B111 The Interpretation of Gunshot Residues (GSR) at the Activity Level: State of Knowledge

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Learning Overview: The goal of this presentation is to share the state of knowledge on the GSR transfer traces at the activity level as stored in the Transfer Traces at the Activity level Database (TTADB), available to any forensic scientist or legal professional. This research helped to establish the current knowledge, identify gaps in the literature, and therefore suggest future research to be undertaken.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing practitioners, forensic scientists, and lawyers access to a user-friendly structured database that inventories the state of knowledge on GSR interpretation in the activity level. This database contains studies on transfer traces at the activity level focusing on transfer, persistence, background, population, and detection of GSR in various scenarios and on different supports that were analyzed, with a critical assessment in a Canadian context.

The purpose of this research, which is part of a larger project on the analysis of studies on transfer traces at the activity level, is therefore to inventory the state of knowledge on GSR interpretation in order to build a structured knowledge database for practitioners and researchers, the TTADB. This database helps identify gaps in the literature and propose lines for incoming research to fill them. The part of the project presented here focuses on GSRs.

GSRs-related papers such as articles, theses, and others (e.g., research reports) were analyzed in order to evaluate the state of knowledge. An analysis of each paper was done to bring out the following characteristics (when possible): year of publication, author(s), country where the study was conducted, type of GSR (organic, inorganic), experimental conditions, and type of study (transfer, persistence, detection, background, population, probabilistic model, methods, etc.). A critical analysis of the relevance of each study regarding the Canadian environment has also been conducted. Once this analysis was completed, the data collected was structured in a database open to forensic practitioners, scientists, and lawyers.

To date, 213 GSR studies, from 1965 to 2020, have been included in the database. The available literature has shown that most of the studies were conducted in various European countries and the United States and very few in Canada. In addition, more studies are conducted on Inorganic GSR (IGSR) than on Organic GSR (OGSR). However, since the advent of so-called non-toxic ammunition, the number of studies on OGSR has tended to increase. Several studies have also recently been carried out on IGSR and OGSR in a complementary manner with a view to finding a viable sequence of analysis and/or comparing the results of the two methods.

Moreover, recent studies have more generally been conducted using high-performance analytical instruments in order to obtain the most sensitive methods of detection rather than focus on issues related to GSR activity and interpretation. However, while it is true that an increase in sensitivity will give greater information on the source of the trace, it will not provide any information as to its relevance, which can only be estimated by considering an interpretation at the activity level. Therefore, techniques such as chromophoric development processes that allow inferences about the shooter, a beholder, and/or a bystander may prove to be fundamental and should be pursued further. Unfortunately, the literature review shows that such research, as well as research incorporating probabilistic or static assessment at the activity level, are rare or even left out.

The purpose of building such a database is to provide a friendly user tool with a large body of literature to assist practitioners in interpreting the data/traces at the activity level. Although the project began with a greater focus on analysis in a Canadian context, international interest in the TTABD is now being expressed.

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