The evolution of nicotine

### Cigarettes
- Nicotine of choice for decades
- Health warnings emerged in 1960’s
- Smoking restrictions introduced in 1970’s
- Smokers begin looking for more discrete alternatives to smoking that still satisfy.

### Smokeless
- No smoke = more discrete than smoking
- Provided consumers with an option as smoking restrictions expanded
- Many smokers didn’t like the mouth feel or spitting associated with STP
- STP oral health warnings issued in 1980’s

### Pouches
- More convenient and easier to use appealed to more smokers
- More discrete than loose smokeless tobacco

### Snus
- More discrete than moist snuff/pouches
- No spitting required
- General snus was first product approved for Pre-Market Tobacco Product Application (PMTA) by FDA

### E-cig/Vape
- First non-tobacco nicotine products emerge
- Inhaled nicotine vapor, not tobacco
- Vapor clouds still identify user as a smoker, less discrete than snus
- Vape restrictions first appear in 2010’s

### Next Gen
- Next gen products for consumers must be:
  - Smokeless
  - Spitless
  - Discrete
  - Convenient
  - Tobacco Free
  - Recreational
- Most importantly, next gen products must satisfy and meet a wide variety of consumer preferences

D.J. Nutt, et al., Eur Addict Res (2014); 20: 218-225
Ii-Lun Chen, CTP presentation, Society for Research on Nicotine and Tobacco, Chicago, USA (2016)
VOLUME DEVELOPMENT FOR CIGARETTES AND SNUS IN SWEDEN AND NORWAY

**Sweden**

Cigarettes (million packs) vs. Snus (million cans)

**Norway**

Share of population (%)

Cigarette smokers vs. Snus users

SNUS IS OUTPERFORMING CIGARETTES IN SWEDEN AND NORWAY

Source Sweden: SMD Logistics and Swedish Match estimates

Source Norway: The Norwegian Directorate of Health
RECORD LOW PREVALENCE OF SMOKING IN SWEDEN

Proportion of daily cigarette smokers (percentage of population aged 15 and over)

Source: Special Eurobarometer 458, European Commission
Lowest incidence of tobacco related cancer

Lung cancer among men in Europe

Oral and pancreatic cancer combined among men in Europe

Source: WHO/IARC, 2008
Among the smokeless tobacco products on the market, products with low levels of nitrosamines, such as Swedish snus, are considerably less hazardous than cigarettes*.

The “Swedish Experience” – A “real world illustration” of tobacco harm reduction

- One component of the public health success of snus is that it is manufactured according to the GOTHIATEK® standard

GOTHIATEK® - the world’s strictest product standard for any tobacco product

- The standard was introduced in the year 2000
  - Based on decades of research and development with consumer protection, product safety and openness as key targets
- Applicable to all Swedish Match Snus products
- The basis for Swedish Match ambition to
  - Produce the best snus products
  - Use the best manufacturing practices
  - Continue to improve the products
  - Maintain the lowest possible levels of undesirable constituents in snus
- Dynamic - continuous development
  - Techniques and processes are improved
  - New scientific data is made available
➢ GOTHIATEK® requires that finished products shall not exceed the maximum allowable levels of certain harmful and potential harmful constituents. These constituents originate from the environment or from the tobacco plant.

➢ The standard has over the years been amended at several occasions: the range of compounds has been expanded and the maximum levels lowered.

*WHO Tob. Reg. Report 955, Scientific Basis of Tobacco Product Regulation 2010*
### GOTHIATEK® STANDARD – MAXIMUM LEVELS FOR SELECTED CONSTITUENTS

<table>
<thead>
<tr>
<th>Component</th>
<th>GOTHIATEK®</th>
<th>Swedish Food Act</th>
<th>WHO TobReg</th>
<th>FDA HPHC list</th>
</tr>
</thead>
<tbody>
<tr>
<td>NNN+NNK (ppm)</td>
<td>0.95</td>
<td>1.0</td>
<td>1.0</td>
<td>Yes</td>
</tr>
<tr>
<td>NDMA (ppb)</td>
<td>2.5</td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Nitrate (ppm)</td>
<td>3.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B(a)P (ppb)</td>
<td>1.25</td>
<td>1.5</td>
<td>2.5</td>
<td>Yes</td>
</tr>
<tr>
<td>Arsenic (ppm)</td>
<td>0.25</td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Lead (ppm)</td>
<td>1.0</td>
<td>3</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Cadmium (ppm)</td>
<td>0.5</td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Chromium (ppm)</td>
<td>1.5</td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Mercury (ppm)</td>
<td>0.02</td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Nickel (ppm)</td>
<td>2.25</td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Aflatoxin (ppb) (B1+B2+G1+G2)</td>
<td>2.5</td>
<td>5</td>
<td></td>
<td>Yes (B1)</td>
</tr>
<tr>
<td>Ochratoxin A (ppb)</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Formaldehyde(ppm)</td>
<td>7.5</td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Acetaldehyde (ppm)</td>
<td>25</td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Crotonaldehyde (ppm)</td>
<td>0.75</td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Agrochemicals**

