

# Optimal Fertilizer storage

25th Januari 2023, Webinar Portzone



**ESI Eurosilos**

# Content of the presentation

- Introduction to ESI Eurosilos – Speaker
- General discussion about fertilizer characteristics
- Comparison of storing fertilizer enclosed
- Eurosilos filling and discharge principle
- Civil structure
- References
- Questions?



# Introduction to Eurosilos

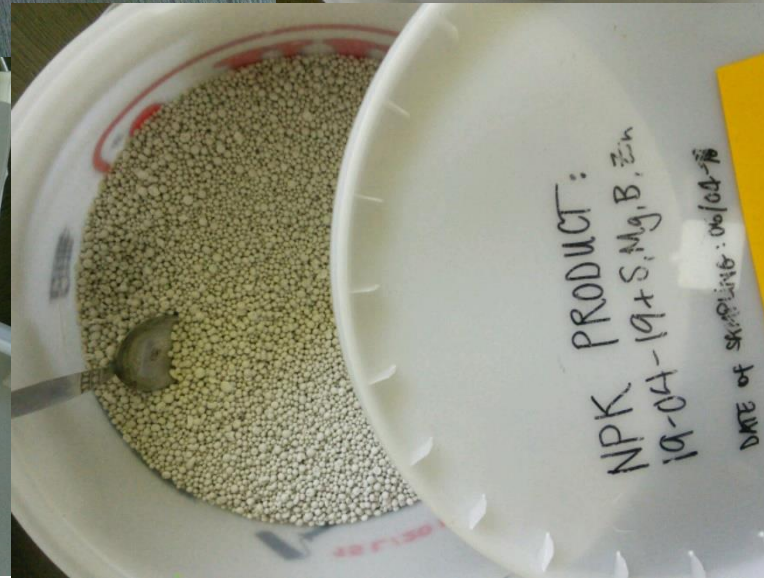
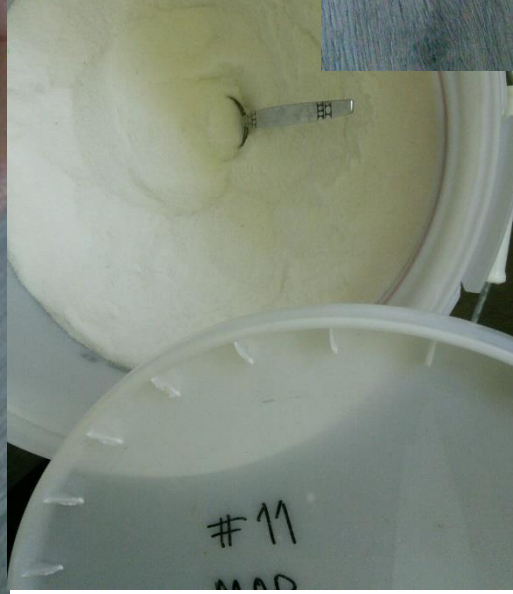
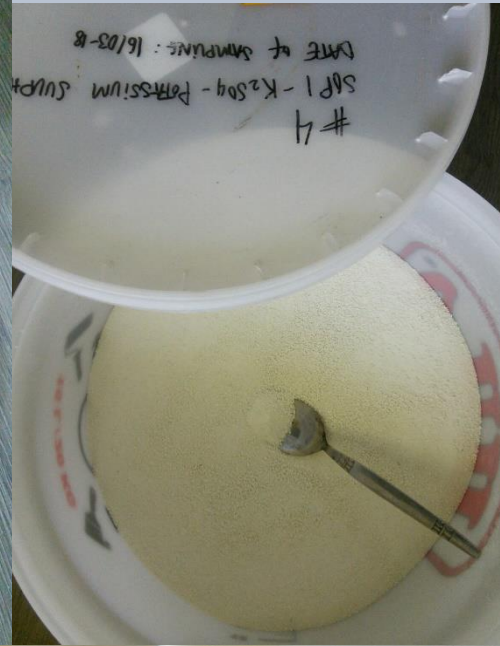
## ESI Eurosilos BV

- Independent Dutch Company
- More than 50 years of experience and over 190 units build
- Specialized in vertical silo storage for a wide range of bulk solids
- Capacities ranging from 1,000 m<sup>3</sup> up to 100,000 m<sup>3</sup>





# Fertilizer – Wide definition



# Fertilizer - Handling characteristics

## 4.4 Numerical characterization of flowability

Flowability of a bulk solid is characterized mainly by its unconfined yield strength,  $\sigma_c$ , in dependence on consolidation stress,  $\sigma_1$ , and storage period,  $t$ . Usually the ratio  $ff_c$  of consolidation stress,  $\sigma_1$ , to unconfined yield strength,  $\sigma_c$ , is used to characterize flowability numerically:

$$ff_c = \sigma_1 / \sigma_c \quad (4)$$

The larger  $ff_c$  is, i.e., the smaller the ratio of the unconfined yield strength,  $\sigma_c$ , to the consolidation stress,  $\sigma_1$ , the better a bulk solid flows. Similar to the classification used by Jenike [1], one can define flow behaviour as follows:

- $ff_c < 1$  not flowing
- $1 < ff_c < 2$  very cohesive
- $2 < ff_c < 4$  cohesive
- $4 < ff_c < 10$  easy-flowing
- $10 < ff_c$  free-flowing

