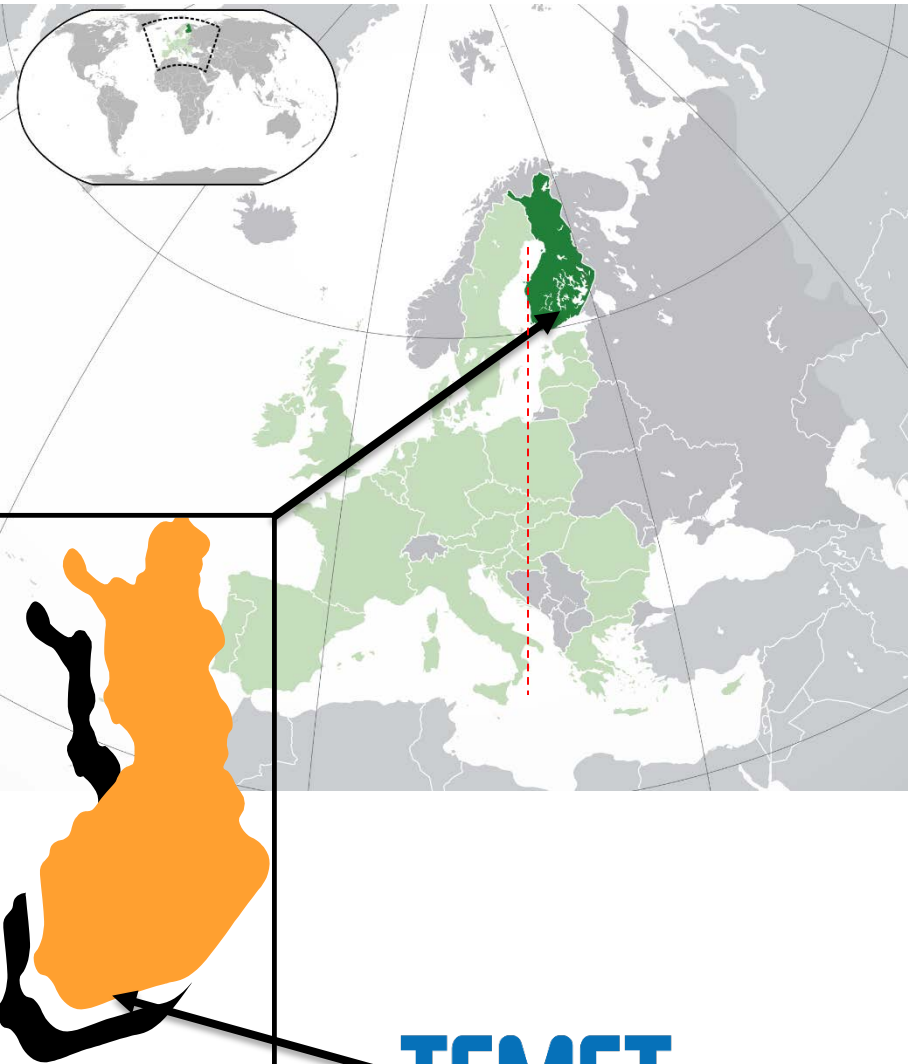


# Finland Civil Defense Shelters and Mining Refuges



# Location



# TEMET

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

# FINLAND IN FACTS

# 5.4 million



1.4 million inhabitants in metropolitan area

Life expectancy: year

78 84

Official languages are **FINNISH**... (spoken by 88.9%)

...and **SWEDISH** (spoken by 5.3%)

**SÁMI** is the mother tongue of about 1,900 people.



Christianity; 73.8% **LUTHERAN** and about 1.1% **ORTHODOX**



GDP per capita (2014)

# 37,559 €

Currency unit: **EURO**

**REPUBLIC**, parliamentary democracy, 200 members in one chamber

Independence Day  
**DECEMBER 6**

# 1917



1995



1955

# Civil Shelters in Finland

- After WW2, Finland has created an extensive preparedness infrastructure and related processes, culture and operating models.
- In addition to authorities, the Association of Shelter Builders in Finland develops jointly the best practises in shelter applications.
- Finland has approx. 55.000 shelters offering 4,2 million shelter places. Construction and management are guided by a developed legal framework with standards.
- NATO Youtube –video ->>

