# RISK SURVEY REPORT

*Property and Business Interruption*

## TURUN SEUDUN ENERGIANTUOTANTO OY, TURUN SEUDUN ENERGIANTUOTANTO OY

## NAANTALI, FINLAND

| | |
|---|---|
| Visiting date: | 29.4.2021 |
| Surveyor: | Jaakko Kangas |
| Report issued: | 18.6.2021 |

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## Contents



## Appendix

## 1 Purpose of the Visit

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|---|---|
| Purpose | This was a remote risk survey intended for updating the risk information to take into account major changes and progress in loss prevention recommendations implementation since the initial visit done in 2019. |

## 2 General Information

| | |
|---|---|
| Group | Turun Seudun Energiantuotanto Oy |
| Company/Plant | Turun Seudun Energiantuotanto Oy |
| Location, address | Satamatie 16<br>21100 Naantali<br>Finland |
| Location coordinates | 60° 27' 34,5" N, 22° 3' 8,1" E |
| Building owner | Turun Seudun Energiantuotanto Oy (TSE) |
| Plant manager | Maija Henell, CEO, TSE |
| Local contact person(s) | Sakari Mikkola, CFO, TSE |
| Participants | • Maija Henell, TSE<br>• Juho Perkonoja, Turkuenergia<br>• Veli-Pekka Kervinen, Turkuenergia<br>• Matti Akkanen, Turkuenergia<br>• Kalle Karjala, Turkuenergia<br>• Ville Pääkkönen, Turkuenergia<br>• Jari Kouki, Turkuenergia<br>• Sakari Mikkola, TSE<br>• Teemu Paavonen, Broker, WillisTowersWatson<br>• Jussi Tunturi, TSE<br>• Jaakko Kangas, Risk-engineer, If<br>• Piiamari Poikonen, Property Underwriter, If |
| Surveyor | Jaakko Kangas<br>Risk Engineer<br>If P&C Insurance Ltd.<br>Phone +358105145507<br>Mobile +358503170706<br>Email jaakko.kangas@if.fi |
| Distributed to | • If P&C Insurance Property UW and RM<br>• Maija Henell, TSE<br>• Teemu Paavonen, Willis Tower Watson |
| Type of activity | Thermal power plant producing district heat, electricity and process steam. |
| Significant changes since last / previous report | • Na1 and Na2 units have been decommissioned permanently<br>• Flue gas condencer installed to NA4 CHP 01/2019 |

- Asphaltene fuel receiving and feeding system installed to NA4 CHP 11/2019
- Fuel feeding hopper from yard to storage < 1 MEUR
- Neste has closed operations at the nearby refinery. Due to this the process steam demand has reduced about 50 % and the use of refinery gas as fuel has ended.

Future plans and projects

- NA4 SRF-project; SRF receiving-, handling and fuel feeding systems including automation and integration to the existing DCS. The project value is an estimated million 17,4 EUR and the system is scheduled to be taken into use during 2021.
- Na4 unit waste heat recovery pump to recover 10 MW of heat from internal cooling circulations and steam venting and during summer time from sea water. The heat pump will be installed on the dismantled Na2 generator concrete. The project value is approximately million 7 EUR and is scheduled to be taken into use during spring 2022.
- No descisions have been made regarding Na3 and this unit will remain in use during peak DH demand periods for the time being. The dismantle of Na1 and Na2 is awaiting descisions concerning Na3.
- The use of coal as a supplementary fuel is scheduled to end and be replaced by alphaltene latest by 2025 when all use of coal in Naantali is planned to end. The use of wood bricket fuel is planned to start during next winter.

## 3 Opinion of the Risk

Information on Navigator tool

If P&C Insurance evaluates the risks and loss prevention level of the site using a benchmarking tool, called Property Navigator. This is a systematic way to evaluate 10 areas, which If has, based on its experience, found to be the most important issues when assessing property damage and business interruption risks. The result of each evaluation area is presented according to four-level scale: “Excellent” (green), “Good” (blue), “Fair” (yellow), “Poor” (red).

“Industry Risk Standard” is based on If’s loss prevention standard for the line of business at the site and consists of the most relevant loss prevention measures including automatic sprinkler systems.

Navigator Result

| **Property Navigator** | **2021** |
|---|---|
| Management | Good |
| Human Element | Good |
| Security | Good |
| Construction | Good |
| Compartmentation | Fair |
| Active Protection | Good |
| Machinery Breakdown | Good |
| Utilities | Good |
| Natural Hazards | Excellent |
| Industry Risk Standard | Good |
| **Total** | **Good** |

Summary and Opinion of the Risk

Turun Seudun Energiantuotanto (TSE) was founded in it's current form in 2012. TSE owns the base energy production power plants at Naantali, Oriketo bio boiler plant and the Kakola heat pumps. TSE optimizes the regional district heat production taking into account electricity production gross profit. TSE is owned by Fortum Power and Heat Oy (53,5 %), Turku Energia (43,5 %) and the City of Naantali (3,0 %). TSE sells the produced district heat, electricity and steam to its owners.