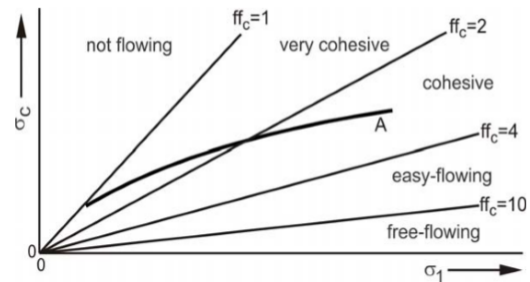
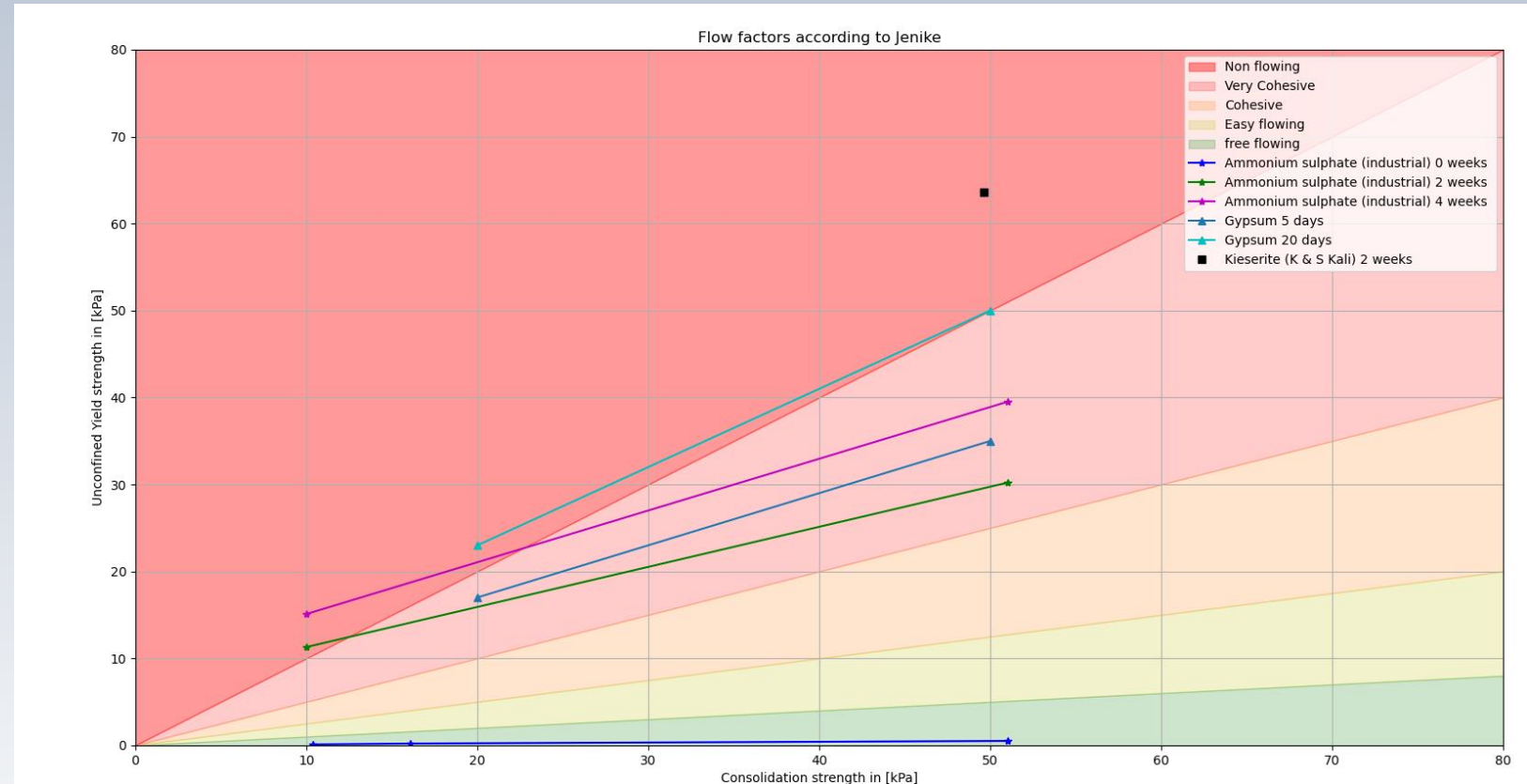


Figure 7: Flow function and lines of constant flowability



# Fertilizer – Important characteristics

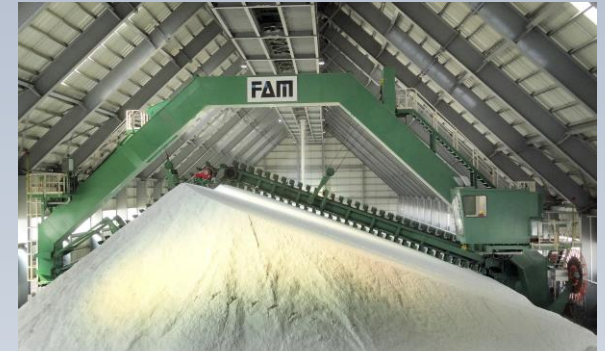
- Due to hygroscopic tendency, fertilizers can consolidate over time.
- Certain degradations should be avoided
  - Degradation due to drop
  - Degradation due to machinery
  - Degradation due to environment (Moisture)
- Fire safety
- Health & Safety





# Methods of storing fertilizer enclosed

- Cover storage in storage shed
  - Loose pile moved with front-end loader
  - Loose pile stacked and reclaimed with stacker reclaimer
  - Big bag storage
- Silo storage
  - Flat-bottom silo type
  - Mass flow silo type



**ESI Eurosil**

# Fertilizer storage in shed

- Pro's
  - Multiple grades can be stored with a reduced overall capacity
  - Fertilizer is “accessible” by front end loaders.
  - Fi-Fo is an option
  - Depending on the grade of automation the Capex lower compared to silos
- Contra's
  - Large footprint is required
  - Not easy to condition the air and the product
  - Depending on the grade of automation the OPEX can be relative high compared to silos.



