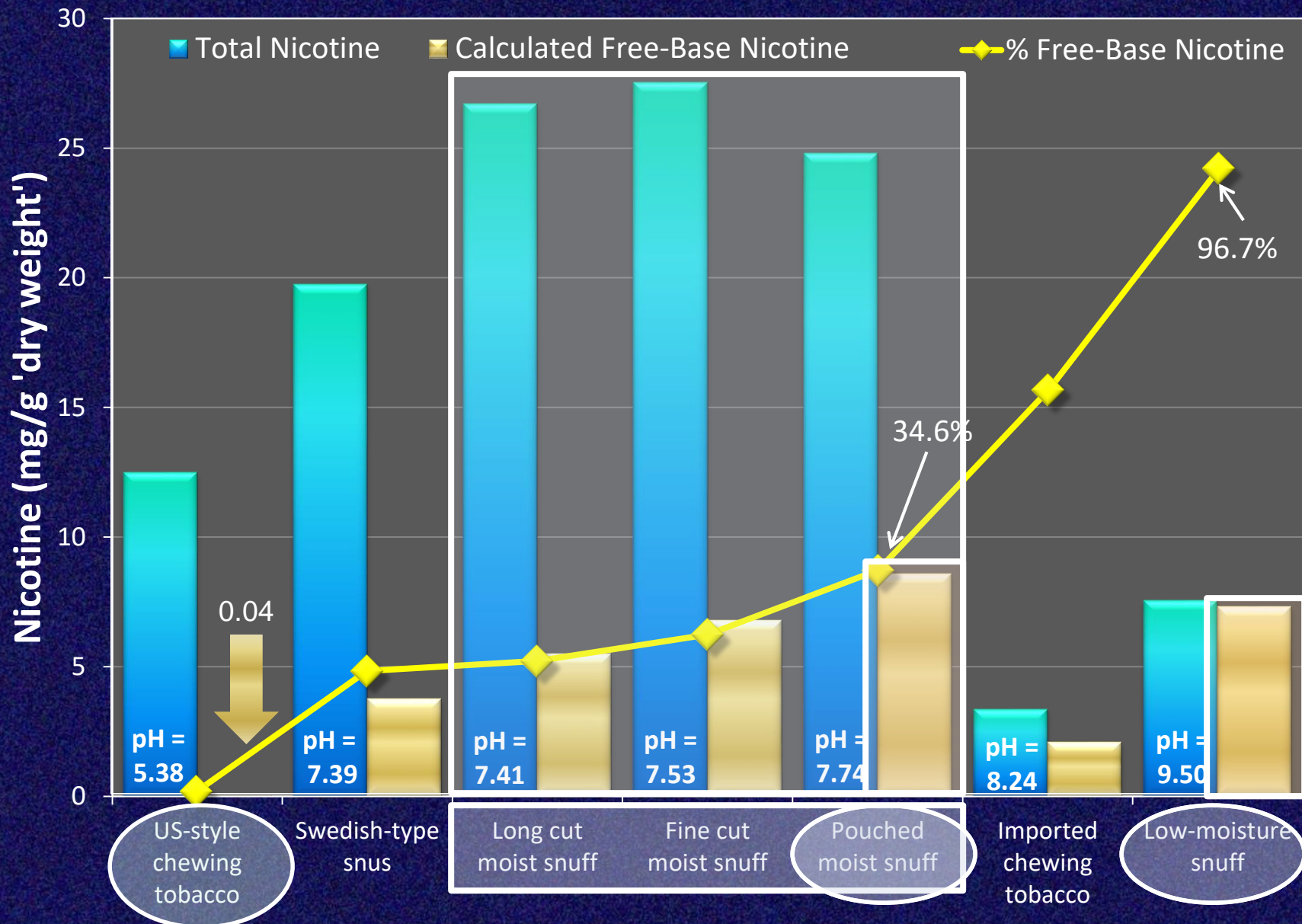
# Partial Characterization of Smokeless Tobacco Products Sold in Canada

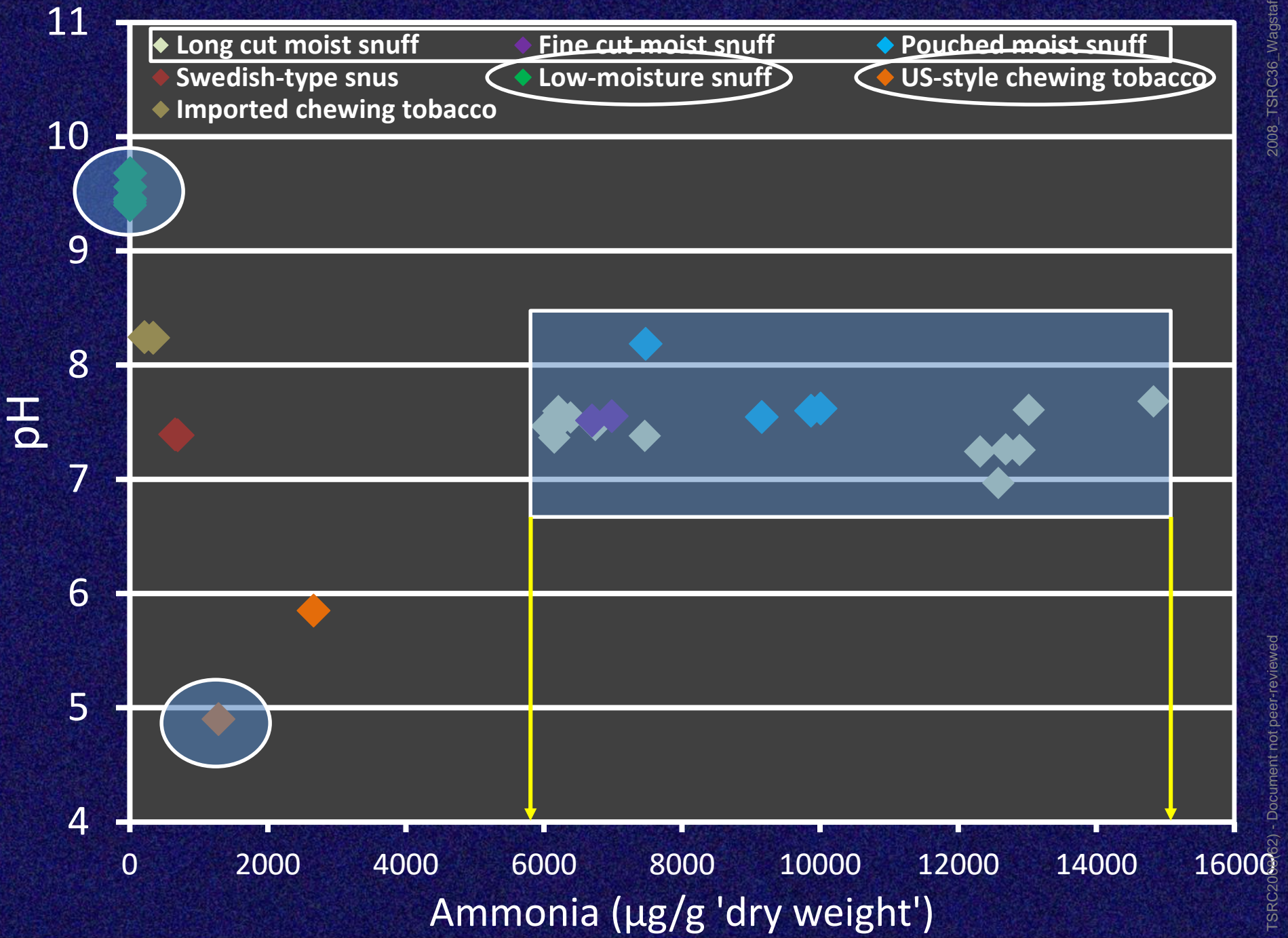
Product Grouping	pH	Ammonia (µg/g)	Nitrate (mg/g)	Moisture (%)	Nicotine (mg/g)	Free-Base Nicotine* (mg/g)
Long cut moist snuff	7.41	9496	30.1	53.3	26.7	5.48
Fine cut moist snuff	7.53	6838	28.7	53.4	27.5	6.78
Pouched moist snuff	7.74	9126	32.5	51.0	24.8	8.58
Swedish-type snus	7.39	676	14.1	27.7	19.8	3.75
Low-moisture snuff	9.50	194	5.52	15.9	7.55	7.31
US-style chewing tobacco	5.38	1974	7.97	19.3	12.5	0.04
Imported chewing tobacco	8.24	277	0.63	6.47	3.36	2.10

