Safety challenges of implementing a new renewable feedstock in a running refinery

PS Congress

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17.05.2023 | Dordrecht

AGENDA

- ➔ Introduction and general insights about renewable feedstocks
- ➔ Hazard investigation
- ➔ Case study: challenges in implementing different categories of animal base feedstock in a running plant
- ➔ Takeaways

Introduction

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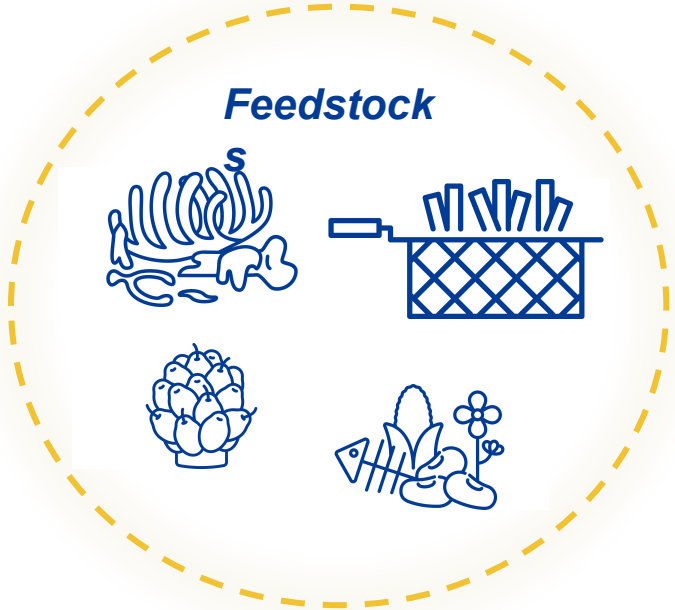
BIOFUEL INDUSTRY



Waste, veg. oils, animal fat...

Fuels

-Net Zero
-Reduction of CO2 emissions
-Satisfy GHG targets
-Sustainability targets

Number of companies with sustainable targets is **increasing very fast**

IS THE BIOFUEL INDUSTRY APPROACHING A FEEDSTOCK CRUNCH?

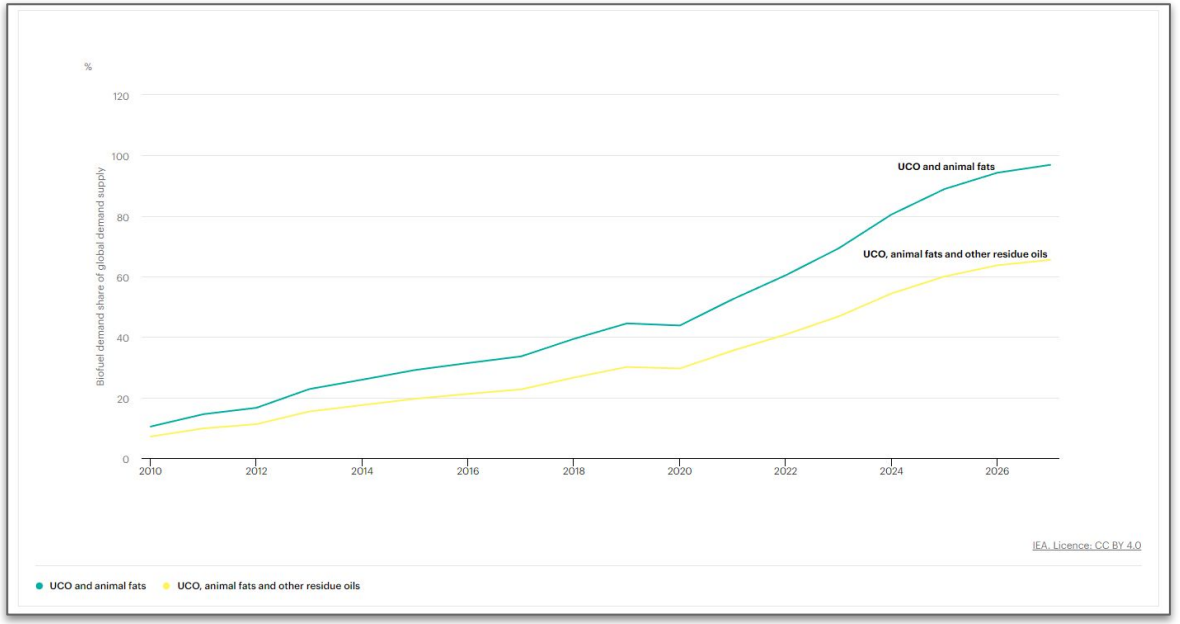
- **Source IEA:**

➢ Demand for vegetable oil, fats, waste and residue oils increases 56% to 79 million tonnes over the forecast period (2022-2027).