<https://www.youtube.com/watch?v=VYod3nMSpe0>

Väistö Group

**Temet Oy**  
1953

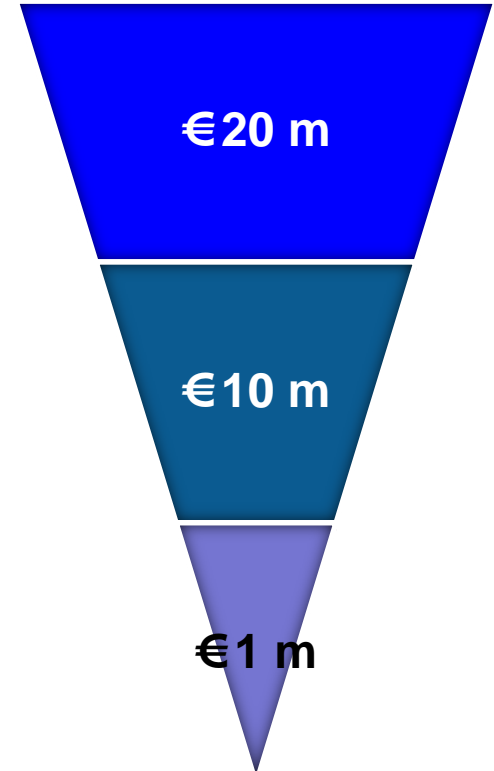
**Suoja-Expert Oy**  
1984

**Other  
business**

**TEMET USA LLC**  
SHELTER TECHNOLOGY

**Temet  
Abu Dhabi**

Turnover



Personnel in total: ~100

### Temet's focus areas

Exports > 50% of sales



**CIVIL SHELTERS**

**MILITARY / DoD**

**INDUSTRIAL  
APPLICATIONS /  
PETROCHEMICAL IND.**

# TEMET – Mastering Challenges of Blast Protection

- TEMET is a global leader in blast protection and special ventilation technology applied in civilian shelters and hardened military facilities
- TEMET is a leading supplier of protective solutions to petrochemical plants, offshore fields and other industrial applications, including nuclear power plants.
- TEMET offers advanced, approved and officially certified products and services. Testing and certification is conducted by VTT and international test labs.
- Deliveries to more than 30 countries worldwide



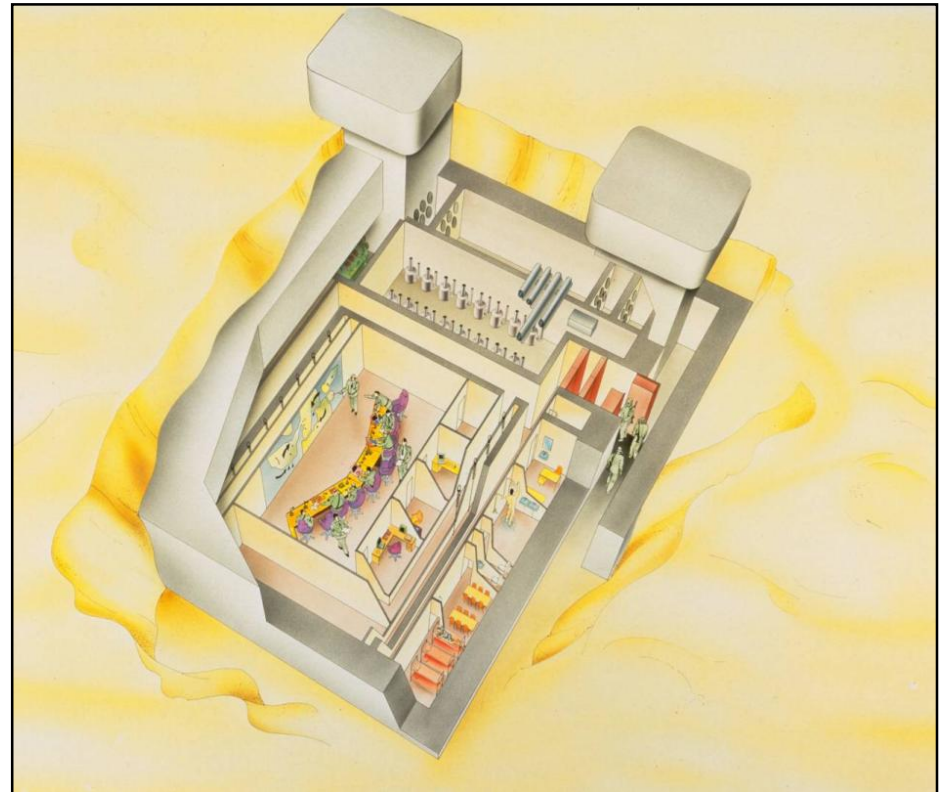
## Shelter Technology

- With over 60 years of experience, TEMET is the name in blast and gas protection and emergency filtration technology for shelters and protective solutions. Temet designs and manufactures all key components of a shelter solution.
- Our comprehensive range of products is recognized in civil defence, military shelters and industrial applications worldwide.
- Specific, country-based Technical Regulations and Specifications for shelters are provided. Success in exports is a result of combining Temet expertise with a carefully built distributor network.
- In addition to technology, it is of utmost importance to understand control & communication in crisis situations. Continuous training and education are vital.