\* Calculated using the Henderson-Hasselbalch equation:  $\text{pH} = \text{pKa} + \log(\text{B}/\text{BH}^+)$



# Total Nicotine and Free-Base Nicotine in Relation to pH





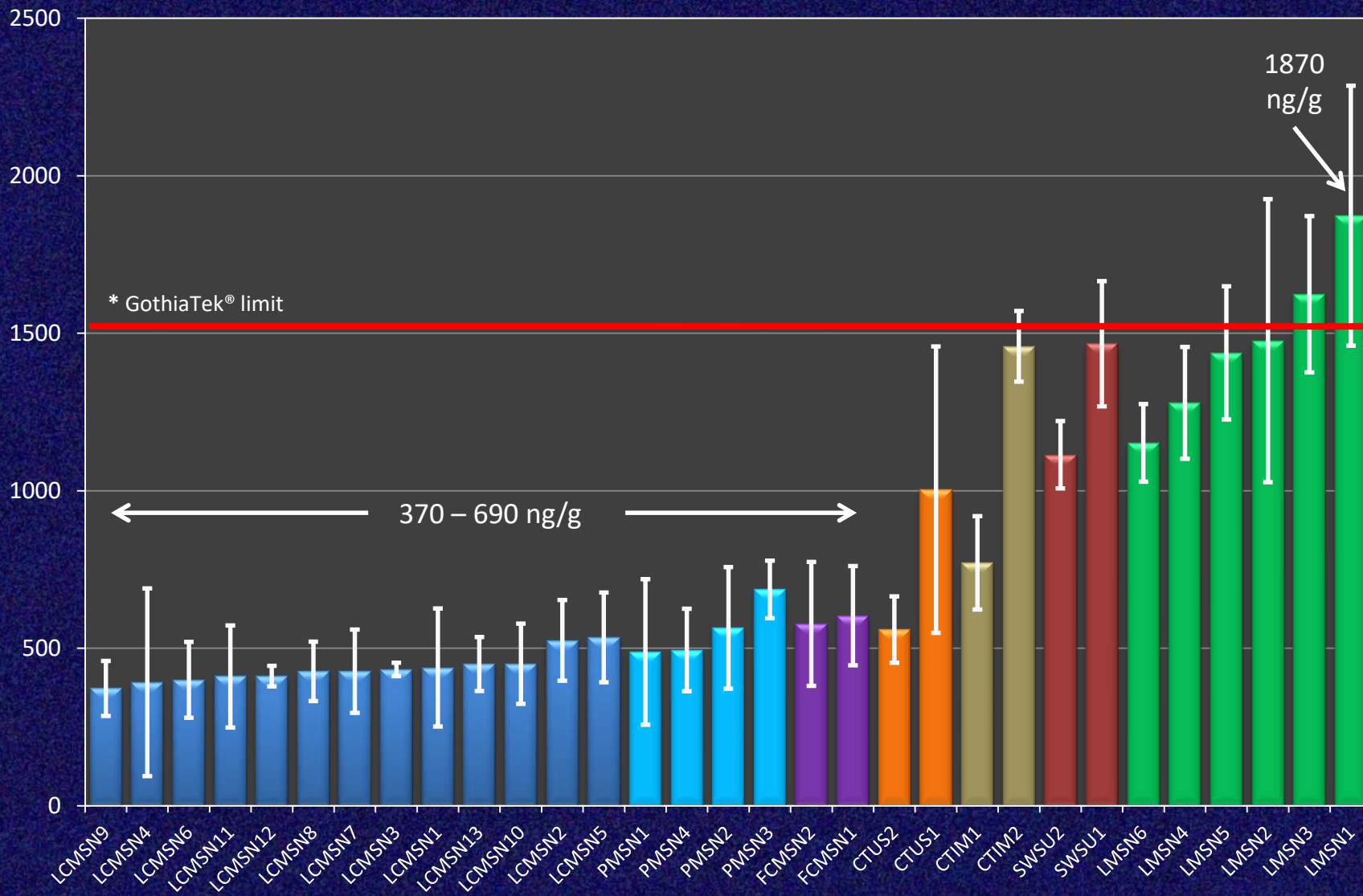
# GothiaTek® Standard (2008) \*

Component	Limit	Component	Limit
Nitrite (mg/g)	0.0035	Cadmium (ng/g)	500
TSNA (ng/g)	5000	Lead (ng/g)	1000
<u>NDMA</u> (ng/g)	5	Arsenic (ng/g)	250
BaP (ng/g)	10	Nickel (ng/g)	2250
Pesticides	According to the Swedish Match pesticide policy	Chromium (ng/g)	1500