➢ Fuels made from wastes and residues are high demand.

➢ Wastes and residues are expected to be used for 13% of biofuel production in 2027.

Biofuel demand share of global wastes and residues, main case, 2010-2027

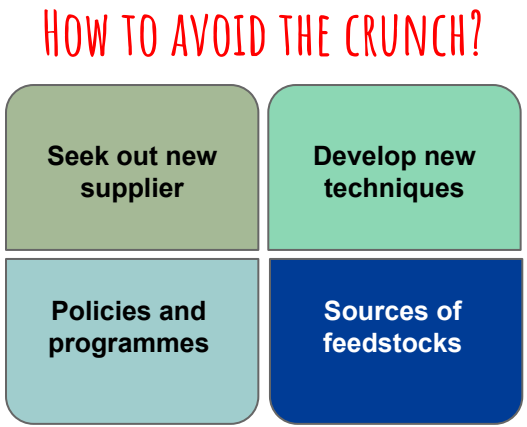


Source: https://www.iea.org/

NEED FOR DIVERSIFICATION

- **Renewable feedstocks:**

  - Vegetable oils
  - Maize
  - Used cooking oil
  - Animal fats
  - Soyoil
  - Palm oil
  - Sugars
  - Used plastic
  - Other waste and residues



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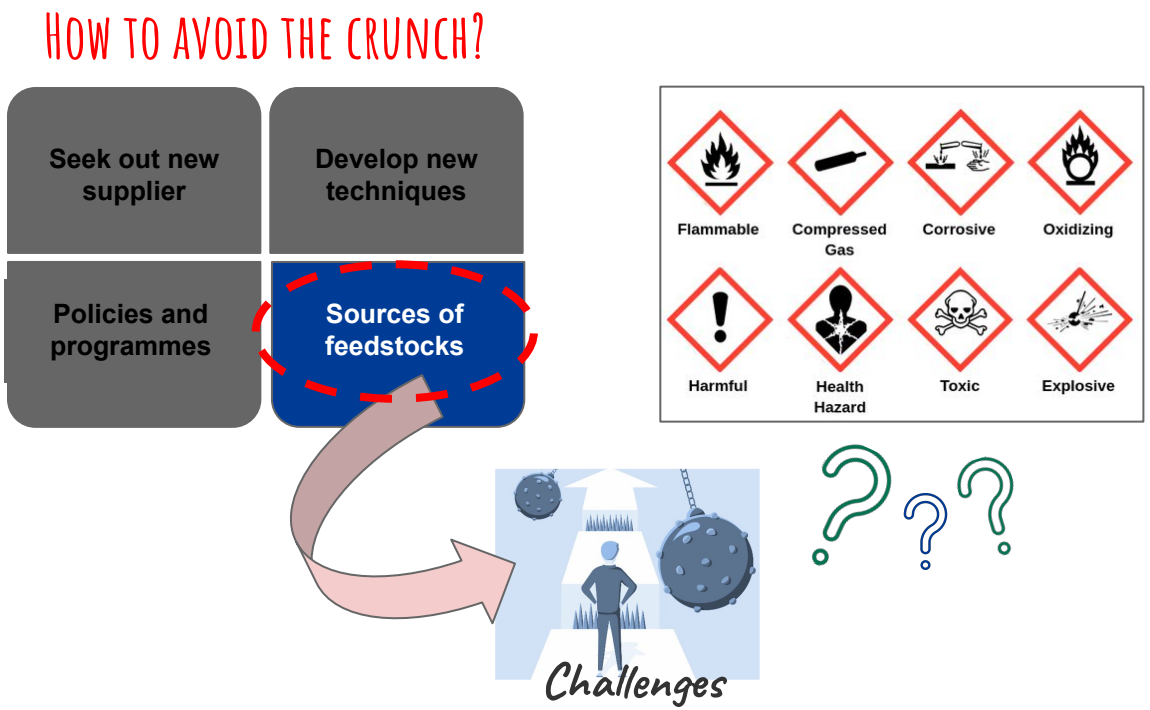


