



Security of Explosives pan-European Specialists Network

## **D6.12**

### **EXERTER 6th report on innovations, standardisation and exploitation within SoE**

#### **Annex 3 to D6.6**

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 786805

**PUBLIC**

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<b>Document information</b>	
<i>Version no.</i>	<i>Date</i>
1.0-1.2 (as D6.6 annex 3 as a publication)	14-24/06/2021
1.3 (=v1.2 plus cover pages)	15/01/2023

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**EXERTER is a collaboration between:**

FOI / FhG / ENEA / TNO / BKA / INTA / RGNF / NLMOD / PSNI / MTA / KEMEA / ICPO / WAT / KSP / MUP / IGPR / PSP / FFI / SPA / ESMIR



# SCENARIO: PERSON- BORNE IED

The third annual report in EXERTER



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EXERTER  
Scenario: Person-Borne IED -  
The third annual report in EXERTER

FOI-2017-1045  
June, 2021





Security of Explosives pan-European Specialists Network

EXERTER is a pan-European network that aims at identifying and promoting innovative methods, tools and technologies that will offer solutions in the fight against terrorism and serious crime, i.e. enhancing the overall Security of Explosives. The core of the EXERTER network brings together experts coming from Law Enforcement Agencies (LEA), Military Institutes, Governmental and Civilian Research Institutes, Academia and Standards Organisations.

By enabling the exchange of information about the challenges of countering current and emerging terrorist threats, the related operational requirements on methodologies, tools and technology and the status in Research and Innovation, EXERTER provides practitioners with the operative knowledge and tools for enhancing the security of our society.

Each year, EXERTER focuses on an attack scenario or set of scenarios with connection to Security of Explosives. The scenario is a terrorist plot defined from planning to execution of an attack, and used to identify weaknesses in our response as well as potential countermeasure improvement. Focus is on the areas standardisation and certification, research and innovation and exploitation.

The scenario for year three in EXERTER involved a person-borne improvised explosive device (PB-IED). A summary of the work, analysis and recommendations related to this year's attack scenario is presented in this report.

# INTRODUCTION

Each year, EXERTER defines a scenario or set of scenarios, based on relevant input from practitioners and experts, and works with issues related to that scenario in all four phases on the time-line: PREVENT, DETECT, MITIGATE and REACT. EXERTER studies requirements, gaps and activities within research, standardisation and certification, and works towards exploitation of innovations within all phases.

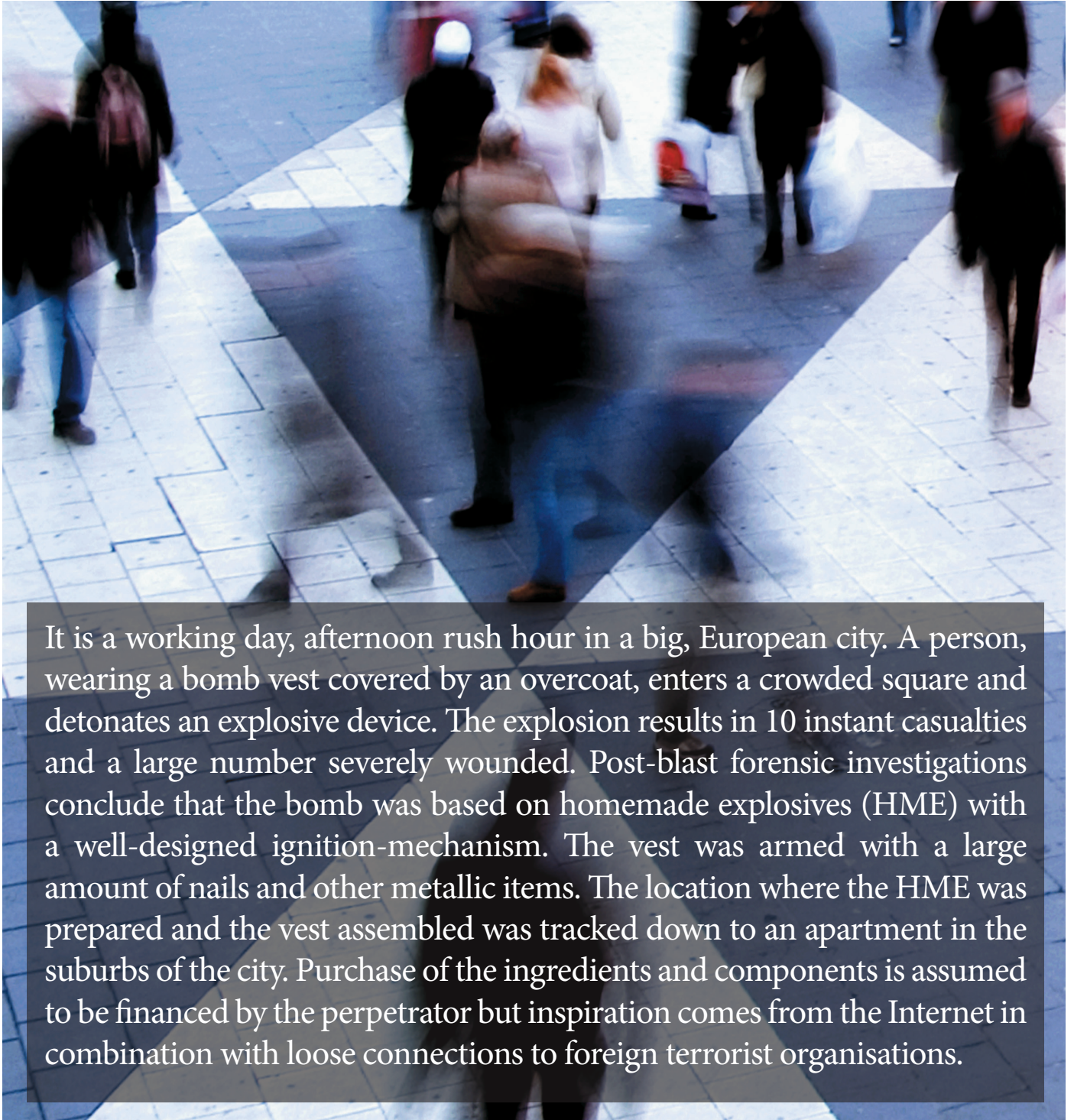
Countermeasures under the four domains differ technically and operationally, and have different sets of users and stakeholders, thus setting a wide scope for the EXERTER network.

