UEFISCDI INOVARE SI CREATIVITATE / MINISTERUL EDUCAŢIEI NAŢIONALE			Proiecte colaborative de cercetare aplicativă			
21	PN-II-PT-PCCA-2013-4-0262	SISTEM DE ALERTARE TIMPURIE SI ASISTARE COMPUTERIZATA A DECIZIILOR,BAZAT PE EVALUAREA ANTICIPATIVA A DINAMICII RAPIDE A VULNERABILITATILOR INDUSE IN TERITORIU DE OBIECTIVELE NUCLEARE	Vasile Dan	Vamanu	INSTITUTUL NATIONAL DE CERCETARE - DEZVOLTARE PENTRU FIZICA SI INGINERIE NUCLEARA " HORIA HULUBEI " - IFIN - HH	SIVECO ROMANIA SA; UNIVERSITATEA POLITEHNICA DIN BUCURESTI

Domeniul 8: Spaţiu şi securitate
Direcţia de cercetare 8.5. Sisteme şi infrastructura de securitate
Tematica de cercetare 8.5.3. Sisteme pentru asigurarea unui management eficient al situaţiilor de criză şi al intervenţiilor în cazul dezastrelor, sisteme de detecţie, prevenire şi alertă.
Aprobat: Ordinul MEN nr. 298/23.06.2014
Contract Nr. 298

SISTEM DE ALERTARE TIMPURIE SI ASISTARE COMPUTERIZATA A DECIZIILOR, BAZAT PE EVALUAREA ANTICIPATIVA A DINAMICII RAPIDE A VULNERABILITATILOR INDUSE IN TERITORIU DE OBIECTIVELE NUCLEARE

RAPORT FINAL

- Septembrie, 2017 -

Obiective prevazute/realizate;
Gradul de atingere a rezultatelor estimate;
Impactul rezultatelor obtinute

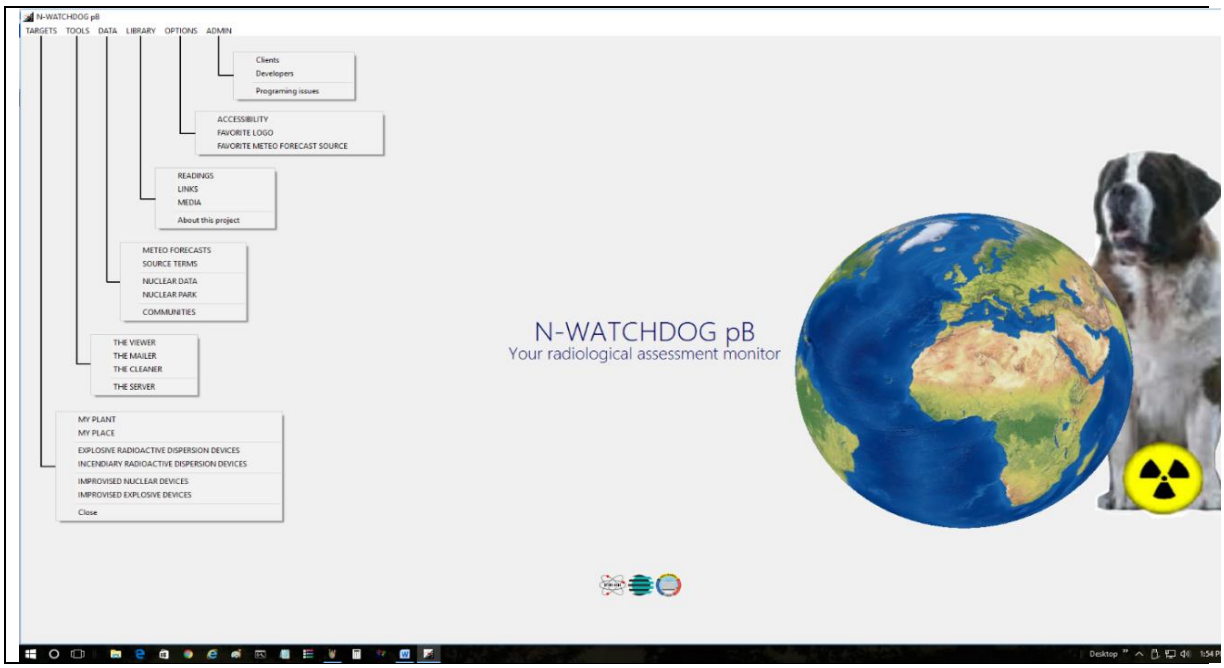
Institutul National de Cerecetare-Dezvoltare pentru Fizica si Inginerie Nucleara 'Horia Hulubei'