# Shelter Design Parameters

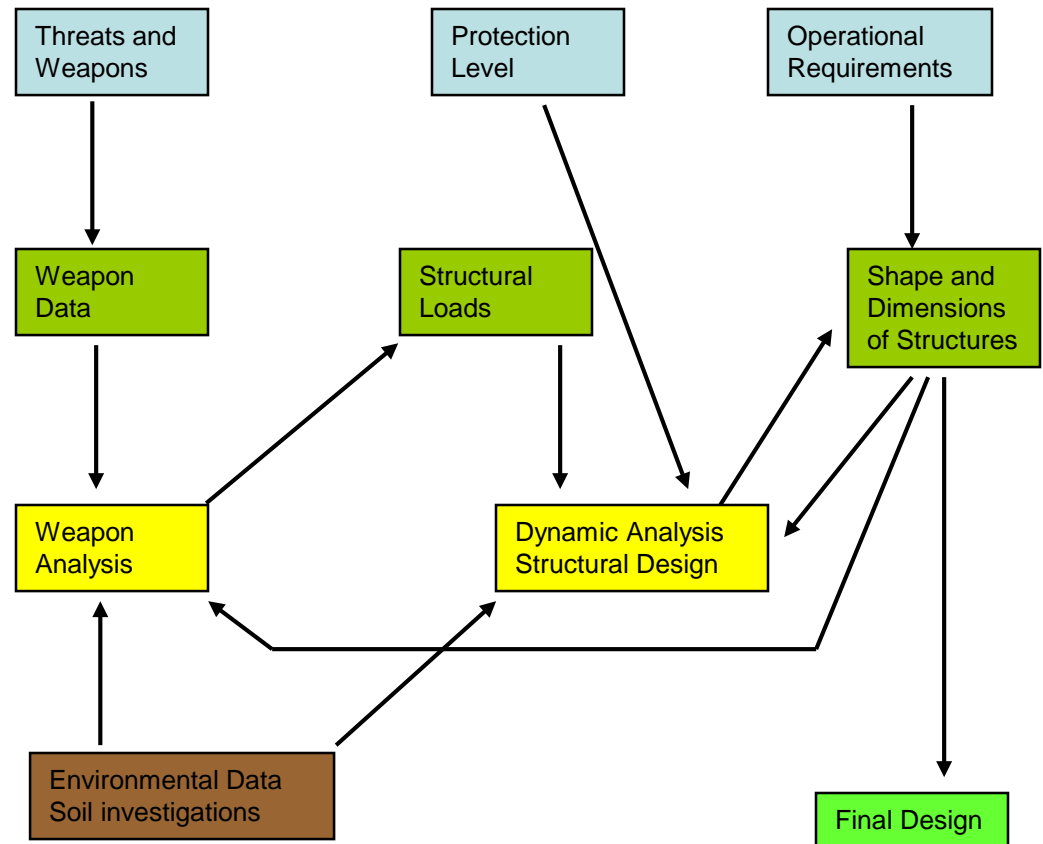
A well designed shelter offers a high degree of protection against the effects of war or an inhospitable exterior environment by providing a hardened mechanical shield against the harmful conditions and sustaining life inside the shelter via temporary life supporting systems.





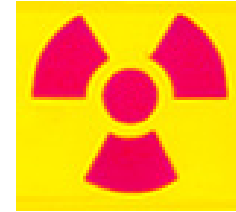
## Aspects of Shelter Design:

- Operational Function
- Threats and Weapon effects
- Life supporting systems
- Structural protection
- Protective equipment
- Communication
- Security
- Human reactions
- EMP Protection



- **The Shelter Offers Protection Against:**

- Conventional and Nuclear Explosions
- Nuclear Radiation
- Chemical Weapons and Toxic Agents
- Biological Agents
- Other?



- **The Shelter Shall be:**

- Blast protected
- Shock protected
- Air and Gas tight
- Provided with positive pressure ventilation and filtration for over pressurization of the shelter space
- Self sustaining in terms of power, water and food for the designed sheltering period



### Shelter Protection Barriers:

#### Blast Resistant Barrier

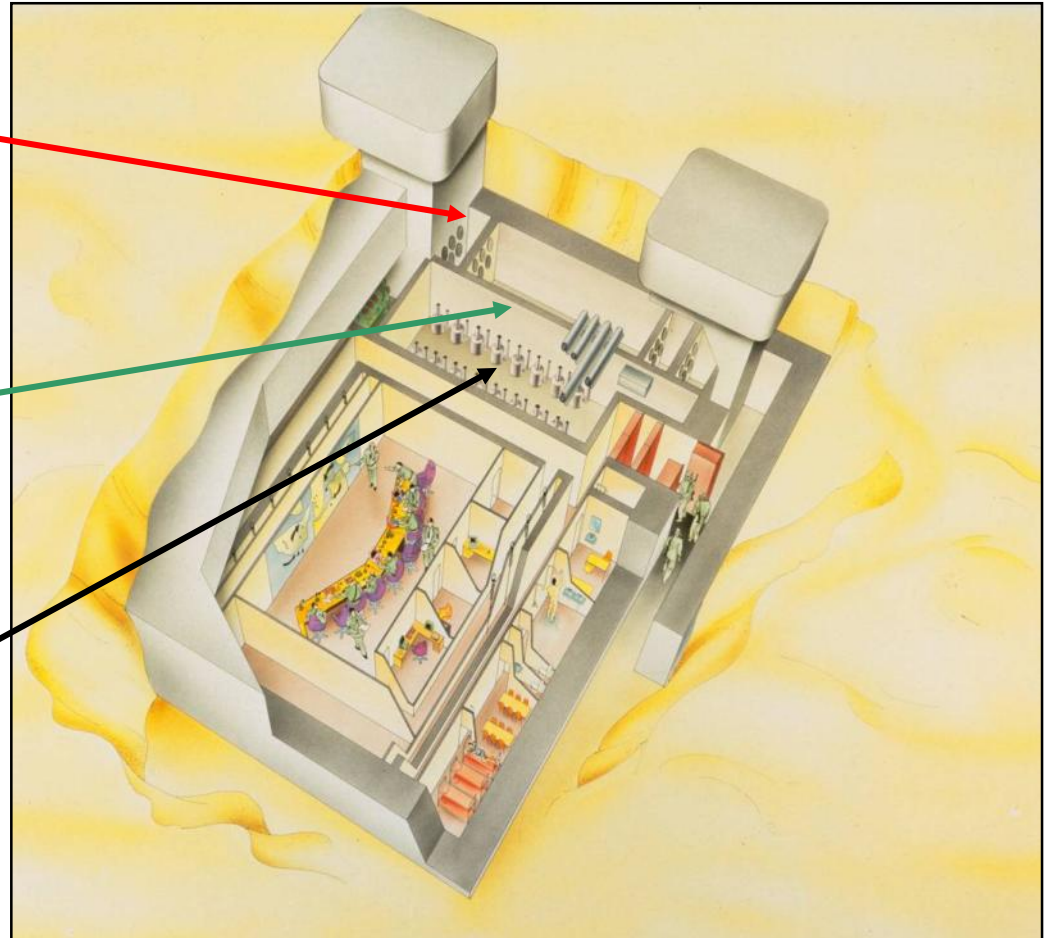
- Along the outer perimeter walls
- Achieved using reinforced concrete structures and blast resistant shelter equipment