- Production costs and are being allocated to electricity, district heat and steam based on agreed principles
- Distribution & sales of district heat are organized by Turku Energia Oy
- O&M services are provided by Turku Energia Oy

Naantali power plant consist of two power blocks with individual boilers and power trains. The boiler blocks are named NA3 and NA4 CHP. The already decommissioned units NA1 and NA2 still remain at the site. The blocks are not cross connected except for process steam production.

NA3 is equipped with coal fired Sulzer boilers and AEG & KVU steam

turbine and matching generator. The NA3 boiler is equipped with flue gas desulphurization (FGD) plant and Low-NOx conversion has been installed to the boiler. NA3 is designed originally as a condensing power plant but turbine has later been equipped with DH extraction. Naantali power plant environmental permits allow continuous use for NA3.

NA4 CHP is a multi-fuel combined heat and power (CHP) plant that is constructed in separate buildings next to older power blocks. NA4 CHP is dimensioned to be capable or producing the entire heat demand. It replaced the NA1 and Na2 units and reduces the operating of NA3 only to peak district heat consumption periods. The NA4 CHP is equipped with Valmet CYMIC CFB boiler and Siemens extraction back-pressure turbine with reheating and Siemens generator. Main fuels used currently are biomass and coal. The use of coal and peat are planned to be phased out latest by 2025 replaced mainly by asphaltene.

In addition, the plant has four electric back-up boilers owned by Turku Energia.

Naantali power plant units and main equipment:

NA3 (Commissioned 1972)

- Sulzer boiler 315 MW
  Pulverized coal
- KVU steam turbine
  123 MW condensing
  95 MW back pressure
- KVU generator
  125 MVA
  Hydrogen cooled

NA4 CHP (Commissioned in 2017)

- Valmet CYMIC CFB boiler 430 MW
  Biomass, Coal, Peat, SRF, Asphaltene
- Siemens steam turbine, 167 MW
  123 MW SST-800
  44 MW SST-500
- Siemens generator
  179 MVA SGen5-100A-2P

The risk is considered as GOOD, but with high priority recommendations.

## 4 Buildings

Description of buildings

All units are located at the same site.

The NA3 unit is connected to adjacent turbine hall by fire doors. NA4 is built in a separate building, but connected to old units with a corridor.

The main buildings are non-combustible, mainly concrete construction and steel frame buildings.

Turbine hall for NA1, NA2 and NA3

Fire divisions

Typical power plant layout and fire divisions.

The NA3 turbine is in one turbine hall. The turbine hall is connected to the boiler halls separated with fire doors. The control room is relocated to NA4 building. Lube oil systems are located under the turbines without fire separation.

NA4 is built next to older units, but in separate building.

Date built and condition

Different built dates for each blocks. The buildings have been maintained well and are in good condition.

- NA1 (Commissioned 1960, no longer in operation)
- NA2 (Commissioned 1964, no longer in operation)
- NA3 (Commissioned 1972)
- NA4 CHP (Commissioned in 2017)

## 5 Occupancy and Utilities

Process description

Naantali power plant produces electricity for national grid, district heating to cities of Naantali, Turku and Kaarina and process steam to Fortum Power and Heat Oy to be delivered to nearby clients. The main fuels currently used are coal and biomass. The use of coal and peat is planned to be completely stopped by 2025 and is being replaced mainly by asphaltene and SRF.

Naantali power plant consist of two power blocks with individual boilers and power trains. The boiler blocks are named as NA3 and NA4 CHP. The

decommissioned power blocks NA1 and NA2 are still present at site and no descision has been taken regarding demolision. The blocks are not cross connected except for process steam production.

NA3 is equipped with coal fired Sulzer boiler and AEG & KVU steam turbines and matching generator. NA3 boiler is equipped with flue gas desulphurization (FGD) plants. Low-NOx conversion has been intalled the NA3 boiler. NA3 is designed originally as condensing power plant but the turbine has later been equipped with DH extraction.

NA4 CHP is a multi-fuel combined heat and power (CHP) plant that is constructed in separate buildings next to older power blocks. It has replaced NA1 and NA2 and reduced the operating hours of NA3. THe NA4 CHP is equipped with Valmet CYMIC CFB boiler and Siemens extraction back-pressure turbine with reheating and Siemens generator. Main fuels currently used are biomass and coal however, use of coal and peat is being phased out by 2025.

Separate fuel handling systems for coal and biomass. Coal is recived with ship transportation into nearby harbour and stacked at the site. Biomass can be fed from harbour (Meribio) or with trucks.

Naantali power plant environmental permits allow continuous use for NA3, but is limited to peak DH consumption periods.

In addition, the plant has four electric back-up boilers owned by Turku Energia.