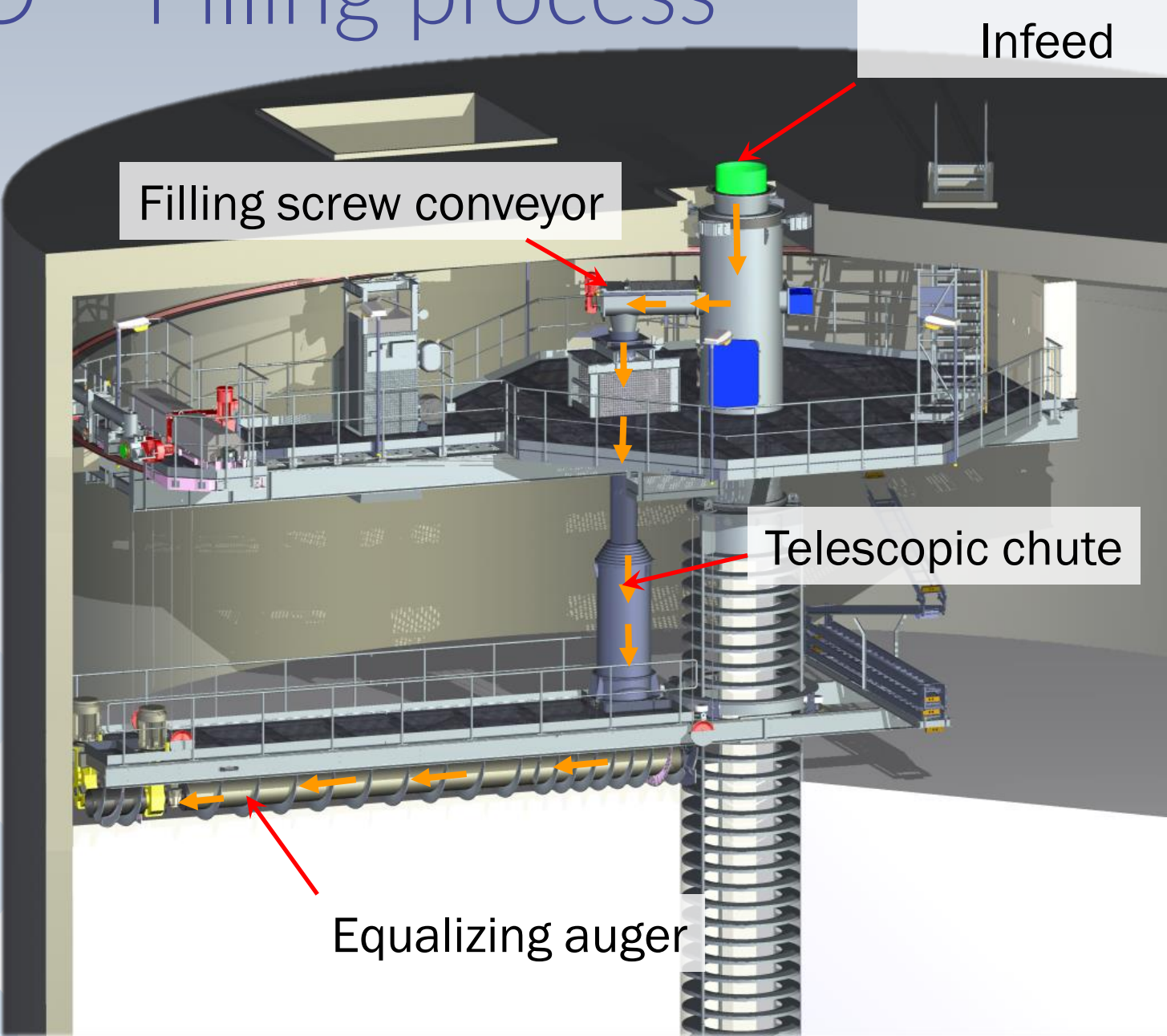
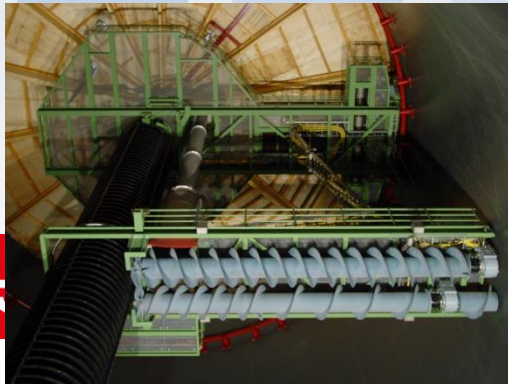
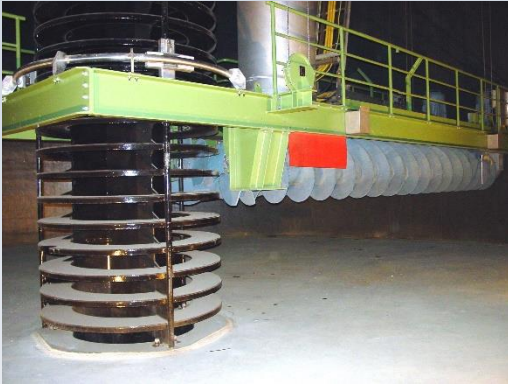


# Fertilizer storage in Eurosilos

- Pro's
  - Compact design on small footprint
  - Fully automated system
  - Secured discharge by screw reclaimer
  - Conditioning of air is possible
  - Low on OPEX cost
- Con's
  - Depending on civil construction cost the CAPEX can be higher than shed storage.
  - Only one grade can be stored per silo
  - FiFo is not possible