This report summarises the outcomes of EXERTER from the work with a scenario involving a person-borne improvised explosive device (PB-IED). It presents the findings related to the different counter attack domains and presents the concluding analyses and recommendations on future possibilities and needs.

In the beginning of EXERTER's yearly cycle, practitioners' requirements and gaps for countering the threat scenario were identified. These were based on analysis of input received from stakeholders and the expert community. The information has been collected in a classified report and it has formed the foundation for the continued work.



# THE SCENARIO



It is a working day, afternoon rush hour in a big, European city. A person, wearing a bomb vest covered by an overcoat, enters a crowded square and detonates an explosive device. The explosion results in 10 instant casualties and a large number severely wounded. Post-blast forensic investigations conclude that the bomb was based on homemade explosives (HME) with a well-designed ignition-mechanism. The vest was armed with a large amount of nails and other metallic items. The location where the HME was prepared and the vest assembled was tracked down to an apartment in the suburbs of the city. Purchase of the ingredients and components is assumed to be financed by the perpetrator but inspiration comes from the Internet in combination with loose connections to foreign terrorist organisations.



# PREVENT



Suicide attacks are often executed without warning and can be difficult to detect before it is too late. The main aspects that have been considered within the PREVENT counter-attack phase are ways to identify potential suspects and hinder the preparation such an attack. Focus within the work has been on homemade explosives (HMEs).

## REGULATION & LEGISLATION

As of 1st of February 2021, the regulation on marketing and use of explosives precursors was updated with the Regulation (EU) 2019/1148. Stricter rules on sulphuric acid, ammonium nitrate and nitromethane have been introduced, and purchases of aluminum and magnesium powders as well as magnesium nitrate hexahydrate are now regulated. It is important to continuously update the regulations to ensure that the chemicals sold to the private sector cannot be used to produce explosives, and therefore further research initiatives on precursors are recommended. It has been observed that the implementation and control of these legislations might vary between the member states. The Standing Committee of Precursors (SCP) are assisting the European Commission to facilitate the implementation of the new regulations as of June 2020.

## RESEARCH INITIATIVES

In the event that the precursors are accessed despite regulations,

inhibition of explosive precursors could theoretically act as a second line of defense. It is however challenging to inhibit a substance without obstructing the legal use of it, and so far, inhibition is only applicable to a limited number of substances. More research is needed regarding inhibition, which is something that e.g. the Horizon 2020-funded project INHERIT will focus on during the next few years.