SIVECO

Universitatea Politehnica din Bucuresti

Introducere

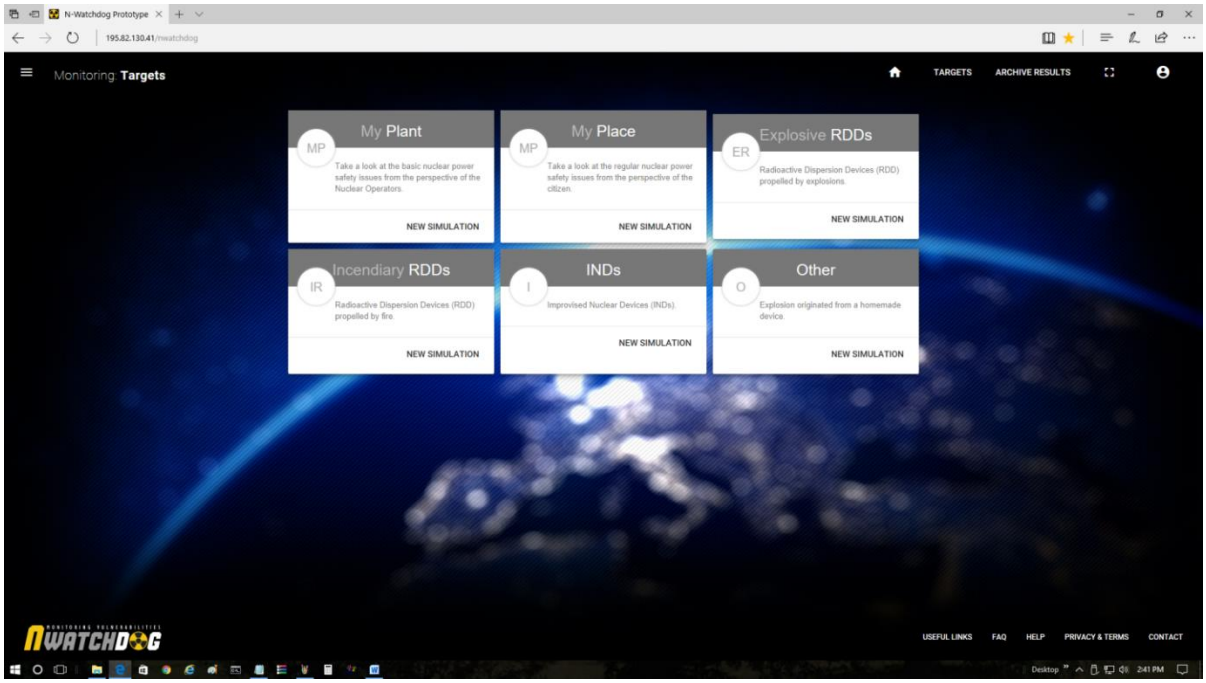
Proiectul a avut ca obiectiv realizarea unei metode si a unui instrument informatic de implementare a unui ansamblu multidisciplinar de soluţii practice, orientate spre nevoile utilizatorilor de monitorizare a vulnerabilităţilor induse de obiectivele nucleare în teritoriul înconjurător, starea populaţiei, mediu şi infrastructuri, având un pronunţat caracter preventiv bazat pe capacitate anticipativă şi de alertare timpurie.