**NA3 (Commissioned 1972)**

- Sulzer boiler 315 MW
  Pulverized coal
- KVU steam turbine
  123 MW condensing
  95 MW back pressure
- KVU generator
  125 MVA
  Hydrogen cooled

**NA4 CHP (Commissioned in 2017)**

- Valmet CYMIC CFB boiler 430 MW
  Biomass, coal, RDF
- Siemens steam turbine, 164 MW
  123 MW SST-800
  44 MW SST-500
- Siemens generator
  179 MVA SGen5-100A-2P

Number of employees

TSE has three employees.

The operation and maintenance services are contrancted to Turku Energia Oy, whom operates the plant with 67 employees.

Working hours

Five shift rotation, 8 hour shifts.

1 + 2 operators in control room

One dedicated operator for water treatment plant

Production capacity / actual production

**ELECTRICITY**

NA3
123 MW condensing
95 MW back pressure

NA4 CHP
161 MW back pressure

**DISTRICT HEAT**
580 MW full back pressure

**TOTAL**
Max electricity: 523 MW

Max back pressure: 421 MW

Max DH: 580 MW

Critical production machinery

All main power plant equipment are considered as critical:

- Fuel handling
- Boilers
- Turbines
- Generators, hydrogen cooled
- Transformers
- Cooling systems
- Automation

Since Naantali power plant has two units and in addition there are the Oriketo bio boiler plant and Kakola heat pumps, there is adequate redundancy in the DH production for loss of any of the units

Combustible loading

**Fuel handling**

Coal used in the power plant is delivered by ships to nearby harbour and further delivered to plant coal yard (7 ha). From coal yard the coal is delivered to feeder hopper and into coal silos with belt conveyor.

Biomass is delivered with road transport and ships. Biomass receiving station has three receiving lines, two screening stations with magnetic separators and crushers. Biomass handling capacity is 600 m³/h. Automatic sampling for each fuel delivery.

From receiving station, the biomass is delivered to A-frame storage building capacity of 15 000 m³. Unloading the storage is with two screw-type dischargers. Discharge capacity is 700 m³/h. Maximum boiler feed is 500

m³/h.

Heavy fuel oil (HFO) is used for start-up and for additional firing. HFO is stored in 2 x 700 m³ tanks. Light fuel oil is used for cleaning HFO lines and nozzles. LFO stored in 100 m³ tank.

High dust load in fuel handling creating risk for dust explosion, **see recommendation.**

**Other**

- Steam turbine lube oil reservoir
- Trafo oil
- Lubricants

Electricity

Mainly own production. In emergency situation all blocks have separate emergency generators and battery banks. Emergency feed from national grid through nearby substation.

NA4 emergency feed is arranged via NA3 feed. The capacity of the feed is not enough to operate NA4 boiler in case there is failure in HV system. **See recommendation.**

Steam supply and heating

Own production with back-up possibilities.

Process related cooling systems

Cooling water from the sea, consumption approximately 170 Mm³ annually. Average flow is 6,4 m³/s, maximum flow 10,5 m³/s.

Cooling water enters to ducting via 85 mm bar screen. Before enetering the process there is another bar screen (25 mm) and chain basket filter with 1 mm² eyelets.

Fouling is prevented with chlorine.

Gas

Hydrogen cooling in generators for NA, NA2 and NA3. Hydrogen delivered with bottles.

Process water

Process water is manufactured from potable water from municipality network.

Water treatment plant has two separate ion-exchange series. Ion-exchange filter are being regenerated with sulphuric acid, natrium hydroxide and natriumchlorid.

Two parallel lines of precoat filters for condensate polishing. Capacity 2 x 400 m³/h. Precoat filters are regenerated with citric acid.

NA1, NA2 and NA3 has common water treatment plant. NA4 have separate water treatment plant.

Automatic water/steam quality control. Laboratory services outsourced.

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|---|---|
| Waste handling | Waste is mainly ash and sand from the boilers. |
| Oil and grease | Turbine and generator lube oil reservoirs comprise most of the lube oil at the site. |
| Compressed air and vacuum | Interconnected compressed air network. Doubled compressors for each unit. Dew point -20 °C. |
| IT systems | The control system for all blocks has been mostly unified with Valmet DNA operating system. NA4 turbine is controlled with Siemens T3000 system. The T3000 integration to Valmet DNA is concidered limited. Although the T3000 display is located at the control room, there is limited utilization of this system. **See recommendation.**<br><br>DH network control system is from ABB. |
| Special hazards | ▪ Storage of fuels<br>▪ Steam boilers<br>▪ Steam turbines<br>▪ Generators<br>▪ High voltage equipment<br>▪ Transformers<br>▪ Large motors<br>▪ Large fans<br>▪ High temperatures<br>▪ High pressures |