#### Gastight Barrier

- Achieved using airtight structures and special gastight equipment

#### Positive Pressure Atmosphere

- Achieved using special ventilation system with effective CBRN detection and filtration



### Blast Valves:

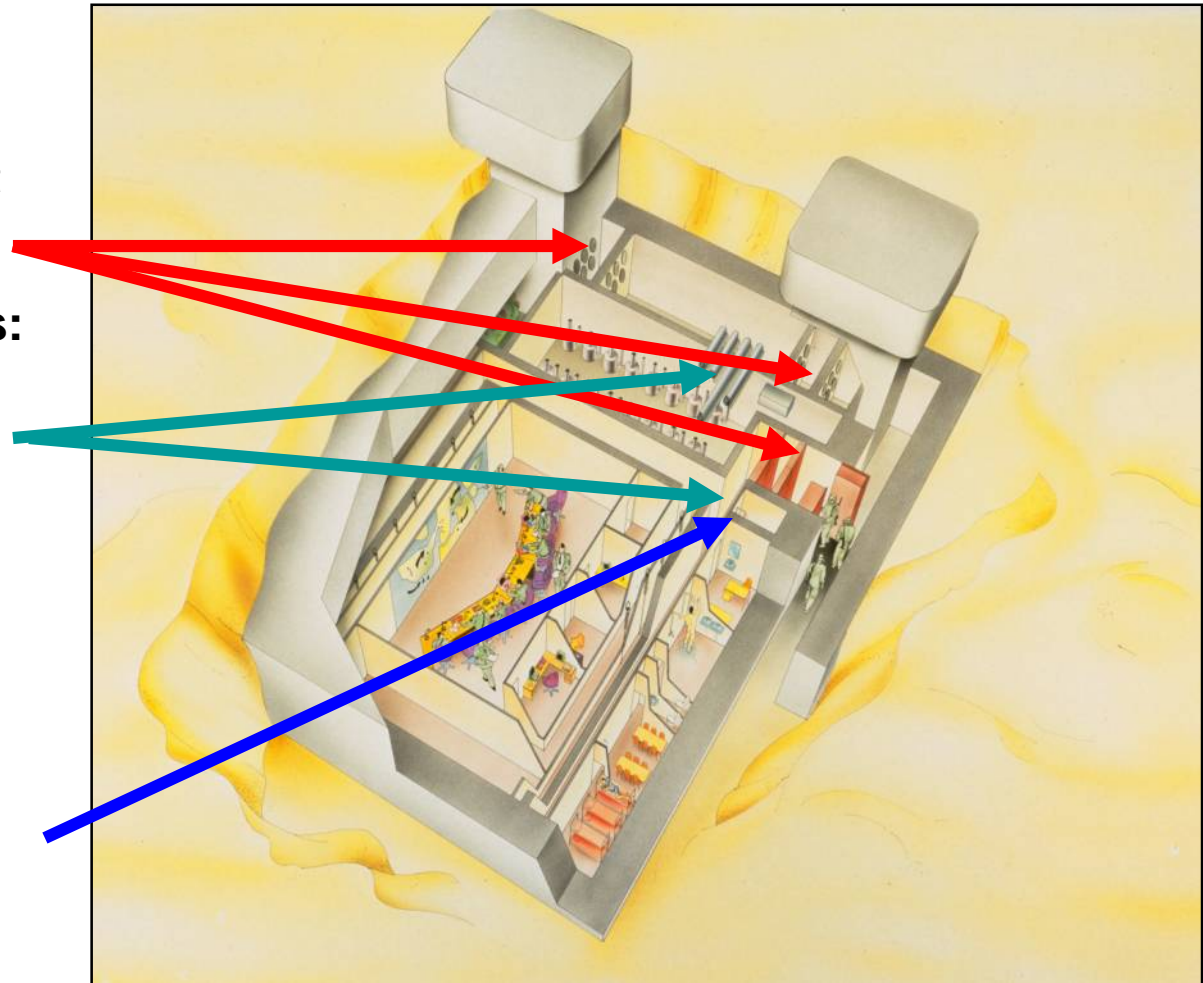
- blast protection of air intake and exhaust
- passage way ventilation
- diesel generator exhaust system