N-WATCHDOG PoC, Demonstratorul de concept (*Proof of Concept*) - Dispecerul

In cadrul misiunilor specifice platformelor de asistare computerizata a analizei si deciziei in situatii de urgenta sistemul propune o abordare complementara, avand drept functiune centrala prognozarea cu o frecvenţă reglabilă (orară etc.), pe intervale de timp anticipate de 8 sau mai multe ore expunerea, impactul radiologic potenţial şi eventualele măsuri de reacţie necesare în zona apropiată de obiectivul nuclear (cca. 25 km) ca şi în zona depărtată (zeci sau sute kilometri), postulând emisii radioactive virtuale în atmosferă si calculand dispersia in teritoriu a acestora sub actiunea factorilor meteorologici, variabili pe intervalele de monitorizare; apoi articuleaza indicatorii obţinuţi în grade de expunere, impact si vulnerabilitate pe scale inteligibile pentru utilizatori si ofera rapoarte de sinteza partilor interesate.

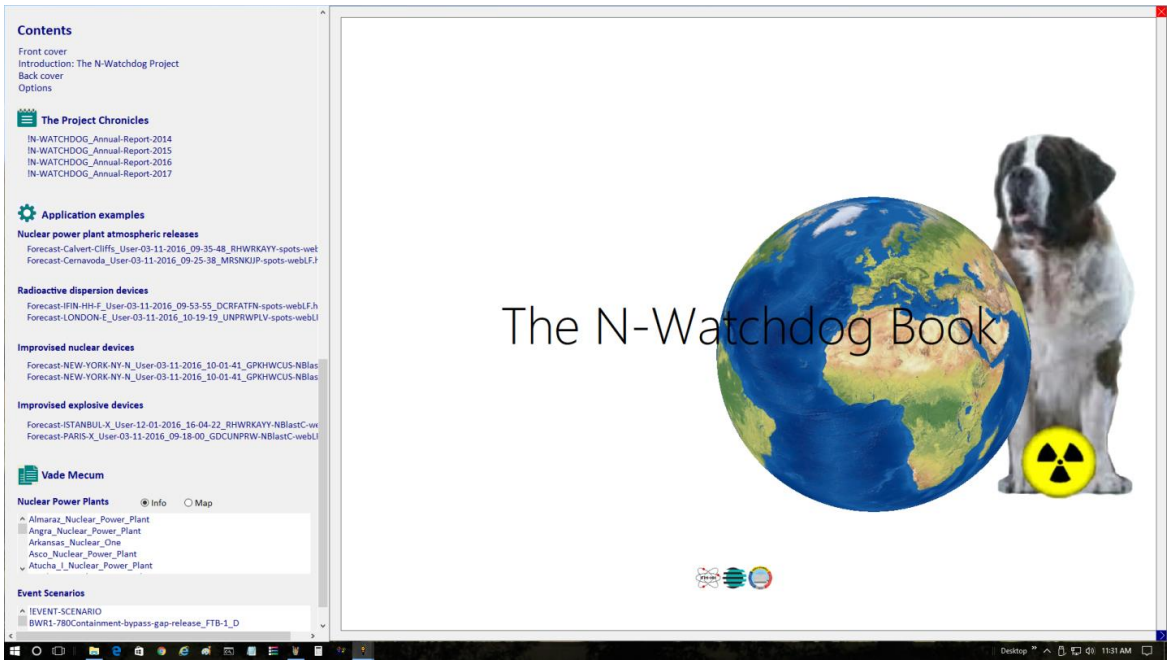
In context, s-a impus si necesitatea unor elemente inovative în materie de (a) *mentalitate*: acceptarea sistematica a posibilitatii reale a unor accidente severe dincolo de ‘baza de proiect', de evaluarea probabilista a riscului si de registrele de securitate operationala; (b) *ontologie*: accent pe dinamica rapida a vulnerabilitatilor în sincronie cu meteorologia zonala si alte variabile; (c) *servicii tematice*: o masina radiologica orientata spre spre evaluarea rapida de termeni sursa, dispersie sub meteorologie variabila in timp si spatiu; si diagnoza dozimetrica a fazei timpurii a urgentelor nucleare, cu identificarea contramasurilor recomandabile si a eventualelor efecte sanitare; in sprijinul acesteia - o masina meteorologica obtinand în timp real prognozele relevante din surse Internet publice; o masina geografica ce poate adresa *ad hoc* orice locatie de pe Planeta; (d) *proiectare software*: o combinatie de moduri de operare *standalone* si *online* ce confera sistemului siguranta in procurarea datelor si capacitati adecvate de comunicare; si (e) *operabilitate*: limitarea gradului de complexitate la 'nivelul suficient de necesitate' (*'the breakpoint of diminishing returns*').