## 6 Machinery Breakdown

Machinery breakdown (table)

| Main production machinery | Description of risk | Start-up year, major upgrades | Capacity/impact on production | Comment on MB exposure |
|---|---|---|---|---|
| Boiler 3 | Explosion, dry firing | 1972/2015 retrofit | 315 MW | |
| Boiler 4 | Explosion, dry firing | 2017 | 430 MW | |
| Steam turbine 3 | Over speed, blade failure, lube oil fire | 1972 | 123/95 MW | HP & IP retrofitted 2015. |
| Steam turbine 4 | Over speed, blade failure, lube oil fire | 2017 | 161 MW | |
| Generator 3 | Reverse power, electrical failure | 1972 | 125 MVA @ 10 kV | |
| Generator 4 | Reverse power, electrical failure | 2017 | 179 MVA @ 10 kV | |
| Transformer 3 | Electrical failure, fire, explosion | 1972 | | |
| Transformer 4 | Electrical failure, fire, explosion | 2017 | | |
| DCS | System failure, fire | | Valmet DNA | |
| Fuel Handling (coal) | Fire, dust explosion | | | |
| Fuel handling (bio) | Fire, dust explosion | 2017 | | |
| Fuel handling (asphaltene) | Fire, dust explosion | 2019 | | |

| | |
|---|---|
| Machinery breakdown | Typical power plant scenarios with high temperatures, high pressures, rotating machinery and high voltage. |

# 7 Loss Prevention

## 7.1 Fire Protection and Detection

Sprinkler installations

Sprinkler protection in the following areas:

**NA3:**
- Coal handling system from coal yard to coal attic including the conveyor
- Turbine lubrication oil tanks and areas below the turbine
- Turbine bearings
- Turbo-generators hydraulic control systems
- Feed water pumps
- All fuel oil preheating stations
- Emergency diesel generators
- Sprinkler pump station

**NA4:**
Turbine hall:
- distribution transformers (dry 20 mm/min)
- cable room (deluge 5 mm/min)
- main transformer (deluge 20 mm/min)
- auxiliary transformer (deluge 20 mm/min)
- oil pump and heat exhanger room, with 3 % foam addition (deluge 5 mm/min)
- process room (3 % foam addition), pressure decrompressor (deluge 5 mm/min)
- oil room and oil tank (deluge 10 mm/min)

Boiler hall:
- conveyors stack hall - conveyor hall (deluge 10 mm/min)
- conveyors sms building - boiler hall (deluge 10 mm/min)
- pressure wall, main staircase and cable trays (deluge 5 mm/min)
- start up burners

Receiving:
- conveyors receiving - stack hall (deluge 10 mm/min)
- receiving and screening (dry 10 mm/min)
- conveyors bio fuel - receiving (deluge 10 mm/min)

Coal screening:
- conveyors (deluge 10 mm/min)
- sms building (dry 10 mm/min)

Deluge valves are triggered by:
- heat detector cables (belt conveyor protection)
- point type detectors (transformer protection, in addition detectors shut down electricity from the transformers)
- aspirating type detector system (IEC cable room)

| | |
|---|---|
| | Emergency diesel generators |
| Special protection | Aerosol extinguishing systems have been installed in:<br>- KIP-device room<br>- coal field electrical container |
| Gas protection systems | Automatic CO2-system is protecting the main fuel oil pumping station (Öljymäki). |
| Fire detection | Practically the whole power plant is covered with fire detection systems signalling both to the control room and also relaying the alarm to the 24/7 manned public alarm centre. Push-buttons are also located through-out the power plant. In case of alarm one operator controls the validity of alarm and notifies the fire brigade in case of false alarm. Automatic alarm from the fire detectors activate the alarms at the control room and the members of the fire team are summoned by phone. |
| Fire water supplies | **NA3:**<br>Fire water:<br>Water for hydrants and hose reels comes from the town main (100 mm pipeline).<br><br>Water supply for sprinklers:<br>Sea (brackish water) + 3 pumps:<br>- one electric pump 4020 l/min, 9 bar<br>- two diesel pumps each 4000 l/min, 8,8 bar<br>In order to decrease the risk of corrosion sprinkler pipes are normally filled with fresh water.<br><br>**NA4:**<br>1500 m3 tank with infilling from the town main (at least 700 m3 reserved for fire water and sprinklers)<br><br>Fire water pumps:<br>One electric + one diesel pump, each 4000 l/min, 9,22 bar<br><br>Sprinkler pumps:<br>Two diesel pumps, each 4800 l/min, 9,22 bar. |

### 7.2 Fire Brigade

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|---|---|
| Public fire brigade | The closest full time professional fire brigade station is in Lieato with a response time of below 20 min. There is a part time fire brigade also in Luolala at distance of roughly 3 km. Additionally several fire brigades are located in Turku and Kaarina with roughly 30 minutes response time. |
| Plant fire brigade | The power plant has an emergency team. capable of oil prevention and with 3 members capable of smoke diving. The team has some equipment but for fire fighting and oil prevention, e.g. there is a fire truck.<br>The tasks of this group are defined to be limited to guiding the professional fire brigade and extinguishing small incipient fires. Major fires are left to be extingusihed by professional fire brigades. |