# EUROSILO – Filling process



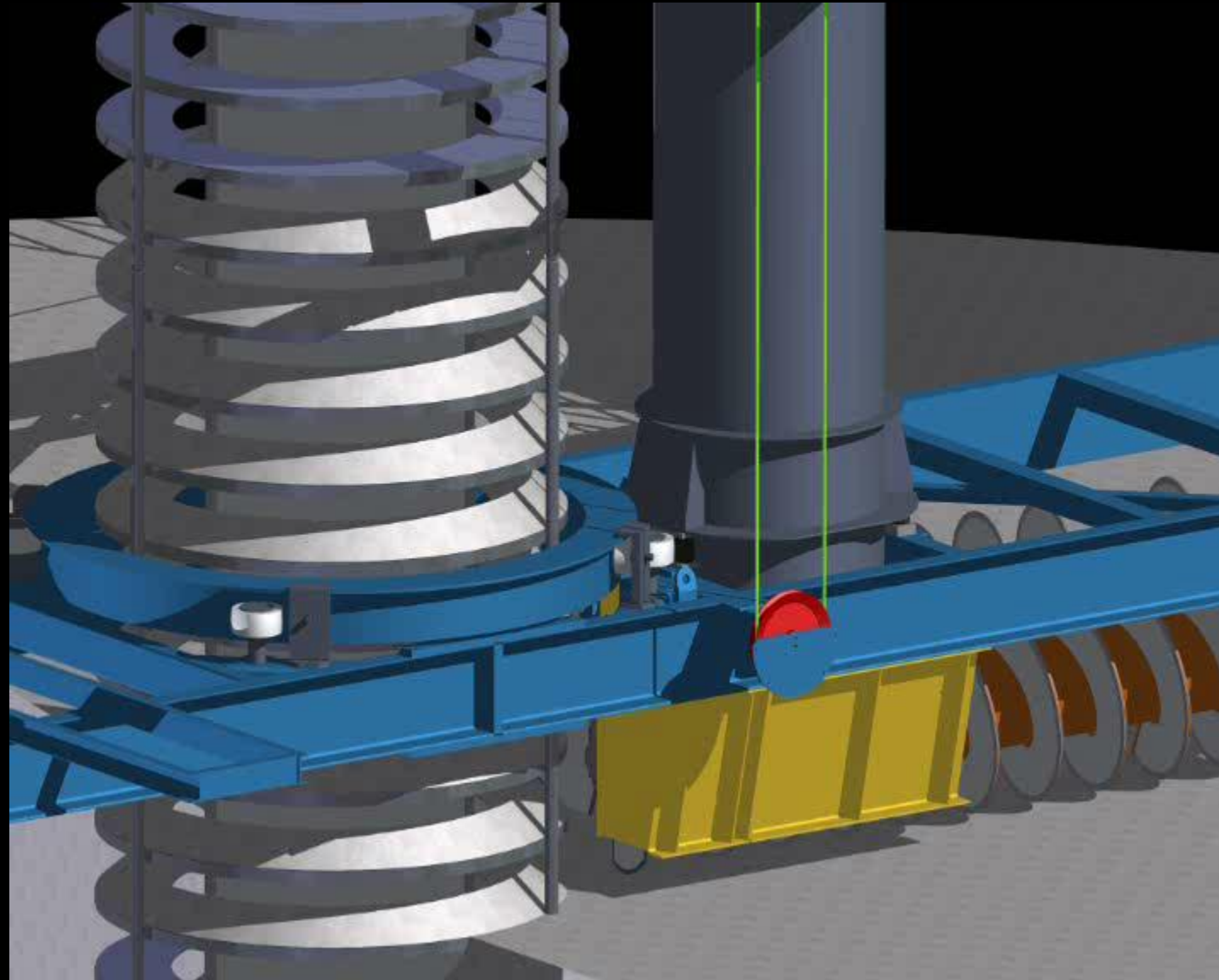
Infeed

Filling screw conveyor