According to Swedish Match internal quality system for agrochemicals **

<table>
<thead>
<tr>
<th>ppm: parts per million (corresponding to ug/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ppb: parts per billion (corresponding to ng/g)</td>
</tr>
</tbody>
</table>

**Comparable to the CORESTA Guide N° 1 for Agrochemicals GRLs in tobacco**

All values based on 50% moisture water or wet basis
Swedish Match has continued our product development work to offer a even less harmful, discreet, recreational nicotine pods product for tobacco users not attracted by snus

- Oral recreational nicotine pods product without tobacco
- No association with the traditional, negative connotations of tobacco including increased cancer risk
- Attractive taste profiles – no tobacco taste
- Socially accepted by smokers, other tobacco users and non-tobacco users
WHAT IS ZYN?

ZYN – Tobacco free nicotine pods

- Small, white, dry, tobacco free, nicotine pods
- Contains filler, pH-adjuster, tobacco derived nicotine, flavors, stabilizer, sweetener and pouch paper
- Manufactured using similar control systems as in snus production
- Nicotine content: 3 and 6 mg/pods (tobacco derived nicotine)
- Comes in a variety of flavors
- Packaged in a plastic can
- pH similar to General snus
- Very low or non-detectable levels of HPHCs
- A recreational nicotine product, used in the same way as snus (i.e. under the upper lip)
- Recently launched in Scandinavia and US
## Nicotine related
- Anabasine
- 4-(Methylnitrosamino)-1-(3-pyridyl)-1-butanol (NNK)
- Nicotine
- N-nitrosodiethanolamine (NDELA)*
- N-nitrosodimethylamine (NDMA)
- N-Nitrosomorpholine (NMOR)*
- N-Nitrosonornicotine (NNN)*
- N-Nitrosopiperidine (NPIP)*
- N-Nitrosopyrrolidine (NPYR)*
- N-nitrososarcosine (NSAR)*
- Nornicotine
- N-nitrosoanabasine (NAB)
- N-nitrosoanatabine (NAT)
- Anabatine

## PAHs
- Benz[a]anthracene
- Benzo[b]fluoranthene
- Benzo[k]fluoranthene
- Benzo[a]pyrene
- Chrysene
- Dibenz[a,h]anthracene
- Indeno(1,2,3-cd)pyrene
- Naphthalene

## Elements
- Arsenic
- Beryllium
- Cadmium
- Chromium
- Lead
- Mercury
- Nickel
- Polonium-210*  
- Selenium
- Uranium-235
- Uranium-238

## “Other”
- Acetaldehyde
- Aflatoxin B1
- Ammonia
- Coumarin
- Crotonaldehyde
- Ethyl carbamate
- Formaldehyde

## “Other”
- Acrylamide
- Bacteria
- Ethanol
- Propylene Glycol
- Glycerol
- Aflatoxin B2
- Aflatoxin G1
- Aflatoxin G2
- Ochratoxin A
- Chloride
- Nitrate
- Nitrite
- pH
- Sugars
- Starch
- Water activity
- Dry Matter

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**Blue:** Draft Initial List of Harmful/Potentially Harmful Constituents in Smokeless Tobacco Products and included in Swedish Match Chemical Control Program  
* Tested on selected products, 3 times / year, 1 replicate

**Black:** Additional Constituents included in Swedish Match Chemical Control program
ZYN "SIDE BY SIDE" COMPARISON WITH MOIST SNUFF AND GENERAL SNUS
## NICOTINE AND pH: ZYN VS MOIST SNUFF AND GENERAL SNUS