### 7.3 Organisation and Procedures

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|---|---|
| Local safety organisation | Safety organization provided as a service by Turku Energia with members also from TSE. The organization is a combination of people related to power plant operations. Safety organization work as side of primary work. |
| Safety plans and guidelines | Following standards are in use:<br><br>ISO 9001<br><br>ISO 14001<br><br>OHSAS 18001<br><br>Safety plan updated. |
| Housekeeping | Cleaning is outsourced to external contractors.<br><br>High dust load in bio fuel handling remains regardless of increased housekeeping intervals and investments to testing different dust binding and removal systems. Development in the area continues. |
| Smoking regulations | Smoking is allowed only in dedicated places outside. |
| Hot work arrangements | Hot work permission in use. Majority of personnel hold a valid Hot Work License. |
| Inspections | Fire protection systems are inspected monthly. Major inspections performed annually. |
| Training of personnel | Everybody has Occupational safety Card. Safety trainings for each work area are provided as an electronic training package.Hot work and elecrtical safety license trainings provided to personnel based on work profile, majority of personnel hold a valid hot work license. The foremen are responsible for adequate training of their staff. Electronic registers of trainings are kept.<br>Evacuation trainings are held regularly. |
| Operational procedures | Mixed level of documented operational procedures depending of the age of the unit.<br><br>NA4 CHP has boiler and BoP simulator installed next to control room. No turbine operating details are included. |

### 7.4 Site Security

| | |
|---|---|
| Fencing, gates | Site is surrounded by two meter high metal link fence. |
| Entrance, exit, internal control | |

The site has five gates that are kept normally closed. The gates can be opened by mobile phone identification.The main gate, harbour gate and northern gate are controlled with security cameras.

### 7.5 Maintenance

**Maintenance organisation and systems**

The maintenance operations are outsourced to Turku Energia Oy. The maintenance team has 21 employees for daily maintenance works. Large scale maintenance projects including the overhauls are outsourced to contractors.

Computerized Maintenance Management System in use.

Condition monitoring of power train is done in collaboration Fortum eNext.

Water chemistry laboratory services have been contracted to Ramboll Oy.

**Maintenance methods and equipment**

Annual maintenance is scheduled to summer months when the DH load is at minimum.

The frequency of the NA4 TG overhauls is according to OEM recommendations. NA3 turbine overhauls is 50.000 operating hours, endoscope inspections at 25 000. Generator overhaul interval is 100 000 operating hours.

Fixed condition monitoring sensors installed to critical points at turbines and genenrators, feedwater pumps and largest fans. Expansion of the system is currently being charted.

Predictive maintenance data is produces from process data for about 40 pieces of key equipment.

Annual steam turbine overspeed protection and turbine lube oil pump testing.

Annual sampling of oils in critical machinery.

Issues with availability or if a repair maintenance cost limit is exceeded initiate an RCA process.

**Critical spare parts**

Heuristic principle applied to defining adequate level for available spare parts. A more systematic criticality analysis for the spares is currently ongoing.

In general, all wall mounted frequency converters have spares in stock, for larger frequency converters discussions are ongoing. Spares for the main reduction valve internals are also available on site.

**Maintenance performance**

The main metric followed is the ratio between preventive and repair maintenance. This ratio has been in 2019 66,16 % and in 2020 66,12 %. A secondary metric for maintenance performance is the delay from work order to work completion.
Availability is not an actively followed metric but has been on a good level.

## 8 Loss Record

Loss record (minimum last 5 years)

| Date of loss | Type | Amount paid, outstanding | Deductibles | Remarks |
|---|---|---|---|---|
| 21.11.2017 | Machinery Breakdown | | | Rotor bent due to rotation not starting after a trip at the NA4 new turbine, covered by supplier warranty. Manual rotation option added after incident. |
| 15.2.2018 | Fire | | | Small fire from NA2 auxiliary transformer ground fault, Under deductible |
| 3.9.2018 | Machinery Breakdown | | | NA3 main transformer oil leak of about 100 l due to wrong gasket type at the expansion tank, below deductible |
| 17.6.2019 | Machinery Breakdown | | | NA3 generator ground fault, under deductible. |

Loss record

In addition, there is a CBI loss from an explosion/fire at the asphaltene supplier's site on 2.12.2019. Claim is still open a the time of writing the report.

# 9 Sums Insured and Loss Estimates

## 9.1 Sums Insured

| Sums insured | Fire / All risk | Fire loss of profit | Machinery breakdown | MB loss of profit |
|---|---|---|---|---|
| Renewal date | 1.1.2022 | 1.1.2022 | 1.1.2021 | 1.1.2021 |
| Deductibles | 500 000 EUR | | 500 000 EUR | |
| Waiting period | | 15 days | | 15 days |
| Indemnity period | | 18 months | | 18 months |
| Total sums insured | 556 150 569 EUR | 109 047 000 EUR | | 109 047 000 EUR |
| Buildings | 124 190 813 EUR | | | |
| Machinery | 411 959 756 EUR | | | |
| Stock | | | | |
| Other | 20 000 000 EUR | | | |
| Valuation / Date | 28.12.2018 | | | |

NA4 CHP building estimated to be 24-25 % of total values based on info from other similar projects, resulting in 72 MEUR for the building. NA4 CHP Boiler estimated to about 102 MEUR, the TG set to about 51 MEUR, and other machinery to about 73 MEUR.