### Gastight Closing Valves:

air ducts along the gas tight perimeter for separation of safe and contaminated areas and for regulation of the internal overpressure

### Regulating Valves:

- Overpressure valves for regulating internal overpressure
- Combined blast / overpressure valves
- Pressure gradients



### Temet Blast doors:

- Doors are installed before concrete is cast
- This allows integration with the rebar to effectively transfer the blast load from the door frame to the wall
- The door is then an integral part of the wall and maintains the structural integrity of the shelter
- Temet blast doors are made of **solid steel** to ensure smooth manual operation, open / close movement and performance under repeat events

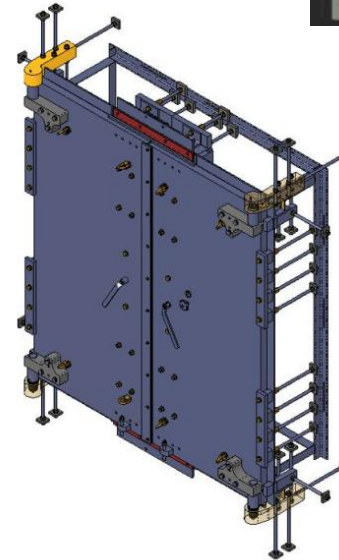




- Solid steel plate doors

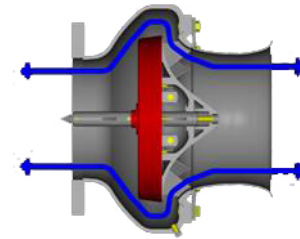
### Temet Blast doors:

- Prevent blast from damaging shelter occupants and equipment
- Single, double and sliding doors in various sizes
- Typically two doors to create a “blast lock” and allow entry and exit while maintaining shelter’s blast integrity
- Doors available standard from SO-1 level (2 bars) to SO-6 level (up to 21 bars)
- Doors can be custom built to customer specified protection level

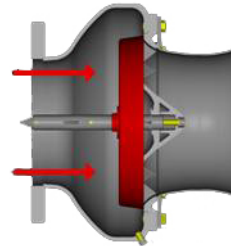


### Temet PSV Blast Valves:

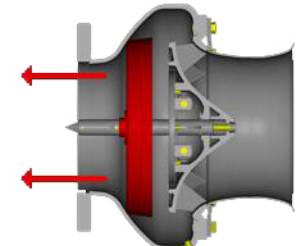
- Blast valves allow for air inlet and exhaust while protecting against blast loads to 60 bars
- The blast valves are fully automatic in operation, closing when acted on by a blast load, and then opening when the load dissipates
- Temet blast valves provide the highest protection level on the market, up to 60 bars blast load



Open position, free airflow



Closed position, positive pressure

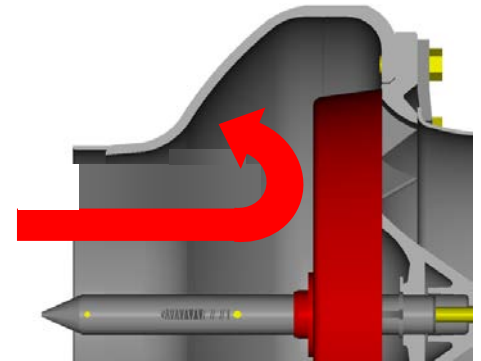
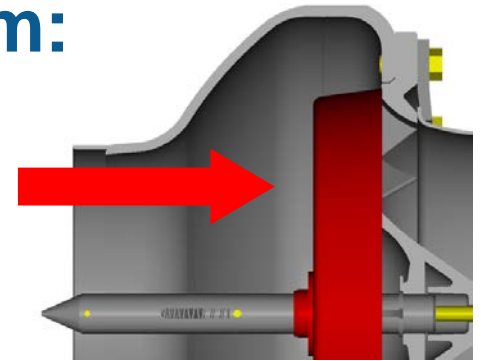


Closed position, negative pressure



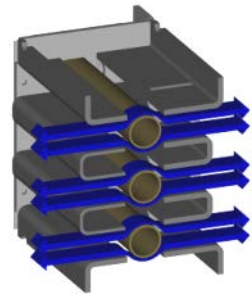
## Principles of blast actuated system:

- The pressure wave generated by the explosion impinges directly on the valve head or closing element, effecting closure
- Valve closing time and internal geometry of the valve ports are critical to minimize the portion of the blast wave passing through the valve during the closing action.
- Modern well designed blast actuated blast valves have closing time from 0.8 to 5.0 ms over the entire specified blast load range (typically 5 psi to 870 psi) and feature effective impulse capturing arrangements to minimize the pass through pressure and impulse.