CHALLENGES

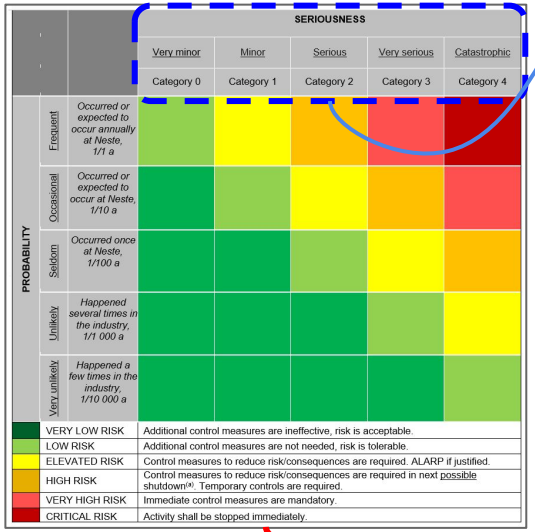
- **New sources of feedstocks:**

➢ Impurities
  - New / Unknown
  - Health concern
  - Safety concern
  - MSDS

➢ Legislation
  - Not well defined in the legislation
  - Permit requirements

Example: *Animal fat -> renewable diesel. Legislation -> FOOD industry. Fuel purposes?*

➢ Risk classification



LOC of new feedstock...

UPDATE!!

Hazard Investigation

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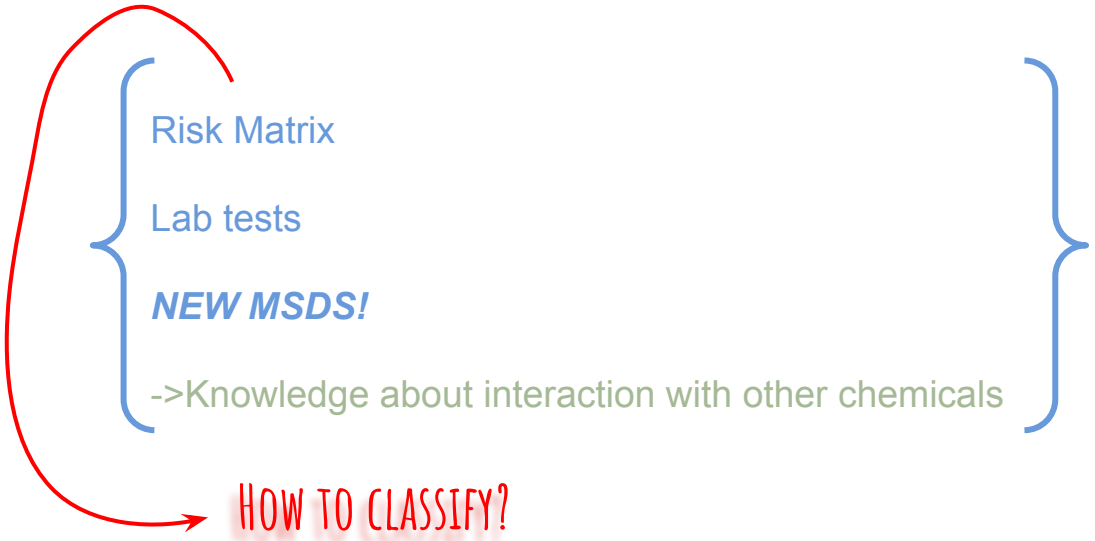
RELEVANT POINTS

