



MADRID
inter.noise 2019
June 16 - 19

NOISE CONTROL FOR A BETTER ENVIRONMENT



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Do We Have To Choose Between **Fast Or Accurate** Noise Modelling?



FONOR

EXPERT KNOWLEDGE WITH HEART & SOUL

Since 1997



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MIKLÓS MÁRKUS · BETTINA TAKÁCS
DO WE HAVE TO CHOOSE BETWEEN **FAST OR ACCURATE** NOISE MODELLING?

2

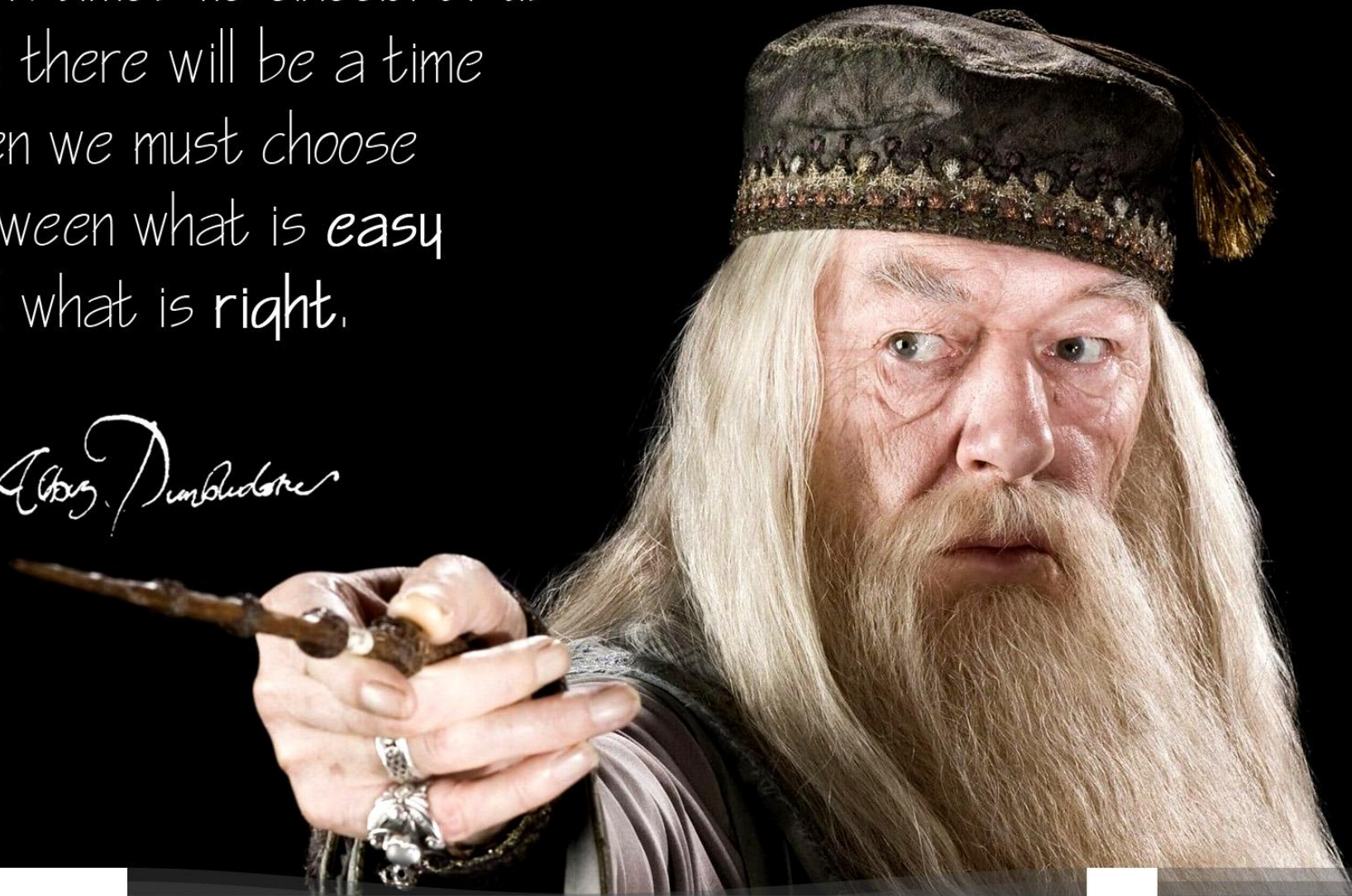




more than **20 years** of professional experience

Dark times lie ahead of us
and there will be a time
when we must choose
between what is *easy*
and what is *right*.

Albus Dumbledore



Is there a **golden path** in the complexity of industrial noise modelling?

No, there isn't.

Thank you for your attention

Miklós Márkus

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01

EXTREMES

02

CUSTOMER

03

SOURCE DATA

04

RESULTS

05

ANALYSIS



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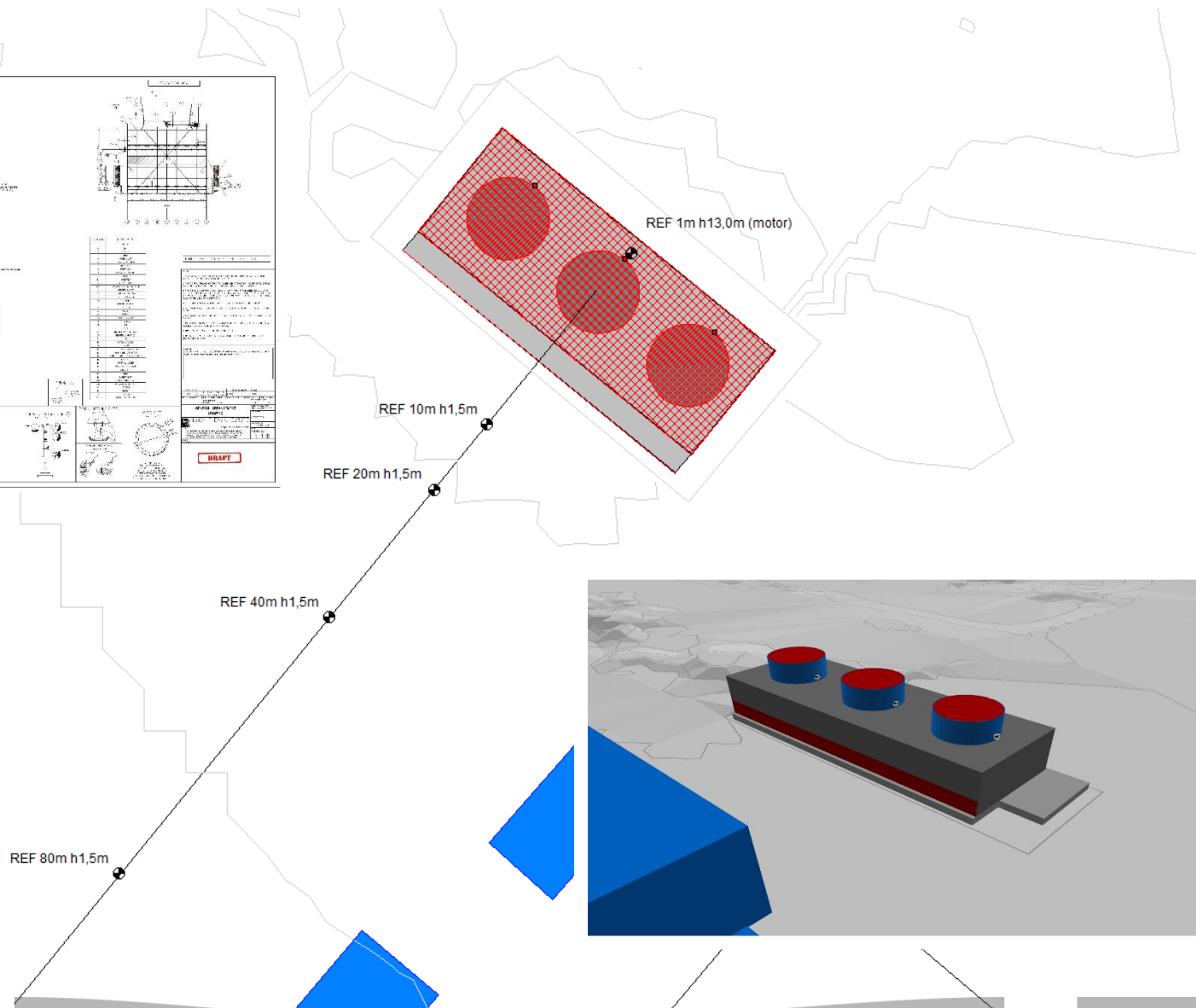
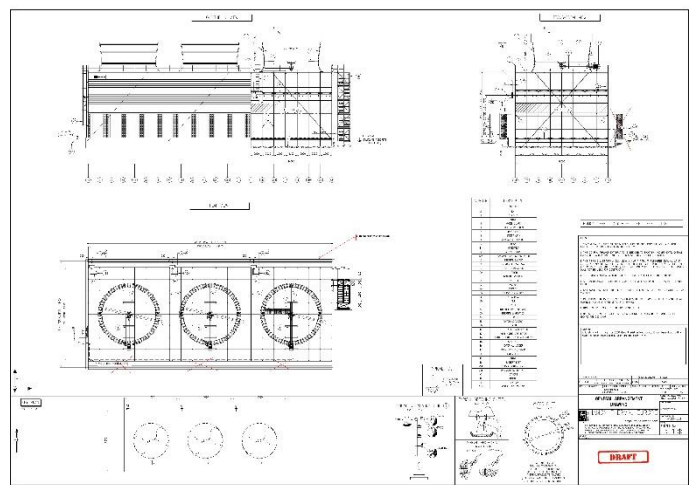
Common Noise Assessment Methods in Europe (CNOSSOS-EU)

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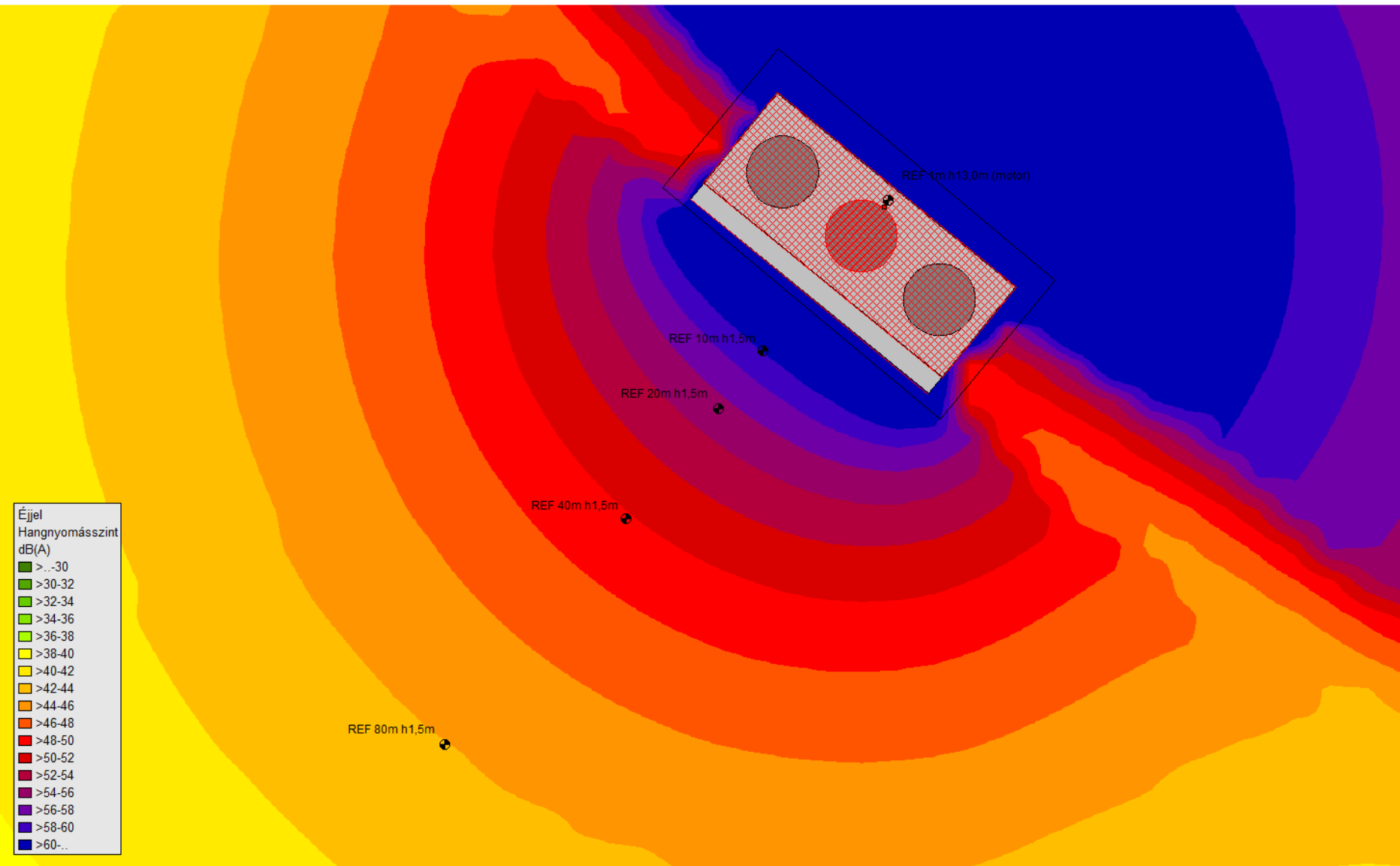


construction of **large-scale** (urban-scale) strategic models
simplifies the model regarding industrial plants
applies modelling technique based on **point sources**

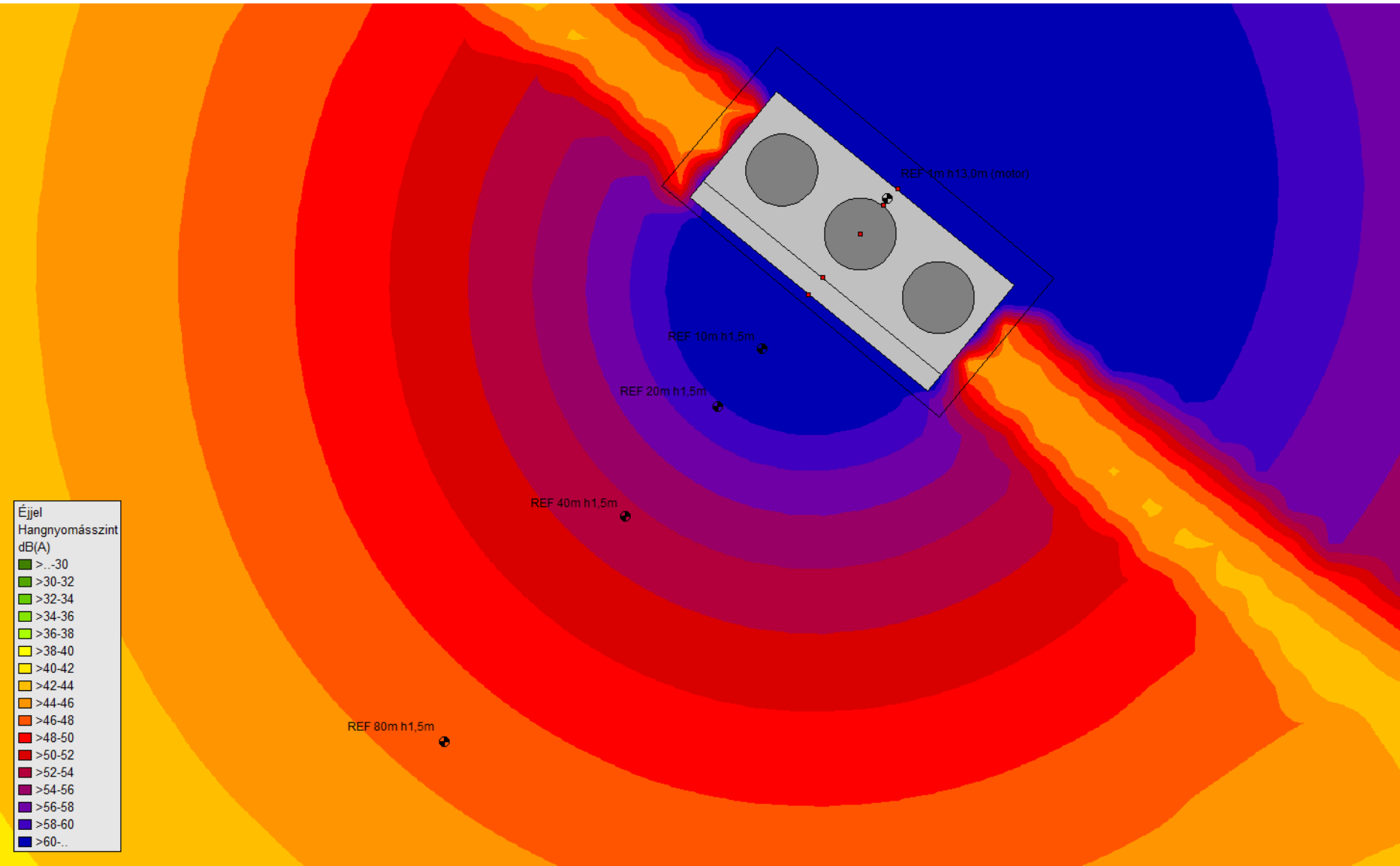
CASE STUDY: point source vs. area source