10 MEUR of Contents are Na1 and Na2 machinery and equipment insured on a first loss basis.

The rest of machinery and equipment is the Na3 CHP including the joint facilities of Na1 and Na2 servicing this unit.

BI sum insured is calculated for increased cost in a scenario where there is a complete loss of the largest power generating unit. The increased cost for disctrict heat from producing this with other available units, for steam increased sosts for utilizing the reserve boilers and for electricity for purchasing the electricity from open market.

## 9.2 EML Fire loss scenario

Scenario - 1: NA4 CHP boiler major explosion (This loss scenario relates to the LLA "LLA - 2: NA4 CHP")
A combustion chamber explosion at NA4 CHP followed by a fire can result in major property damage, 70 % to boiler and 30 % to buildings and additional 30 MEUR to surrounding machinery.

14 months interruption of power production of NA4CHP.

District heat and steam can be supplied by the other plants at increased costs. The electricity can be bought from the market at increased costs.
The BI loss is estimated as follows:
- 100 % of steam dum insured 15,581,651 EUR
- 14/18 months of district heat sum insured 14/18 x 89,965,540 EUR = 69,973,197.78 EUR
- 100 % of electricity sales sum insured 3,500,000 EUR
Total BI loss = 89 054 849 EUR

| | | |
|---|---|---|
| Property damage (PD) | Building | 22,0 MEUR |
| | Content | 100,0 MEUR |
| | Stock | |
| | Other | |
| | Total | 122,0 MEUR |
| Business interruption (BI) | BI value | 80,1 MEUR |
| Subtotal | Excluding sublimits | 202,1 MEUR |
| | Sublimits | 3,0 MEUR |
| **Combined Fire EML (PD+BI)** | | **205,1 MEUR** |

The total for policy sub-limits is made up from the following percentages of the respective items (with the sums resulting in brackets, in EUR):
Errors and omission: 100% (1M), Removal of debris: 100% (2M)

## 9.3 NLE Fire loss scenario

Scenario - 1: NA4 CHP boiler minor explosion (This loss scenario relates to the LLA "LLA - 2: NA4 CHP")
Minor boiler explosion at NA4 CHP resulting in minor damage to the boiler (30 %) and 6 months stop to heat, steam and power production at this unit.

District heat and steam can be supplied by the other plants at increased costs. The electricity can be bought from the market at increased costs.

| | | |
|---|---|---|
| Property damage (PD) | Building | |
| | Content | 30,0 MEUR |
| | Stock | |
| | Other | |
| | Total | 30,0 MEUR |
| Business interruption (BI) | BI value | 54,5 MEUR |
| Subtotal | Excluding sublimits | 84,5 MEUR |
| | Sublimits | 3,0 MEUR |
| **Combined Fire NLE (PD+BI)** | | **87,5 MEUR** |

The total for policy sub-limits is made up from the following percentages of the respective items (with the sums resulting in brackets, in EUR):
Errors and omission: 100% (1M), Removal of debris: 100% (2M)

## 9.4 Machinery breakdown

Scenario - 1: NA4 CHP boiler dry firing
Dry firing of the NA4 CHP boiler resulting in major damage to all internal stuctures. Tubes, drums and other internal structures have to be exchanged as they have been subject to overheating and are not approved by the authorities. 60 % damage to boiler. A repair time of 12 months must be foreseen due to long lead times for especially the drums.

District heat and steam can be supplied by the other plants at increased costs. The electricity can be bought from the market at increased costs.
The BI loss is estimated as follows:
- 100 % of steam sum insured 15,581,651 EUR
- 12/18 months of district heat sum insured 12/18 x 89,965,540 EUR = 59,977,026.67 EUR

- 100 % of electricity sales sum insured 3,500,000 EUR

Total BI loss = 79 058 678 EUR

| | | |
|---|---|---|
| Property damage (PD) | Building | |
| | Content | 60,0 MEUR |
| | Stock | |
| | Other | |
| | Total | 60,0 MEUR |
| Business interruption (BI) | BI value | 79,1 MEUR |
| Subtotal | Excluding sublimits | 139,1 MEUR |
| | Sublimits | 3,0 MEUR |
| **Combined MB EML (PD+BI)** | | **142,1 MEUR** |

The total for policy sub-limits is made up from the following percentages of the respective items (with the sums resulting in brackets, in EUR):
Errors and omission: 100% (1M), Removal of debris: 100% (2M)

**Loss Estimate Definitions** **Appendix 1**

**Estimated maximum loss (EML)**

The EML (Estimated Maximum Loss) is defined as an estimate of the maximum loss that may be expected from a single insured event under normal circumstances within a defined area as a result of a property damage which develops to its worst scenario.