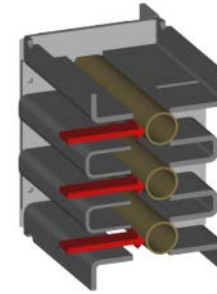


### Temet PV-KK Blast Valves:

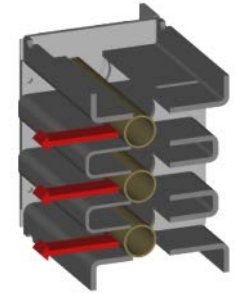
- Blast valves allow for air inlet and exhaust while protecting against blast loads to 15 bars
- The blast valves are fully automatic in operation, closing when acted on by a blast load, and then opening when the load dissipates
- PV-KK Blast Valves are installed prior to concrete casting to integrate the frame with wall reinforcement
- Modular design allows variety of sizes
- Easy to select according total air flow amount



Open Position

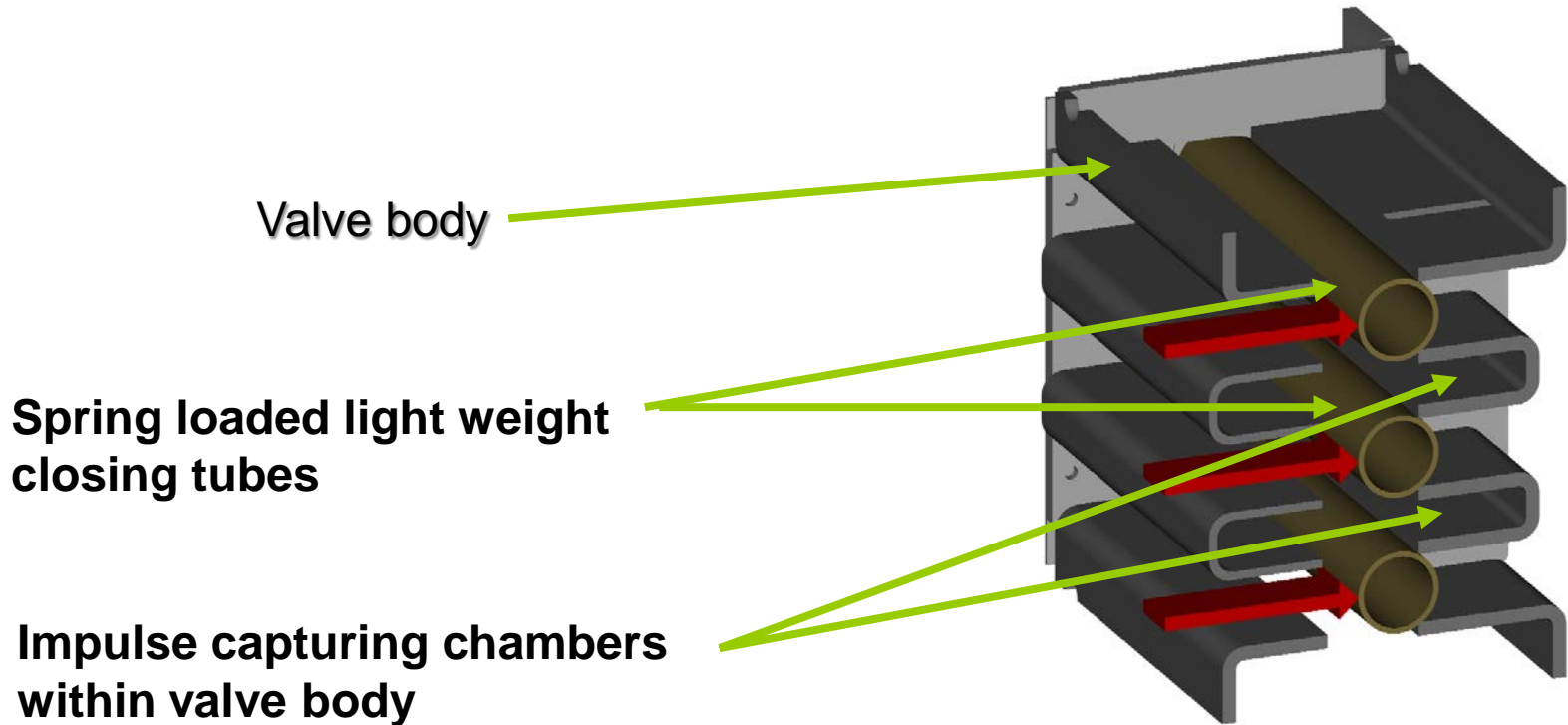


Overpressure



Underpressure





- Temet blast actuated blast valves are tested either in blast simulators or in the field verifying their function over the entire specified blast load range