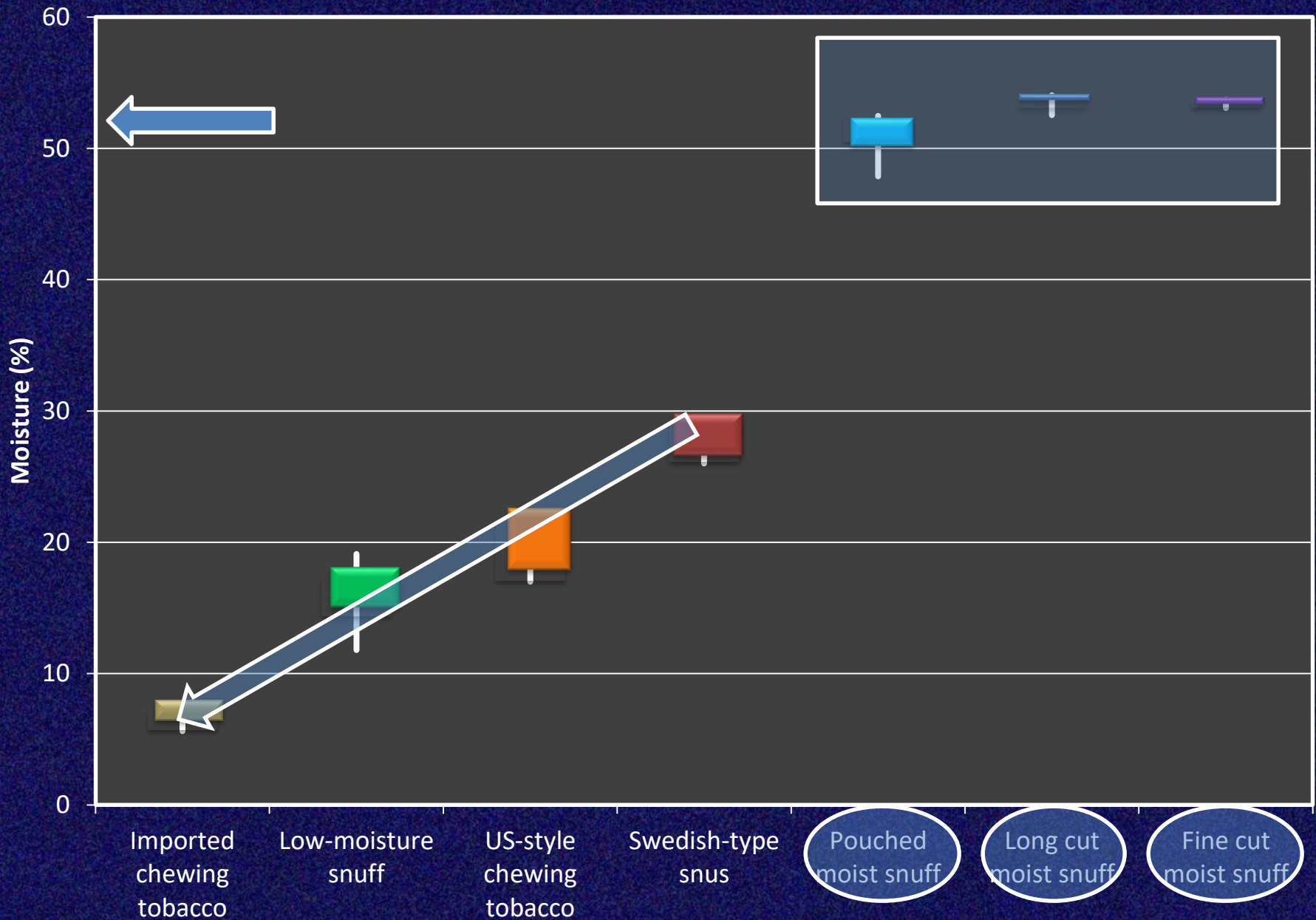
\*Assumes 50% moisture content

# Observed Levels in Relation to GothiaTek® Maxima

Chromium (ng/g) 'as received' ( $\pm$  95% C.I.)

