

OSAC RESEARCH NEEDS ASSESSMENT FORM



Title of research need:	Environmental prevalence of perchlorate and other inorganic ions relevant to forensic explosives investigations		
Keywords:	post-blast, pyrotechnics, ion chromatography, mass spectrometry		
R&D Need Rank: Low, Medium, High	High	SAC Approved Date:	July, 7, 2026
Submitting subcommittee(s):	ILEGSR		

Research Need Summary:

The purpose of these research needs is to build a stronger scientific foundation for forensic science standards. The information provided herein will help to evaluate and strengthen existing standards, and/or fill any standards related gaps. In the space below, please provide a brief narrative of the need to be addressed. This should include:

- The identity of any specific standards that would be affected/improved/evaluated
- A discussion on gaps that exist within the standards or standards related gaps that need to be filled
- How this work would fill those gaps
- An overview of any current or past research efforts that may be relevant to this effort
- A discussion regarding how this research might improve current laboratory capabilities and/or forensic services within the criminal justice system
- Any relevant references

Many commercially available and improvised explosive mixtures are comprised of an inorganic oxidizer paired with a fuel. These fuel/oxidizer explosive mixtures are used in many improvised explosive devices but are also found in commercially available pyrotechnic products as well. An assessment of the prevalence of perchlorate and other inorganic ions relevant to forensic post-blast explosives investigations present in the environment will aid with the correct forensic interpretation of the presence of these ions when conducting explosives casework. This interpretation may prove particularly important in circumstances where device-related components are not available/present. The identification of post-blast explosives and combustion residues can help identify what explosive materials were used, which is forensically important to an explosives investigation. Some anions and cations of interest include: SCN^- , ClO_4^- , Cl^- , NO_2^- , SO_4^{2-} , NO_3^- , ClO_3^- , $\text{C}_7\text{H}_5\text{O}_2^-$, and $\text{S}_2\text{O}_3^{2-}$ and NH_4^+ , Ba^{2+} , Sr^{2+} , and Mg^{2+} .

Standards that would be impacted by this study would include E3329-21 (Standard Practice for Establishing an Examination Scheme for Explosives Residues) and WK73484 (Standard Practice for Reporting Results and Opinions of Explosives Analysis).

Similar research has been conducted internationally, including in the Netherlands and the United Kingdom (Great Britain). These studies have also considered how events where pyrotechnic displays (i.e., New Years Eve celebrations) impacted the prevalence/abundance in the environment.

[1] van Damme, I., Hulsbergen, A., Allers, S., Bezemer, K., van Asten, A., (2025) Assessing the abundance of pyrotechnic traces from new year's eve celebrations in the netherlands: implications for forensic explosives investigations *Propellants, Explosives, Pyrotechnics*, 50, Article 202400118.

<http://dx.doi.org/10.1002/prop.202400118>

[2] van Damme, I., Hulsbergen, A., Allers, S., Bezemer, K., Miller, J., & van Asten, A. C. (2024). A study into the natural occurrence of inorganic ions relevant to forensic explosives investigations on human hands. *Forensic Science International*, 361, 112119. <https://doi.org/10.1016/j.forsciint.2024.112119>

[3] Winder, R. J., Wilby, S. A. J., Lessey, L., Hutson, H. E., Broome, S. M., & Beardah, M. S. (2025). A survey of explosive traces in public places. *Journal of Forensic Sciences*, 70(4), 1450-1459.

<https://doi.org/10.1111/1556-4029.70042>

This research need has been identified by one or more subcommittees of OSAC and is being provided as an informational resource to the community.