Telescopic chute

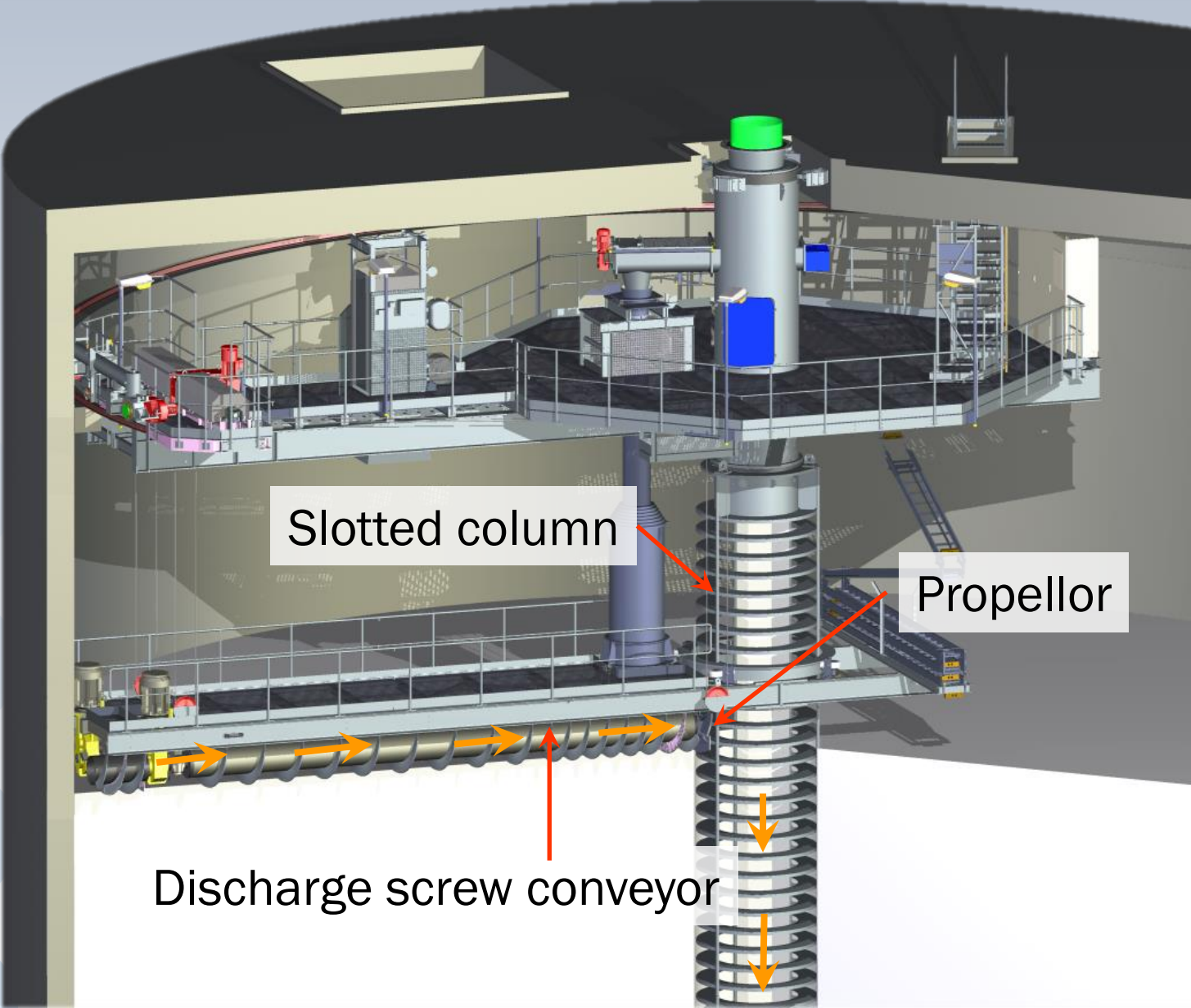
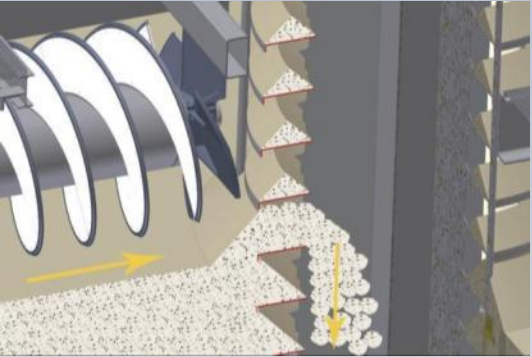
Equalizing auger