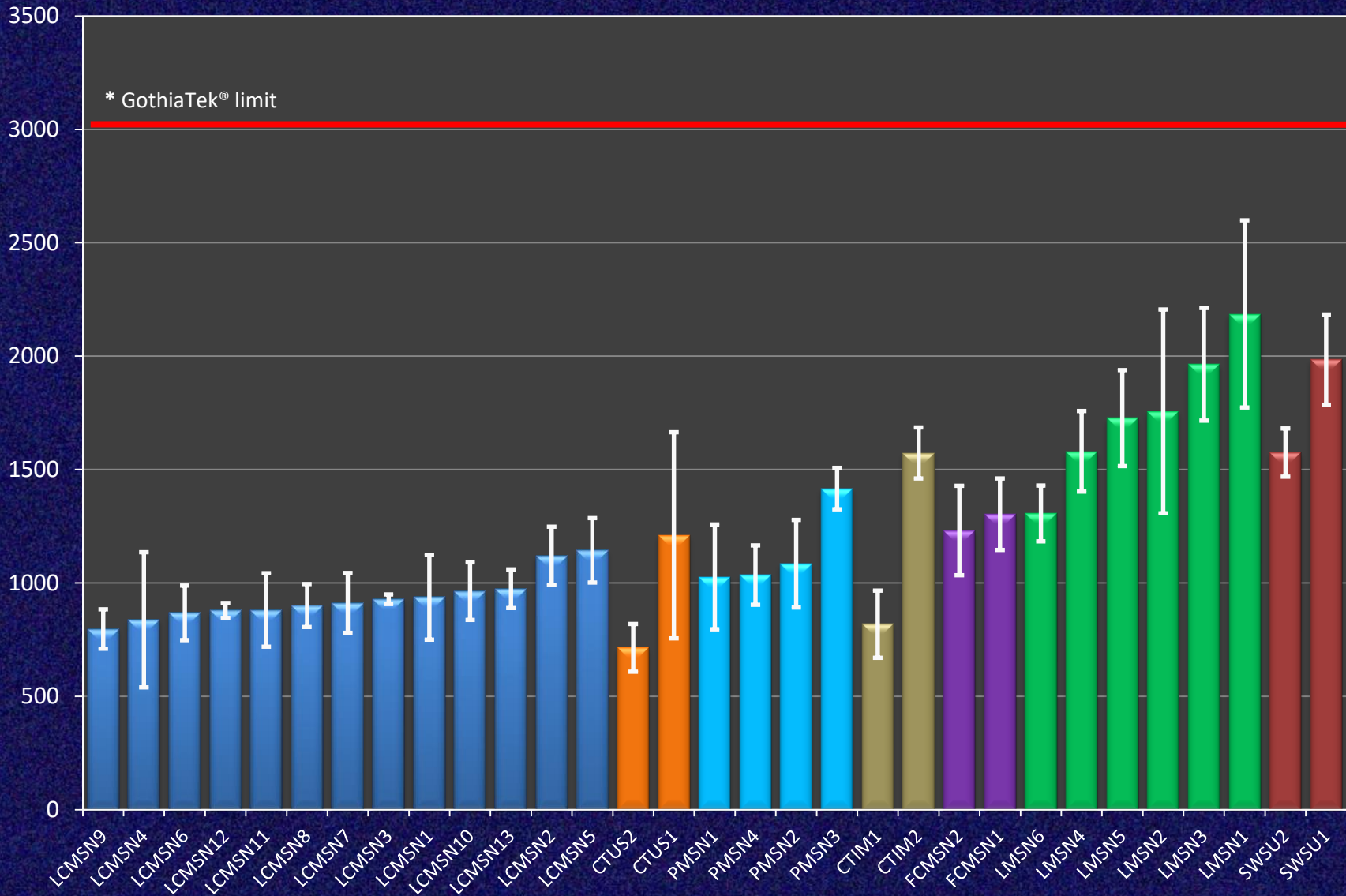


# Moisture Content by Product Type



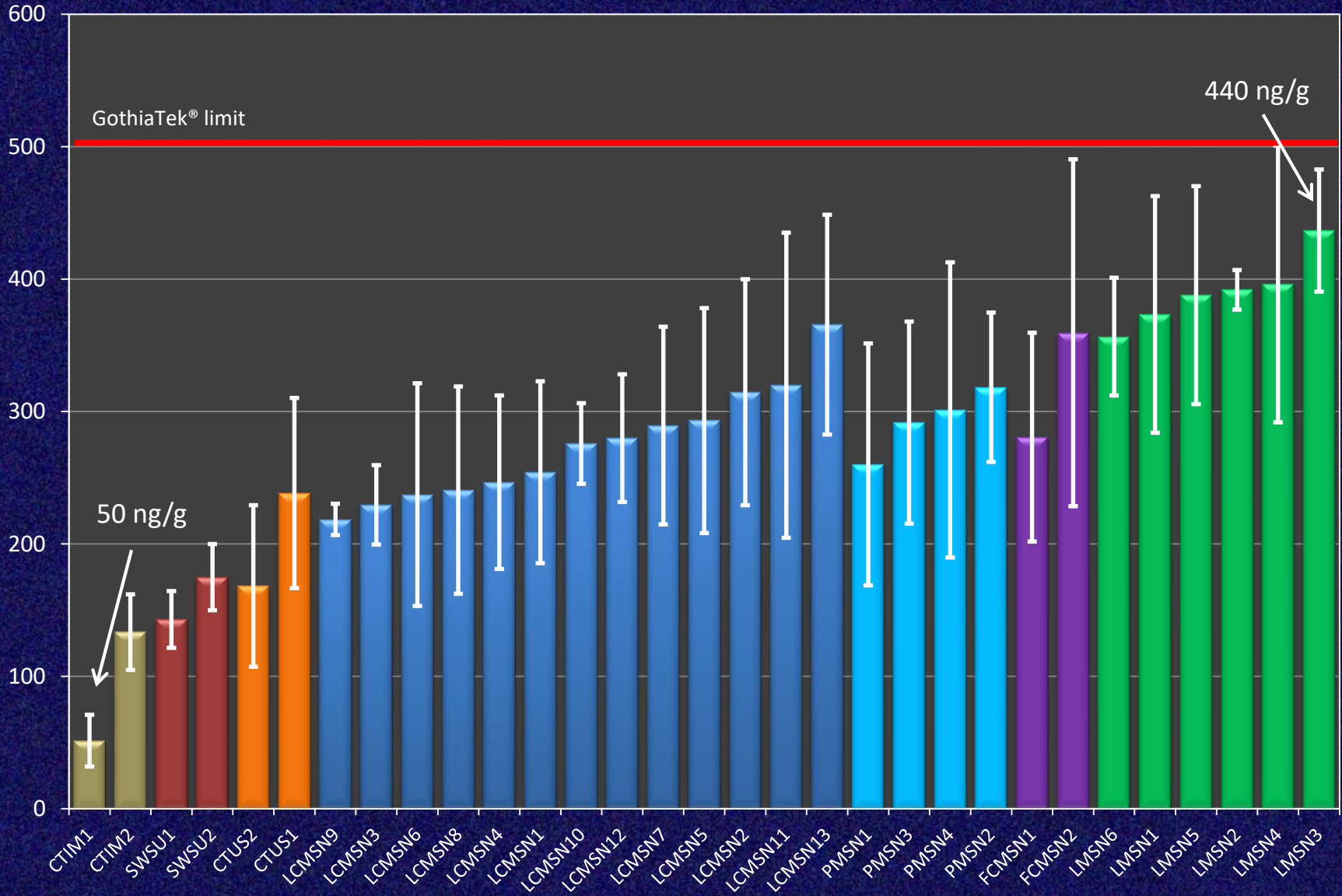
# Observed Levels in Relation to GothiaTek® Maxima

Chromium (ng/g) 'dry weight' ( $\pm$  95% C.I.)