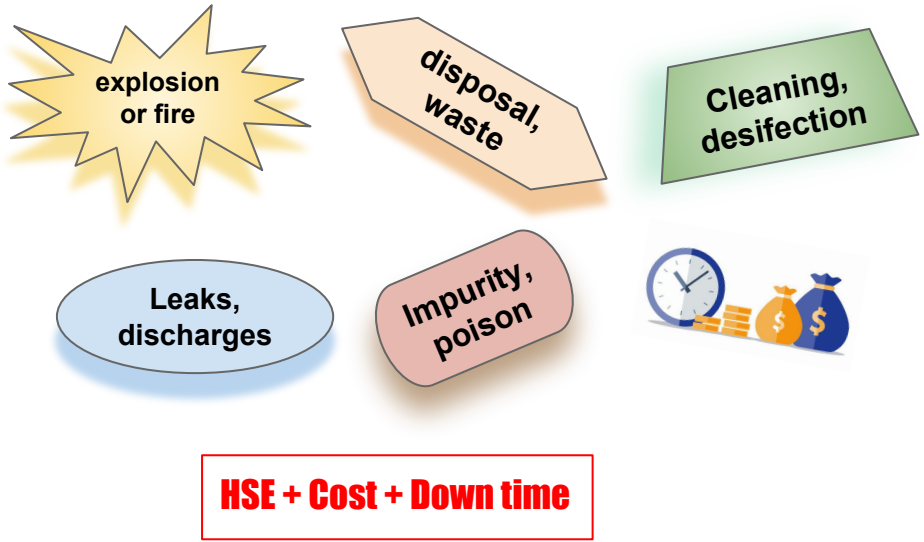
- **Evaluation of new chemicals**

  ➢ How to incorporate this new chemical in your process production?



RELEVANT POINTS

- **Identification of hazards**
  - ➢ Brainstorming
  - ➢ Literature research
  - ➢ Lab tests



- **Multidisciplinary discussions to raise questions**
  - ➢ What and where are the high risks concerns?
  - ➢ Check interaction with operators. What needs to be modified?
  - ➢ What are the main modifications needed on site to implement new feedstock?
  - ➢ Any new materials?
  - ➢ Any new mode of disposal?
  - ➢ What are the environmental concerns?
  - ➢ Etc…

IDEA CREATION AND PRE-STUDY

HSE Plan

- Describes the HSE activities to be performed during the whole life cycle of the project (Idea creation -> Execution)
- Including HSE Design and construction activities to ensure safe execution
- Report
- Developed by HSE Designer

Preliminary Hazard Study

- Identify the hazards related to the process concept and chemicals used at an early stage of the design
- Report
- Inherent safety principles
- Process alternatives
- Siting options
- Multidisciplinary document coordinated by HSE Designer

Reaction Matrix

- Prepared when new/uncommon chemicals or materials are going to be handled in the process plant
- Identifies the possible interactions with the existing chemicals
- Developed by chemists

Case study: implementing different categories of animal base feedstock

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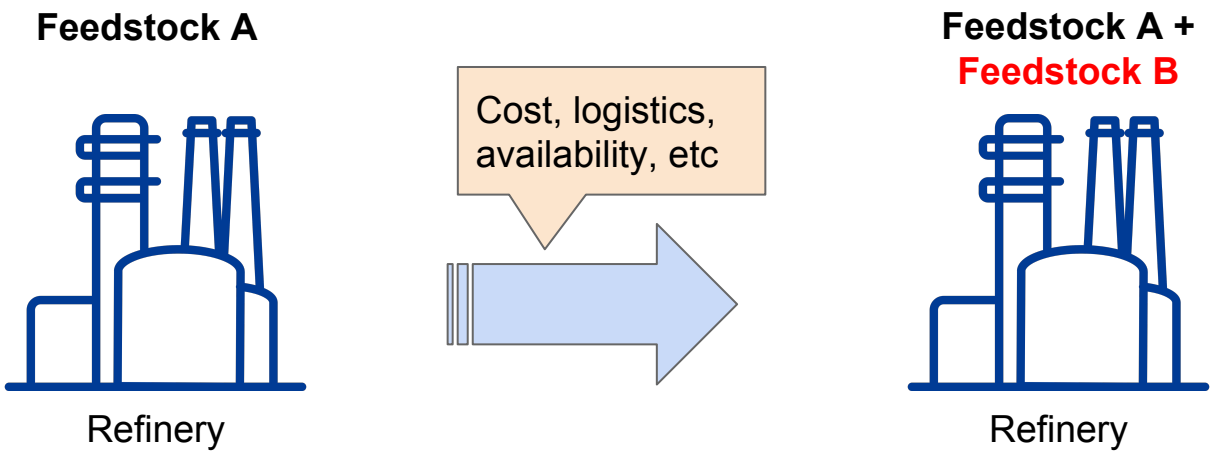
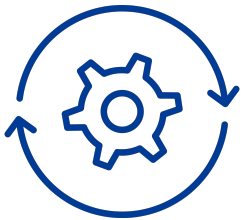
IMPLEMENTING DIFFERENT CATEGORIES OF ANIMAL BASE FEEDSTOCK



1. What are the changes necessary to make this happen?
2. Will the plant operate safely?
3. Is it safe for personnel and environment?

