

# NATIONAL INSTITUTE FOR NBC PROTECTION: PROCESSING OF POTENTIALLY CBRNE CONTAMINATED FINDINGS

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## Abstract

*National Institute for Nuclear, Chemical and Biological Protection (SÚJCHBO) provides technical and analytical support to basic units of Czech Integrated Rescue System. To potentially CBRNE contaminated finding belong for example unidentified substance, hazardous material, sealed (pressurized) container such as a gas cylinder, unidentifiable postal item etc. SÚJCHBO specialists carry out complex processing of a finding, identification of hazardous components and their safe disposal. First, a possible presence of explosive components is excluded by means of X-ray scanner. Afterwards, the finding content is screened for the presence of radioactive substances and highly dangerous chemical compounds. For the subsequent detailed CB analysis, samples of presented materials for trace chemical analysis and biological agents/ toxins identification are prepared. In case of particularly important findings, fingerprint and DNA analysis in cooperation with police specialists are performed. The statistical evaluation of total findings number processed by SÚJCHBO in 2010 - 2016 is presented, with a special stress on (chemically) significant findings.*

## Key words

*CBRNE; hazardous materials; contamination; toxic compounds; analysis.*

## 1 Introduction

For more than 20 years, SÚJCHBO has been continuously dealing with situations where there is a risk of CBRNE presence. During that time, a large number of partial procedures and certified methodologies have been developed for detection and identification of CBRNE substances, their decontamination and possible protection against their effects. Within the framework of several research tasks, was defined the interconnection of selected partial methodologies into a complex procedure, which would clearly define the sequence of steps in the handling of a potentially hazardous substance from its detection or capture through detection and identification to final disposal, with all security measures.

Nowadays SÚJCHBO has developed, certified, and routinely introduced comprehensive technical procedures for finding of CBRNE substances. These methodologies [1, 2] include localization or capture activities (mobile laboratory activities) and procedures of stationary laboratories for identification of CBRNE substances from detection of these hazardous materials presence.

## 2 Principle of processing of findings with potential presence of CBRNE substances

In event of an emergency when detection or reasonable suspicion of finding C substances or B agents is notified by submitting information to the Operational Centre (OC) of

some units of the Integrated Rescue System, than this OC informs the OPIS (Operational and Informational Centre) of regional FRS and activates fire protection units or other bodies of the IRS. Subsequently, SÚJCHBO's professional assistance as other parts of the IRS may also be requested through the Operational and Informational Centre of General Directorate, in the form specified in the Agreement on Planned Assistance on Demand between the Czech Republic Ministry of Interior - General Directorate of the Fire Rescue Service of the Czech Republic and SÚJCHBO [3].

In case of an emergency with a risk of B agents, the following activity is carried out according to the Type activity STČ-05/IZS [4]. Technical assistance of the SÚJCHBO may also be requested in other cases related to control / detection / identification / verification of presence of C or B substances also directly through the SÚJB, some of the Czech Republic Police departments or another body of the state administration.

Professional assistance of SÚJCHBO is also required to address finding with a risk of CBRNE substance (i.e. containing a non-specified component C, B, R, N, or E, or a risk of a combination thereof). The sequencing of post-transport handling procedure with finding towards the SÚJCHBO from internal units' activation through pilot screening, sampling and corresponding analysis is schematically illustrated in Figures 1 and 2.

In case of possible presence of an Improvised Explosive Device (IED), the Pyrotechnic Service of the Czech Republic Police is contacted as the first. After exclusion / delaboration of IED, a pilot screening of closed findings (presence of ionizing radiation source, leakage of C substances, RTG) is carried out. In case of positive detection of SS, SÚJCHBO is not entitled to further manipulate the finding and report it through the Regional Centre Kamenná at SÚJB. Further handling of the finding is then followed by SÚJB's instructions.

If the initial examination is inconclusive, the finding is gradually delaborated, and presence of C substance and ionizing radiation source is determined with the same scenario. Following this process, content of the finding is being sampled for special analyses to prove / refute presence of B substances and toxins listed in the List of High Risk Biological Agents and Toxins in Annex 1 to Decree No. 474/2002 [5] and / or C substances listed in List 1, Annex 2, Decree No 208/2008 [6]. For analyses, SÚJCHBO has introduced sub-accredited and certified procedures.

If the Czech Republic Police requires cooperation to perform a dactyloscopic analysis and / or a DNA trace request (for example in case of mail parcel analysis with a threatening letter containing an unknown chemical), is, under keeping up all safety conditions, access to the incriminated finding in the SÚJCHBO laboratory enable.

