65th ANNIVERSARY

VÚPCH

Research Institute of Industrial Chemistry

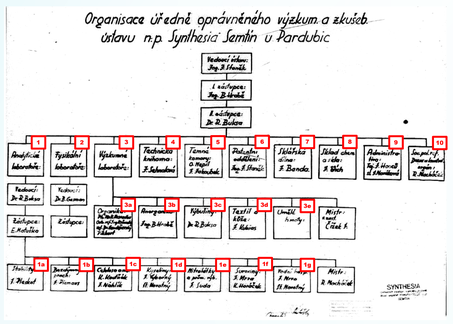
1954 - 2019

History and Present

Research Institute of Industrial Chemistry (VÚPCH) with its seat in Pardubice-Semtín was established by the Ministry of Defense Decree of November 2nd, 1953 to January 1st 1954 as a state administration facility with the scope of activities - research and development of explosives. VÚPCH was entitled to administrate research workplaces of national enterprise Synthesia, and experts were centralized there from the original research department, the so-called Central Laboratories of the company, and technological groups of the former Explosia. The activity of VÚPCH continuously linked up to the activity of departments R and X that had been entrusted with research, development and testing within the framework of Explosia a.s. since 1923.

By the Ministry of Chemical Industry Decree of December 30th, 1958 VÚPCH was abolished as an independent budgetary organization and to the date of January 1st, 1959 transferred into administration of national enterprise East Bohemian Chemical Works Synthesia. Within the framework of Synthesia there were, however, some changes in actual organizational incorporation of VÚPCH, especially in connection with establishing the position of Deputy for Special Production in the 1970s, and the Plant 05 Special Production in the 1980s. VÚPCH, however, managed to keep relatively high proportion of economic independence for the whole of that time, if considered practically 100 % state financial backing.

Since 2002 VÚPCH has been the part of Explosia a.s.



The First Structure of VUPCH taken from Officially Authorized Research and Testing Institute of company Synthesia:

1 - Analytical Laboratories
1a - Stabilities
1b - Smokeless Powders
1c - Cellulose and Nitrocellulose
1d - Acids
1e - Nitrocompounds and Industrial Explosives
1f - Raw Materials
1g - Water Resources Management
2 - Physical Laboratories
3 - Research Laboratories
3a - Organic Chemistry
3b - Inorganic Chemistry
3c - Explosives
3d - Textiles and Leather
3e - Plastic Materials
4 - Technical Library
5 - Darkroom
6 - Patent Office
7 - Glassworks
8 - Chemicals and Glass Storage
9 - Administrative
10 - Supervisory and Controlling

Research and Development activity

Research and development activity of VÚPCH is very closely connected with building of armament industry in the fifties of the last century. VÚPCH employees participated practically in all development projects not only in the field of propellants and military explosives and ammunition, but also in implementation of production technologies both in the today's Explosia a.s. and in other companies and abroad.

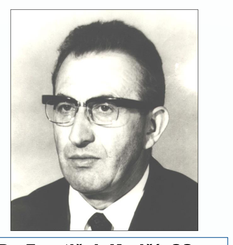
Main part of present Explosia a.s. production scope in the assortment of explosives, propellants and ammunition and also production technologies used and their know-how has been developed in VÚPCH namely in cooperation with other departments of Explosia a.s. and Synthesia a.s., or with other companies.

Activities of VÚPCH are primarily aimed at research and development of production technologies for propellants, explosives and combustible masses, and also at loading of charges and ammunition, short-run production of propellants and explosives and related application techniques, as e.g. production of components for aircraft rescue systems, special blasting and demolition works, assessment of detectors of explosives according to users' requirements etc.

In addition to research and development activities the VÚPCH laboratories ensure also a wide spectrum of analyses and tests for production departments of Explosia a.s. , as well as for external customers, e.g. analyses and identifications of unknown explosives, ballistic tests of propellants, explosive and safety tests of explosives etc. Many of these tests are accredited according to ČSN EN ISO/IEC 17025.

VÚPCH workers provide expert activities in the field of propellants stability problems, detection of explosives, identification of propellants from ammunition, further in the field of disposal of propellants, pyrotechnic compositions and other components de-loaded from large caliber ammunition and rockets, and provide also expert services for army research base and specialized training services (e.g. training of pyrotechnists).