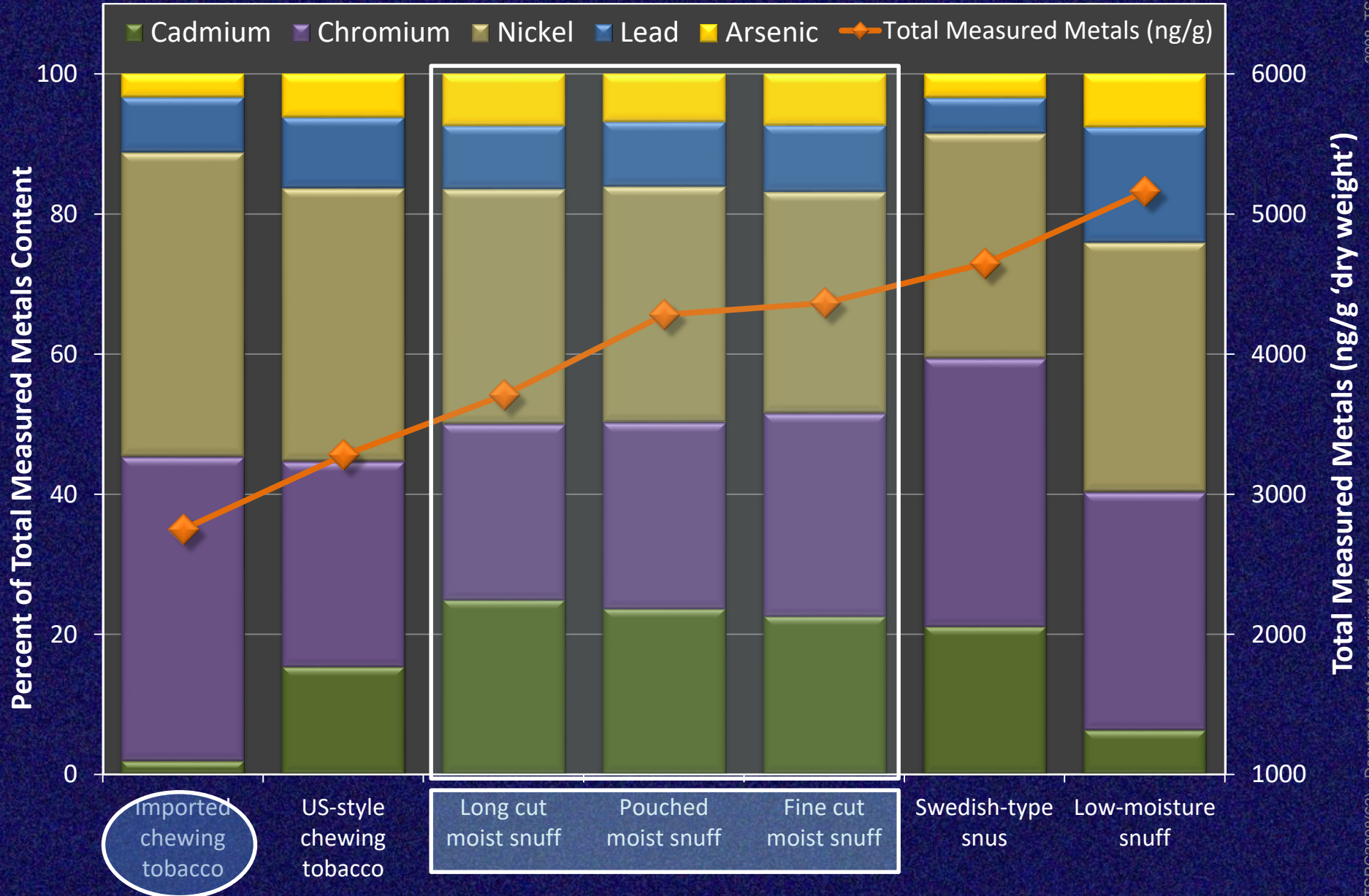


# Observed Levels in Relation to GothiaTek® Maxima

Arsenic (ng/g) 'dry weight' ( $\pm$  95% C.I.)



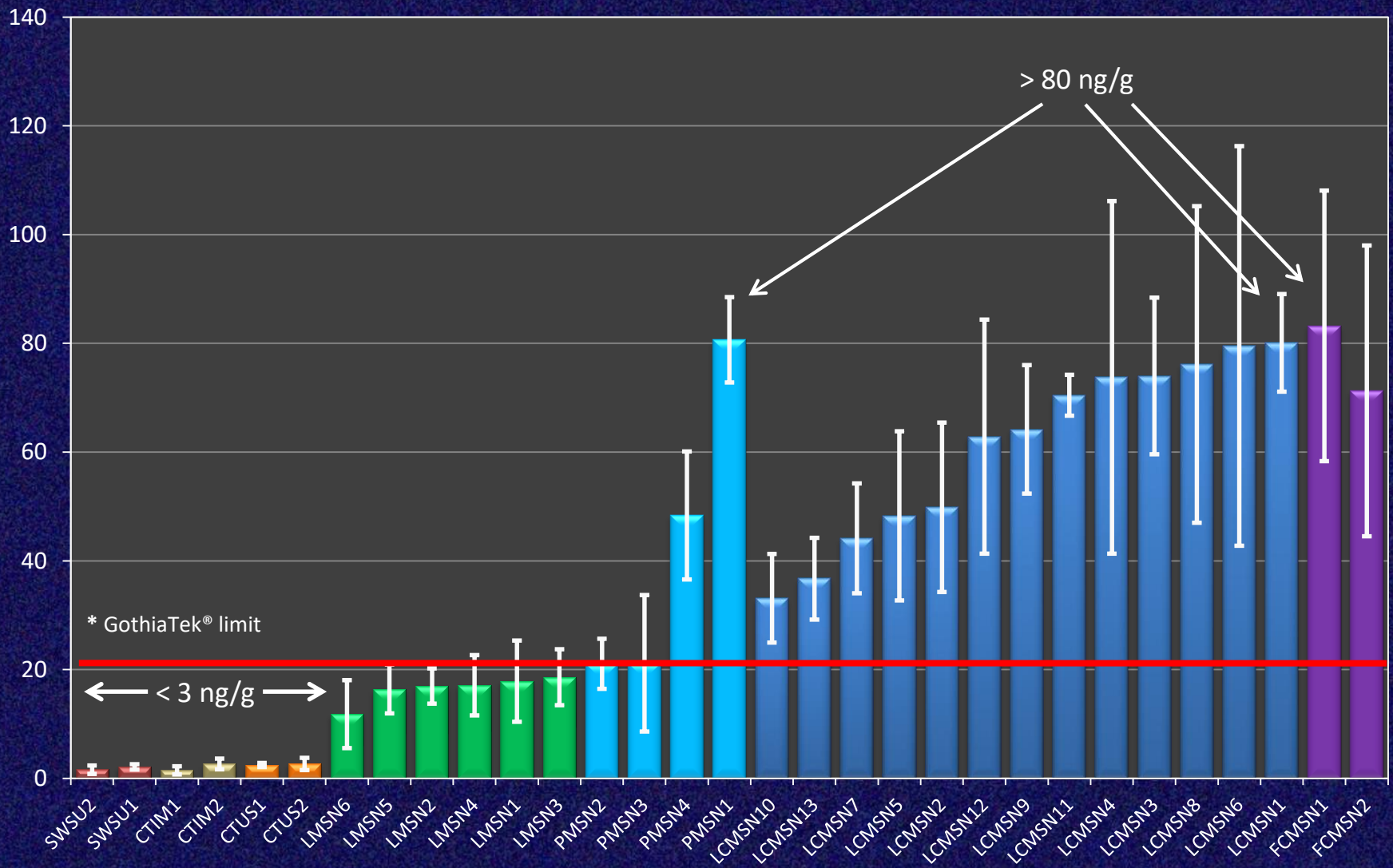
# Percentage Contribution by Individual Metals