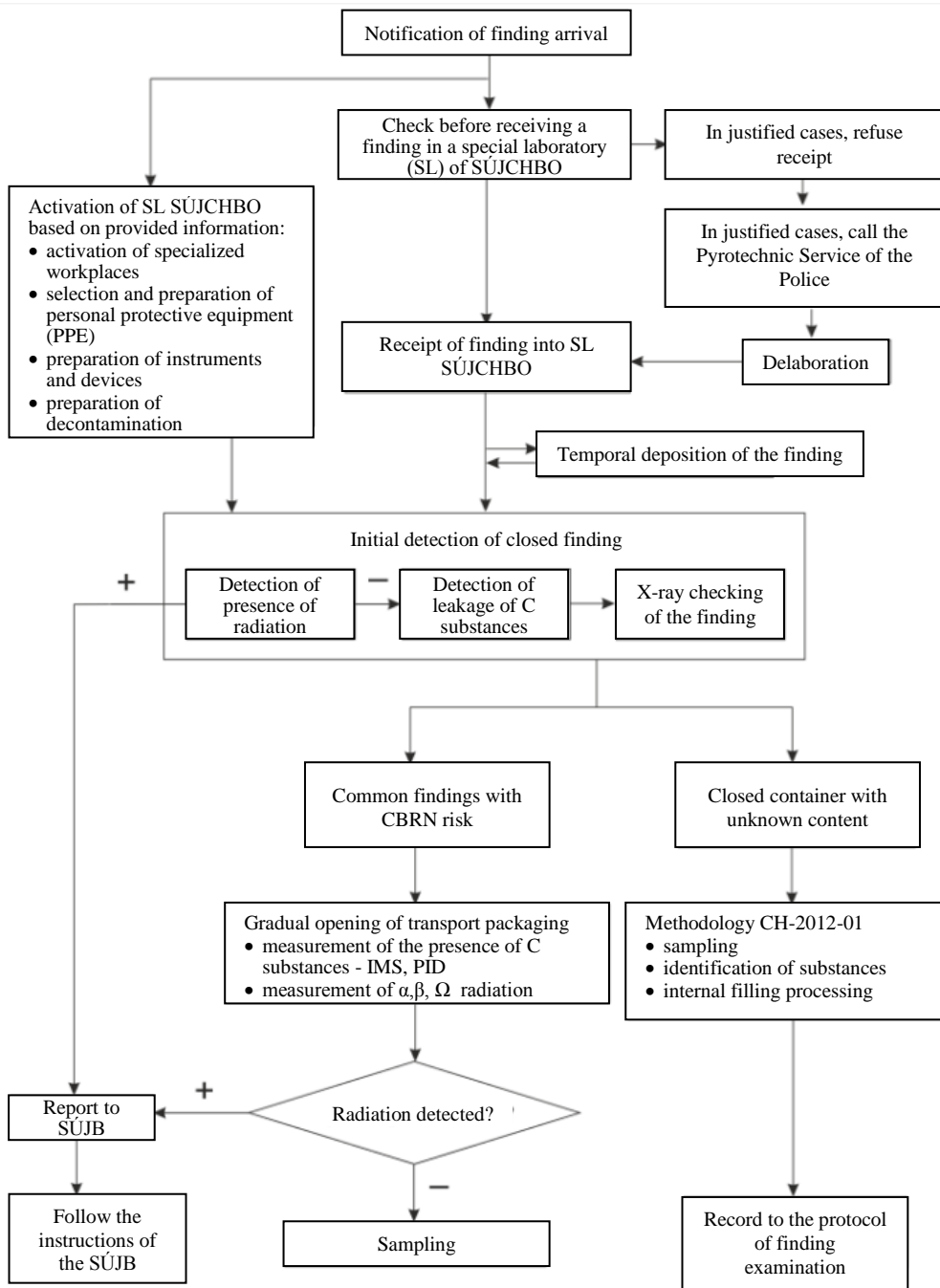


Figure 1  
Algorithm of Inventory Management Procedure - activation of SÚJCHBO internal components and pilot screening [1]