IMPLEMENTING DIFFERENT CATEGORIES OF ANIMAL BASE FEEDSTOCK

- Process conditions ✓
  - Operate the same way
  - Same flash points, boiling points, melting points, etc
  - Same T and P
  - Same corrosion behaviour



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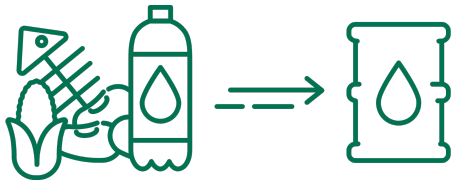
Source, different impurities and contaminants

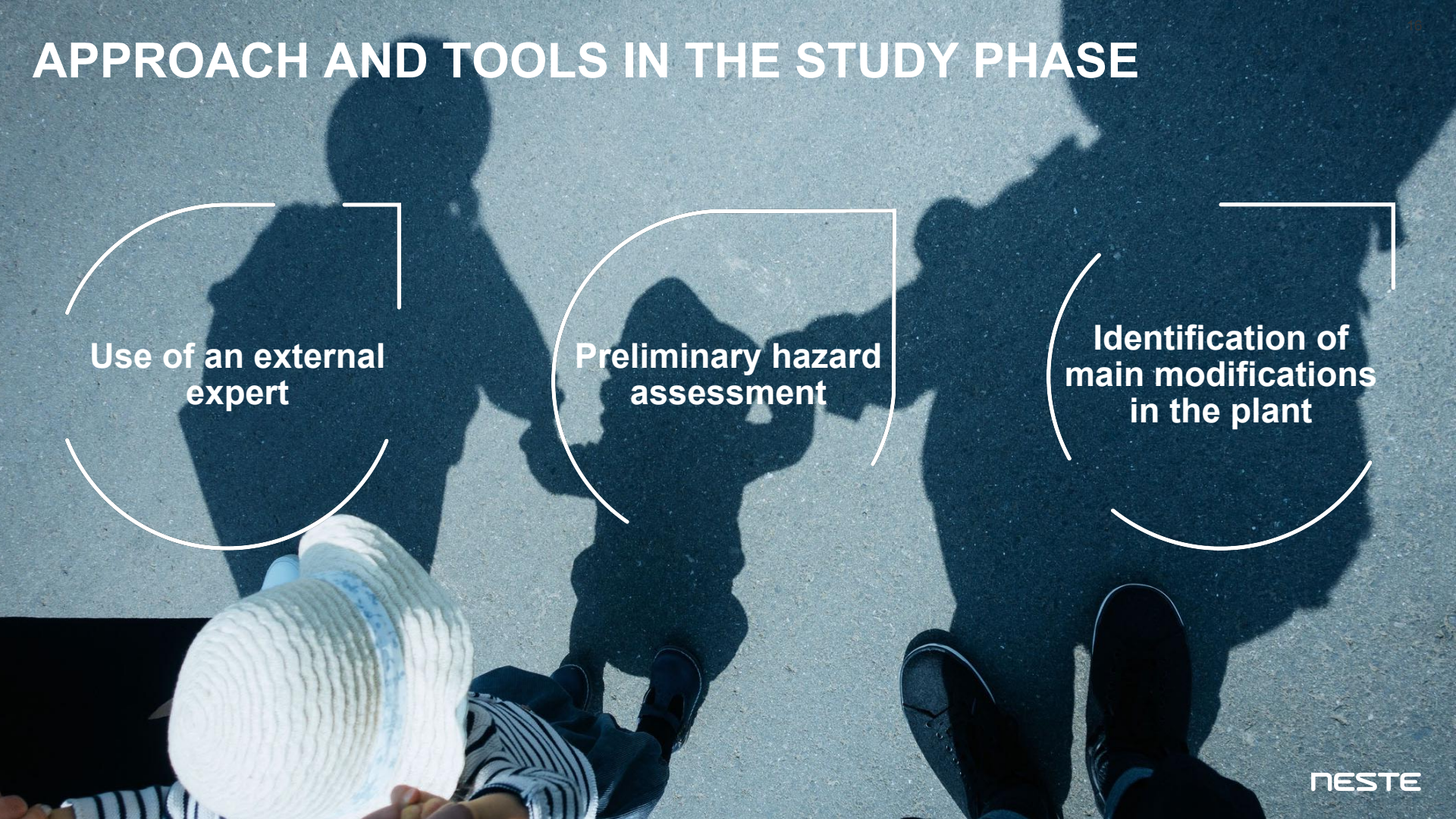
Waste

Renewables



- ***Challenges***
- Process ✗
- Health ✓
- Environmental ✓
- Procedures ✓

APPROACH AND TOOLS IN THE STUDY PHASE



Use of an external expert

Preliminary hazard assessment

Identification of main modifications in the plant

IMPLEMENTING DIFFERENT CATEGORIES OF ANIMAL BASE FEEDSTOCK

1) Use of an external consultant

- Understand the legislation
- Comments on our first draft of preliminary hazard assessment
- Close contact with the Local regulators to inform what we were doing and to check what do they expect
- Help with the development of the necessary documentation to authorities
- Help with new necessary internal procedures

IMPLEMENTING DIFFERENT CATEGORIES OF ANIMAL BASE FEEDSTOCK

>> Biggest challenge was the **Source**

- **Feedstock A** has a certain quality (comes from restricted group of animals)
- **Feedstock B** can come from all groups

- **Impurities, contaminants and prions that if ingested by animals (e.g. birds, mice) could spread, generate diseases and lead to death**
- **If ingested by people could lead to death (not likely since it is a fuel facility)**

IMPLEMENTING DIFFERENT CATEGORIES OF ANIMAL BASE FEEDSTOCK

>> Biggest challenge was the **Source**

➢ Regulations were more restrict
- contamination could generate diseases and even death
- mainly animals (risk of escalation is bigger)

Regulations are written for **food** industry and **not fuel** industry

Tricky to interpret and understand where to comply and where not to comply!!

IMPLEMENTING DIFFERENT CATEGORIES OF ANIMAL BASE FEEDSTOCK

2) Preliminary Hazard Assessment

- **Waste management**
  - could not be re-used (to be incinerated)
  - cannot go to conventional disposal facilities