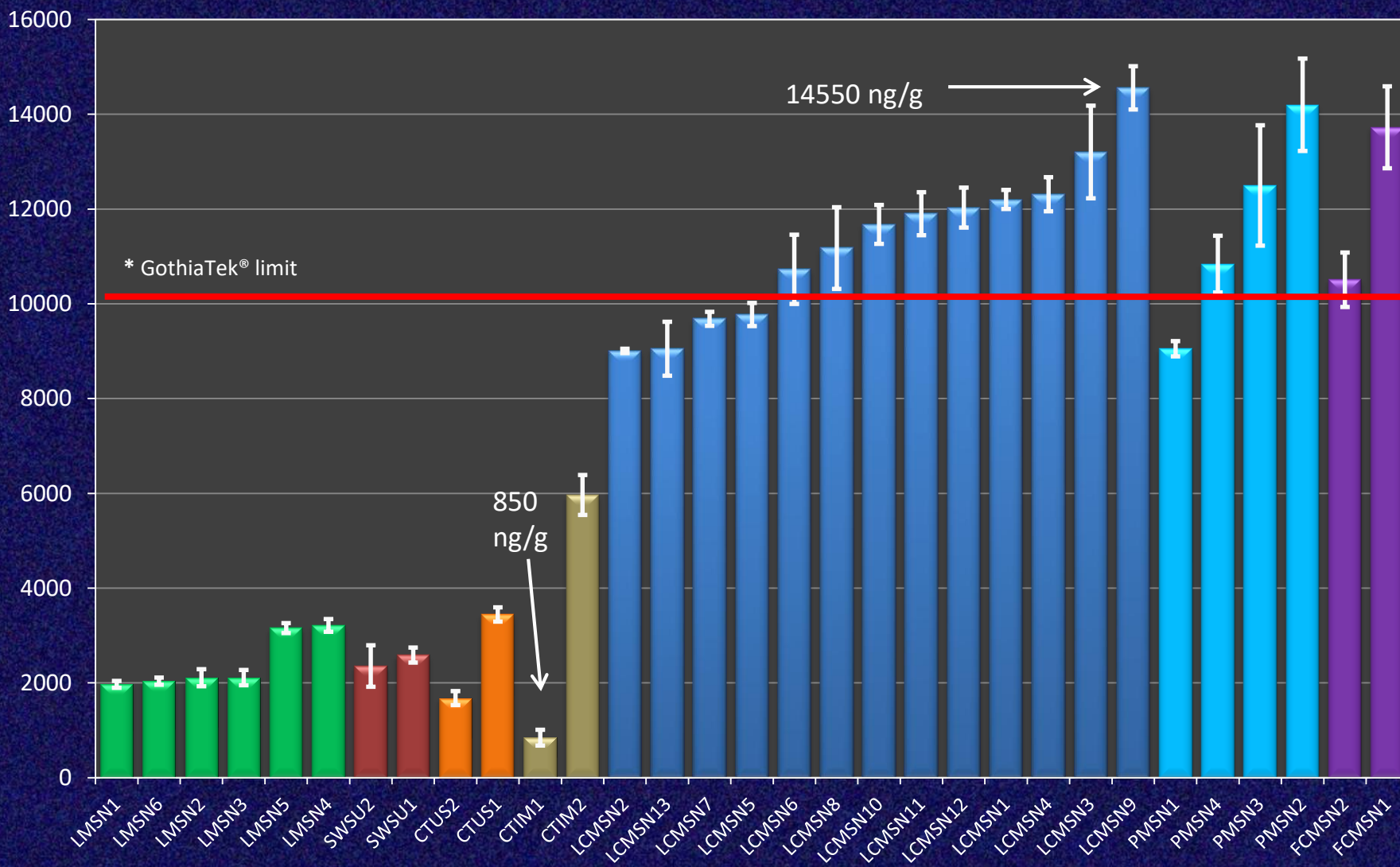
# Observed Levels in Relation to GothiaTek® Maxima

Mean B[a]P (ng/g) 'dry weight' ( $\pm$  95% C.I.) with GothiaTek® Limit\*

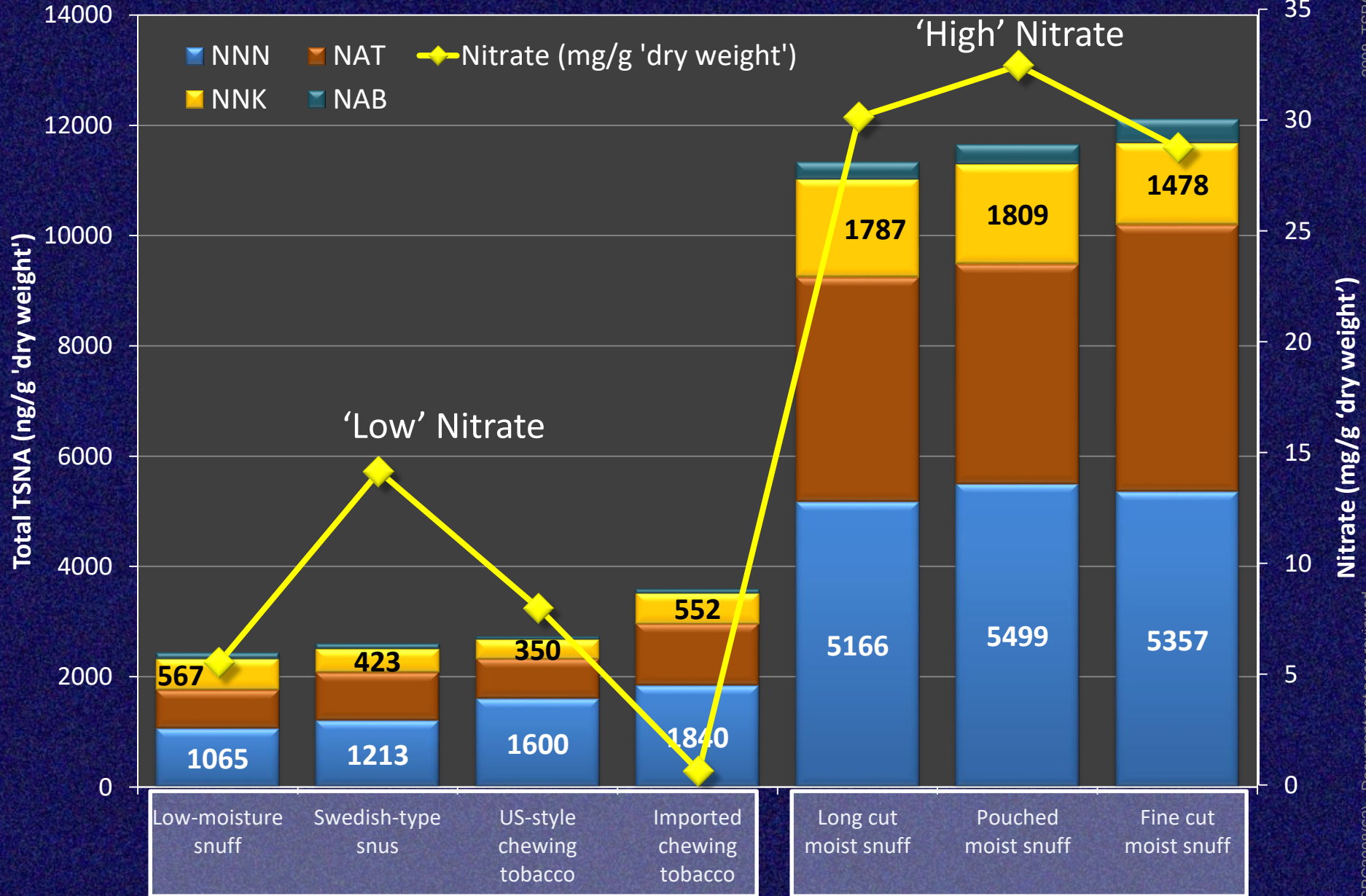


# Observed Levels in Relation to GothiaTek® Maxima

Total TSNA (ng/g) 'dry weight' ( $\pm$  95% C.I.)



