[PRACTICE]

D5.2 MODELLING SOFTWARE/ STANDARDS

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Summary Work Package 5

The overall aim of the project “Preparedness and Resilience Against CBRN Terrorism using Integrated Concepts and Equipment” (PRACTICE) is to improve the ability to respond to and recover from a Chemical (C), Biological (B), Radiological (R) or Nuclear (N) incident. The objective of the project is to create an integrated European approach to a CBRN crisis – i.e. a European Integrated CBRN Response System. This will be achieved through the development of an improved system of tools, methods and procedures that is going to provide EU with a capability to carry out a truly integrated and coordinated operational reaction following the occurrence of a CBRN crisis, whether it is caused by a terrorist act or an accident.

The objectives of WP5 are to develop, integrate and test a complete toolbox for first responders, decision makers and the public, including innovative components developed during the project to provide an improved and integrated preparedness and response to CBRN events.

The tools will be organized in 6 categories:

1. Recommendations
2. Standards
3. Protocols / procedures
4. Equipment and systems (eventually simulated): hardware, software, with performances, Technology Readiness Levels (TRLs), validation/certification status
5. Simulated environment (with 3D databases)
6. Real equipment and system emulation capabilities.

These tools will fulfil functions as defined in WP3, organized in line with the ESRAB/Staccato taxonomy functions, completed and detailed when needed for PRACTICE. The toolbox should be considered as living system gathering “bricks” into an integrated solution to manage a CBRN crisis. It will include actual tools and equipment and ICT simulated environments including hardware and software. This will allow plugging and playing new components and guarantee their interoperability.

The toolbox will be developed and integrated in two steps:

- A V0 version integrating in an innovative way existing validated capabilities (fed from WP 2 and WP 3) i.e., tools, methods and procedures that will be put together into an information system, with specified standard interfaces.

- A V1 version integrating innovative tools, methods and procedures and supporting future standards to improve interoperability and consistency without impeding the existing operational systems.

Developing V0 and new CBR tools for V1 will be an iterative process with all the stakeholders in the loop. Focus will be put on specifying simple interfaces for any supplier to describe and present its "bricks" in order to "index / reference" them in our PRACTICE Toolbox Information System. Any new tool that satisfies the "standards" interfaces should be easily added to build new solutions ("buildings").

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Contents

1. Executive Summary

This document will describe the Modelling standards that should be considered for inclusion in and supported by the PRACTICE Toolbox. This document is part of the work package 5 in the FP7 **PRACTICE** project.

The standards must satisfy the key features of PRACTICE that are at least:

- European scope to guarantee interoperability within Europe
- Non-proprietary unless this is a De-facto standard
- Prone to be widely deployed in the future

This report:

- Examines the main standards that should be considered for use in the PRACTICE Toolbox
- Describes features with advantages and limitations
- Identifies how we plan to implement and handle them in the Toolbox.

2. Introduction

This document will describe the modelling standards recommended for inclusion within the PRACTICE Toolbox. The purpose of this paper document is threefold:

1. List the relevant standards
2. Justify the inclusion of the standards in the PRACTICE Toolbox
3. Identify how the standards should be utilised in the Toolbox

2.1 Context

The standards described in this document will be utilised by WP5 of the PRACTICE project. The standards recommended within the document have been highlighted due to the potential to assist first responders and emergency services deal with the immediate aftermath of a CBRN incident.

Astrium is a consortium partner leading the WP5 work package, responsible for the implementation of the Toolbox. Furthermore Astrium as a service provider in a number of fields including Telecommunications and Public Safety can bring the expertise to identify the standards to be used in the future.

2.2 Problem Definition

When a CBRN incident occurs the first hours are the most critical. First responders need information fast in order to make the correct decisions not only on dealing with the incident itself but also on dealing with the risk to critical infrastructure and the general public. Observations and information from sensors can provide up to date information on what is happening but just as important is the need to know what will happen. Accurate prediction of the state of the hazard in the coming hours / days could prevent significant loss of life and critical infrastructure as well as decreasing the likelihood of major disruption to the general public.

For many years hazard prediction of this type has been mainly in the military domain and dominated by manual processes specified within NATO standards. In recent years, mainly due to the increasing power of mobile computers used on the battlefield, the military have been able to leverage software has been able to assist with these predictions (known as Plume Modelling) to a level of detail that is unattainable manually. However, these software packages are reliant on the use of complex computer models, all of which are based on complex mathematical solutions that rely on a complex array of data. Each model will produce different results and therefore operators need in-depth training in order to be able to interpret the vast array of outputs from these models.