Techniques for detecting explosives residuals from liquid and solid waste are evolving and becoming more and more sensitive, but problems often lie in backtracking the source of the residuals and localize the exact location of an illegal production site.

A large portion of terrorist radicalization and recruitment occurs online, which is why projects such as the H2020 projects DANTE, RED-Alert, and TENSOR, and the EU-ISF funded project SAFFRON have worked/work with methodologies and tools for detecting such online activities. The tools aim to facilitate and save time for the LEAs and intelligence units that monitor deviating actions in



order to catch the perpetrators before an attack occurs.

Enhanced information exchange and communication between different LEAs, such as intelligence units, uniformed officers and bomb squads, as well as to the research community and industry, might be an additional way to increase the capability within preventive work.



## STANDARDIZATION NEEDS

Monitoring of suspicious precursor orders and purchases might help in tracking down the culpable at an early stage, or to find the site of an IED-preparation. The EU-funded project FOLLOW discusses the difficulties of delivering Suspicious Transaction Reports, seeing as there are no common guidelines that define the nature of a “suspicious transaction”. There might be a need to define a “suspicious transaction” and standard operating procedures on how to search for, identify and follow up on transactions that could be connected to terrorist financing.

## HUMAN FACTORS

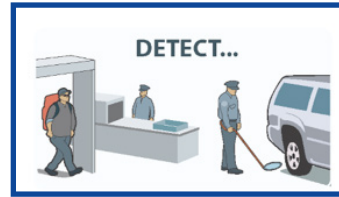
One aspect that is especially relevant in a terrorist attack with a suicide bomber is the human factor. These type of attacks might be easier to predict if the psychology of the attacker is better understood, and if it is known what type of characteristic behavior to search for and what counter-actions that could be effective to prevent an attack.

Some future suggestions are to develop psychological and behavioral profiles based on suicidal risk factors from previous suicide bombers. These profiles could be used for education of LEAs, security officers and other relevant parties, to increase their capabilities of identifying future suicide bombers. Perhaps an increased collaboration between social scientists and law enforcement agencies could give more knowledge in this field.

### Suggestions for the future:

- Further research precursors to establish grounds for new legislations
- Introduce standard operating procedures for the search of suspicious transactions
- Enhanced information exchanged between different LEA units (use best-practices)
- Create psychological profiles based on suicide bombers to educate LEAs and security staffs

# DETECT



Terrorists operating today are better organized, more professional and better equipped. This is a big challenge for the R&D of detection technology, especially since the threat and modus operandi are constantly evolving. The focus within the DETECT-phase this year was identifying what type of new solutions and methodologies that are needed.

## CHALLENGES & POSSIBILITIES

It is impossible to deploy security personnel in sufficient numbers to protect every location towards attacks with person-borne IEDs. When security personnel are present they currently lack sufficient tools to detect concealed threats, such as PB-IEDs, guns and knives, at a safe range. Generally, the solution applied is a more thorough screening at venues, but every time the security at venues are tightened, the crowds outside the security check

Evolving terrorist-methods cause detection challenges:

- Development of new explosives;
- IED without wiring or electronic devices;
- Operation methods that do not include any metal parts;
- Operation methods that hide all explosives under clothing



increase and become more attractive to attacks.

A new solution is needed to strengthen the ability of security personnel to detect PB-IEDs at a sufficient distance. Ideally it should have a high degree of certainty within reasonable time, to allow appropriate decisions to be made and effective actions to be taken to safely deal with the threat posed. The risk or result of the counter-tool used also needs to be connected to the degree of certainty of the detection system. Potential technologies for this purpose could e.g. be active and passive THz, Raman, IR, and Millimetre-wave radar.

## SURVEILLANCE SYSTEMS

In cases where humans are involved, such as a suicide bomber in this scenario, psychological and physiological methods could be considered for operations together with IED-detection to identify individuals exhibiting suspicious behaviour. Modern video surveillance equipment is not sufficient to detect hostile or threatening activity in crowded areas. Moreover, operators responsible for observing real-time footage can be subject to human error.



While current surveillance systems store the footage and mostly use it for post-event analysis, upcoming surveillance systems aim at detecting anomalous and threatening incidents and behaviors while the incident is in progress or even better, as it unfolds. Such systems would enable pro-active measures to be taken, typically notifying the local security personnel that they should attend a possible incident or crime scene. Trained CCTV operators and security staff are also important resources to identify suspicious activity, hostile reconnaissance or similar.