# TSNA Content by Product Type



# GothiaTek<sup>®</sup> Summary

Compound	Product Category						
	LCMSN	FCMSN	PMSN	LMSN	CTUS	CTIM	SWSU
Cadmium	13/13	1/2	2/4	6/6	2/2	2/2	2/2
Lead	13/13	2/2	4/4	6/6	2/2	2/2	2/2
Arsenic	13/13	2/2	4/4	6/6	2/2	2/2	2/2
Nickel	13/13	2/2	4/4	6/6	2/2	2/2	2/2
Chromium	13/13	2/2	4/4	6/6	2/2	2/2	2/2
Total TSNA's	4/13	0/2	1/4	6/6	2/2	2/2	2/2
Benzo[a]pyrene	0/13	0/2	0/4	6/6	2/2	2/2	2/2

Approximately 40% of the brands tested in this survey met the GothiaTek<sup>®</sup> standard. For those brands which did not meet the standard, failure was due primarily to increased levels of benzo[a]pyrene.

# Communication of Results

## Amount 'as received'

- Representative of the product as consumed

## Amount corrected for moisture content

- Adjusts for the diluting effect of water

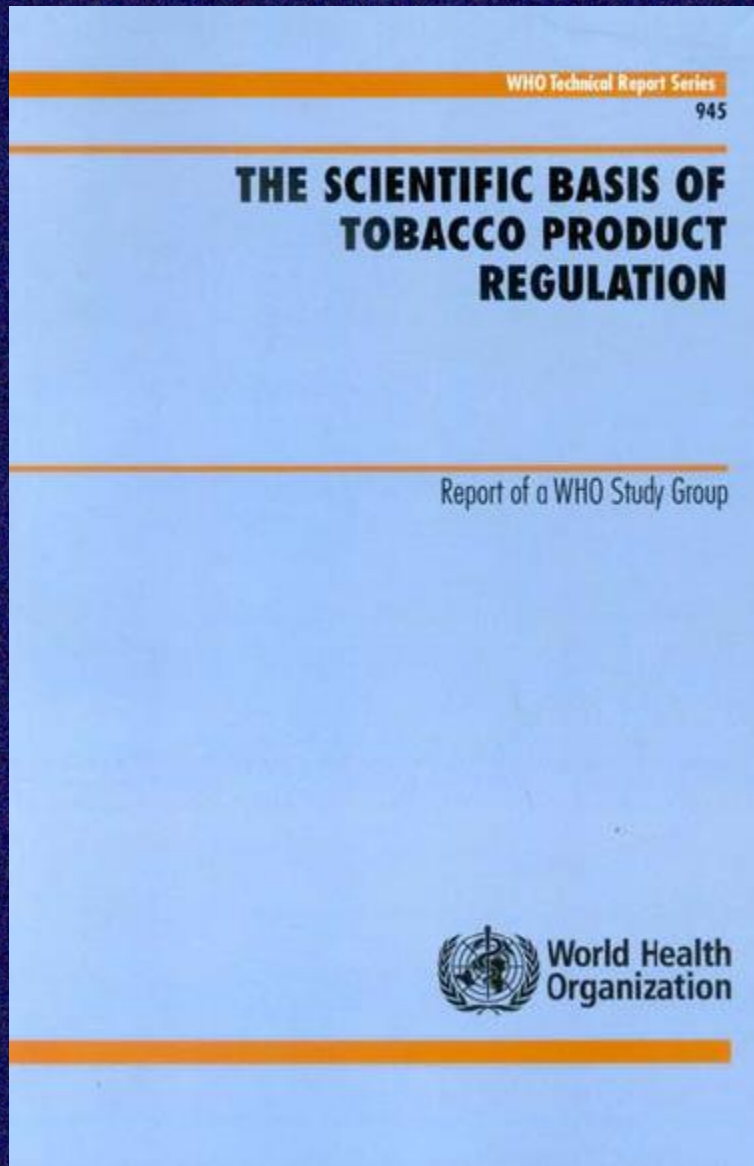
## Amount per mg nicotine

- 'Corrects' for moisture content and has been suggested for the reporting of cigarette yields.

## Amount as a percentage of a peer group ('market map')

- Allows for the evaluation of the characteristics of specific products in relation to typical products currently in the market place

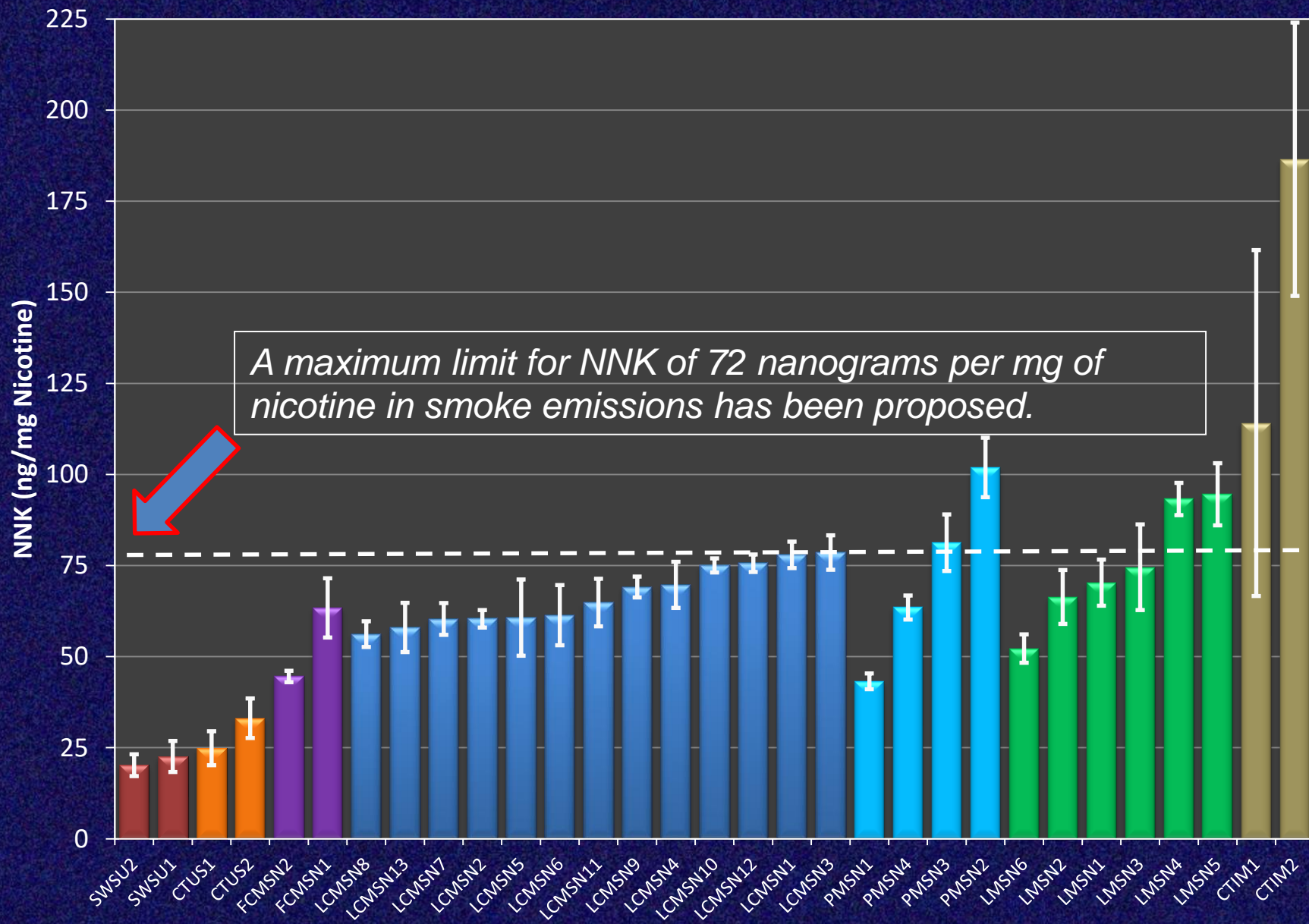
# Cigarette Emissions: Amount Per Unit Nicotine