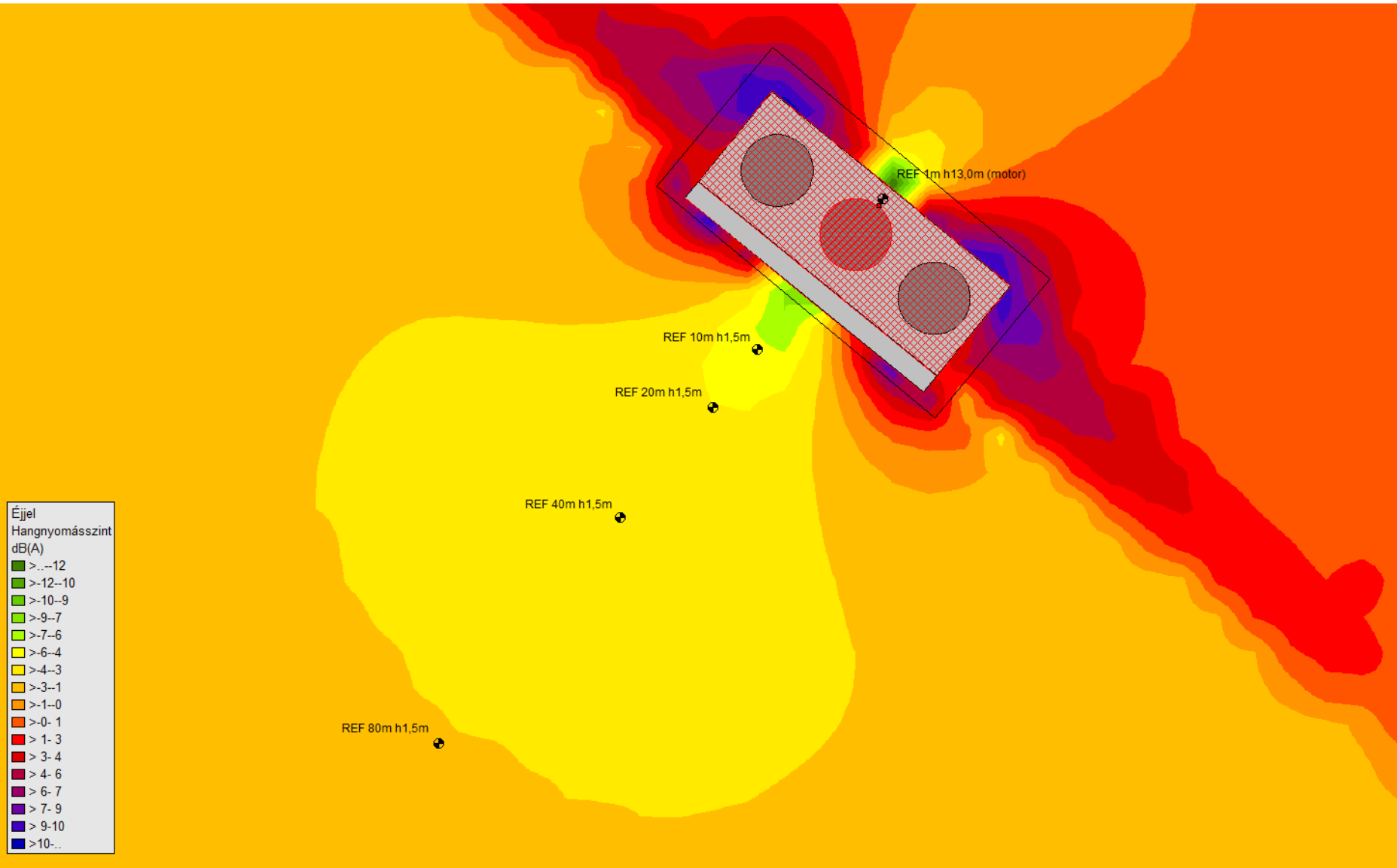
CASE STUDY: cooling tower with area sources

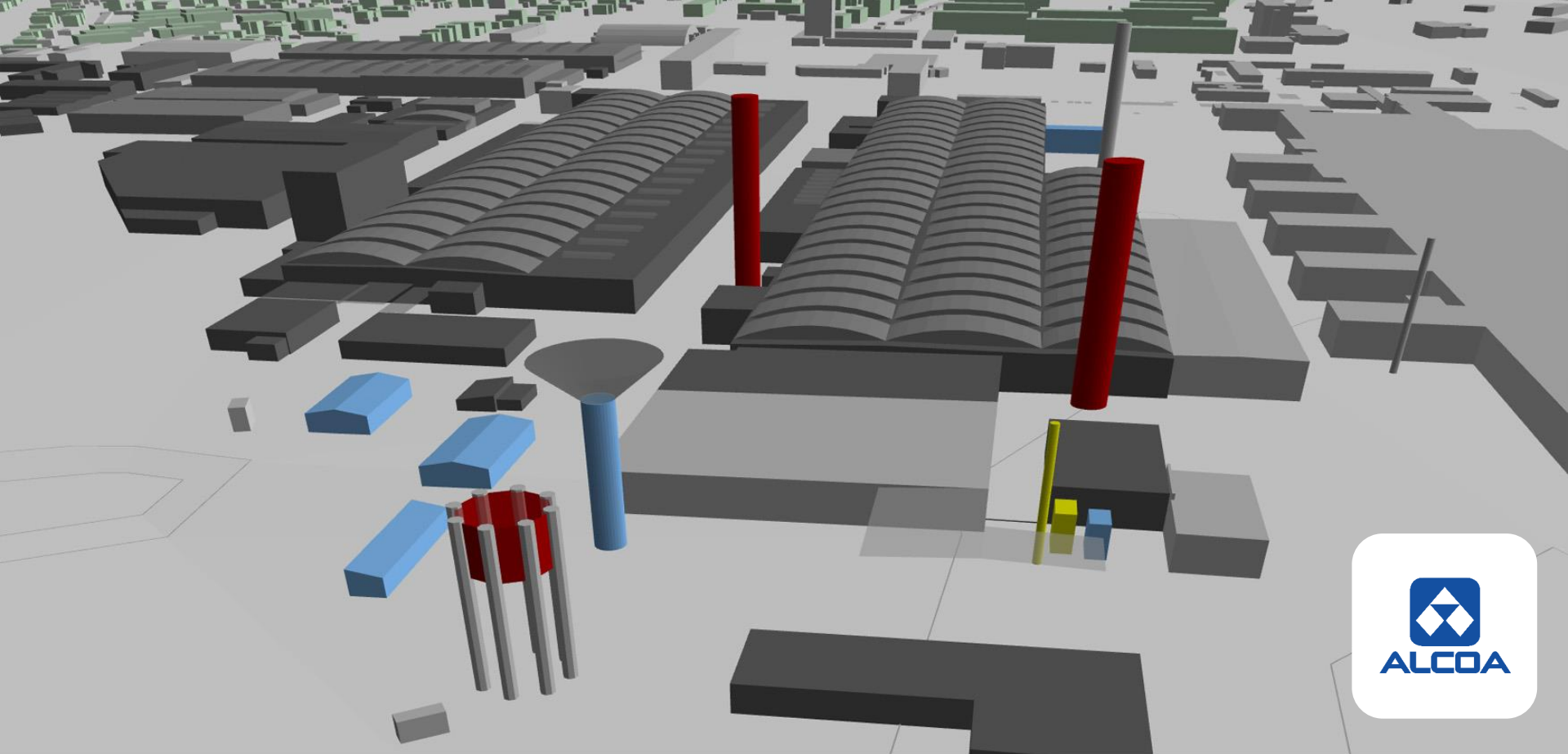


CASE STUDY: cooling tower with point sources



CASE STUDY: difference between area and point sources





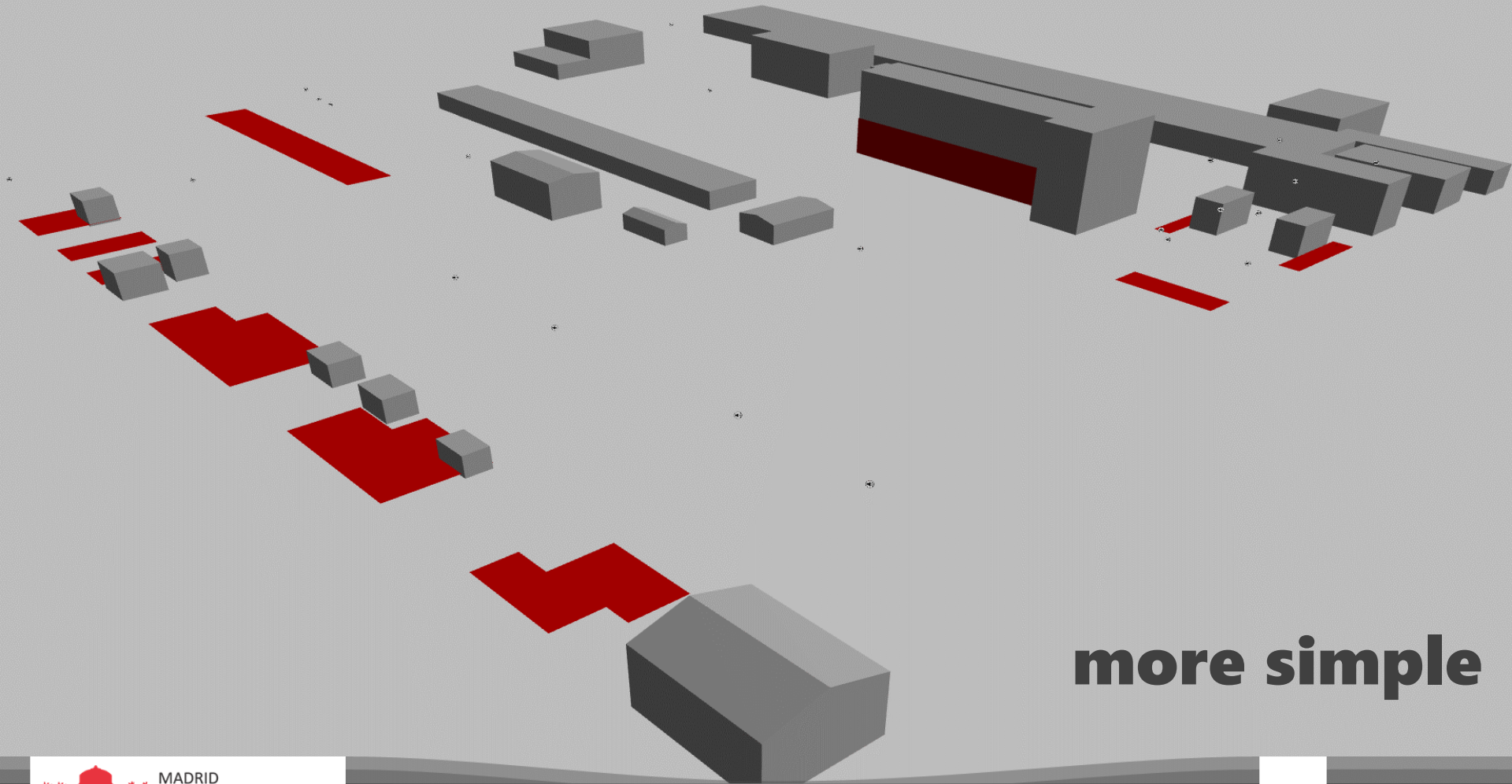
01 EXTREMES

of industrial noise modelling

from strategic noise mapping...
...to noise control action plan
capabilities of the software
planning in advance

STRATEGIC NOISE MAPPING

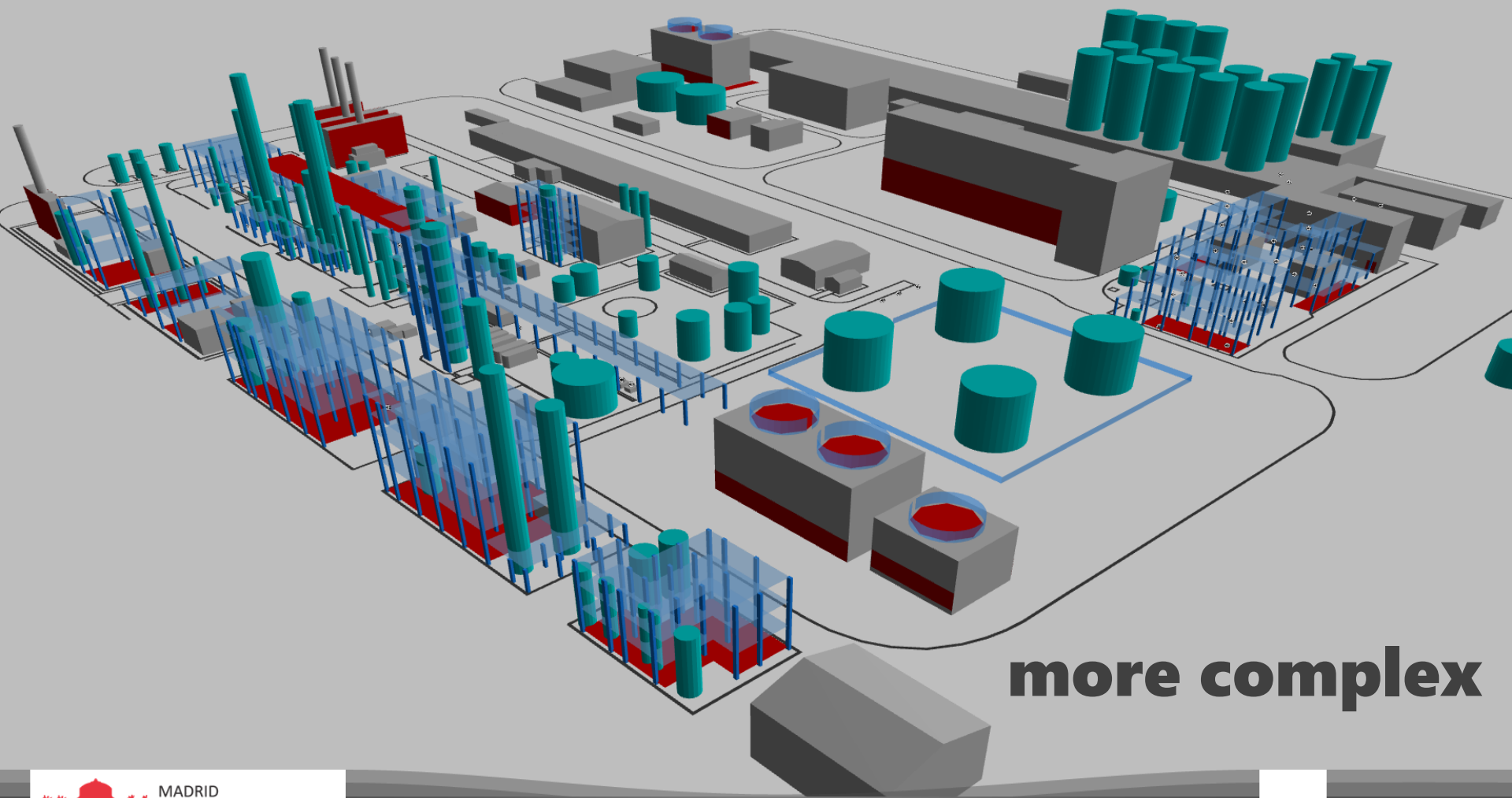
the strategic model of industrial areas includes few objects and **few noise sources**



more simple

NOISE CONTROL ACTION PLAN

every dominant noise source has to be indicated in the **highly detailed model**



more complex

it's nearly impossible to switch from
a simple **strategic model**
to a detailed **industrial model**



KEEP CALM AND PLAN AHEAD

THE CAPABILITIES

determine the limits of model complexity



Edit: Building

HAUS0816 [1260]

Description:
SUNPRO +27,9 T1

Presentation: Világos szürke

Exception: Colour Width/mm

Show label at selected node

Group: HAUS Bunge új

Identifier: 0

Note Picture

Ignore area for grid calculation

OK Cancel Help

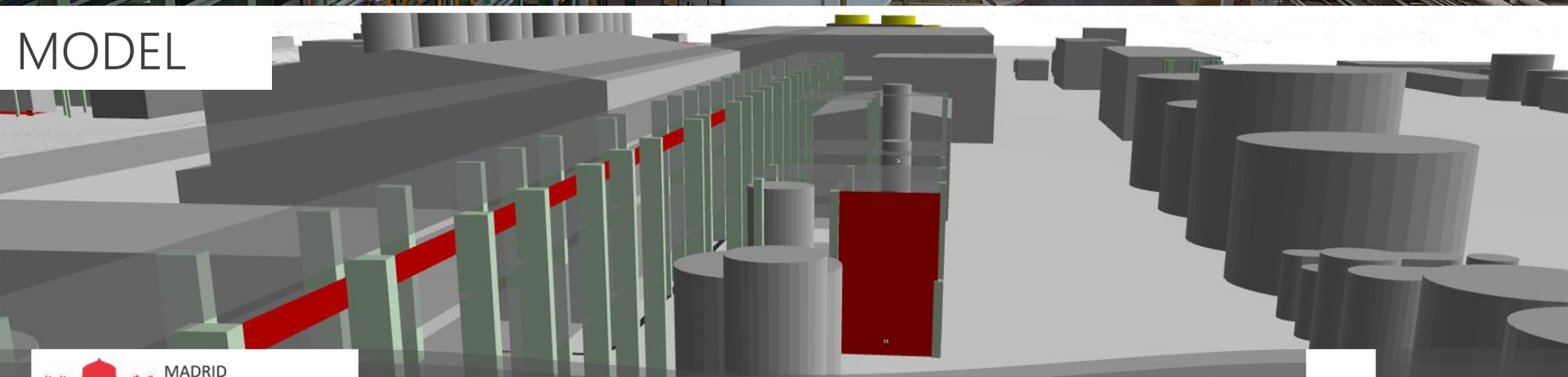
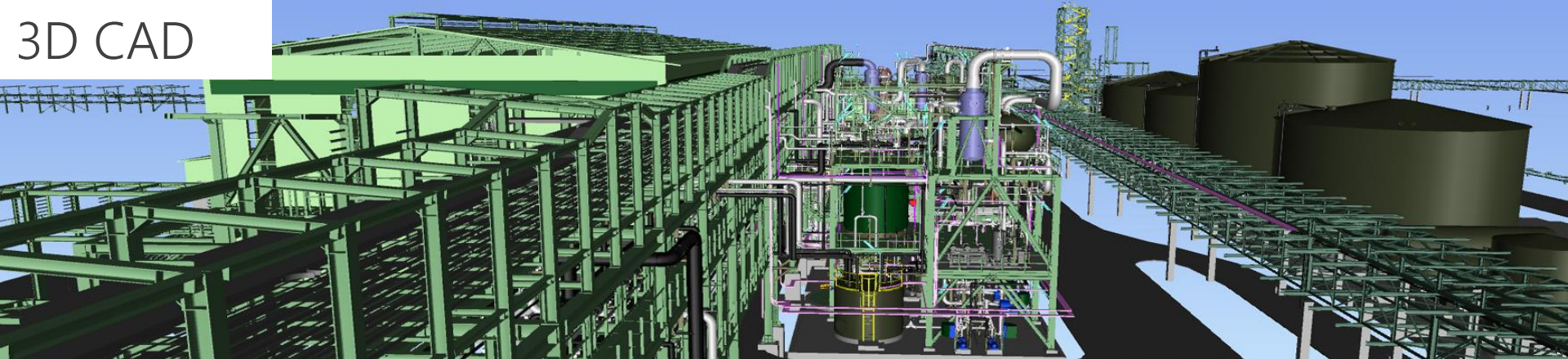
Geometry input: HAUS0816 [1260]