## QUICK AND JUSTIFIABLE DECISION-MAKING

In some situations when fighting a PB-IED, Law Enforcement Agencies are required to make decisions in a very short time period. New technologies for LEAs should provide a proactive security solution that will enable LEAs to sort through massive volumes of data to predict, anticipate and prevent a suicide attack. This goal could be achieved for instance by combining technologies such as:

- augmented reality (AR) capabilities with powerful machine learning algorithms,
- sensor information fusion techniques,
- wearable technologies

Whatever new approach that is proposed for the identification of a PBIED and subsequent incapacitation of the bomber must have a degree of certainty that is legally sufficient to justify the use of whatever means of incapacitation that is employed.





# MITIGATE



Mitigation measures towards a person-borne IED at an open, public square packed with citizens is a real challenge. This MITIGATION chapter presents which research projects that have dealt with this issue in the past and what future initiatives could focus on.

## RESEARCH INITIATIVES

Potential mitigation measures are typically related to organisational/management measures, measures addressing the design of public spaces and structural measures. A recent EU-funded research initiative related to organisational measures in the surrounding of public spaces is BRIDGE (Bridging resources and agencies in large-scale emergency management), which aimed to increase the safety of citizens across the EU.

In the EU-project SUBCOP (Suicide Bomber Counteraction and Prevention) non-lethal methods and technologies to neutralise suicide bombers were investigated aiming at mitigating or even hinder the effects of an explosion.

Related to structural mitigation measures, the ERNCIP Thematic Group (TG) Resistance of Structures to Explosion Effects (European Reference Network for Critical Infrastructure Protection) investigated and supported pre-standardisation activities to improve

test procedures of structural elements against explosions with the overall objective to design resistant building elements that can mitigate explosion effects.



## STANDARDISATION & CERTIFICATION

Further standardisation initiatives that might be relevant for attacks on public places are related mainly to structural components, such as glass (CEN, TC1299) and, in a wider sense, the design of buildings, sites and urban areas against criminal attacks



(e.g. CEN TC263 and 325). However, terrorism is not specifically included in these standards and, hence, their specific characteristics are not addressed. Also, the previously mentioned ERNCIP TG does not specifically address terrorist attacks, however explosion effects in general are included.



### LIMITED MEASURES AT OPEN PUBLIC SPACES

Despite the progress of the research initiatives, technology developments and standardisation activities on the design and structural properties of urban places and surroundings, the mitigation of explosion effects for the given scenario is challenging for city planners, policy-makers, LEA's and first responders.

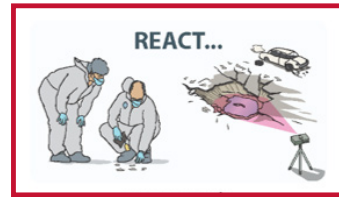
The scenario is characterized by a large number of people at spaces that

are widely distributed across Europe and as such it is almost impossible to comprehensively design them, respectively to protect them, against explosive effects. The balance between the probability of an event, and the required efforts in order to mitigate the effects of an attack, is also an important factor, considering aspects such as the costs of such measures, an open and welcoming cityscape or potential data protection issues.

Future research initiatives and technology developments could be focused on:

- How to implement existing and verified structural and design mitigation measures at public spaces
- Planning capabilities that support city planners and security practitioners by the identification of vulnerabilities – and the derivation of proven effective mitigation measures in the design phase of new places as well as during assessments of existing places. This could also include research on crowd behaviour and measures that reduce congestions at public spaces.
- Vulnerability identification and elaboration of mitigation strategies (e.g. evacuation concepts) based on attack scenario simulations for security practitioners and policy-makers at public spaces in realistic conditions
- Training of LEAs and first responders to enhance their preparedness to attack scenarios to public spaces and as such to mitigate the effects of a potential attack
- Further development of IED neutralisation techniques

# REACT



The React domain covers emergency management, spanning everything from case training for security agencies and first responders, to crime scene investigation. An overview of research initiatives in this domain and a selection on challenging areas for future focus are presented in this chapter.

## THE DIFFICULTIES IN COMBATting A PB-IED

A person-borne IED can come in many different disguises, and the carrier might have different aims to fulfil. The attacker does not have to be a terrorist, and he/she does not even have to be a suicide bomber. Many cases fulfil both assumptions later, but there are also other possibilities. For example, there are cases when the person is not even aware that he delivers an IED, or the IED is simply a means to threaten the police from trying to capture the suspect. The effects and outcomes of these situations will be very different.

To reconstruct these events and to understand what has actually happened is quite difficult. Nonetheless, it is important to identify the real reason behind an attack as quickly and correctly as possible, in order to hinder follow up attempts of the same group and to tackle the perpetrators behind the attack.