The main problem is that historically the software used has been different on a country by country basis and there has been no de-facto modelling standard in place.

The PRACTICE project therefore faces a number of challenges in this area:

- **Utilization of Military Technologies:** Plume Modelling has come from a military background and is still firmly situated in that arena. The PRACTICE project needs to recommend software that suits use in a civilian capacity across Europe.
- **Modelling Standards:** A de-facto modelling standard or set of standards needs to be agreed upon for use by the software.
- **Integration:** The software to be utilized needs to be able to integrate with other functions provided by the PRACTICE Toolbox. Integration with existing and new sensors is a must have to be able to create accurate predictions.

2.3 Project Scope

In order to address the problems outlined in section 2.2 this document will focus on the following areas that require attention. These are as follows:

- Dominant Models: This document will consider what the dominant models currently are and whether they are supported by the available software packages.
- Other Options: This document will also look into alternatives to the use of software such as services provided by third party organizations.

2.4 End-users

While the key facet of the PRACTICE Toolbox is one of simplicity it should be noted that it is highly likely that end users will require some form of specialist training in order to utilize Plume Modelling capabilities provided by the PRACTICE Toolbox. However that is not to say that the goal of simplicity can not be partly achieved. If the software in question is modular enough then custom simplified user interfaces and functionality could be achieved by utilizing standard SOA techniques.

This document will attempt to briefly outline the possibilities in this area.

2.5 Document Contents

This document will be divided into three major sections. Section 3 describes the standards and services currently available. Section 4 evaluates the various offerings laid out in section 3 while the Section 5 concludes the document with high level recommendations.

3. Modelling Standards / Services

3.1 Standards

It should be noted that the standards that currently exist in the area of CBRN Prediction and alerting are largely military based, such as those developed by NATO and the US DoD.

3.1.1 Data Exchange

The following standards relating to data exchange (e.g. for reporting from sensors, or for communicating between systems) have been identified:

- **NATO STANAG 2103 ATP-45:** Standards for reporting nuclear detonations, biological and chemical attacks and predicting and warning of associated hazards and hazard areas.
- **NATO STANAG 2497 AEP-45:** Describes methodology for procedures detailed in ATP-45
- **METAR:** A format for reporting weather information. Raw METAR is the most popular format in the world for the transmission of weather data, and is highly standardized through International Civil Aviation Organization (ICAO)

3.1.2 Modelling

The following standards relating to modelling (e.g. for reporting from sensors, or for communicating between systems) have been identified:

- **Joint Effects Model (JEM):** US developed modelling standard developed for hazard prediction warning. The standard is designed to be the next generation that utilizes the capabilities of HPAC and other older models.
- **Aerial Locations Of Hazardous Atmospheres (ALOHA):** Chemical release model developed by the National Oceanic and Atmospheric Association in the US.
- **Hazard Prediction and Assessment Capability (HPAC):** HPAC provides the capability to accurately predict the effects of HAZMAT releases into the atmosphere and their impact on civilian and military populations.

3.2 Service Providers / Consultants

The following table lists some of the more prominent Service Providers in the market today.

ST-1 UK MetOffice

- Offers services to UK and International governments / organizations
- Services for prediction of Chemical / Radioactive Material dispersion

ST-2 RiskAware

- Formed in 1999 to provide CBRN Prediction & Simulation to the UK Government.
- Offers consultancy and Software Development Services

ST-3 National Oceanic and Atmospheric Administration (NOAA)

- Provides meteorological data

ST-4 Chemical, Biological, Radiological & Nuclear Defense Information Analysis Center (CBRNIAC)

- The CBRNIAC generates, acquires, processes, analyzes, and disseminates CBRN Defense Science and Technology Information (STI) in support of the Combatant Commanders, warfighters, the Reserve Components, the CBRN Defense Research, Development, and Acquisition community, and other federal, state, and local government agencies

ST-5 ABS Consulting

- Expertise in this areas, but there is relatively little information available

4. Service Evaluation

4.1 Standards (1)

This section provides more detailed information on the standards which it is believed are worth further investigation as part of the development of the PRACTICE CBRN Toolkit.

- Data Exchange

  The NATO standards which include NATO STANAG 2103 ATP-45(C) and STANAG 2497 AEP-45(B) specify standards for reporting nuclear detonations, biological and chemical attacks and predicting and warning of associated hazards and hazard areas. It is recommended that compliance with these standards could be a prerequisite of software seeking addition to the toolkit. Also the fluid nature of these standards should be considered and any software needs to be able to adapt to these rapidly changing standards.