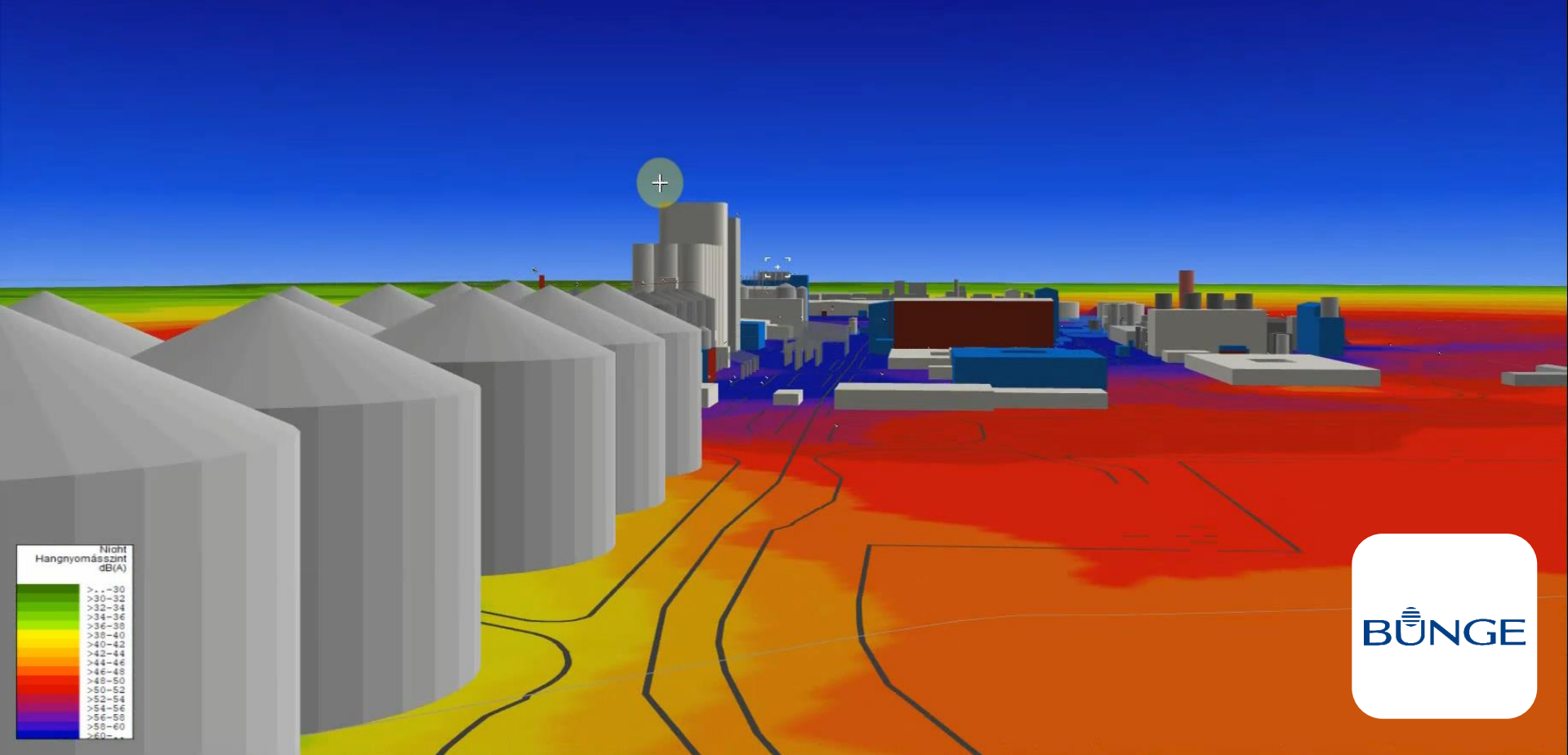
Absolute z No. Direct entry
 []: 8.92m x 6.96m Enter z only

Node	x/m	y/m	z(rel)/m
1	744385,70	189230,19	25,10
2	744384,92	189229,68	25,10
3	744384,27	189229,02	25,10
4	744383,75	189228,24	25,10
5	744383,39	189227,38	25,10
6	744383,21	189226,47	25,10
7	744383,21	189225,54	25,10
8	744383,39	189224,63	25,10
9	744383,74	189223,77	25,10
10	744387,91	189226,00	27,00

Number of vertices
 Length (3) /m
 Length (2D) /m
 Area /m
 Segment (2D) /m
 Segment (3D) /m

Add
 OK Cancel





02 CUSTOMER focused modelling

- correspond to customer requirements
- build objects to help navigation
- color the buildings or tanks
- draw the borderlines of roads