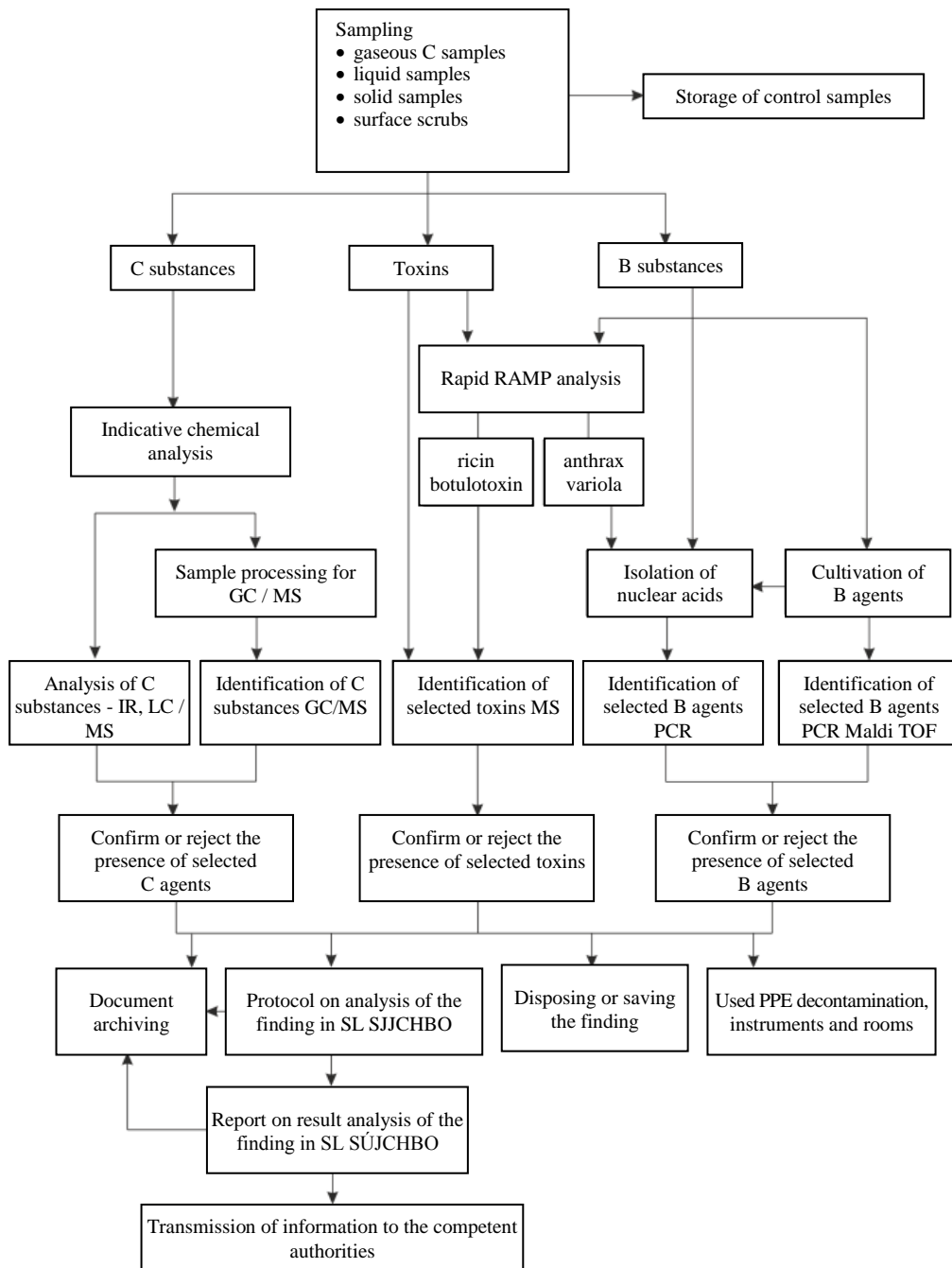


Figure 2  
Algorithm of the Disposal Procedure - Sampling and Analysis [1]

### 3 Evaluation of findings with potential presence of CBRNE substances processed at SÚJCHBO

SÚJCHBO has been dealing with processing of packets or findings with potentially dangerous contents since 2001. During this time, various hazardous substances of type C, B and RN were identified in stationary laboratories. Examples of significant findings of this type are shown in Figure 3. These include, for example, lyophilisates of biological agents, short-term inactive radiopharmaceuticals, psychotropic substances, drugs, certain highly dangerous substances of List No. 1, Annex 2, Decree No. 208/2008 Coll. and other dangerous chemicals or biological agents.

SÚJCHBO mobile group of emergency, may be requested, for example, to assist the Police in investigating and taking samples from detected illegal chemical storehouse, to find CBRNE substances of unknown origin, to safely dispose of highly hazardous substances in an emergency situation and so on. Some of these cases are documented in Figure 4.