<table>
<thead>
<tr>
<th>Product</th>
<th>Moist snuff CRP2</th>
<th>General Snus (Portion) (PMTA) N=26</th>
<th>ZYN 3 mg N=33</th>
<th>ZYN 6 mg N=35</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nicotine mg/unit of use</td>
<td>10.3</td>
<td>4.3 – 9.2</td>
<td>2.89</td>
<td>5.93</td>
</tr>
<tr>
<td>Free nicotine mg/unit of use</td>
<td>3.5</td>
<td>0.9 – 7.4</td>
<td>2.12</td>
<td>4.50</td>
</tr>
<tr>
<td>pH</td>
<td>7.74</td>
<td>7.17 – 8.99</td>
<td>8.49</td>
<td>8.55</td>
</tr>
</tbody>
</table>

**CRP:** Coresta Reference Product

**N:** the number of tested products

**PMTA:** Premarket Tobacco Product Application

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## NITROSAMINES: ZYN VS MOIST SNUFF AND GENERAL SNUS

<table>
<thead>
<tr>
<th>Compound</th>
<th>Moist Snuff CRP2.1</th>
<th>SNUS Chemical control (PMTA) 2016-2017</th>
<th>ZYN Chemical control 2016 - 2017</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>N Max Median</td>
<td>N Max Median</td>
<td></td>
</tr>
<tr>
<td>TSNA-NAB (µg/g)</td>
<td>0.5</td>
<td>26 0.03 0.02</td>
<td>68 &lt;0.004 &lt;0.004</td>
<td></td>
</tr>
<tr>
<td>TSNA-NAT (µg/g)</td>
<td>8.7</td>
<td>26 0.45 0.36</td>
<td>68 &lt;0.15 &lt;0.15</td>
<td></td>
</tr>
<tr>
<td>TSNA-NNN (µg/g)</td>
<td>7.0</td>
<td>26 0.62 0.53</td>
<td>68 &lt;0.15 &lt;0.15</td>
<td></td>
</tr>
<tr>
<td>TSNA-NNK (µg/g)</td>
<td>4.2</td>
<td>26 0.25 0.12</td>
<td>68 &lt;0.15 &lt;0.15</td>
<td></td>
</tr>
<tr>
<td>TSNA NNN+NNK (µg/g)</td>
<td>11.2</td>
<td>26 0.83 0.68</td>
<td>68 &lt;0.03 &lt;0.03</td>
<td>1.9</td>
</tr>
<tr>
<td>TSNA tot (µg/g)</td>
<td>20.5</td>
<td>26 1.3 1.10</td>
<td>68 &lt;0.05 &lt;0.05</td>
<td></td>
</tr>
</tbody>
</table>

**CRP:** Coresta Reference Product

All results are on product dry weight basis

**N:** the number of tested products

**PMTA:** Premarket Tobacco Product Application

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**GOTHIA-TEK®**
# BENZO[a]PYRENE, B[a]P: ZYN VS MOIST SNUFF AND GENERAL SNUS

<table>
<thead>
<tr>
<th>Compound</th>
<th>Moist snuff CRP2</th>
<th>SNUS Chemical control (PMTA), 2016-2017</th>
<th>ZYN Chemical control 2016 -2017</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>B[a]P (ng/g)</td>
<td>Mean 296</td>
<td>N 26, Max 1.2, Median &lt;0.6</td>
<td>n 68, Max &lt;0.6, Median &lt;0.6</td>
<td>2.5</td>
</tr>
</tbody>
</table>

**CRP:** Coresta Reference Product  
All results are on product dry weight basis  
N: the number of tested products  
PMTA: Premarket Tobacco Product Application
CONSUMER DEMOGRAPHIC

• The US ZYN consumer is very diverse
• Tobacco consumers looking for a discreet alternative
• Broad (legal) age spectrum
• Smokers, moist snuff users, snus users and vapers all have shown interest
• Higher level of acceptance among female consumers versus other oral options
• Both urban and rural consumers
ZYN is very similar, though superior to General snus

• Both are pouched recreational products, used in the same manner (i.e. under the upper lip)

• Nicotine and pH levels are in the same ranges

• Manufactured by the same company in the same facility

• Similar quality control programs for ZYN as for GOTHIATEK® Snus

• No levels of TSNAs detected in ZYN

• No levels of B(a)P detected in ZYN

• No or low levels of other HPHCs in ZYN

• A product standard similar to the GOTHIATEK® standard will be developed
CONCLUSION - WHY ZYN?

THE FULL NICOTINE EXPERIENCE BUT WITHOUT TOBACCO

• Spit-free, smoke-free and tobacco free
• Discrete – small
• Clean – dry and white
• Instant nicotine delivery, gives nicotine satisfaction
• Offers an array of pleasant flavors and an enjoyable usage experience
• Attractive to many tobacco users of both gender
• Can be used anywhere and anytime