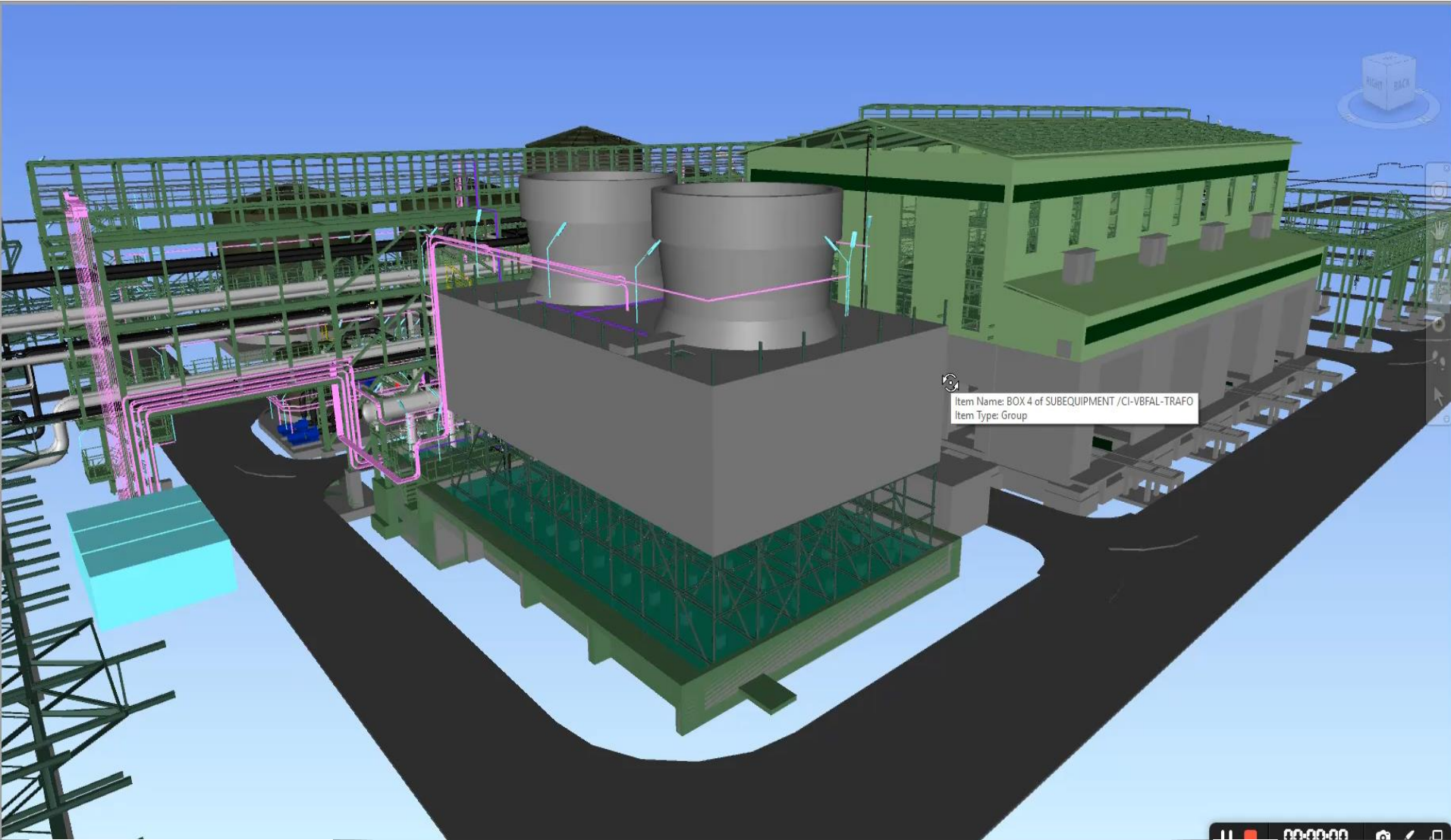


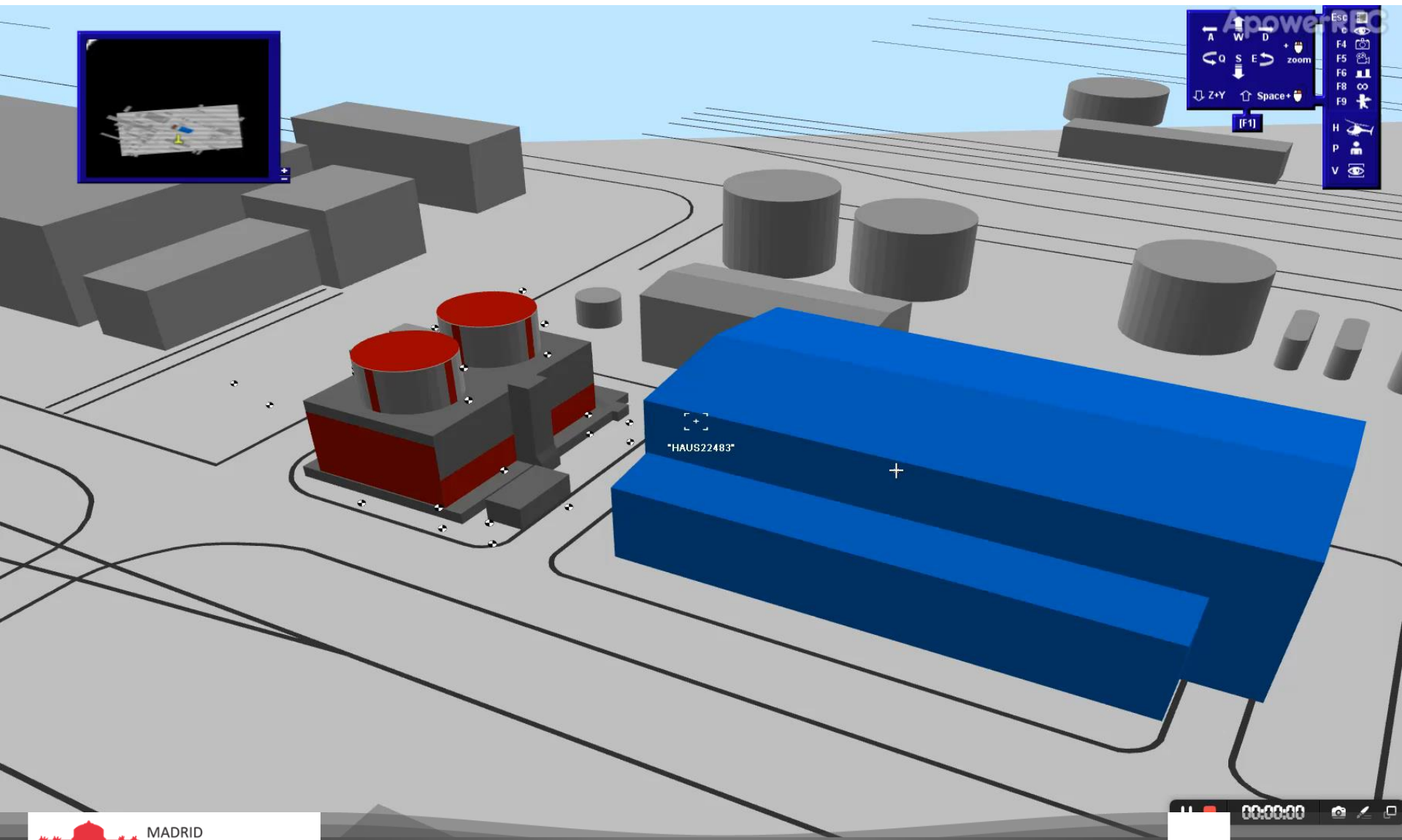
GOALS

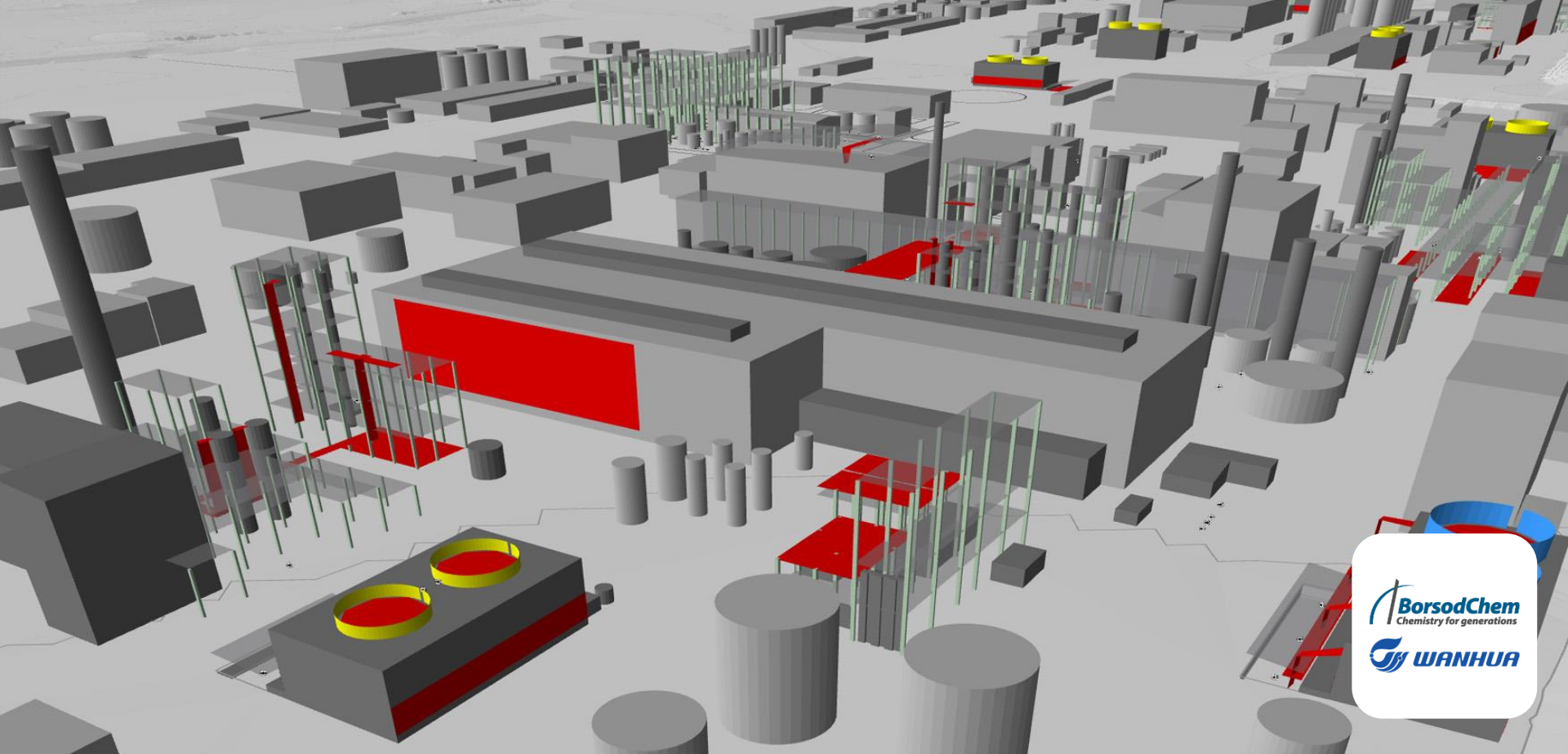
of the customer focused modelling



Navisworks







03 SOURCE DATA

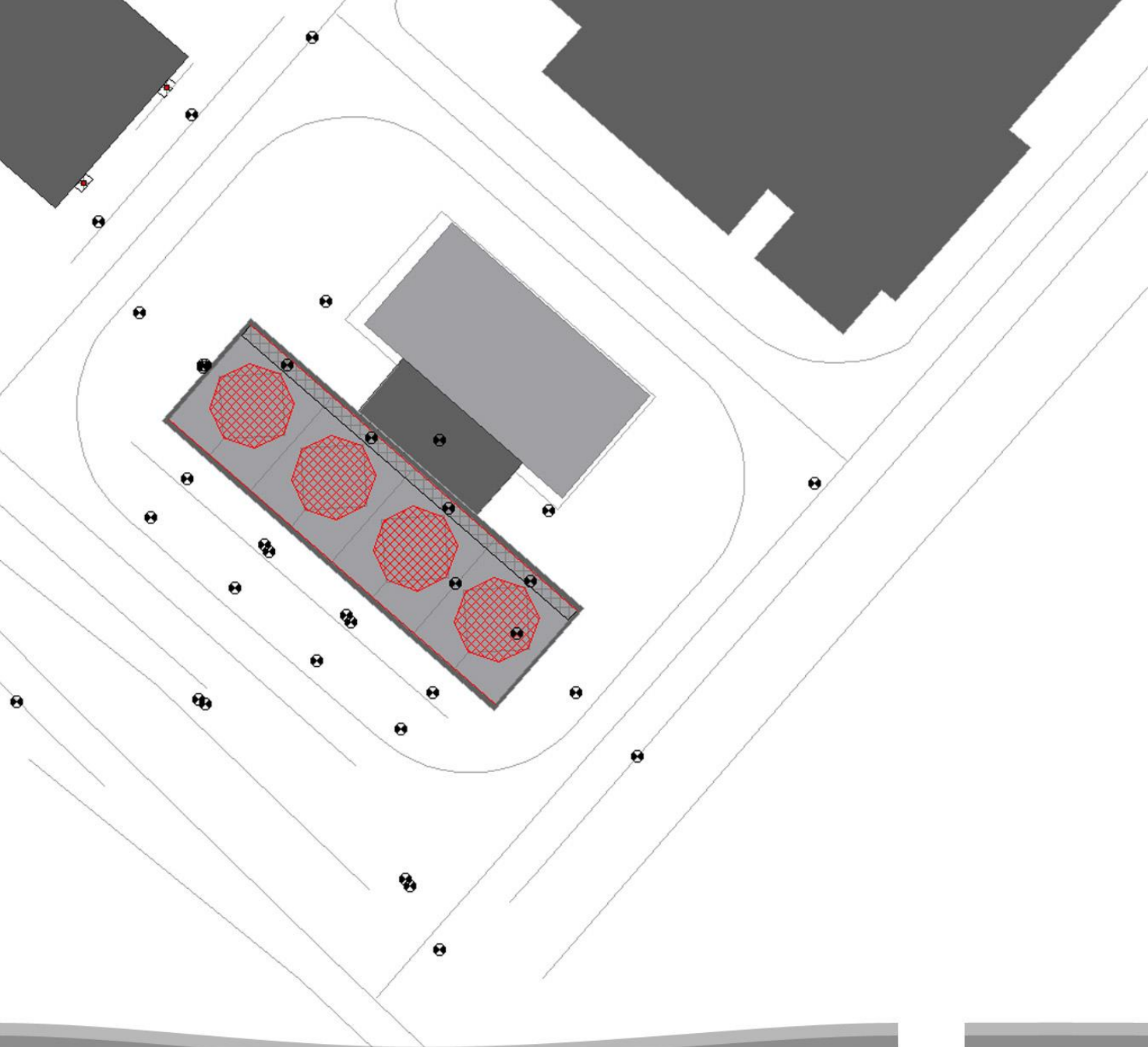
types and production methods

we prefer to measure the source
accuracy of the source data
method of data production
complexity of objects

we obviously obtain **more accurate** data at existing industrial sites, therefore we prefer to **measure** an actual noise source which is **similar** to the planned technology



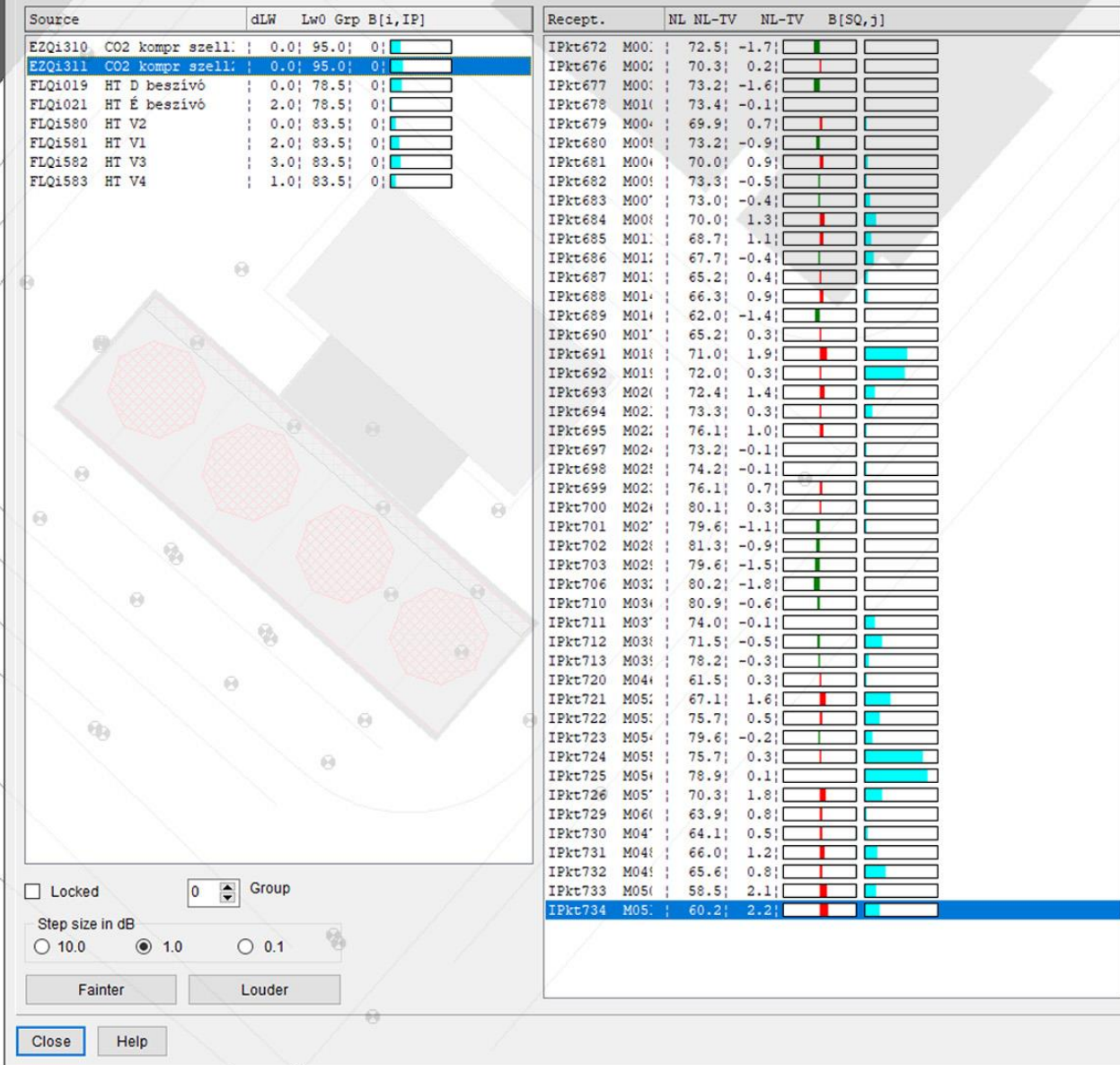
we measure
the sources
according to
ISO 3746



we measure
the sources
according to
ISO 3746

we calibrate
the model
according to
ISO 9613

Development plan - Imposition of noise quotas



T01 Type of source data

how we provide the noise emission parameters

TYPE OF SOURCE DATA	COMPLEXITY	ACCURACY	COST/TIME
A-weighted Sound Pressure Level (SPL)	●	●	●
SPL in octave or 1/3 octave band levels	● ●	● ●	●
A-weighted Sound Power Level (PWL)	●	●	● ●
PWL in octave or 1/3 octave band levels	● ●	● ●	● ●
SPL & PWL in 1/3 octave band levels	● ● ●	● ● ●	● ● ●
SPL & PWL in 1/3 octave with directivity	● ● ● ●	● ● ● ●	● ● ● ●

T02 Method of source data production

we measure ourselves or use internal database of the software

METHOD OF SOURCE DATA PRODUCTION	COMPLEXITY	ACCURACY	COST/TIME
Default values	●	●	●
Calculated back from noise limit	●	●●	●●
Public database	●●	●●	●●
Software internal database	●●	●●	●
Manufacturer catalogue data	●●	●●●	●●●
Measured SPL	●●●	●●●●	●●●
Measured SPL & Calculated PWL	●●●	●●●●●	●●●●

T03 Method of surface model (DSM) production

the best method is using 3D CAD formats or measure ourselves (LDM)

METHOD OF DSM PRODUCTION	COMPLEXITY	ACCURACY	COST/TIME
Estimation based on photos	●	●	●●
2D layout with height data	●●	●●	●
On-site measurement (LDM)	●●	●●	●●
2D view & sectional plan with height data	●●●	●●●	●
Photogrammetric survey	●●●	●●●	●●
3D CAD (e.g. Navisworks, Solidworks)	●●●●	●●●●	●●
3D Laser Scanning	●●●●	●●●●	●●●●

T04 Method of terrain model (DTM) production

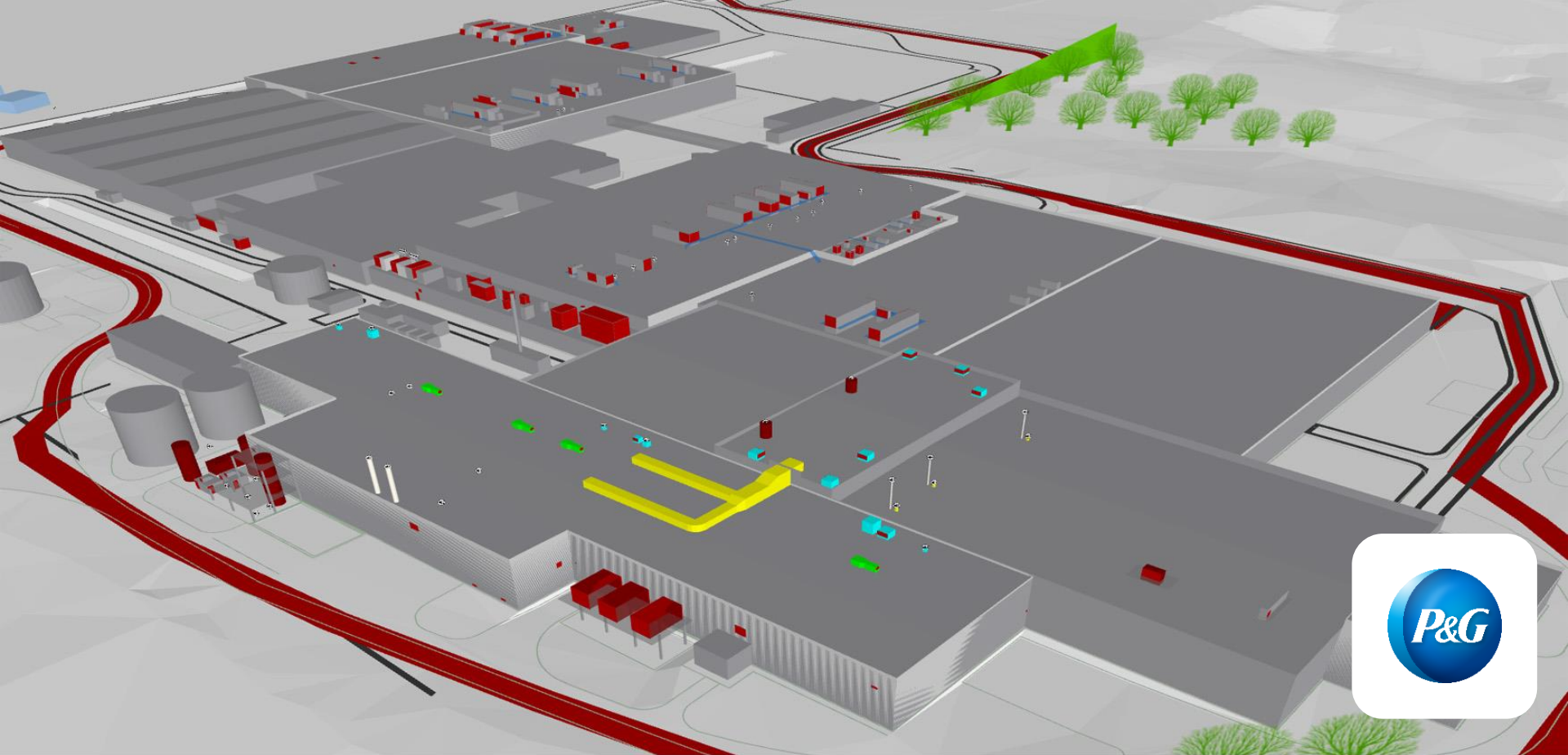
we prefer photogrammetric survey (but a good topographic map is enough)

METHOD OF DTM PRODUCTION	COMPLEXITY	ACCURACY	COST/TIME
No terrain model	●	●	●
Topographic map or data source	●●	●●	●
Digitization of topographic map	●●	●●	●●
Processing of orthographic aerial photos	●●	●●●	●●
On-site geodetic survey	●●●	●●●	●●●
Airborne Laser Scanning	●●●●	●●●●	●●●●

T05 Complexity of objects

the complexity of the model affects the accuracy of the calculated results

Objects	Complexity	Accuracy	Cost
Large buildings (blocks)	●	●	●
Buildings & structures (with roof shapes)	● ●	● ●	● ●
Tanks, pipelines, pipe bridges, bundles	● ● ●	● ● ●	● ● ●
Columns, pods, walls, diffusers etc.	● ● ● ●	● ● ● ●	● ● ● ●

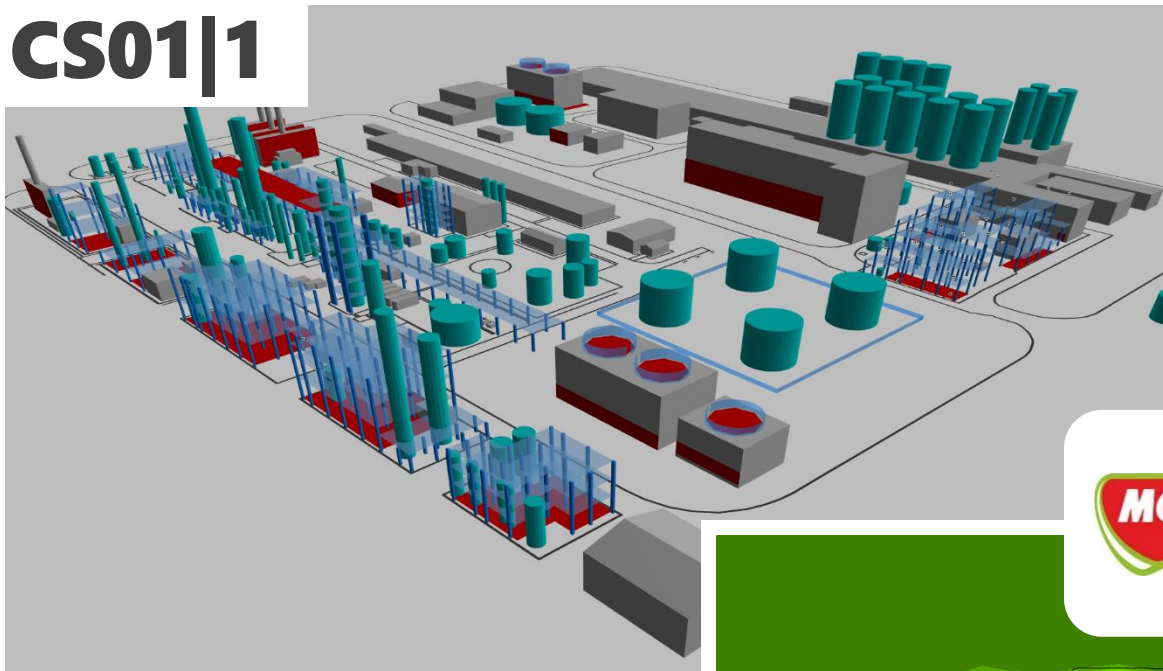


04 RESULTS

of gradually decreasing complexity

great reduction in calculation time
leave out the extra objects
much lower calculation time
bigger uncertainty

CS01|1



FULL DETAIL MODEL



NUMBER OF OBJECTS :