The Czech Republic Police in cooperation with the SÚJCHBO laboratories also deal with cases of seizure of mails with suspicious content. The role of SÚJCHBO lies primarily in qualitative analysis and the subsequent safe disposal of suspicious content and in such way, without damaging possible dactyloscopic traces. Examples of these seizures are shown in Figure 5.



*Figure 3*  
*Example of CBRN findings and seizures*

*A - illicitly transported addictive substances; B - lyophilisates of biological agents;  
C - tablets with psychotropic substances; D - short-term radiopharmaceuticals.*



Figure 4  
Example of findings and seizures of toxic substances

A, C - highly hazardous substances of List 1 of Decree 208/2008 Coll.,  
B, E - toxic substances; D - Closed warehouses of chemicals.

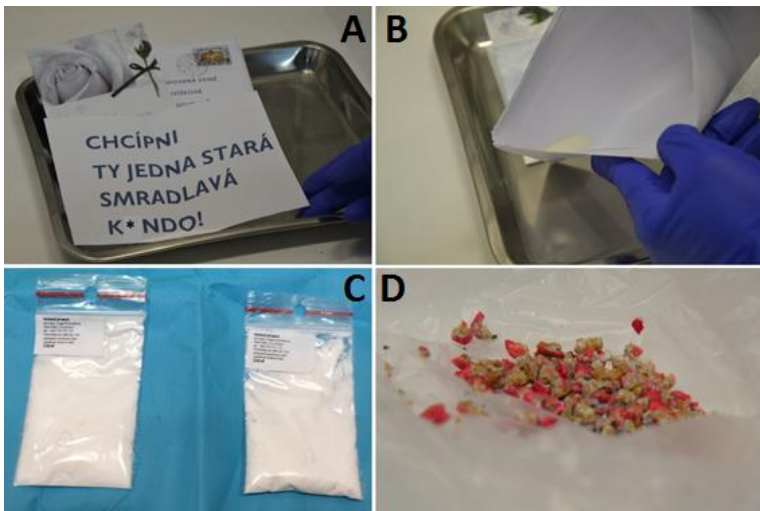


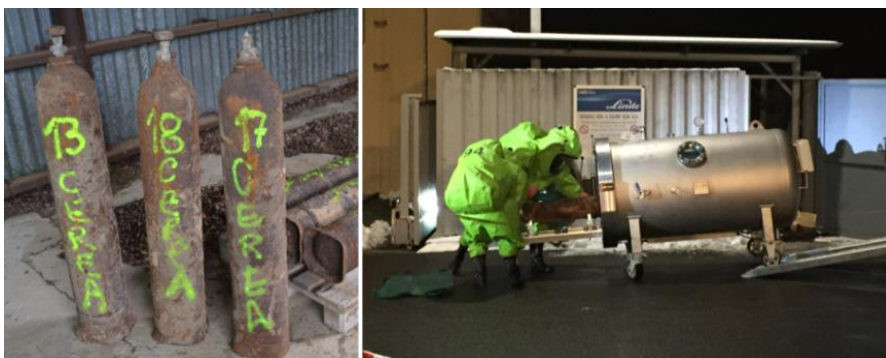
Figure 5  
Collaboration in Detecting Criminal Offenses

A, B, D - analyses of postal items with suspicious content;  
C - analysis of potentially dangerous "white" powders found.

Closed containers with unknown content detected within territory of the Czech Republic by IRS units with an average annual incidence of up to 15 pieces are a relatively frequent and potentially dangerous finding. In most cases, those are findings of old, unidentified cylinders or pressure cylinders with varying degrees of damage, as well as findings of remains of chemical ammunition from World War II.

Particularly, unlabelled cylinders containing acetylene, chlorine, oxygen, acetone, carbon dioxide, nitrogen, methane, ammonia, helium, air or wood gas have been delaborated in recent years in SÚJCHBO. In addition, there were partial cases of gas cylinders found to contain nitrogenous fluoride, bromide fluoride, sulphur hexafluoride, bromine chloride, arsine, phosgene, trifluoromethane, silane, tetrafluorosilane, etc.

Hermetically sealed pressure reactor, which serves to safe dispose of such closed (pressure) vessels, is shown in Figure 6 during insertion of detected cylinder into the interior reactor by specialists of the SÚJCHBO. Another use of the hermetic reactor was also delaboration of found old artillery ammunition potentially containing chemical warfare agents, or processing of smoke grenades with dichlorodisulfide, etc. Delaboration of pressure vessels follows the instructions given in the SÚJCHBO Certified Internal Method No. CH / 2012/01 [7].