- **How to deal with spills/leaks**
  - shall be quickly cleaned
  - avoid possibility of animals feeding on it and spreading disease
  - reduce leak possibility
- **Sampling requirements**
  - Adequate PPE
  - Adequate design
- **Laboratory requirements**
  - special register with the local regulators
- **Personal hygiene / work clothing requirements**
  - Separate cleaning facilities
  - Separate disposal containers
- **Operator trainings**
  - Development of new trainings to made them aware of the risks
- **Maintenance of equipment**
- **How to manage calamity scenarios** (e.g. tank failure)
- **Material selection**
- **Etc**

IMPLEMENTING DIFFERENT CATEGORIES OF ANIMAL BASE FEEDSTOCK

3) Identification of main modifications in the plant

Plant needed to be adapted with the following to be able do deal with Feedstock B:

a. Waste management
- i. 3rd party to collect and dispose

b. How to deal with spills
- i. reduction of valves and flanges
- ii. extra rounds to check for leaks
- iii. immediate cleaning

c. Sampling requirements
- i. modification of sampling to avoid close contact with operators face
- ii. separated sampling stations for feedstock A and B

d. Cross contamination
- i. separated piping and equipment with no possibility of contamination (e.g. wrong valve is open)
- ii. separated truck routes

e. Personal hygiene / work clothing requirements
- i. new cleaning facilities specific for feedstock B
- ii. no entering of clean area before proper hygiene

f. Procedures
- i. hygiene procedure
- ii. HACCP plan (Hazard Analysis and Critical Control Points)
- iii. adapt plant procedures (e.g. emergency, rounds, cleaning, PPE)

TAKEAWAYS

- Expand our renewable feedstock sources
- Need for more research in how to deal with “worse-dirty” feedstocks
- Understanding of the existing legislation and how to adapt to fuel business
- New regulations specifically for fuels
- ***When process conditions don’t differentiate too much, a lot is possible with slight changes and different procedures***

Thank you

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