N-WATCHDOG Ex, Modelul experimental - Dispecerul

In deplina cunostinta de legile, reglementarile si misiunea institutiilor nationale acreditate în domeniul pregatirii pentru situatii de urgenta si raspunsului la crize, sistemul propune o augmentare a capacitatilor curente cu noi abordari si solutii consonante cu termenii de referinta si bunele practici internationale, pe baze stiintifice valide asigurate de Fizica si Dinamica Fluidelor, Stiintele Mediului, Geografie, Stiintele Formale si Ingineria Informatica.

Dedicat nevoilor si specificului tarii, sistemul acorda, totodata, o deosebita atentie implicatiilor trans-frontaliere ale proceselor analizate, cautand cai posibile de armonizare si inter-operare cu platformele europene cu vocatie similara, urmarind consecvent consistenta cu politicile UE în materie (Directiva Consiliului, 96/29/EURATOM cu deciziile si reglementarile ulterioare).



N-WATCHDOG - cartea electronica interactiva.

In cadrul unui consortiu alcatuit dintr-un institut national de cercetare-dezvoltare, o importanta universitate politehnica si o proeminenta companie privata in domeniul IT, proiectul a urmarit dezvoltarea, pornind de la un Demonstrator de concept, a unui Model experimental software care, ulterior, poate evolua intr-un produs marketabil capabil sa ofere unei varietati de utilizatori – entitati de guvernanta si securitate, unitati de invatamant, ONG, foruri media - facilitati customizate interactive precum si/sau servicii analitice si de alertare timpurie in materie de impact al activitatilor nucleare, cu referire la orice locatie domestica sau planetara.

Prin calitati educationale derivand din resursele de cunostinte si date mobilizate, din capacitati de simulare si vizualizare ('*serious gaming*'), precum si cu sprijinul unei carti electronice cuprinzatoare si interactive, sistemul poate contribui si la cresterea nivelului de informare în materie al Societatii Civile, incurajand o viziune mai echilibrata asupra meritelor si riscurilor inerente ale Energiei Nucleare.

1. Obiective prevazute si realizate

Tabelul ce urmeaza rezuma obiectivele Proiectului.
Detalii - in Rapoartele de etapa, accesabile la adresele:

http://proiecte.nipne.ro/pn2/n-watchdog/rezultate/N-WATCHDOG_Annual-Report-2014.pdf
http://proiecte.nipne.ro/pn2/n-watchdog/rezultate/N-WATCHDOG_Annual-Report-2015.pdf
http://proiecte.nipne.ro/pn2/n-watchdog/rezultate/N-WATCHDOG_Annual-Report-2016.pdf
http://proiecte.nipne.ro/pn2/n-watchdog/rezultate/N-WATCHDOG_Annual-Report-2017.pdf