## Quoting from the report:

- ... *the principal value used for regulation should be the level of emissions per mg of nicotine. ...*
- ... *The initial smoke constituents proposed for regulation are the tobacco specific N'-nitrosamines NNN (N-nitrosornicotine) and NNK (4-(Nnitrosomethylamino)-1-(3-pyridyl)-1-butanone). ...*
- ... *A maximum limit for NNK of 72 nanograms per mg of nicotine in smoke emissions is proposed. ...*

# NNK Content of STP's in Relation to a Proposed Standard for Cigarette NNK Emissions



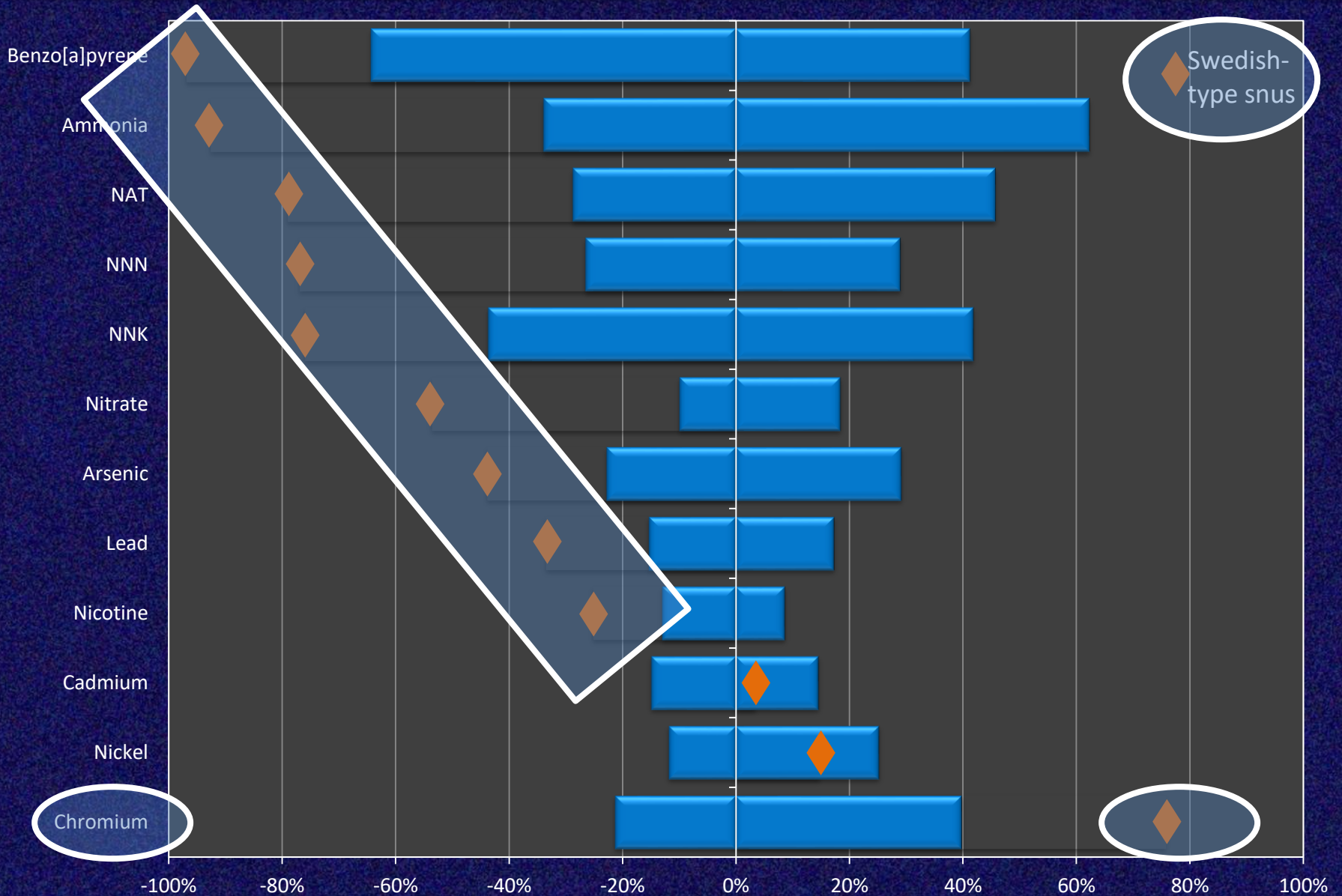
# Market Mapping



Counts, M.E., Hsu, F.S., Tewes, F.J., 2006. Development of a Commercial Cigarette “Market Map” Comparison Methodology for Evaluating New or Non-conventional Cigarettes. Regul. Toxicol. Pharmacol. 46:225-242.



# Market Mapping



# Summary

- Smokeless tobacco products are far more heterogeneous than cigarettes. In this study, a 10 fold range in nicotine, 50 fold range in ammonia and an 8 fold range in moisture contents was found.
- The 19 brands of moist snuff products were characterized by about 6 times the nitrate and total TSNA contents of the other products.
- None of the moist snuff brands met the GothiaTek<sup>®</sup> standard for benzo[a]pyrene.
- Market mapping can be applied to STP's and clearly differentiates Swedish-type snus from the most popular type of products.

# Acknowledgement

This study was funded by Health Canada under contract number H4133-060012/001/SS