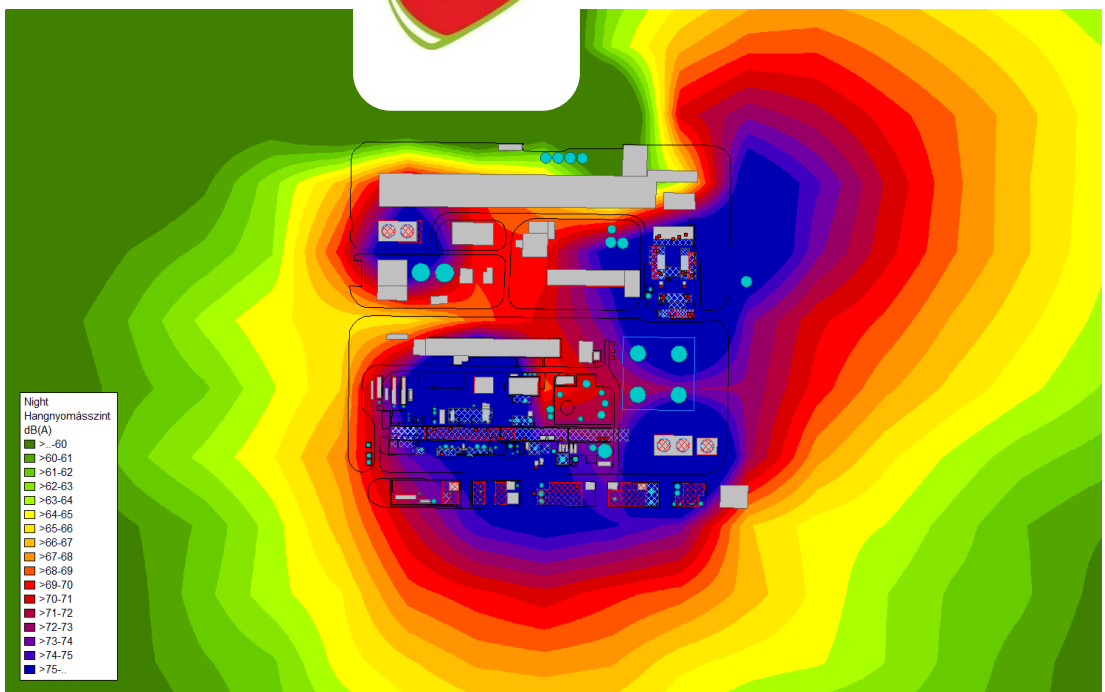
747

CALCULATION TIME :

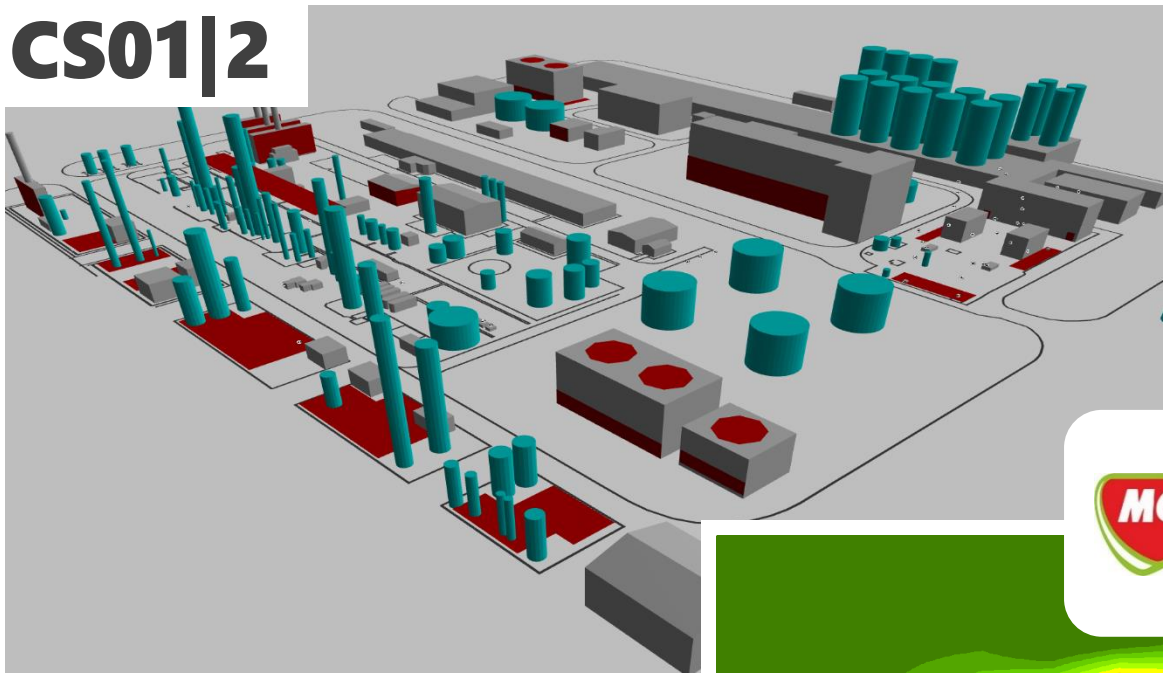
26:24

AVERAGE SPL :

58.6



CS01|2



WITHOUT COLUMNS,
PODIUMS, WALLS



NUMBER OF OBJECTS :

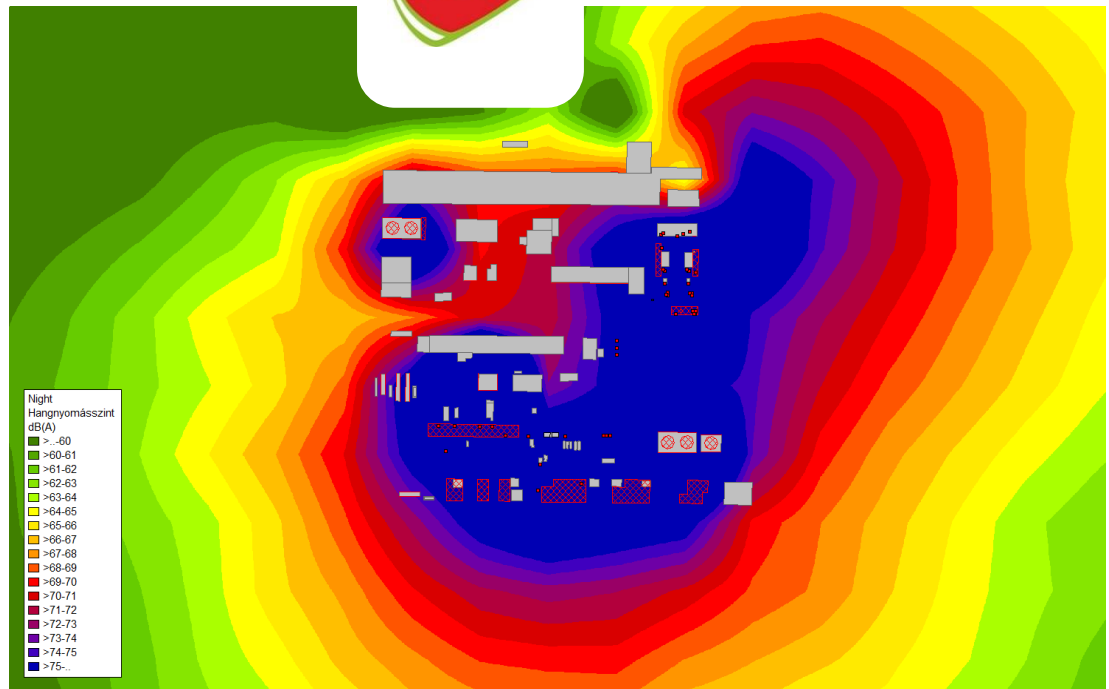
289

CALCULATION TIME :

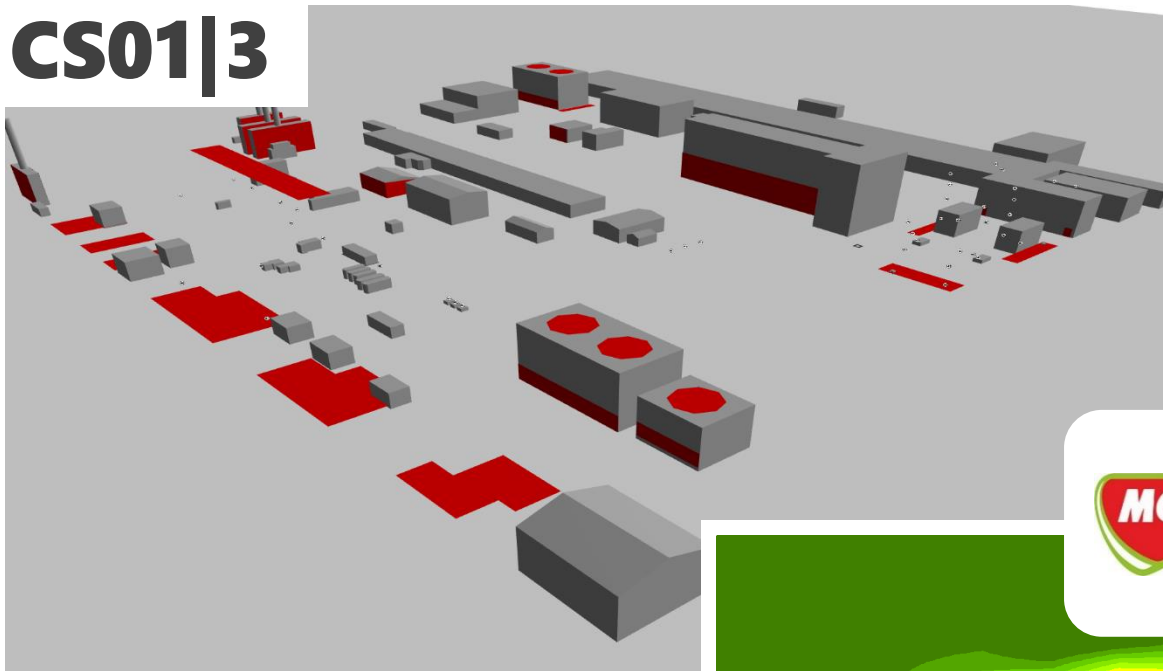
08:15

AVERAGE SPL :

59.2



CS01|3



WITHOUT TANKS,
PIPELINES, PIPE
BUNDLES



NUMBER OF OBJECTS :

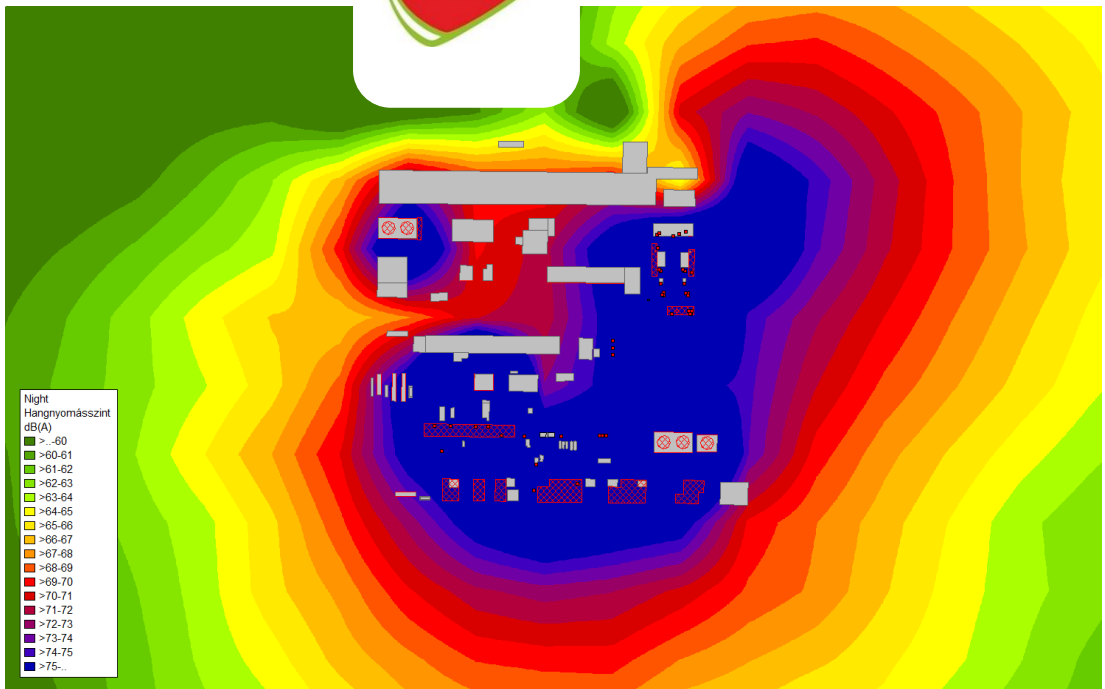
171

CALCULATION TIME :

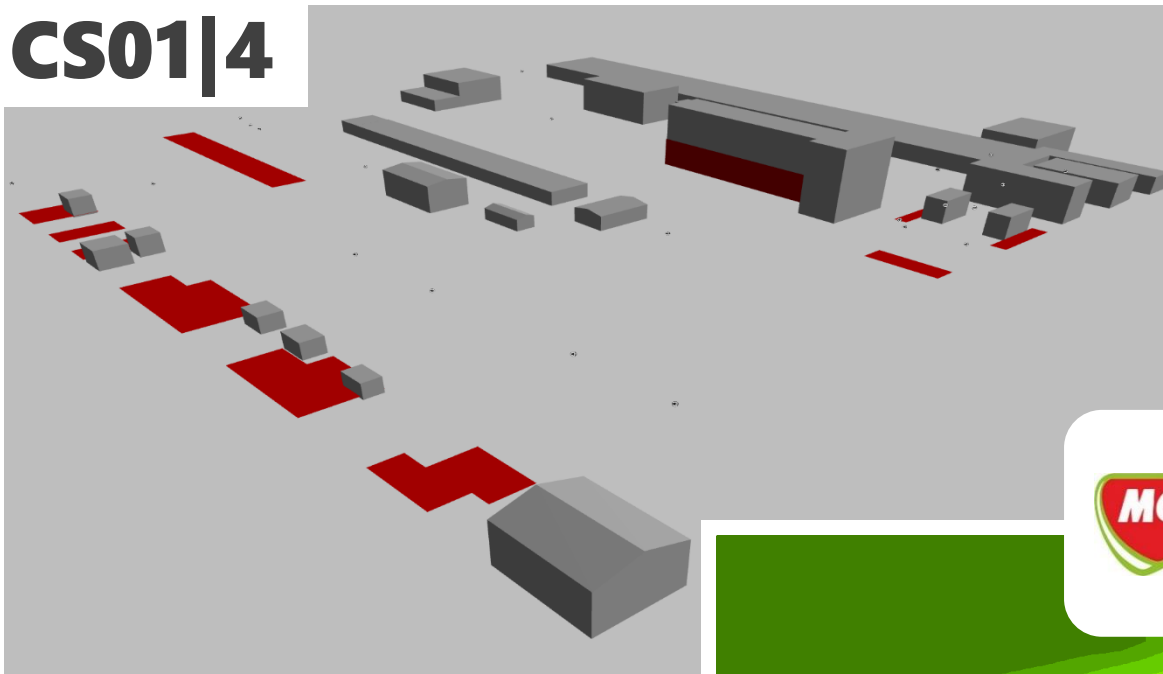
02:03

AVERAGE SPL :

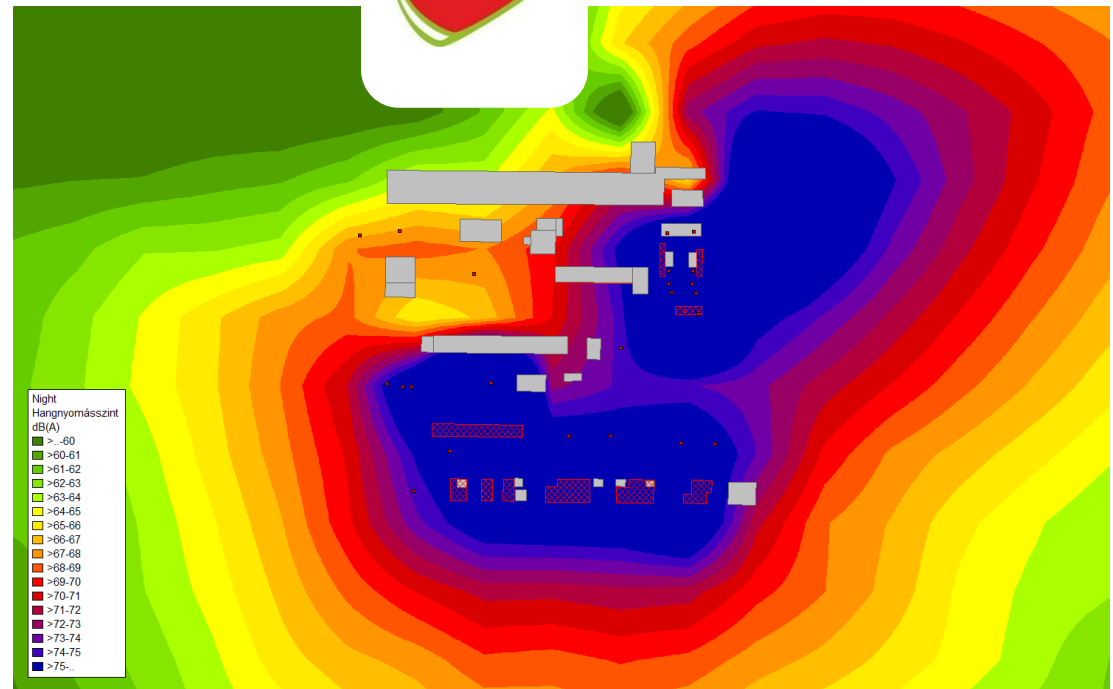
60.0



CS01|4



SIMPLIFIED SOURCES
(A-WEIGHTED PWL)



NUMBER OF OBJECTS :