DIRECTORS of VÚPCH



Dr. František Krejčí, CSc.
1954 - 1955

Ing. Josef Žalský
1956 - 1961

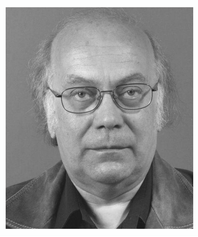
Ing. Boris Vetlický, CSc.
1961 - 1985

Ing. Jiří Tůma, DrSc.
1985 - 1990

Ing. Bedřich Štefan
1990 - 1992

Ing. Tomáš Král
1992 - 1993

Ing. Miroslav Horáček, CSc.
1993 - 2002



Ing. Ladislav Lehký, CSc.
2002 - 2010

Ing. Ladislav Velehradský, Ph.D.
2010 - 2018

Ing. Kamil Dudek, Ph.D.
2018 -

Plastic Explosives

In the fifties of the last century the research and later the industrial production of plastic explosives based on High explosives and non-explosive plasticizer was started in VCHZ (today known as Explosia).
Plastic explosives from Explosia are known under the trade name Semtex®. From the beginning, the newly established research institute (VÚPCH) was the author of the technical solutions of plastic explosives as well as most of the production equipment.

PRUNA - Specialized production facility from sixties of the last century

Pl Np 10 (The Black Semtex)
- The first produced plastic explosive.
- For military use.
- In 1987 released for civil use as Semtex® 10

Masa B1 (B1 Composition - The Red Semtex)
- For military use
- For mine clearing devices ROD and VO
- In 1964 realeased for civil use as Semtex® A

Semtex® 1H (The Yellow Semtex)
- Production starts in 1967
- The first Semtex with RDX

Semtex® 2
- Variant of Semtex® 1A
- For secondary blasting works
- For booster charges

Pl Hx 30
- For military use
- Aluminized explosive
- Replacement of Pl Np 10

Pl U-EP 14
- Thermoplastic explosive
- For extrusion or pressing
- Primary used in URG-86 hand grenades

Pl D-E 12
- Thermoplastic explosive
- Primary used in DYNA reactive armor system

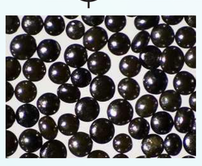
Semtex® 10 SE
- Sheet explosive for hardening of metals
- In production from 1995

Pl SE M
- Sheet explosive
- Primary for military use
- Basic explosive for many demolition charges
- In production from 2005

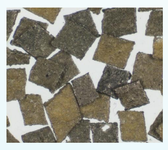
Semtex® C4
- Czech surrogate of US Composition C-4
- In production from 2010
- Good customer references

Semtex® 90
- Wide working temperature range (-40 °C - + 70 °C)
- Produced in three variants (PETN, PETN / RDX, RDX)
- High power explosive

Propellants



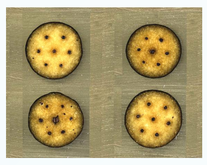
DOUBLE-BASE SPHERICAL POWDERS
small and middle calibers up to 30 mm



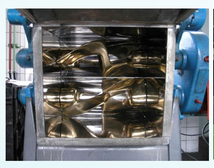
FLAKE SINGLE- AND DOUBLE-BASE POWDERS
shotguns

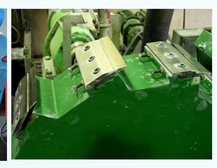
MULTI-PERFORATED TRIPLE-BASE POWDERS
large caliber systems

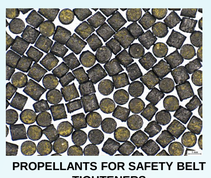
TUBULAR SINGLE- AND DOUBLE-BASE PROPELLANTS
small caliber weapons and safety systems



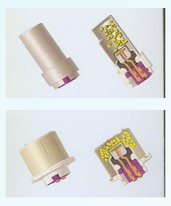
SEVEN-PERFORATED SINGLE-BASE POWDERS
middle calibers







PROPELLANTS FOR SAFETY BELT TIGHTENERS
S503-09 (copy of MK-1)
S501-05 (copy of MK-3)
S503-06 (copy of MK-4)
P501 "green propellant"



LOWTOX® PROPELLANTS
REACH compatible - no DBP, DNT and Pb

extruded-impregnated propellant D025
9 x 19 NATO

spherical propellant D073
5.56 x 45 NATO

Analytical laboratories

1954 — **2019**

DETEX® – system for easy detection and identification of explosives based on simple color reactions of detection solutions with all commonly used military, commercial and improvised explosives.

Explosives containing TNT | Explosives containing DNT | Explosives containing tetryl | Explosives containing picric acid | Explosives containing nitroglycerine, pentrit, hexogene, octogene, DINA, ethyleneglycoldinitrate | Explosives containing inorganic nitrates and chlorates

Dog Training Kit – designed for dog training. Kit contains 25 samples of plastics, high and industrial explosives

Inert Explosives Kit – Set is designed for educational purposes. Individual samples are visually very close to original explosives but totally inert.

Composition IRTG – inert plastic explosive mock-up for detection training
- RTG detection and identification
- Detectable by chemical and electronic devices
- Contains 20 % of high explosive (PETN, RDX).