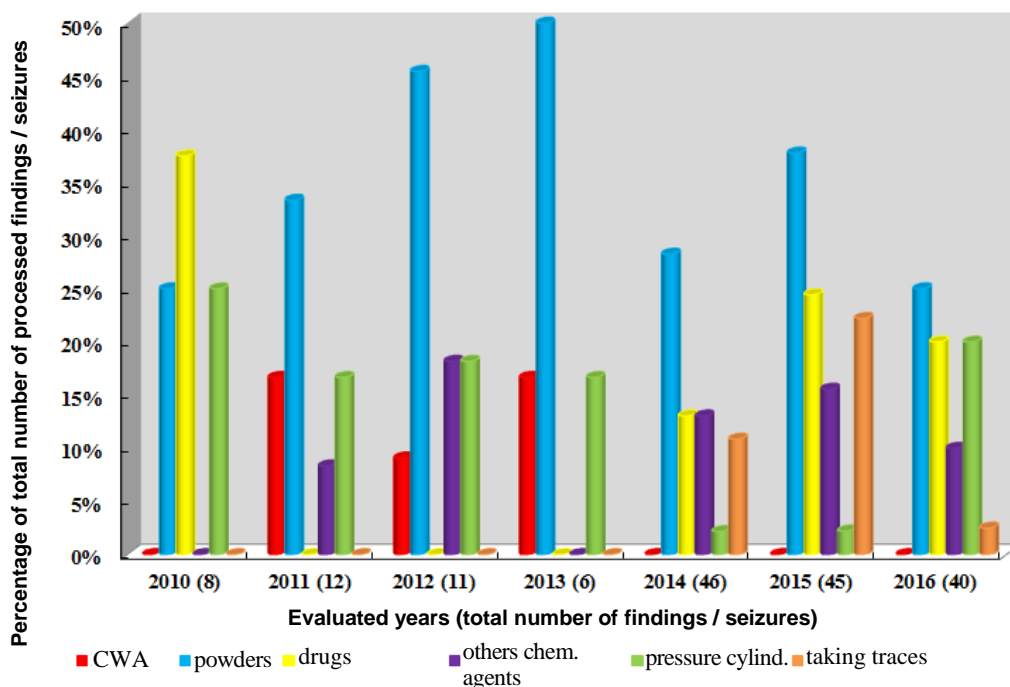


*Figure 6*  
*Found cylinders and their safe disposal*

The following Table I summarizes data on seizures and findings from the point of view of chemical significance (toxicity) processed in SÚJCHBO in the period of 2010-2016. The graph in Figure 7 evaluates these data in more detail according to nature of found substance. This is a clear trend, which shows that the number of so-called "white powders" has increased over the last few years, with an increase in seizures of psychotropic substances or drugs. In past three years, there has also been closer cooperation with police specialists who carry out dactyloscopic analyses and take DNA traces (typological link between crimes) in investigating these cases.

*Table I*  
A statistical summary of data on seizures and findings produced by SÚJCHBO during the period 2010-2016

| Year | Number of packets | Number of samples | Examples of toxicologically significant chemical substances                      | Number of processing pressure bottles |
|------|-------------------|-------------------|--|---------------------------------------|
| 2010 | 8                 | 11                | fentanyl   | 5                                     |
| 2011 | 12                | 15                | KCN, ricin   | 2                                     |
| 2012 | 11                | 33                | $\gamma$ -lewisite, nitrobenzene, HgBr <sub>2</sub> , methanol, m-dinitrobenzene | 10                                    |
| 2013 | 6                 | 70                | yperit (HD), $\gamma$ -lewisite, MDMA  | 1                                     |
| 2014 | 46                | 60                | bromoethane, HgCl <sub>2</sub> , amphetamine, THC                                | 6                                     |
| 2015 | 45                | 116               | tadalafil, fentanyl, alprazolam, THC   | 24                                    |
| 2016 | 40                | 124               | alprazolam, methamphetamine, cocaine, pyrovaleron, 5-methyl ethylene             | 15                                    |



*Figure 7*  
Evaluation of Findings and Seizures in Monitoring Period by Type



## 4 Conclusion

The current trend of complex treatment of findings containing (potentially) hazardous CBRNE substances requires high specialization of concerned specialized bodies and calls for a broader inter-ministerial cooperation. This is mainly due to higher relative frequency of findings of so-called white powders, chemical compounds with real toxic potential. The identification of the CBRNE risk components as well as the expert assessment of their real toxicity are key to the investigation of the listed offenses.

### Thanks

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