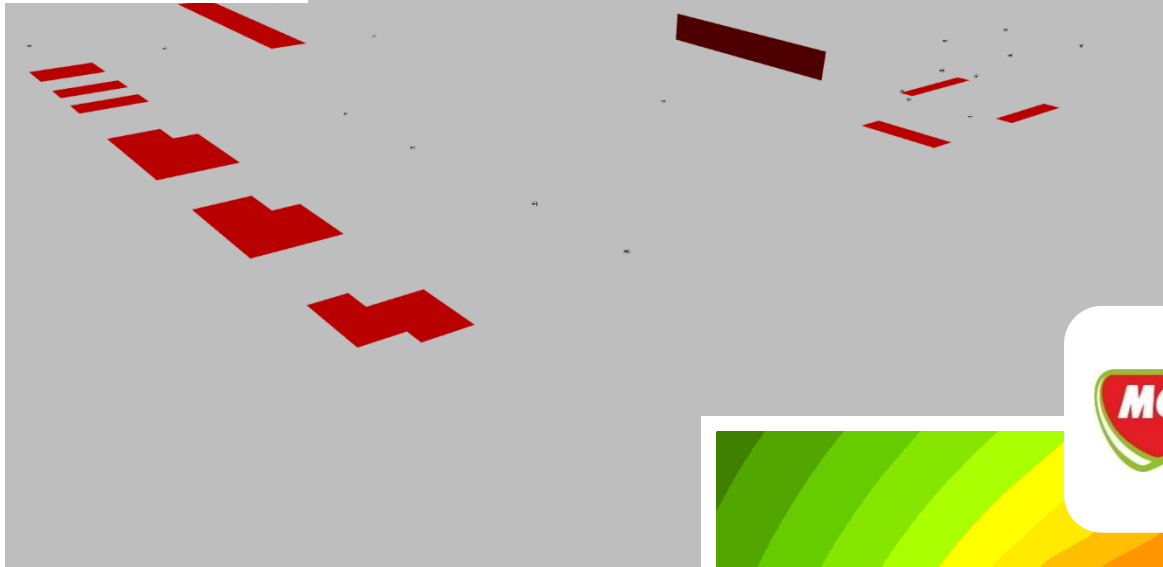
67

CALCULATION TIME :

00:09

AVERAGE SPL :

61.1



WITHOUT BUILDINGS



NUMBER OF OBJECTS:

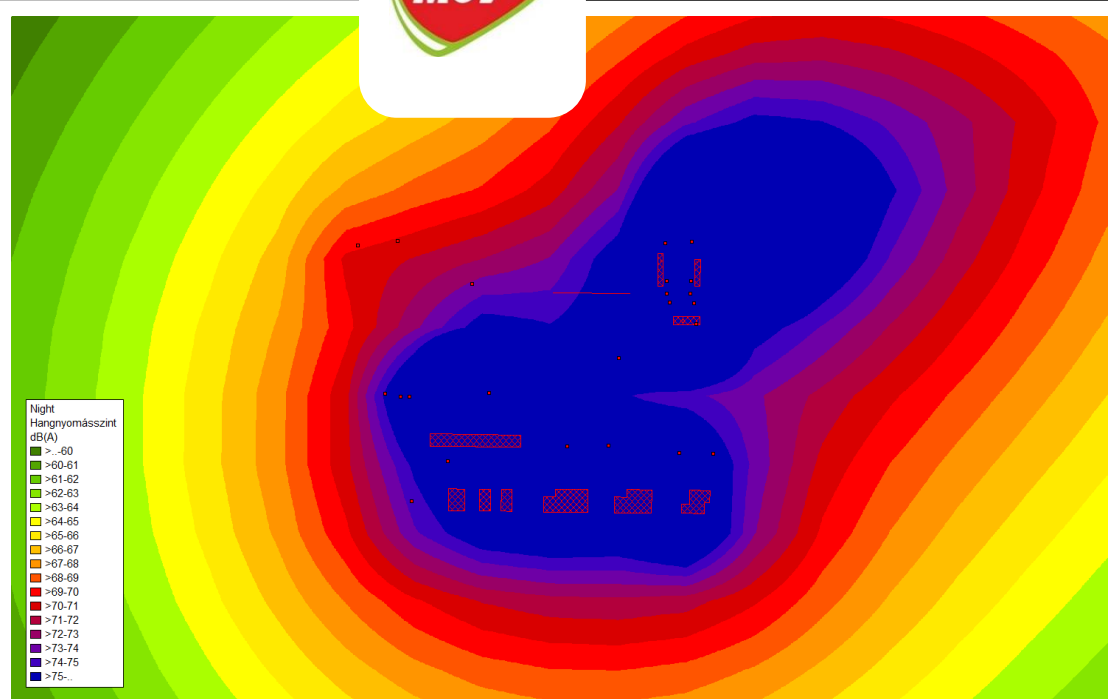
37

CALCULATION TIME:

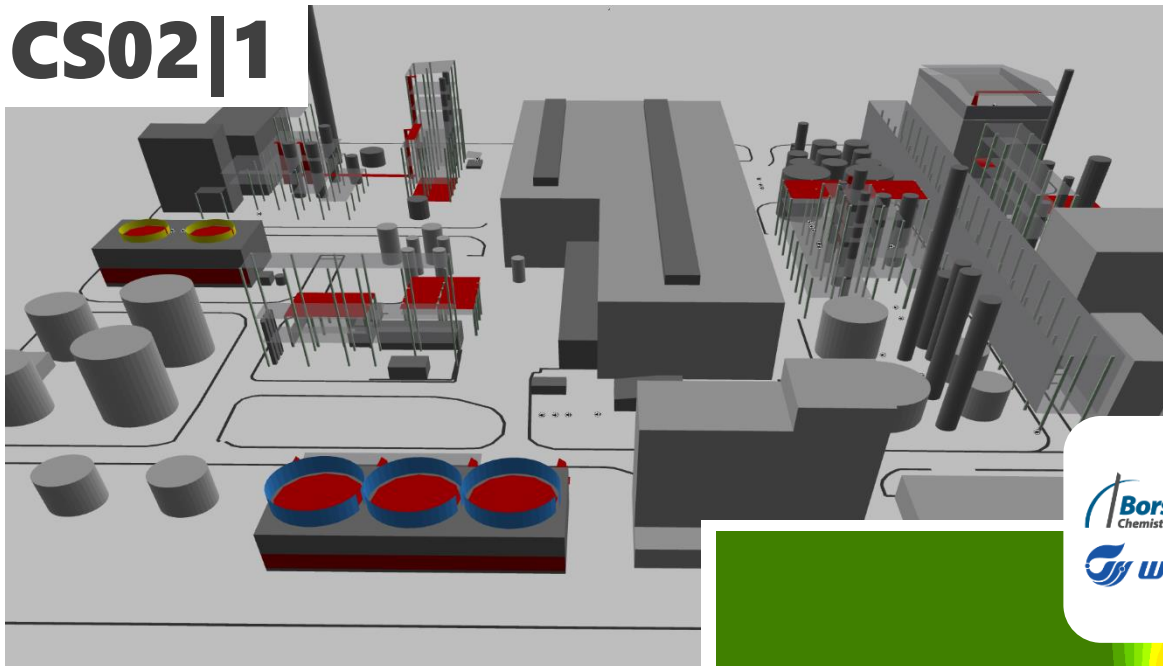
00:04

AVERAGE SPL:

62.0



CS02|1



FULL DETAIL MODEL



NUMBER OF OBJECTS :

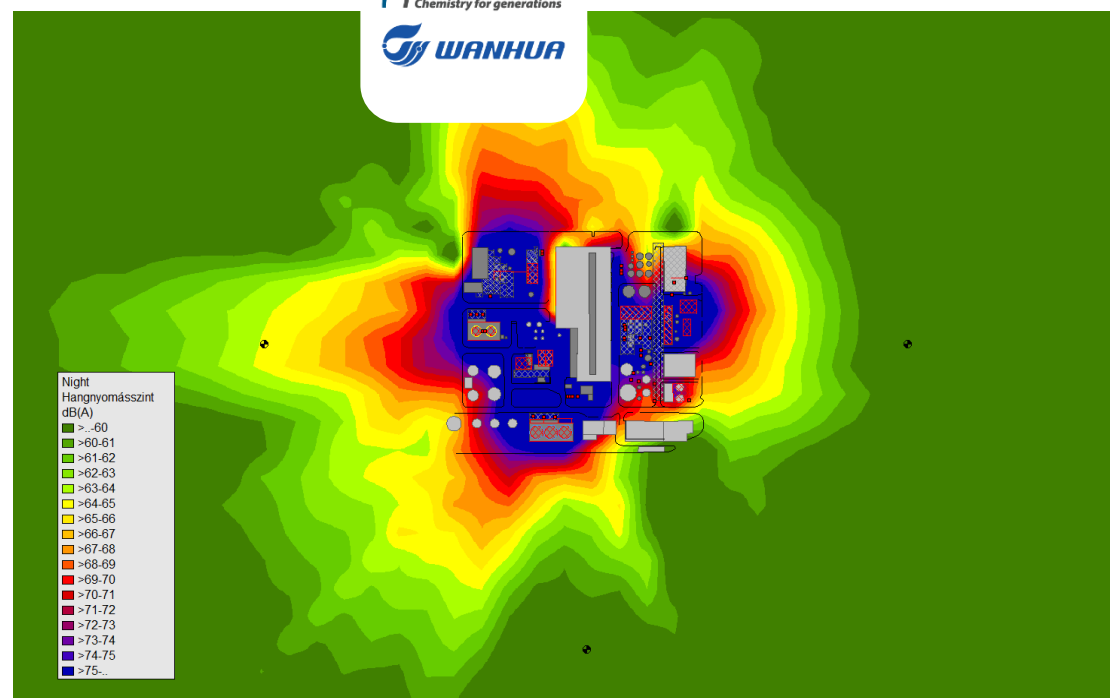
528

CALCULATION TIME :

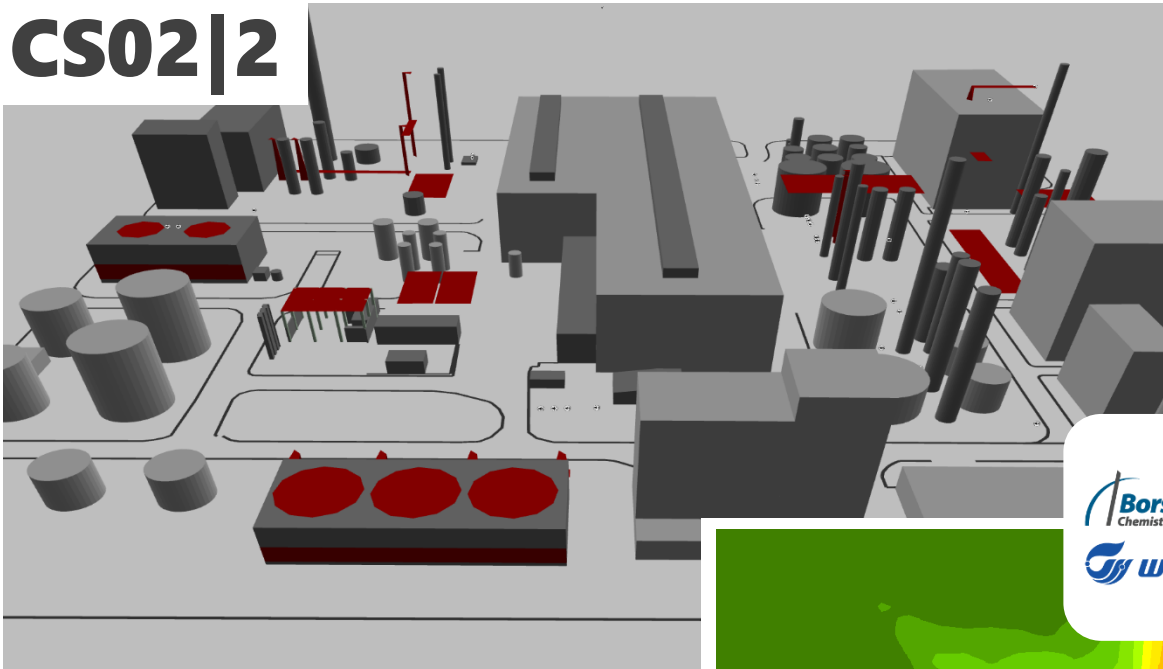
40:30

AVERAGE SPL :

60.6



CS02|2



WITHOUT COLUMNS,
PODIUMS, WALLS



NUMBER OF OBJECTS :

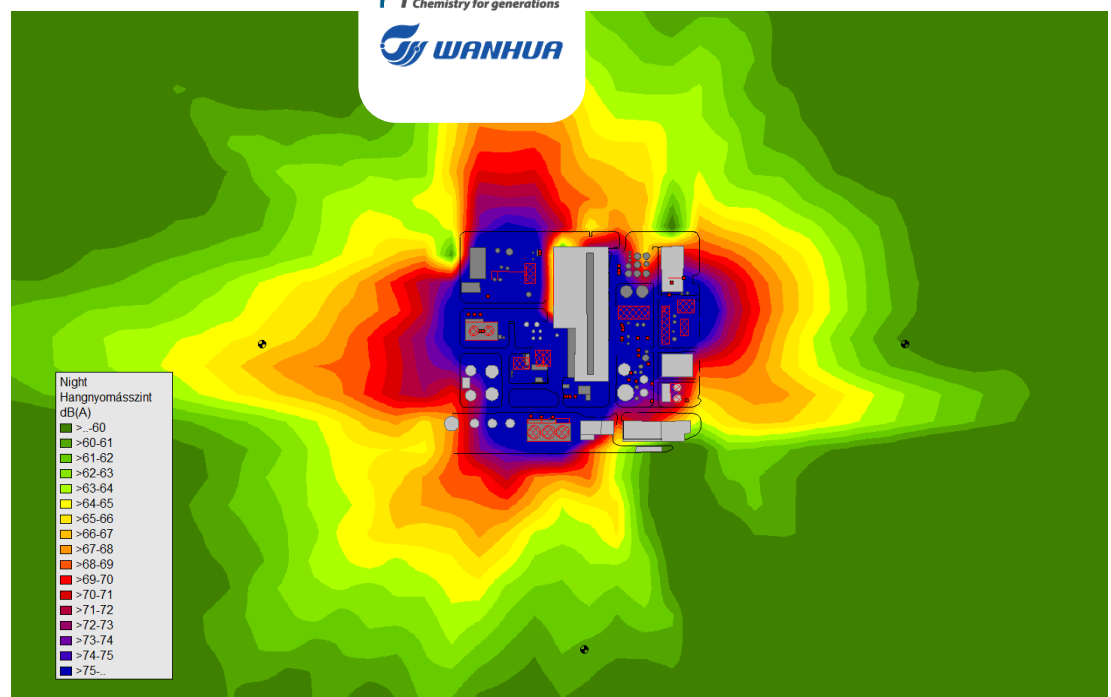
284

CALCULATION TIME :

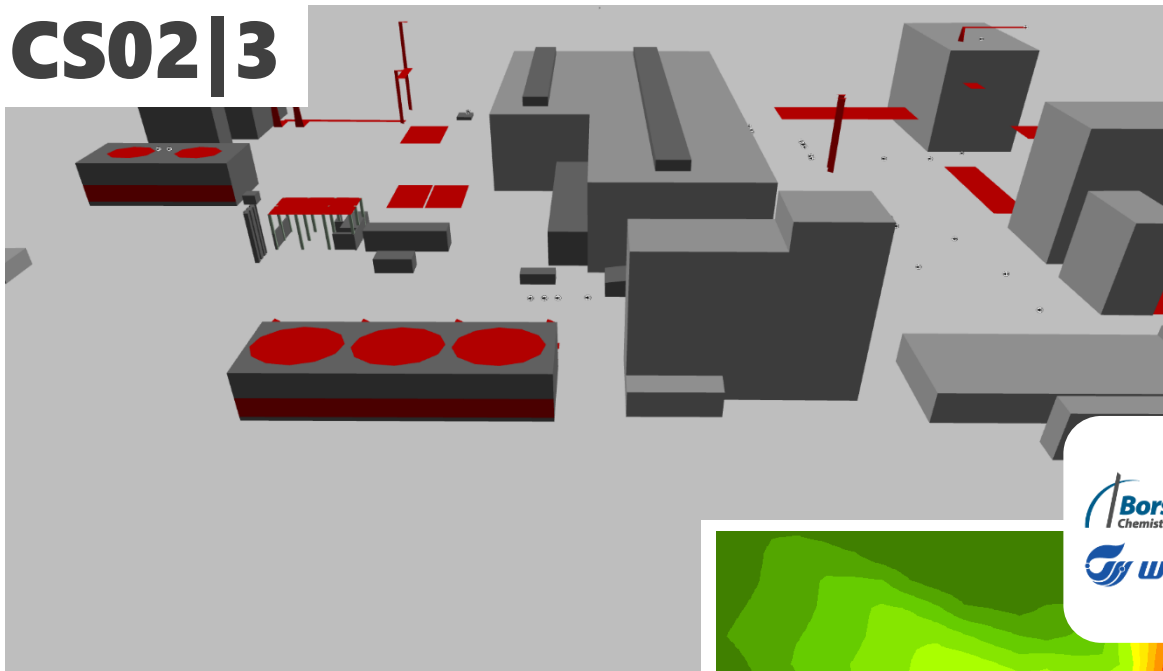
17:43

AVERAGE SPL :

62.3



CS02|3



WITHOUT TANKS,
PIPELINES, PIPE
BUNDLES



NUMBER OF OBJECTS:

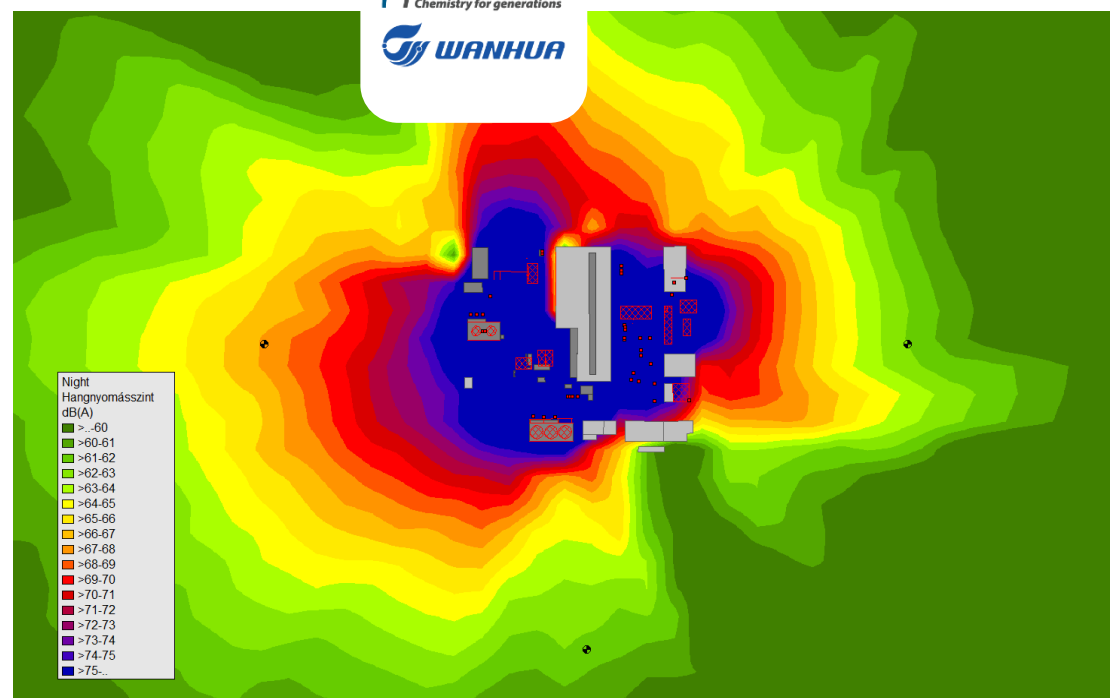
114

CALCULATION TIME:

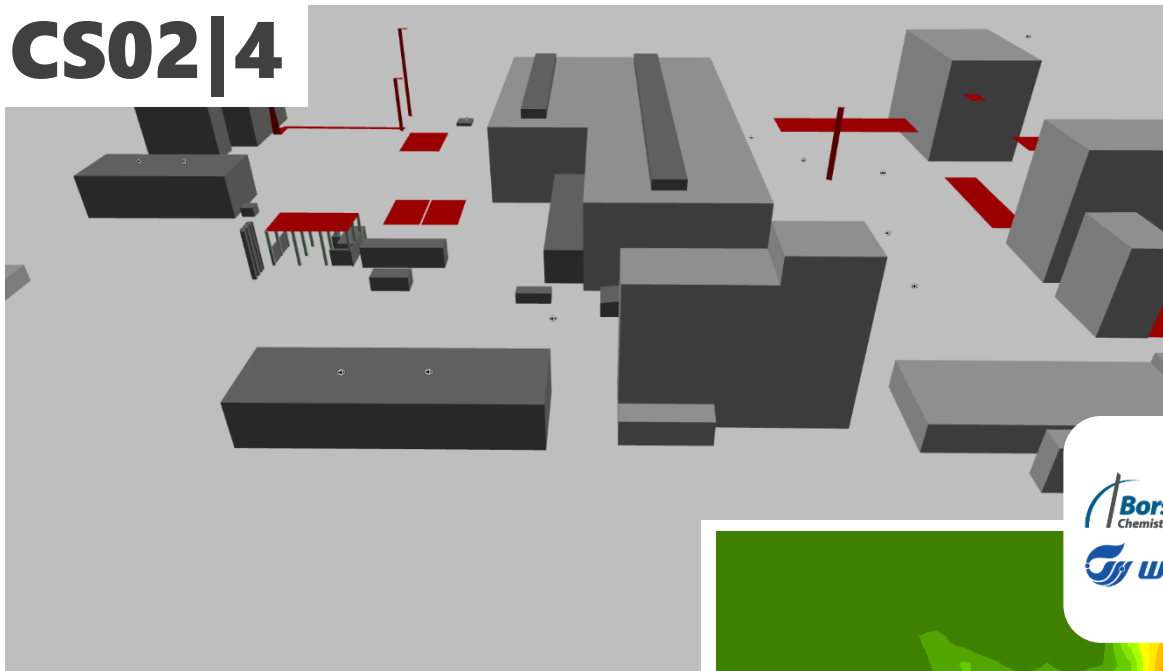
00:47

AVERAGE SPL:

63.8



CS02|4



SIMPLIFIED SOURCES
(A-WEIGHTED PWL)



NUMBER OF OBJECTS :

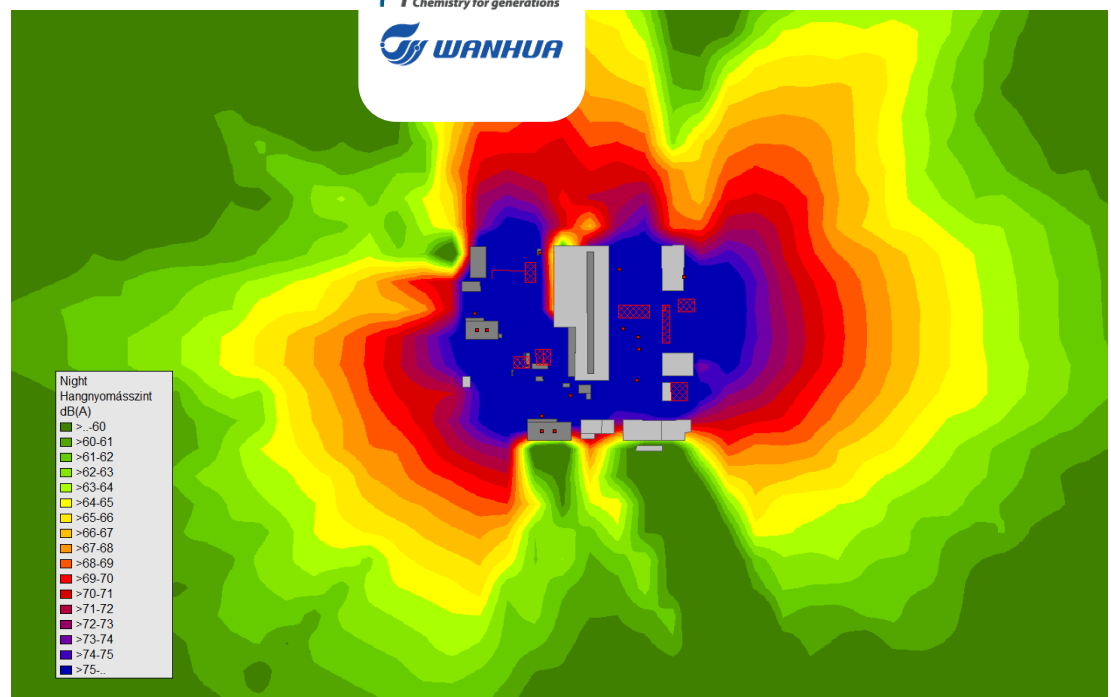
72

CALCULATION TIME :

00:23

AVERAGE SPL :

64.3

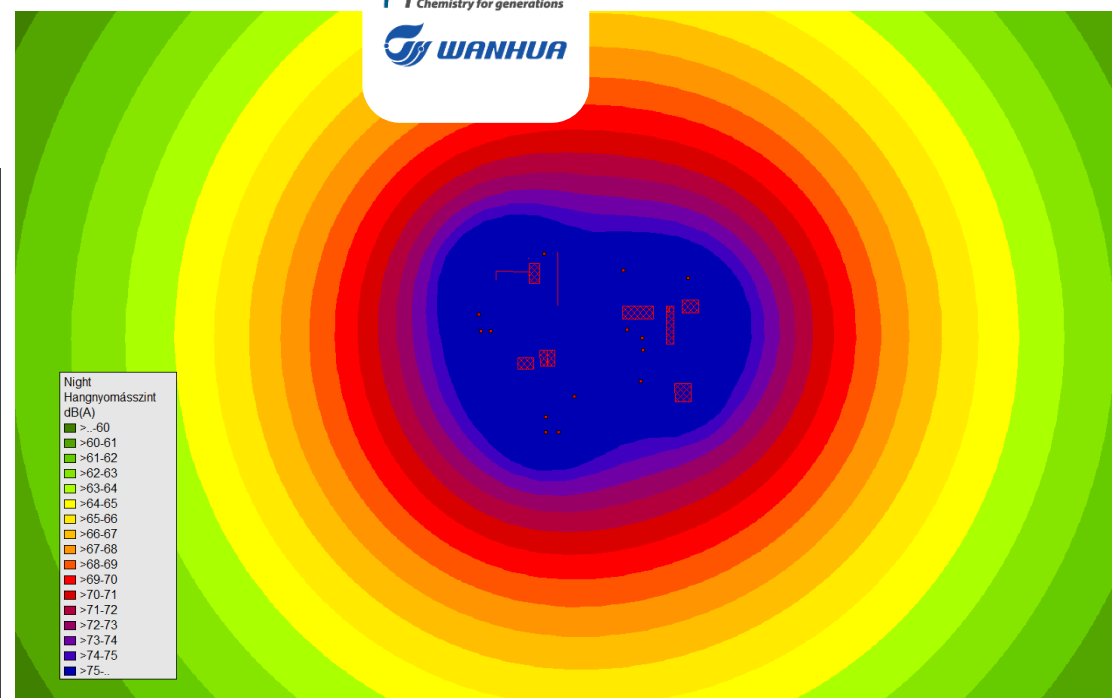


Night Hangnyomásszint dB(A)	
>..60	
>60-61	
>61-62	
>62-63	
>63-64	
>64-65	
>65-66	
>66-67	
>67-68	
>68-69	
>69-70	
>70-71	
>71-72	
>72-73	
>73-74	
>74-75	
>75-..	

CS02|5



WITHOUT BUILDINGS



NUMBER OF OBJECTS :

29

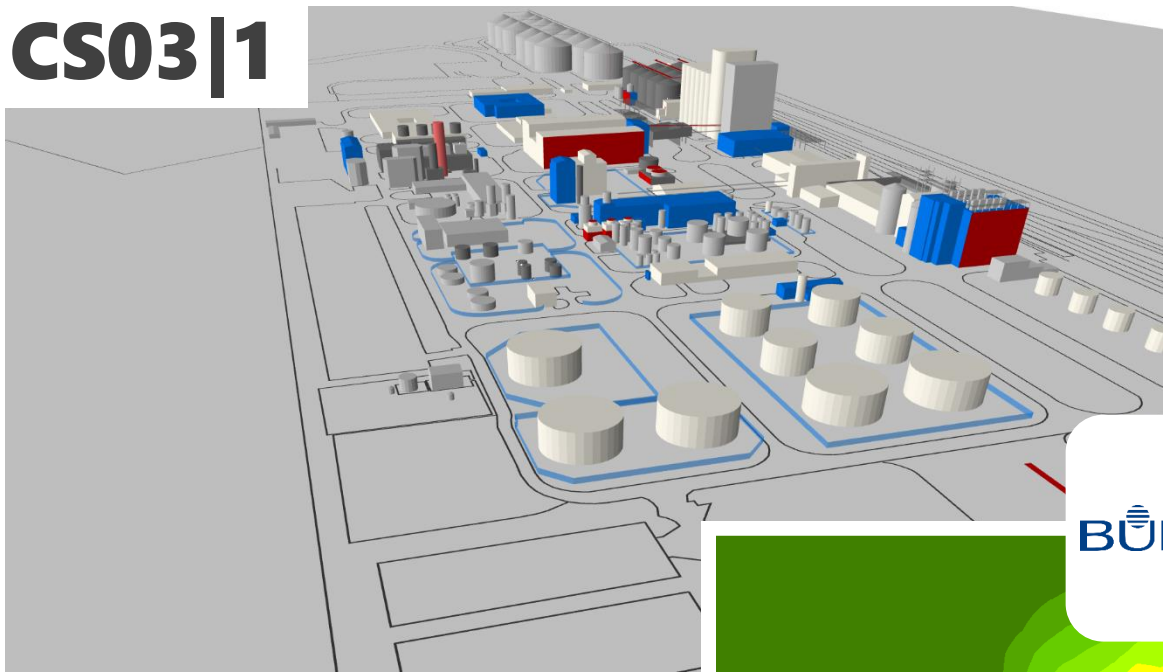
CALCULATION TIME :

00:05

AVERAGE SPL :

66.6

CS03|1



FULL DETAIL MODEL

BUNGE

NUMBER OF OBJECTS:

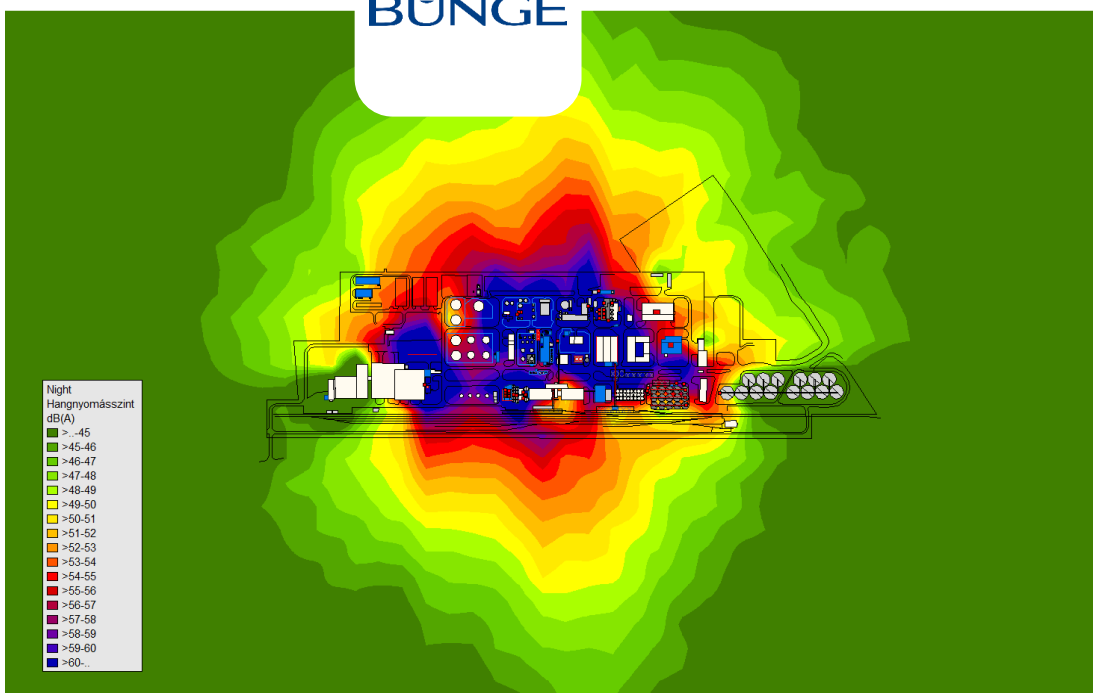
780

CALCULATION TIME:

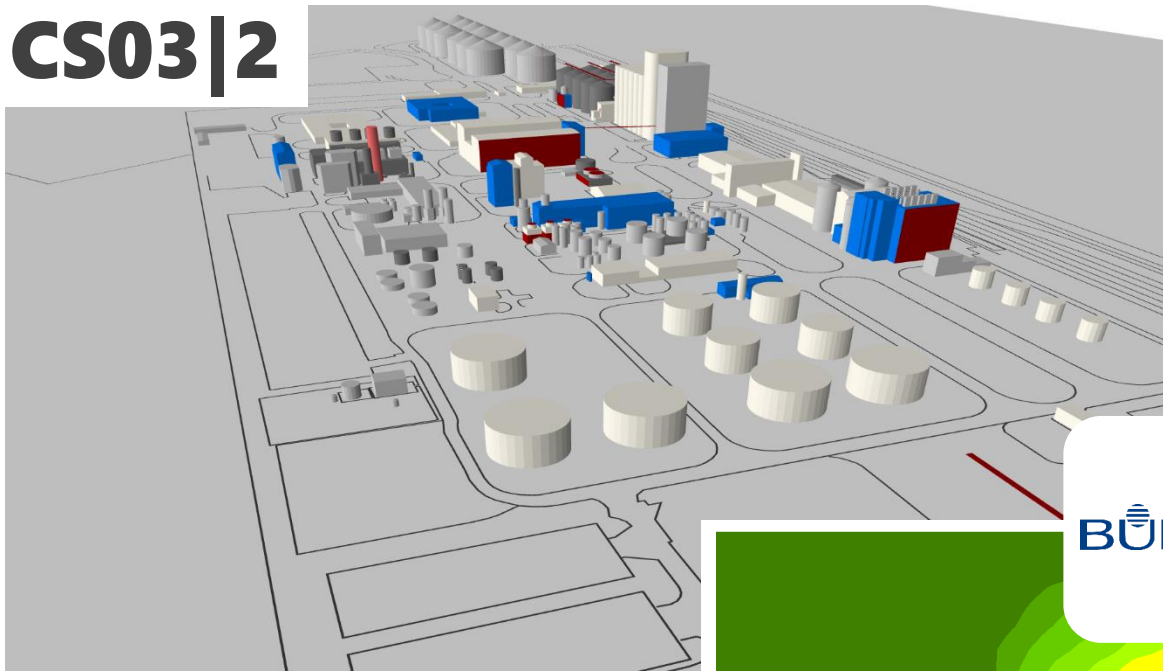
36:01

AVERAGE SPL:

44.0



CS03 | 2



WITHOUT COLUMNS,
PODIUMS, WALLS

BUNGE

NUMBER OF OBJECTS:

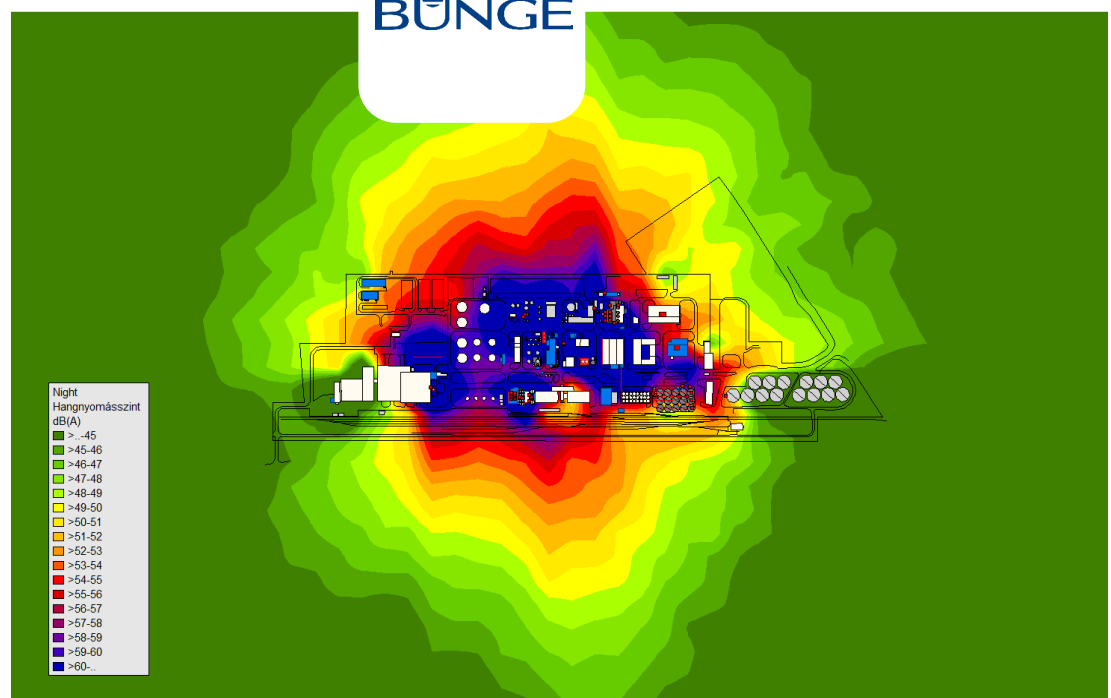
579

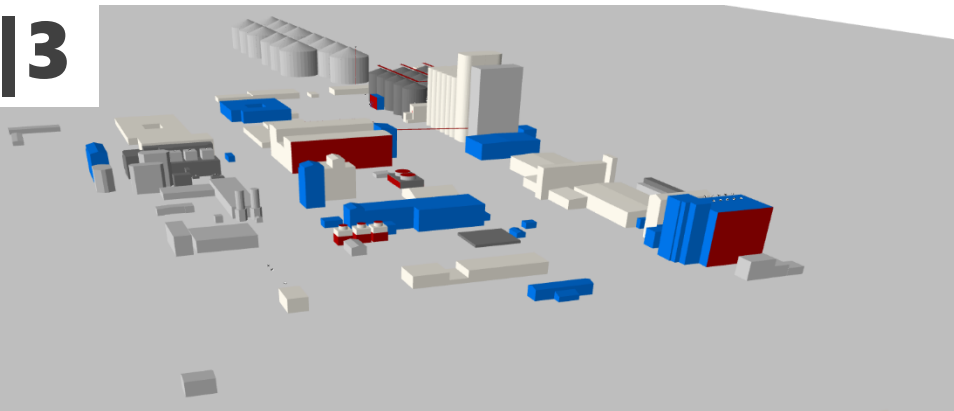
CALCULATION TIME:

24:15

AVERAGE SPL:

44.4





WITHOUT TANKS,
PIPELINES, PIPE
BUNDLES

BUNGE

NUMBER OF OBJECTS:

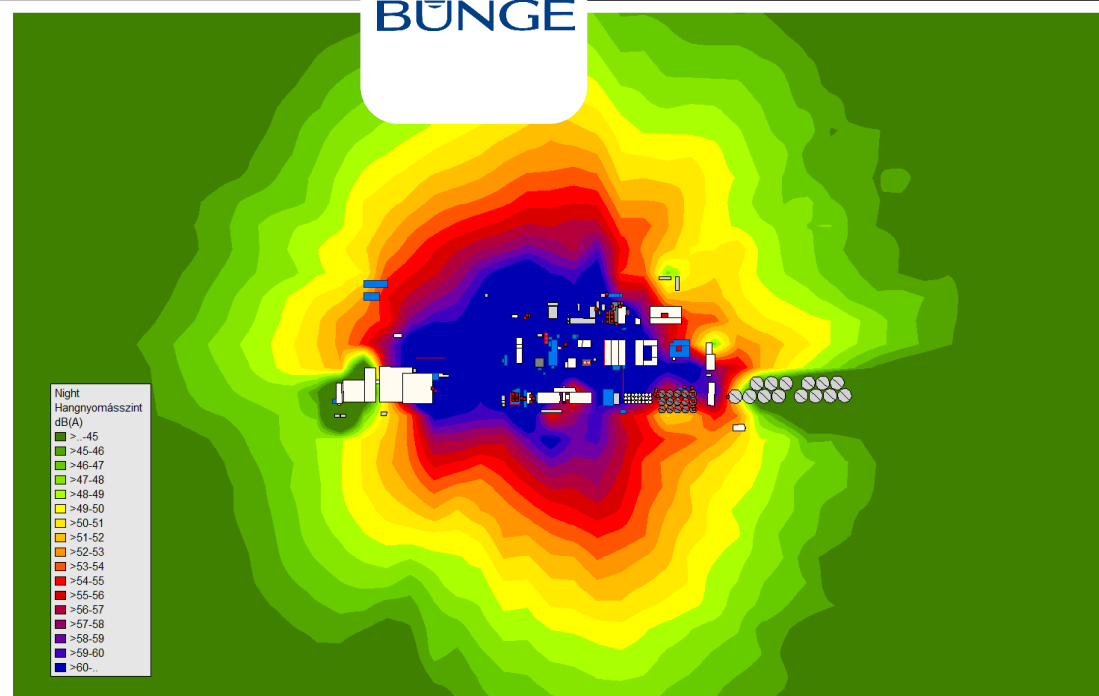
306

CALCULATION TIME:

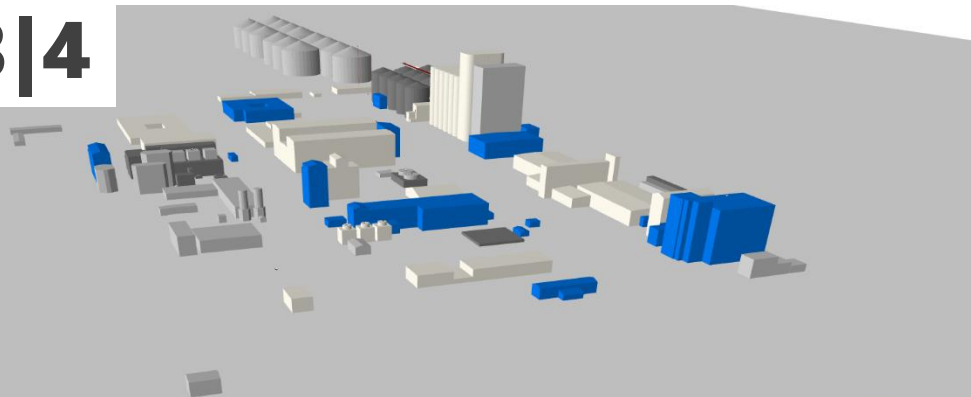
07:26

AVERAGE SPL:

45.2



CS03 | 4



SIMPLIFIED SOURCES (A-WEIGHTED PWL)

BUNGE

NUMBER OF OBJECTS:

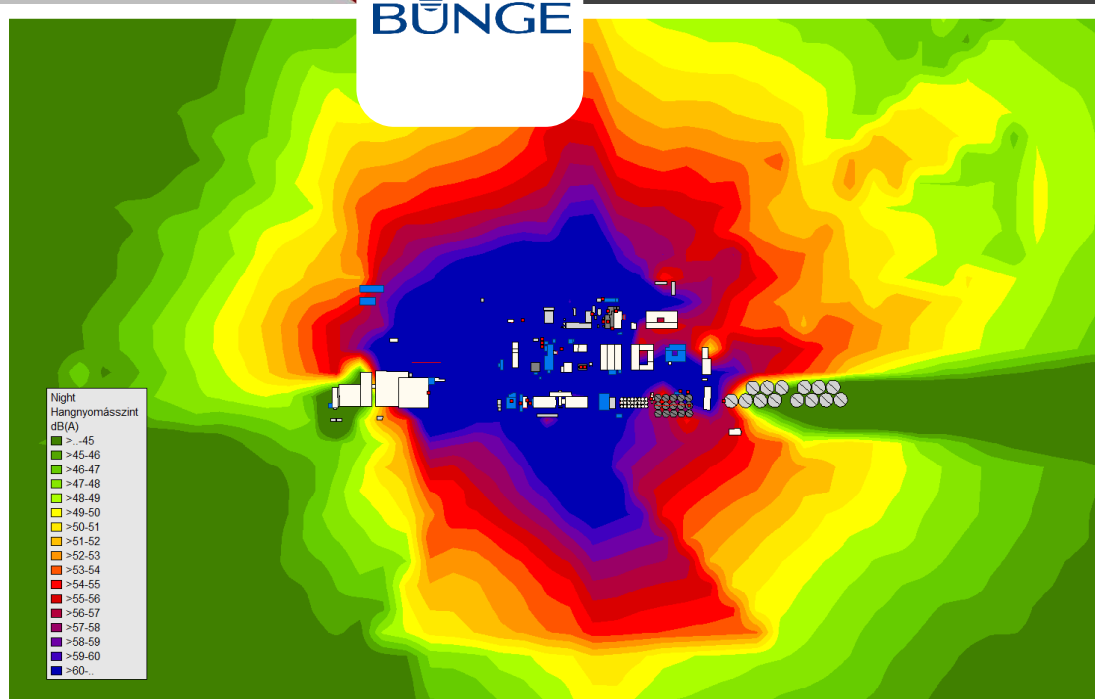
254

CALCULATION TIME:

00:50

AVERAGE SPL:

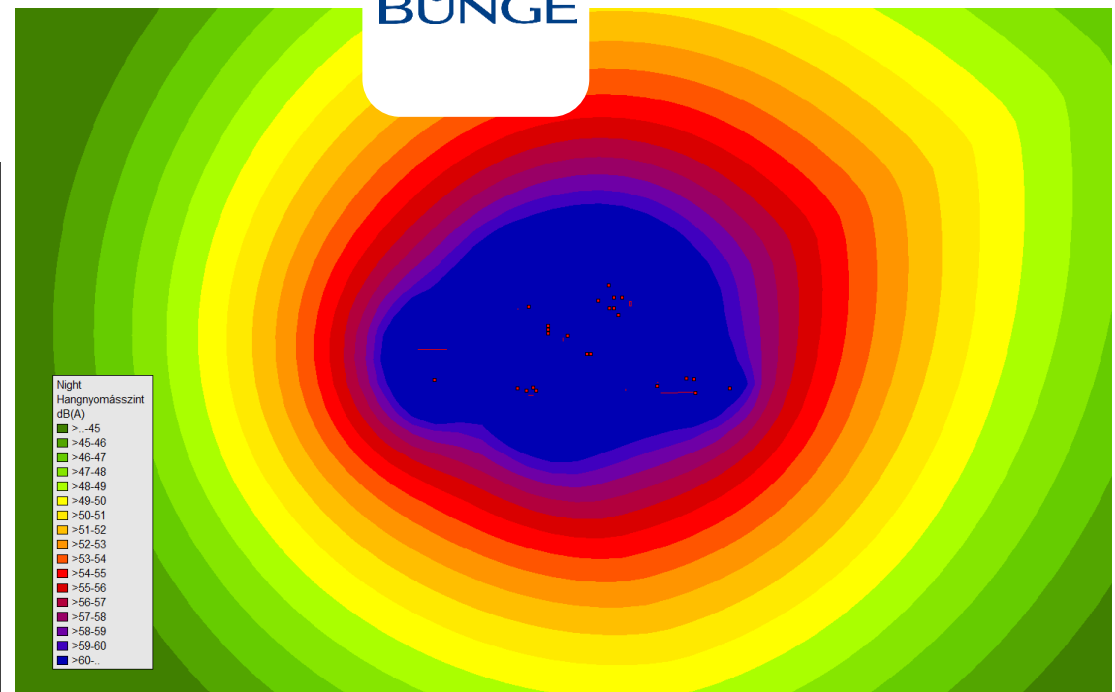
47.1





WITHOUT BUILDINGS

BUNGE



NUMBER OF OBJECTS:

38

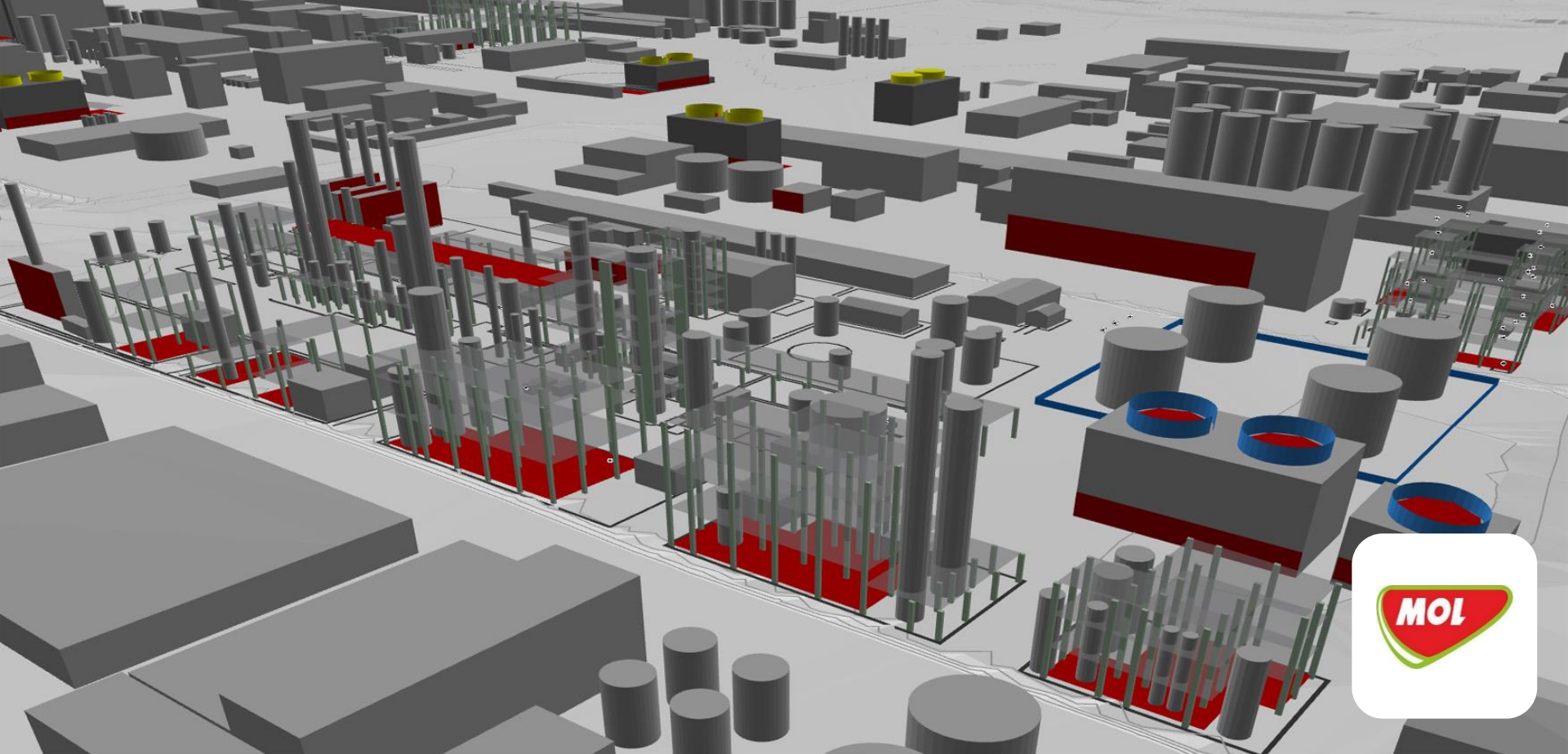
CALCULATION TIME:

00:08

AVERAGE SPL:

49.4

Night Hangnyomásszint dB(A)
> -45
>45-46
>46-47
>47-48
>48-49
>49-50
>50-51
>51-52
>52-53
>53-54
>54-55
>55-56
>56-57
>57-58
>58-59
>59-60
>60-



05 ANALYSIS

of the complex model

results are more accurate
solutions can be modelled
time requirement is higher
level of IT knowledge is higher



ADVANTAGES OF THE COMPLEX MODEL

why we like the complex industrial noise models...

- calculation results are **more accurate**
- and much **closer to the measured** results
- requirements can be **determined independently**
- noise sources can be **controlled individually**
- **solutions can be modelled** in a detailed form
- the spectacular model stands **closer to reality**

DISADVANTAGES OF THE COMPLEX MODEL

why we don't like the complex industrial noise models...

- the **time requirement** is significantly higher
- the **possibility of failure** is higher
- it's more difficult to **detect the errors**
- calculation time significantly **increases**
- higher level of **IT knowledge** is needed
- we are **pushing the limits** of the software

CONCLUSION

- 1st** There is **no golden path**: model complexity must be chosen depending on the aim of the task.
- 2nd** There are cases when **we must go further** in the complexity of the model: customer-focused modelling.
- 3rd** The noise model is **as good as the source data**. We have to go far and work for the most accurate results.

We are able to **go** far
We **work** for the most accurate results
We are open to **cooperate** with you
We are happy to **share** our experiences with you



THANK YOU FOR YOUR ATTENTION



If you are open to **cooperation**, please feel free to **contact** us:

Miklós Márkus

markusmiklos@fonor.hu

Bettina Takács

takacsbettina@fonor.hu