When assessing the EML figure the following shall be taken into consideration:
– Automatic fire extinguishing systems are impaired
– Automatic fire detection systems are impaired
– Manual fire fighting response
– A fire division between at least two adjoining fire compartments within a large loss area fails.

The following should not be taken into consideration:
– Crashing and/or falling aircraft
– Acts of terrorism
– Fires starting simultaneously in more than one section/area, including arson.

**Normal Loss Expectancy (NLE)**

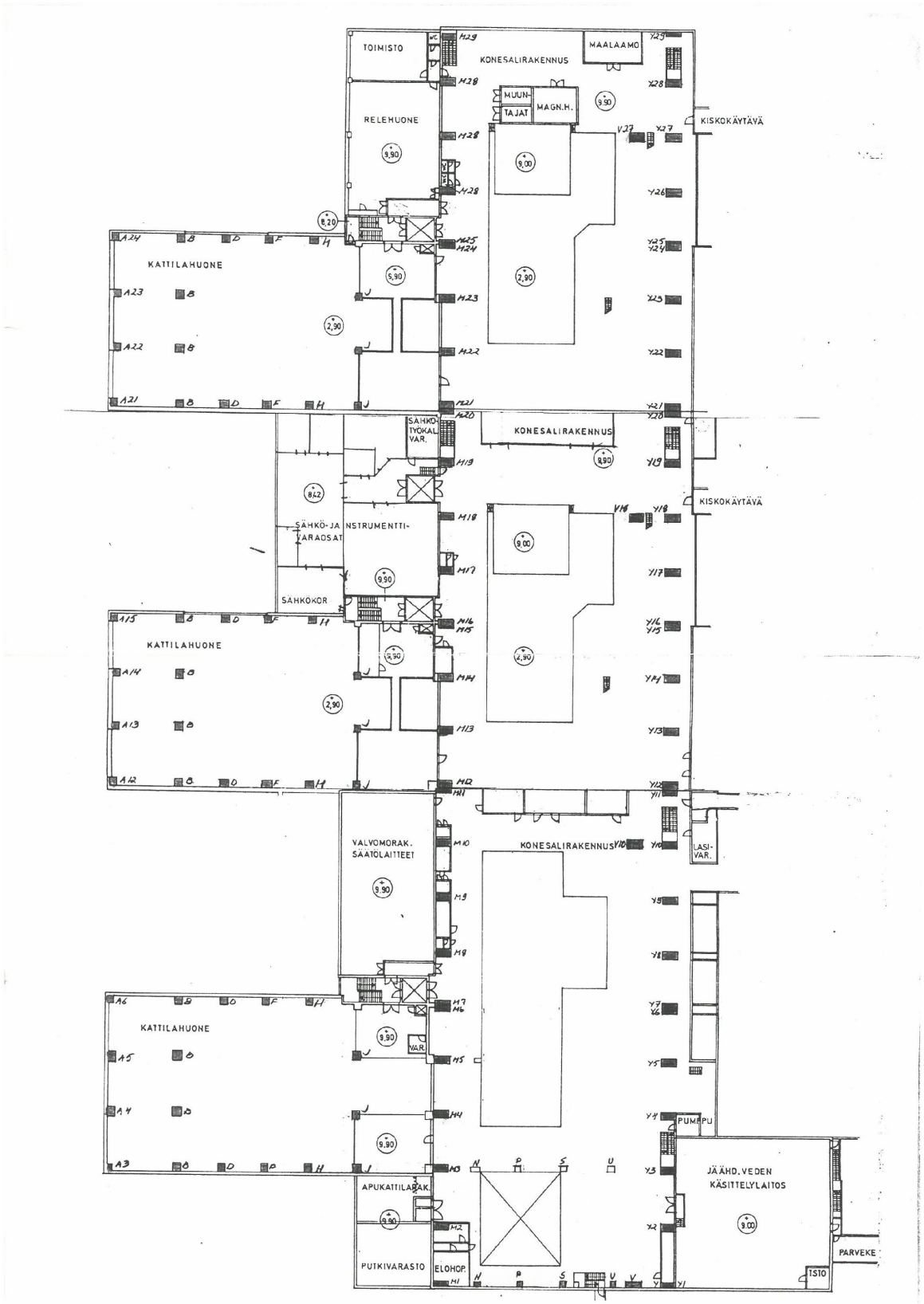
The Normal Loss Expectancy (NLE) is the expected monetary loss that may result from a single insured event under normal circumstances within a defined area, assuming:

– Available protection (both passive and active) is operating as expected under normal circumstances,
– Competent intervention by manual fire fighting within normal response time.
– Other loss limiting activities are available and operating as intended.