- Modelling

  The modelling standards JEM, ALOHA and HPAC provide advanced hazard prediction modelling capabilities. It is recommended that compliance with these standards could be a prerequisite of software seeking addition to the toolkit. Also the fluid nature of these standards should be considered and any software needs to be able to adapt to these rapidly changing standards.

4.2 Service Providers (1)

This section provides more detailed information on service providers which it is believed are worth further investigation as part of the development of the PRACTICE CBRN Toolkit.

4.2.1 UK Met Office

The UK Met Office have some of the most powerful computer systems in the world and can provide hazard prediction services to agencies on request. These predictions make use of the Met Office's own sophisticated dispersion model known as Numerical Atmospheric-dispersion Modelling Environment (NAME) which when combined with the sophisticated weather prediction services they provide can provide extremely detailed models. At first glance the services provided appear too UK centric however this report concludes that it is worth further consideration and also further investigation is required into the services provided by met offices from other European countries.

- ***Chemical Meteorology (CHEMET)***

  CHEMET can be used to track the dispersion of a chemical release. Telephone advice is available on demand which will give a simple short-range prediction of the anticipated behaviour of the plume. CHEMET is accessed through Hazard and risk management, an online portal for category 1 & 2 emergency responders.

- ***FireMet***

  FireMet is a web based weather system designed to provide fire and rescue service responders with the latest weather information to help them identify a safe approach when dealing with a major incident.

- ***Procedures And Communications in the event of a release of Radioactive Material (PACRAM)***

  PACRAM is a comprehensive service that provides predictions of the trajectory of possible contamination plumes and streamlines our response to any potential incident at a UK nuclear power plant. The service allows the nuclear industry and overseeing government bodies to access the atmospheric dispersion predictions which come from our Met Office Dispersion Model.

- ***The national radiation monitoring network and emergency response system (RIMNET)***

  RIMNET lies at the heart of the National Response Plan and over the years has developed both as a multi-purpose response tool and as a platform for the effective coordination of emergency response. RIMNET now supports the UK response to any radiological event and has the potential to be used in non-radiological events.

  RIMNET has a network of 94 fixed gamma dose rate monitoring sites across the UK, automatically measuring, analysing and informing on background radiation levels 24/7. All measurement and reference data is stored in the UK National Nuclear Database.

- ***DataPoint***

  The DataPoint service from the UK Met Office provides detailed weather datasets available for public access and reuse in the UK.

  DataPoint is aimed at professional application developers looking to re-use Met Office weather data within their own innovative applications. The Met Office is providing this data in line with government objectives to make public data more widely available and support the growth of the UK economy.

  The following datasets are available in XML and JSON format:

  - UK locations 3 hourly forecast from Day zero to Day five
  - UK locations daily forecast from Day zero to Day five
  - UK locations hourly observations for the last 24 hours
  - UK locations site details

4.2.2 RiskAware

RiskAware are UK based company who specialise in consultancy and software development in the area of CBRN. They have considerable experience in the subject matter and have worked with both the UK and US Military working on high profile projects such as the US DoD JEM. The strengths of RiskAware lie in the breadth of skills available to complement the consultancy and

software services. These include mathematicians and physicists as well as software architects and engineers. This has led to breakthroughs such as 3D visualisation of dispersion in urban environments and within indoors enclosures and buildings.

4.2.3 National Oceanic and Atmospheric Administration (NOAA)

The NOAA has coded METAR information available for cities worldwide, referenced by ICAO airport code (e.g. EGLL for London Heathrow, LFPG for Paris Roissy/CDG, etc.) This is available in XML and JSON format over public Internet. The Reports contain weather data which may be useful for modelling purposes.

4.2.4 Chemical, Biological, Radiological & Nuclear Defense Information Analysis Center (CBRNIAC)

The CBRNIAC has a collection of over 203,000 CBRN Defense and Homeland Security (HLS)-related items in a variety of formats and maintains access to a wide range of journals, magazines, and newsletters on CBRN Defense and HLS topics. Some information sources are CBRNIAC staff-accessible only, while others can be accessed by individuals after sponsoring agency registration requirements are met. It should be noted that some data may be accessed only by parties associated with the USA government. Therefore although it appears that the services are too US centric, time available has precluded further investigation into how suitable this may be for use in Europe.

4.3 Standards (2)

This section provides more detailed information on service providers which could be potentially useful as part of the PRACTICE CBRN Toolkit, but it is believed may not be as well-suited as those listed in the previous section.