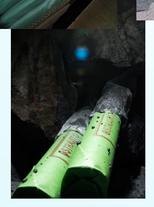
IRTG P 20 WG simulating plastic explosive based on PETN

IRTG H20 WG simulating plastic explosive based on RDX

Industrial Explosives

Emulsions development
Emsit® 20
Emsit® 1
Emsit® M
Design and construction of production line.
Development of new types.

Dynamites development
Permissible explosives.
Ostravit® C (II. class according to DIN)
Semtinit® 50 (I. class according to DIN)
Smooth-blasting explosive
Obrysit (removed from production)



ANFO development
Permon® DAP P
Permon® DAP D
Permon® DAP M
Design and construction of production line.

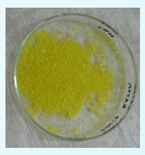
Powder explosives development
Replacement of toxic components

Synthesis Pilot Plant

Synthesis group and pilot-plant
- research group of VÚPCH which deals with research and development of new energetic materials
- successfully finished laboratory and pilot-plant scale production of energetic materials as e.g. NTO, TAGN, TNAZ, HNIW, TEX, ATZ, GZT, GA, DMNB, FOX-7, DADNE57 etc.
- energetic materials used as components for gas generating charges, propellants and low vulnerable explosives
- participation in many international and national research projects
- cooperation with well-known European research centers (FOI, HERAKLES, Eurenco, Chemring, LEDAP, AVIO, etc.)

GA GUANIDINIUM 5-AMINOTETRAZOLE
Active component for gas generators
Molecular formula: $C_2H_7N_8$
Molecular weight: 144.15 g.mol^{-1}

DMNB 2,3-DIMETHYL-2,3-DINITROBUTANE
Detection agent (up to 1%) for plastic explosives.
Molecular formula: $C_6H_{12}N_2O_4$
Molecular weight: 176.17 g.mol^{-1}
CAS: [3964-18-9]



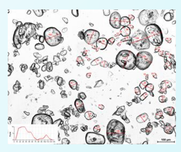
TAGN TRIAMINOGUANIDINE NITRATE
Component of propellants and gas generating formulations.
Molecular formula: $CH_9N_7O_3$
Molecular weight: 167.13 g.mol^{-1}
CAS: [4000-16-2]

RDX-R SPHERICAL 1,3,5-TRINITRO-1,3,5-TRIAZACYCLOHEXANE
Active component of fire-resistable detonators, detonating cords and special means
Molecular formula: $C_3H_6N_6O_6$
Molecular weight: 222 g.mol^{-1}
CAS: [121-82-4]

NTO 3-NITRO-1,2,4-TRIAZOLE-5-ONE
Component of low vulnerable explosives and propellants.
Molecular formula: $C_2H_2N_4O_3$
Molecular weight: 130.1 g.mol^{-1}

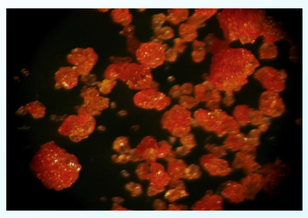
ATZ 5-AMINOTETRAZOLE-HYDRATE
Intermediate product for synthesis, component for gas generators
Molecular formula: CH_3N_5O
Molecular weight: 103.06 g.mol^{-1}
CAS: [4418-61-5]

TEX 4,10-DINITRO-2,6,8,12-TETRAOXA-4,10-DIAZA-TETRACYCLO [5,5,0^{5,9},0^{5,11}]DODECANE
Component of low vulnerable explosives
Molecular formula: $C_4H_8N_4O_8$
Molecular weight: 261.2 g.mol^{-1}



HNIW 2,4,6,8,10,12 - HEXANITRO - 2,4,6,8,10,12 - HEXAAZAISOWURTZITANE
Component of mixing explosives and propellants
Molecular formula: $C_6H_6N_{12}O_{12}$
Molecular weight: 438 g.mol^{-1}

GZT GUANIDINIUM AZOTETRAZOLATE
Active component for gas generators
Molecular formula: $C_2H_7N_{13}$
Molecular weight: 284.24 g.mol^{-1}



Pilot plant
- Built in 1995.
- Synthesize of energetic materials in pilot plant scale
- Nitration
- Crystallization of energetic materials
- Phlegmatization of energetic materials
- Distillation of hazardous solvents
- Transfer of new technology from laboratory scale to pilot plant scale
- Production of specialties from ten to hundred kilos scale in glass, enamel and stainless steel reactors (20-1200 l)
- Brine cooling system (-25° C)
- Steam and hot water heating system (up to 140° C)
- Glass distillation column for recovery of solvents

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