There are still many challenges to overcome with respect to combating

and reacting to person-borne IEDs. Some suggestions for future initiatives are:

- Providing cross-border training of current case law for stakeholders/LEAs
- An exchange of evaluation and monitoring data of relevant websites/darknet/ subversive literature between the EU-Security agencies.
- A unified training of stakeholders/LEAs regarding psychology of suicide bombers
- Factual awareness campaigns in public spaces/raising public awareness without causing panic

## NEW PROCEDURES AND TOOLS

There are several research initiatives that aim at making the reconstruction and investigation of explosion attack sites more convenient and effective. Especially the EU-funded project “3D-Forensics (Mobile high-resolution 3D-Scanner and 3D data analysis for forensic evidence)”, the

German/Austrian project FLORIDA (Flexible, semi-automated video forensics system for the analysis of mass video data) and the German project AISIS (Automated generation of information and protection of critical infrastructures in the event of a disaster). All projects can be very beneficial to the investigation attempts of the police and security agencies. In order to reach effect, it is important that the project results are being disseminated to the end-user community in an adequate way.

Furthermore, there are new organisational support methods on the horizon for security agencies in this area, ranging from assessment of tools / training with serious gaming platforms (EU-funded project AUGGMED, Automated Serious Game Scenario Generator for Mixed Reality Training) to the support in the time of the actual incident with the EU-funded project ESS (Emergency support system).



As with all research projects it remains to be seen how these new methods are accepted and implemented by the users, and how the development

proceeds.

### ISSUES WITH IMPLEMENTATION

There are also challenges that technically might be "easily" solved but have to be ethically assessed by the relevant authorities before implementation could be possible, such as:

- Raising awareness among family members/friends, recognizing abnormal behaviour/changes in personality of relatives/friends
- Improvement of CCTVconnected techniques

The raising of awareness within close family/friends with subsequent reporting is still a difficult area, and there are very few promising approaches to legally and ethically solve the implementation of such a reporting program.

While improvement of CCTV is a constant point of discussion in some member states, it is of no concern in others. The effectiveness of this measure is undisputed, especially if it is combined with the storage of the acquired data for a prolonged time. Obviously, this combination is rightly of great concern to many members of the public since this data potentially can be misused.

The developments in the past years have taken significant steps to make a reaction to PB-IEDs easier, and to raise awareness regarding the preparation of these devices.

# CONCLUDING REMARKS

To work in a networking project during a pandemic is not an easy task, but EXERTER managed to finish this year's work nevertheless. Even though the classical face-to-face workshop could not take place, national discussions with stakeholders and practitioners exposed several requirements and gaps that could be further assessed by the partners and stakeholders of EXERTER. Several webinars with topics connected to the PB-IED scenario was held, followed by some very interesting web-discussions. The virtual conference that replaced the physical one used the advantages of a virtual event by live demos of equipment, and a great audience could attend.

The focus within the **PREVENT** counter attack-domain this year was identifying legislations and research initiatives that support the tracking of a potential suicide bomber during the early preparation of an attack. Even though there exists regulations of precursors and explosives, as well as many projects that work to develop tools for monitoring of suspicious online activities, a main challenge seems to be the implementation of them. How can we ensure that the purchases of relevant precursors within the EU are restricted and reported? How can we implement and make use of new tools and techniques that are developed? That is something to ponder for the future.

The **DETECT** phase highlights the struggle with identifying perpetrators, since their modus operandi are continuously changing. Even though the detection methods are evolving, how could the difficulty with large flows of people and potential crowds be solved in connection to screening at entrances and similar? Stand-off detection techniques that can identify a suicide bomber at a safe distance is suggested as a solution, but the technique must be certain enough to justify the means needed to stop the perpetrator.

The biggest challenge in **MITIGATION** for this year's scenario is probably how to mitigate against an explosion in open or easily accessed spaces, i.e. soft targets. Projects that deal with organisational measures near public spaces and non-lethal measures to cancel out PB-IEDs are highlighted as initiatives that work towards a safer Europe.

In the **REACT** domain the challenge lies both in understanding and reconstructing the event in order to find the perpetrators and prevent further attacks, and in reacting to the threat once a suicide bomber is identified. Research projects working on both of these issues have been identified, and the output from them discussed.

Please visit our EXERTER's web-page, or contact us for more information about our work and activities.



# EXERTER CONSORTIUM



Keeping People Safe