# Eurosilos – Filling process





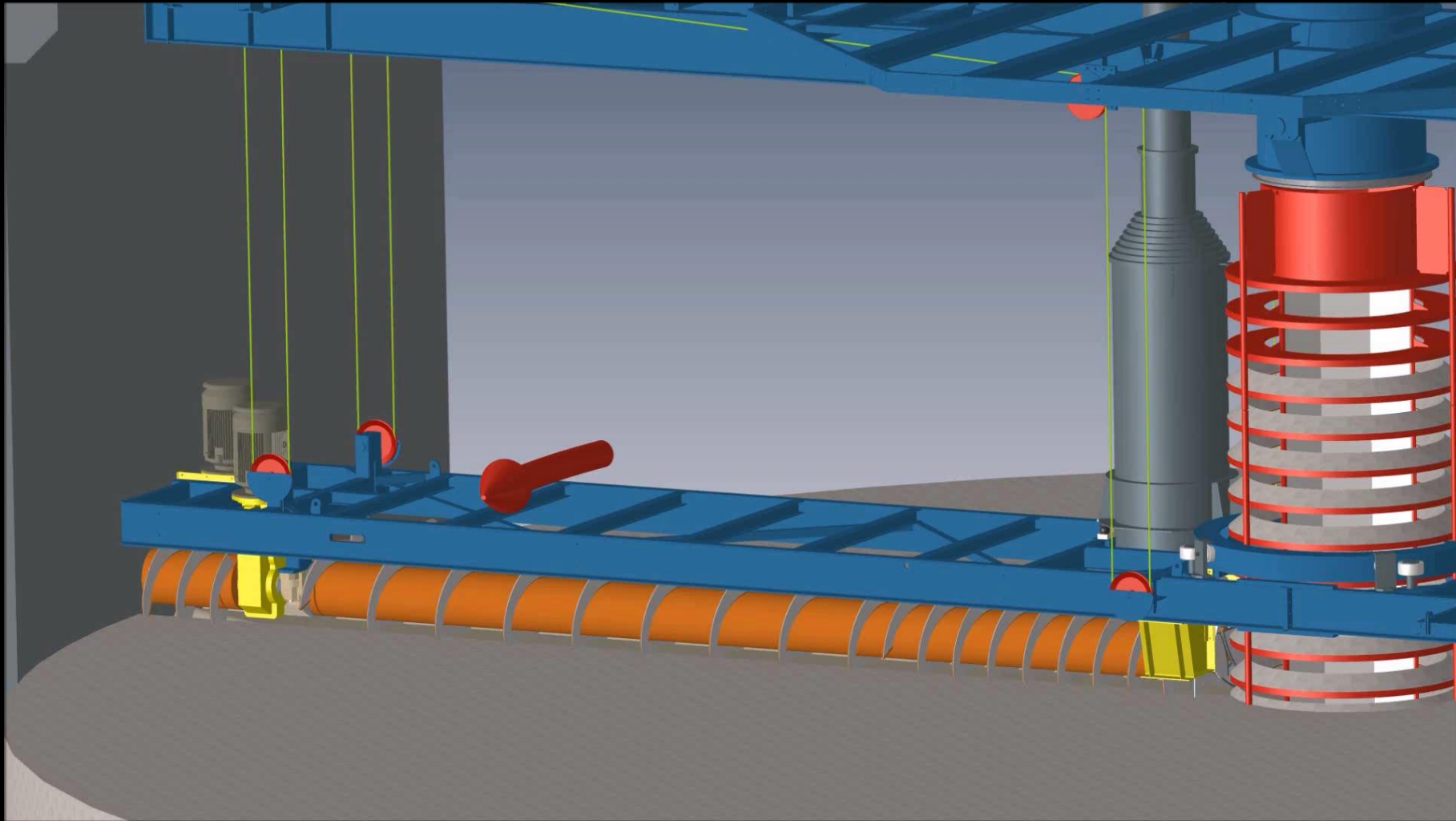
# Eurosilos - Discharge process



# Eurosilos – Discharge