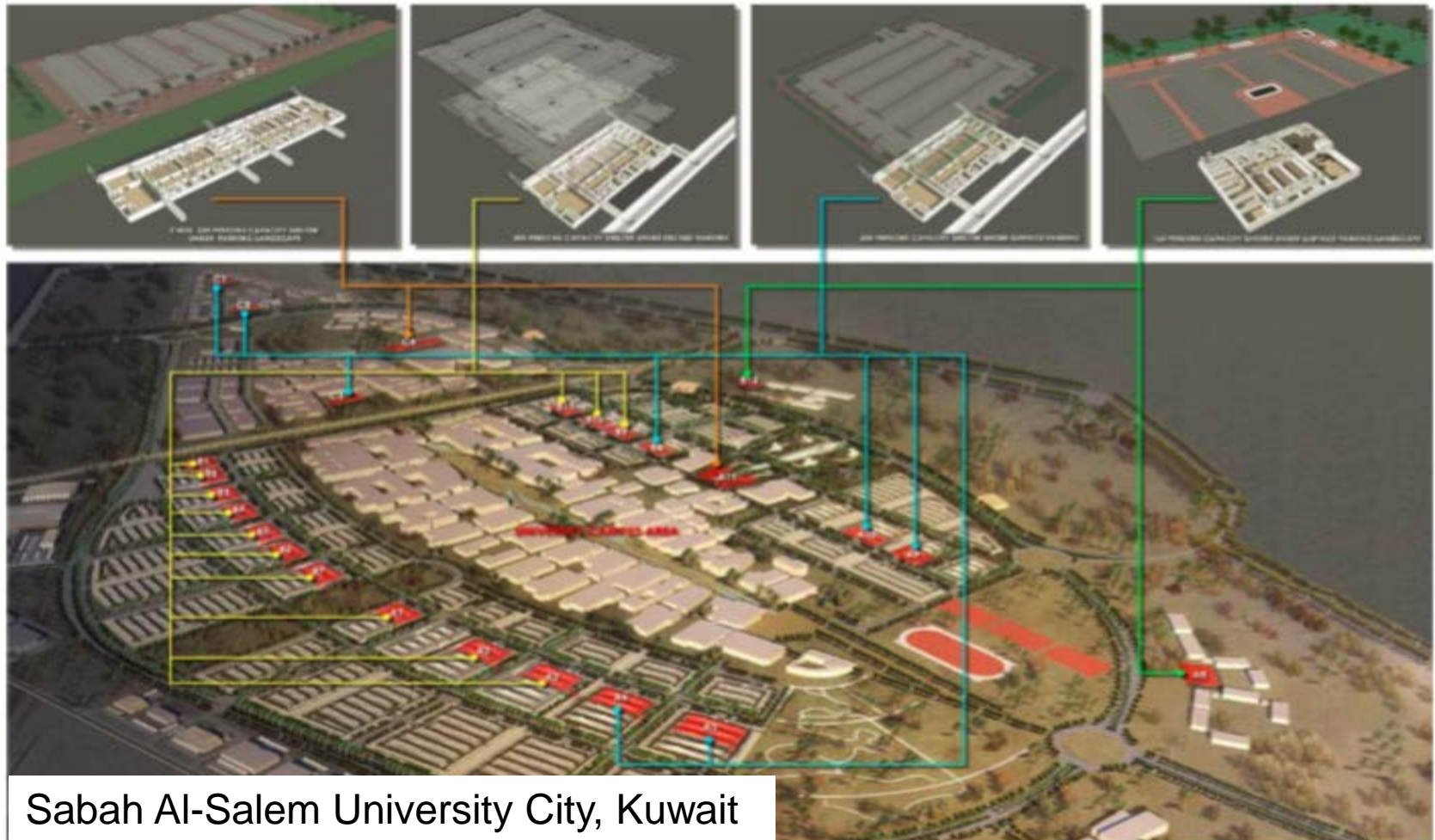




Client: Municipality of Sipoo

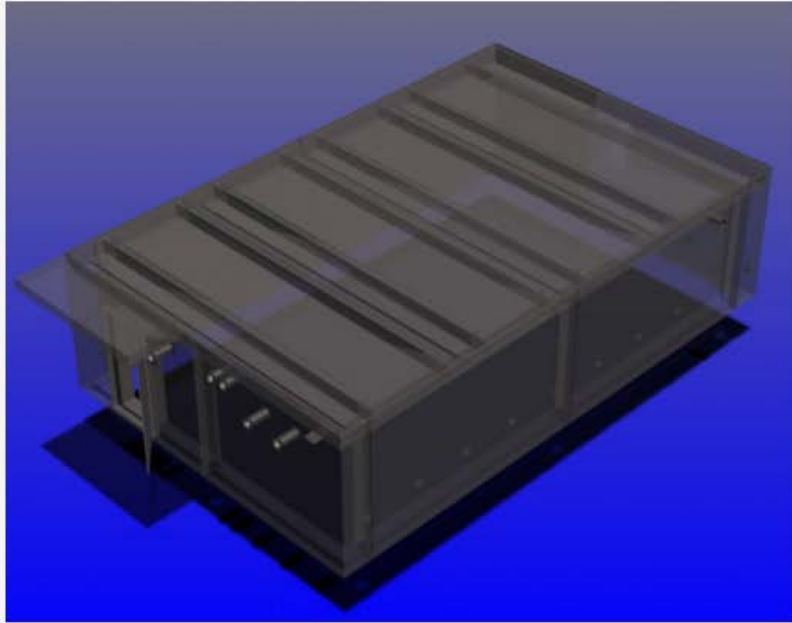
- Sipoo multipurpose sports hall and 1,800-person air-raid shelter.
- Main design, architectural, rock structure and structural planning, 35 000 m<sup>3</sup> 5 700 m<sup>2</sup>, 1999 – 2004





### Sabah Al-Salem University City, Kuwait

*Picture 1: Shelters in the campus area of University. In the first stage, 23 shelters are build, six more planned to build in the near future.*



BIM model for a concrete element shelter – a shelter operational in 3 days! (foundations work done before delivery).