- METAR

  METAR is a format for reporting weather information. Although METAR is an international standard for reporting weather information this report concludes that it is too focused on the aviation industry for addition to the practice toolbox.

4.4 Service Providers (2)

This section provides more detailed information on service providers which could be potentially useful as part of the PRACTICE CBRN Toolkit, but it is believed may not be as well-suited as those listed in the previous section.

4.4.1 ABS Consulting

ABS Consulting have expertise in this areas, but there is relatively little information available. Also, the material that could be found suggests an apparently bespoke nature.

4.5 Integration into the PRACTICE Toolbox

The PRACTICE toolbox will be built around the concept of so-called 'functions'. Functions are the tools and procedures used to handle incidents, which will be included and integrated in the PRACTICE toolbox. The toolbox will be a web based Information system ("database") fed with a catalogue of existing and innovative components provided and developed during the project.

The PRACTICE Toolbox is meant to be an integrated solution to manage CBRN incidents. One of the bigger challenges in the PRACTICE project will, in fact, be this integration of all functions and components in one large package: an integrated toolbox.

Detailed decisions on how the standards and technologies discussed in this document should be integrated into the toolbox are not possible until the toolbox architecture is defined in more detail. However, it is safe to assume that Service Oriented Architecture techniques utilising Web Services will form the core of the integration.

5. Conclusion

As can be seen from the earlier sections of this document there is a limited number of common standards and services available in the area of CBRN Prediction / Simulation. The NATO standards which include NATO STANAG 2103 ATP-45(C) and STANAG 2497 AEP-45(B) appear the most dominant in this area. Although firmly fixed in the military domain the number of applications of these standards within software targeted at the civilian market are growing. This can be highlighted by the fact that Bruhn Newtech has NATO compliance in these areas in their software which is targeted at the civilian market.

If an advanced hazard prediction model is required, then in addition to the ATP/AEP-45 areas it is recommended that the toolbox items could support HPAC, JEM, and ALOHA, and by design provide support for the operation of those advanced models.

If the PRACTICE Toolbox needs to deliver state of the art detailed modelling, perhaps utilising 3D capabilities and complex models then it may be an option to explore the use of the expertise available at RiskAware and potentially the computing power of the UK Met Office. Although the services provided by the UK Met office appear too UK centric further investigation is required into what they can provide and also what can be provided by other European Met offices. RiskAware has expertise in producing software based on the complex mathematical models developed by their in-house scientists. However it should be considered that the more detailed the modelling process the longer the model will take to produce. This fact may be crucial in the immediate aftermath of a CBRN incident.

Appendix A – Glossary

AEP	Allied Engineering Publication
ALOHA	Aerial Locations of Hazardous Atmospheres
ATP	Allied Tactical Publication
CB	Chemical and/or Biological
CBRN	Chemical Biological Radiological Nuclear
CBRNIAC	Chemical, Biological, Radiological & Nuclear Defense Information Analysis Center
COTS	Commercial Off The Shelf
DoD	Department of Defense
ESRAB	European Security Research Advisory Board
HLS	Homeland Security
HPAC	Hazard Prediction and Assessment Capability
ICAO	International Civil Aviation Organization
JEM	Joint Effects Model
JSON	JavaScript Object Notation
METAR	*MÉTéorologique Aviation Régulière* (Meteorological observation message for routine aviation)
NAME	Numerical Atmospheric-dispersion Modelling Environment
NATO	North Atlantic Treaty Organisation
NOAA	National Oceanic and Atmospheric Administration
PACRAM	Procedures And Communications in the event of a release of Radioactive Material
PRACTICE	Preparedness and Resilience Against CBRN Terrorism using Integrated Concepts and Equipment
RIMNET	The national radiation monitoring network and emergency response system (UK)
SOA	Service Orientated Architecture
STANAG	Standardization Agreement

STI	Science and Technology Information
TRL	Technology Readiness Level
WP	Work Package
XML	Extensible Markup Language

Appendix B – Sources and References

This section lists a number of sources of information which were used in the production of this document.

Source	Notes
Atlas OPS website http://ww.atlasops.com/	Information on Atlas OPS products
Bruhn Newtech website http://www.bruhn-newtech.com/homeland-security/products/	Information on CBRN products
CBRNIAC website https://www.cbrniac.apgea.army.mil/	Information services from CBRNIAC
NAOO website http://weather.noaa.gov/pub/data/observations/metar/stations/	Information on provision of METAR data
UK Met Office website http://www.metoffice.gov.uk/publicsector/cbrn http://www.metoffice.gov.uk/public/ddc/	Information on CBRN Incident Management Information on DataPoint