process



# Eurosilos – Discharge process

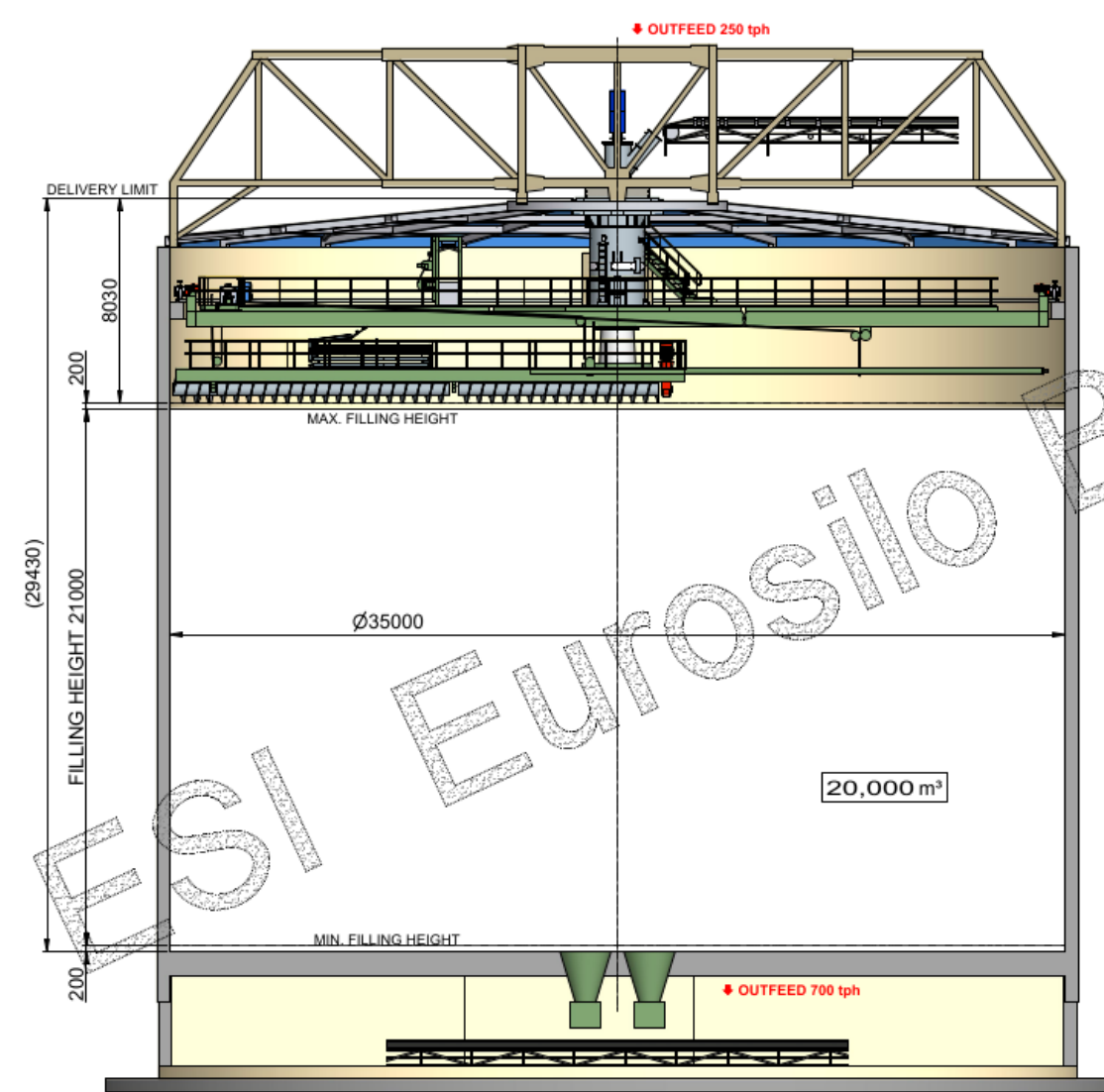
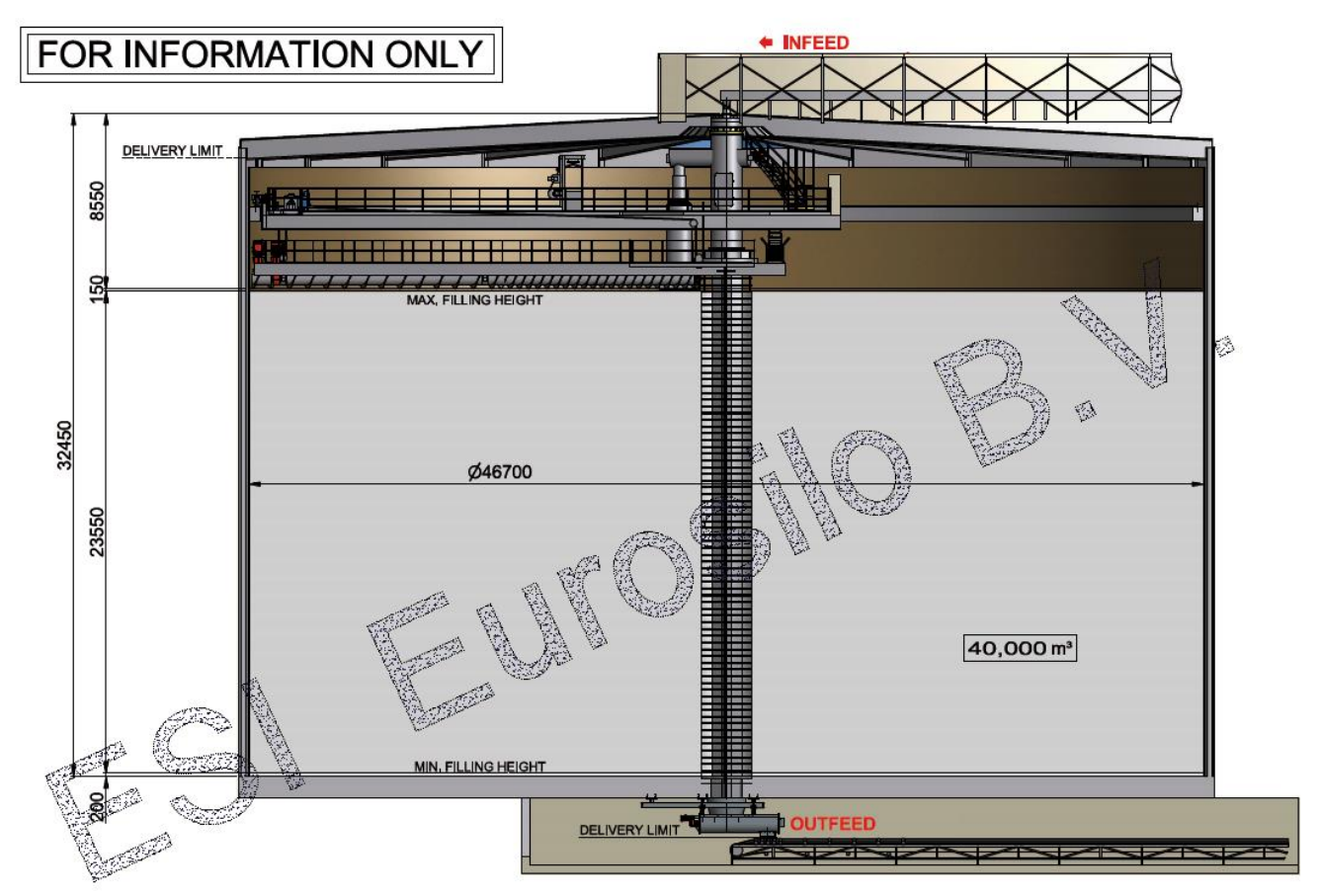