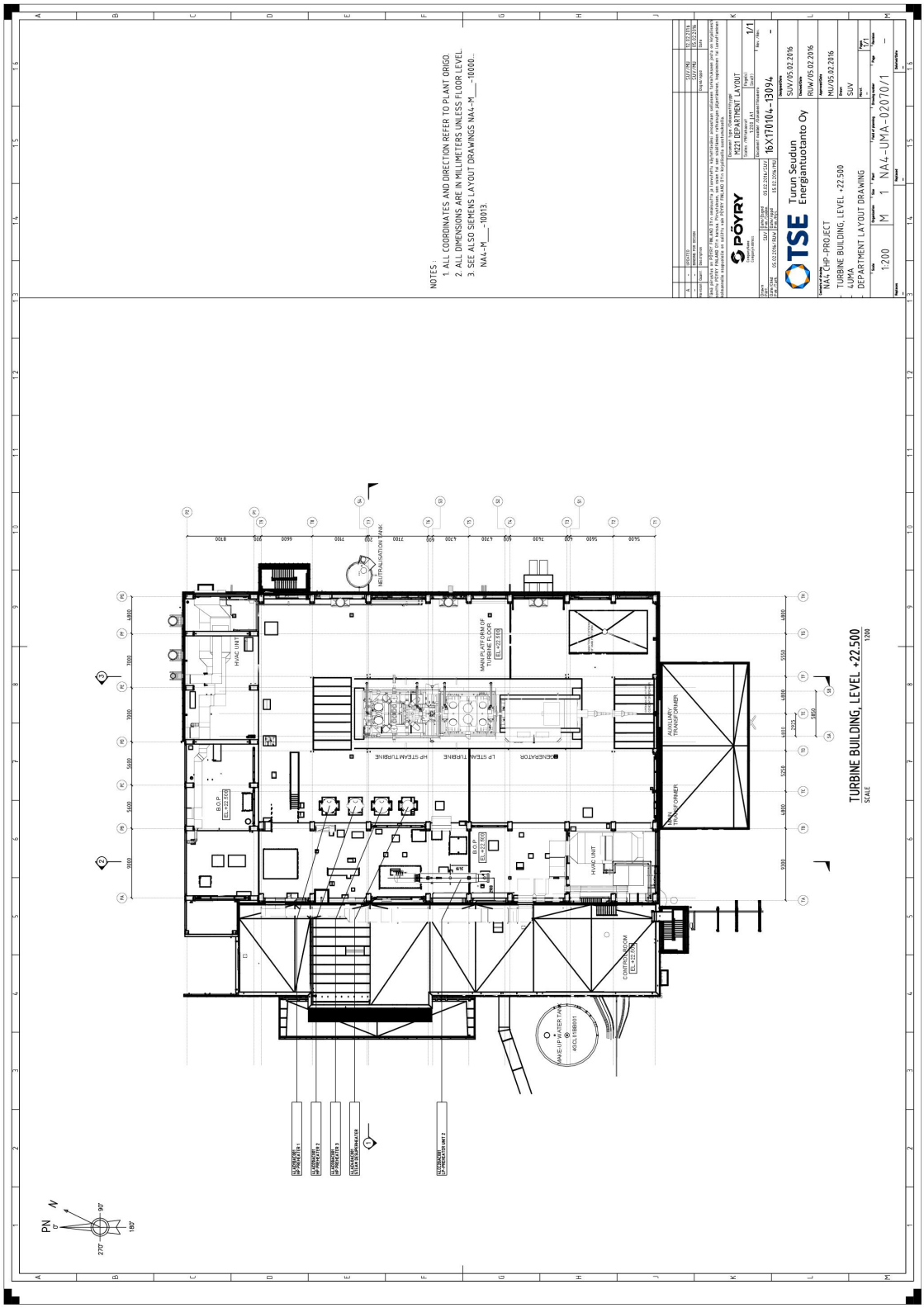
Each site might have a number of loss expectancies (LE). However, the largest combined Property Damage and Business Interruption LE figure would be the Normal Loss Expectancy (NLE) for the site.

Caution: the NLE scenario need not necessarily be in the same location as the EML.

**Site plan** **Appendix 2**




NA1 - NA 3 turbine hall.




NA4 turbine hall

**Turbines and generators** **Appendix 3**

| Turbine / Generator ID | Type | Manufacturer | Model | Operating hours | Capasity | Latest revision | Comments |
|---|---|---|---|---|---|---|---|
| Steam turbine 3 | Reheat steam turbine. Modified to back pressure with condencing tail. | KWU | KIII/125021 a/ZU | Not available | 123 MW | Major 2014, Minor 2018 | HP & IP retrofitted in 2015 by Doosan Skoda Power. LTA 70 000 h. |
| Steam turbine 4 | Back pressure reheat turbine | Siemens | SST800 & SST500 | | 161 MW | | |
| Generator 3 | Hydrogen cooled | KWU | | Not available | | | |
| Generator 4 | Air cooled | Siemens | Gen5-100A-2P | | 125MVA | | |