## HARDENED SHELTER EQUIPMENT DELIVERIES SELECTED REFERENCE CASES

PROJECT NAME OR IDENTIFICATION	CLIENT OR CONSIGNEE / PROJECT LOCATION	SCOPE OF SUPPLY	CONTRACT PERIOD
Classified project	Silver Coast Construction / UAE	Complete Package of Shelter Equipment	2017
Classified Project	RAJU Constructions LTD / India	Blast Valves	2017
Bucharest Metro	UTI Group	Blast Protection Equipment	2017
Myanmar PJT	Temet Singapore / Singapore	Blast Protection Equipment	2017
Classified Embassy projects	Various locations	Complete Package of Shelter Equipment	2017
Classified project	Capriole Construction / UAE	Complete Package of Shelter Equipment	2017
Ministry of Finance	Boodai Trading / Kuwait	Complete Package of Shelter Equipment	2017
Classified project, 3pcs	Nael Construction / UAE	Complete Package of Shelter Equipment	2017
KGOC HQ	Boodai Trading / Kuwait	Complete Package of Shelter Equipment	2016
Classified project	Ideal Projectlink / Bahrain	Complete Package of Shelter Equipment	2016
CMW / Classified project	JGB International / UAE	Shelter Equipment	2016
Credit Savings Bank HQ	Boodai Trading / Kuwait	Complete Package of Shelter Equipment	2016
Classified project	Brodosplit / Croatia	Specific filtration components	2016
BOT MPW HQ	Boodai Trading / Kuwait	Complete Package of Shelter Equipment	2016
Classified project	Ideal Projectlink / Bahrain	Complete Package of Shelter Equipment	2016
NEC	Navayuga Engineering / India	Blast Protection Equipment, Filtration unit	2016
Ferguson Kilgore	Temet USA LLC / USA	Blast Valves	2016
Classified Project	RAJU Constructions LTD / India	Blast Valves	2016
Classified Embassy project	Kurortno Stroitelstvo ltd / Nigeria	Complete Package of Shelter Equipment	2015
LNG Receiving Terminal Expansion	Ventilation Engineering Co. / Thailand	Blast Protection Equipment	2015
Classified project	Indra Sistemas / Spain	Blast Doors	2015
Classified project	Temet Korea / South Korea	Gastight Doors	2015
Ammunition Storage, Saudi Arabia	Al Esnad Est.Military Supplies/Saudi Arabia	Blast Protection Equipment	2015



## INDUSTRIAL DELIVERIES SELECTED REFERENCE CASES

Project Name	Description	Country	Customer / Desing Comp.	End Customer	Year
RUC/ODC	Residue Upgrading Complex	South Korea	STS	S-Oil	2017
Rapid Analyser house	Petrochemical complex	Malaysia	Shore Petro	Petronas	2017
Ras Gas QCon	Gas processing	Qatar	JGB	Ras Gas	2017
Sitra storage expansion	Natural Gas	Bahrain	Ideal Projectlink	Banagas	2017
DOW	Petrochemical plant	USA	Temet USA	DOW	2017
Rabigh II	Refinery	Saudi-Arabia	JGB	Saudi Aramco	2017
Propylene production upgrade	Ethylene Unit	Finland	Iimalinkki	Borealis Polymers Oy	2017
Lower Fars	Refinery	Kuwait	Boodai	KNPC	2017
NRP	Refinery	Kuwait	Boodai	KNPC	2017
CGB-3	Gas processing	Bahrain	Ideal Projectlink	Banagas	2017
QP Mesaeed	Oil gathering center	Qatar	JGB	QP	2017
GC-30	Oil gathering center	Kuwait	Larsen&Toubro	KOC	2017
Clean Fuel	Refinery upgrade	Kuwait	Boodai	KNPC	2016
Seal Sands	Gas processing	UK	Halton Marine	BP	2016
Bamboo	Fertilizer plant	Norway	Direct	Yara	2016
Tempa Rossa	Refinery	Italy	STS	Total, Shell	2016
STAR	Refinery	Turkey	Ventek	SOCAR	2016
ETA Power	Substations, refinery	UAE	JGB	Gasco	2016
Zubair DGS	Gas and oil separation plant	Iraq	STS	Eni, Oxy, Missan, Kogas	2016
Oyster Creek	Petrochemical plant	USA	Temet USA	DOW	2016

# TEMET

Mastering Challenges of Blast Protection

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