# Eurosillo - Discharge process

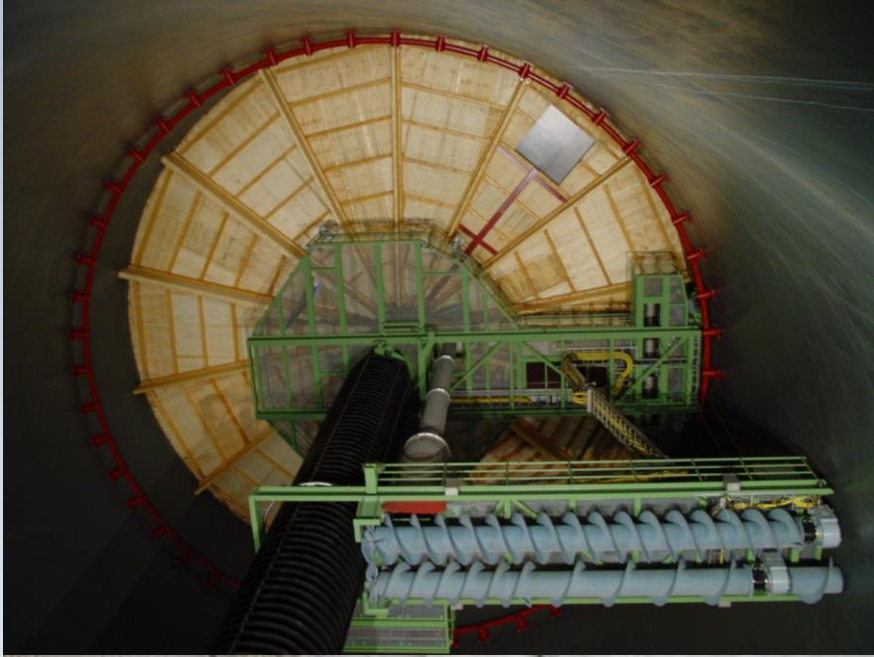


# Examples of systems



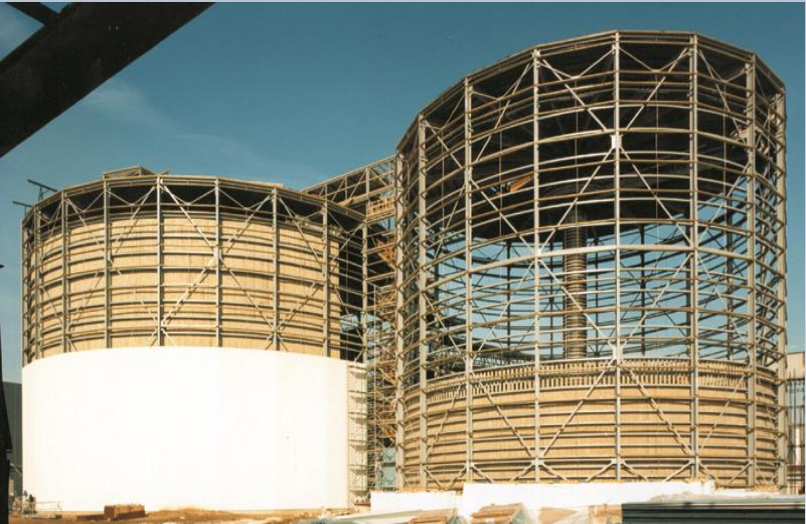


# Silo civil structure: Concrete or Steel





# DSM Geleen Netherlands



Product	Ammoniumsulphate
Year	1987 - Decommissioned
Capacity	13,000 - 28,000 m <sup>3</sup>
# Silos	2
Diameter	29,2 - 42,5 m
Filling height	19.5 m
Infeed cap.	50 m <sup>3</sup> /hr
Discharge cap.	250 m <sup>3</sup> /hr



# Capro corp. Ulsan South Korea



Product	Ammoniumsulphate
Year	2001 - 2013
Capacity	40,000 m <sup>3</sup>
# Silos	3
Diameter	46.7 m
Fillingheight	23.75 m
Infeed cap.	100 m <sup>3</sup> /hr
Discharge cap.	400 m <sup>3</sup> /hr



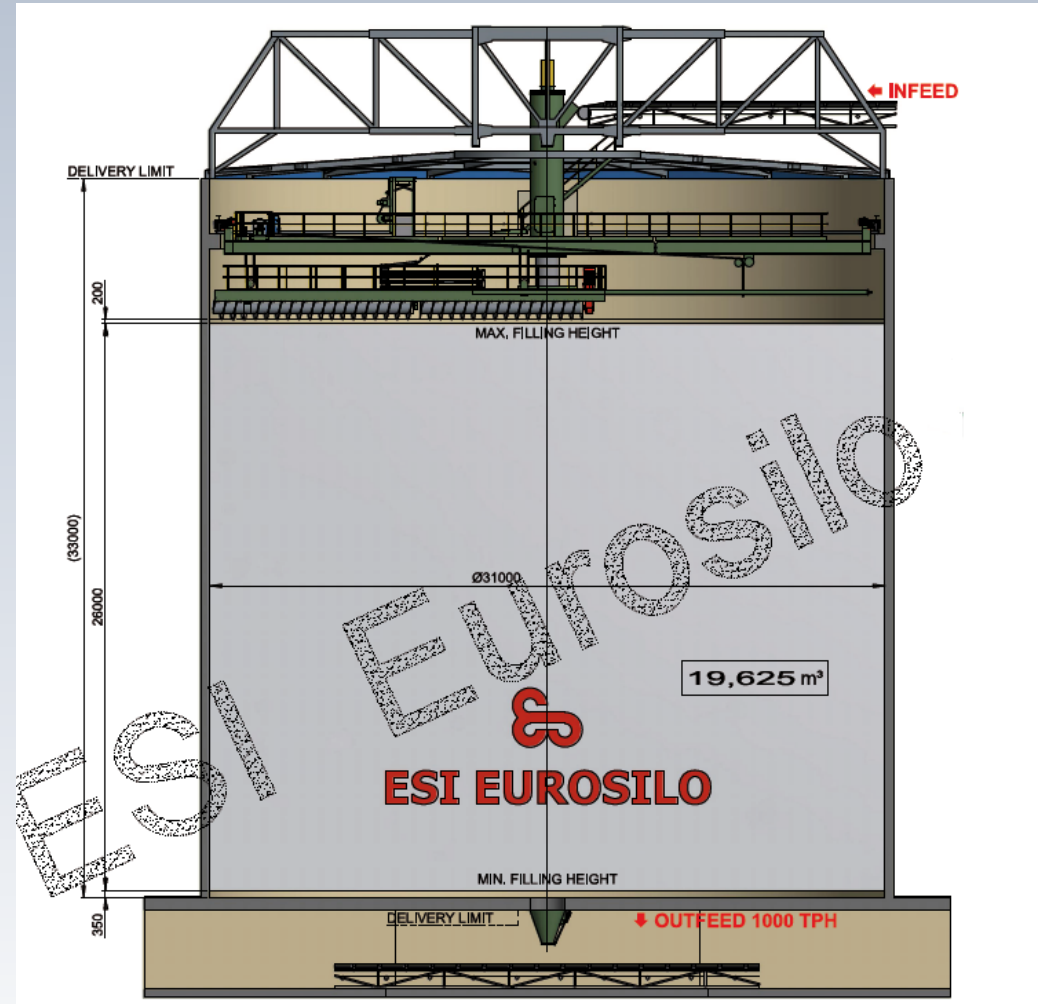
**ESI Eurosil**



# Yara Porsgrunn Norway



Product	CN
Year	2016
Capacity	19,625 m <sup>3</sup>
# Silos	1
Diameter	31 m
Filling height	26 m
Infeed cap.	150 m <sup>3</sup> /hr
Outfeed cap.	1000 m <sup>3</sup> /hr



**ESI Eurosillo**

# Thank you for your attention!

Any questions?

For more information please contact us!

ESI Eurosilos BV

[www.eurosilos.com](http://www.eurosilos.com)

[sales@eurosilos.com](mailto:sales@eurosilos.com)

+31299630730



**ESI Eurosilos**