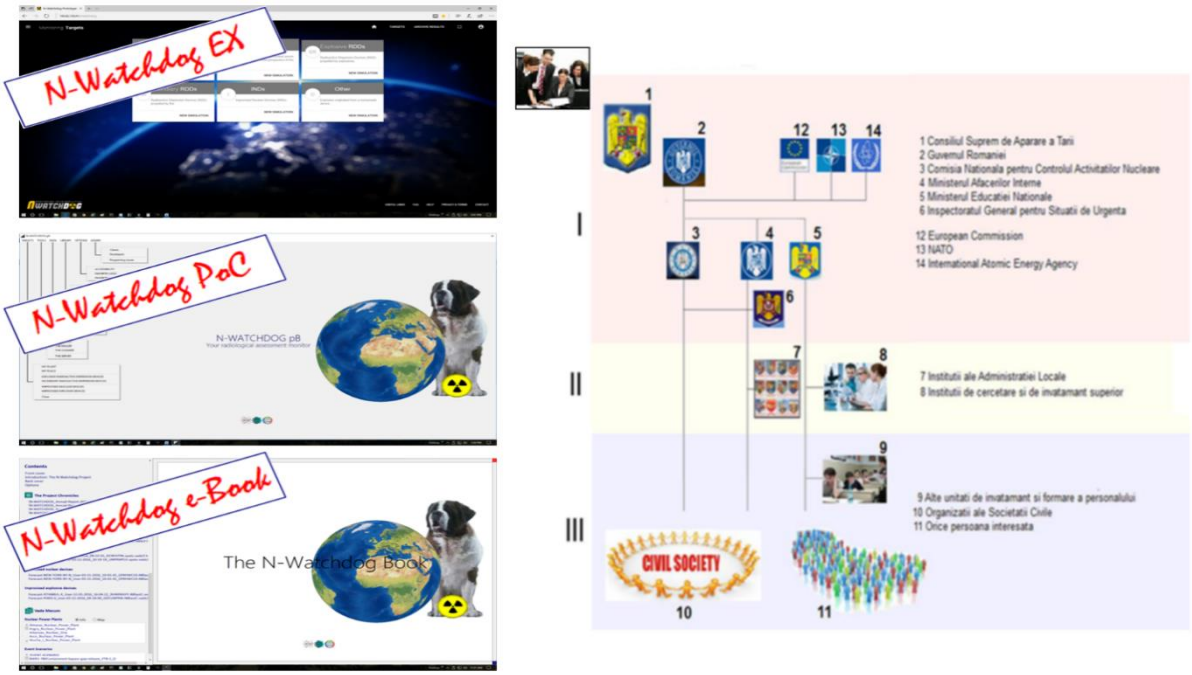
OBIECTIVE	Livrabile
I. Proiectarea Demonstratorului functional de concept N-WATCHDOG (PoC) - Documentarea cunostintelor de Fizica; a datelor si a modelelor specifice, adaptate proceselor PoC-executabile; si a bibliotecilor de date. Solutii de implementare IT. - Proiectul structurii modulare a PoC. - Analiza Sistemului Informatic (IT System Analysis)	- Baza de cunostinte, modelele, cerintele de date, solutii de implementare IT (Raport tehnic, IFIN-HH). - Proiectul Demonstratorului de fezabilitate (PoC) (Raport tehnic, IFIN-HH) - Raport de analiza a Sistemului Informatic (Raport tehnic, SIVECO, UPB) - Demonstratorul functional al conceptului N-WATCHDOG (PoC) Partea I: N- WATCHDOG Light (IFIN-HH)
II. Dezvoltarea software si implementarea Demonstratorului N-WATCHDOG (PoC) - Dezvoltarea software si implementarea structurii modulare a Demonstratorului N-WATCHDOG si a inventarelor de date structurate - Sistemului Informatic N-WATCHDOG in perspectiva Modelului Experimental (EM), folosind solutii algoritmice sau alternative	- Demonstratorul functional al conceptului N-WATCHDOG (PoC), Partea a II-a : Platforma integrala de referinta (IFIN-HH). - Software, subsisteme educationale pentru asigurarea tranzitiei de la PoC la livrabilul final N-WATCHDOG, Model Experimental (EM) (Raport tehnic, SIVECO, UPB)

- Diseminarea rezultatelor N-WATCHDOG către comunitatea ştiinţifică şi către publicul larg - Proiectarea Suportului Decizional al N-WATCHDOG EM, Partea I	- Termeni de referinta si repere tehnice ale asimilarii PoC in EM (Raport tehnic, UPB). - Articole si lucrari stiintifice (Raport de diseminare, UPB)
III. Testarea in-house si evaluarea Demonstratorului N-WATCHDOG . Dezvoltarea Modelului experimental N-WATCHDOG(EM), PARTEA I - Proiectarea Suportului Decizional al N-WATCHDOG EM, Partea a II-a - Testare PoC in cadrul partenerilor Proiectului - Integrarea feedback-ului si finalizarea unei versiuni de referinta PoC pentru a servi la specificatiile produsului final EM si la dezvoltare, Partea I - Dezvoltarea modelului experimental N-WATCHDOG, Partea I	- Suport decizional pentru asigurarea tranzitiei de la PoC la livrabilul final N-WATCHDOG, Model experimental (EM) (Raport tehnic, UPB) Partea a II-a - Raport de evaluare privind testarea Demonstratorului de concept N-WATCHDOG PoC (Raport tehnic, UPB) - Versiunea de referinta post-testare, a Demonstratorului N-WATCHDOG PoC (IFIN-HH, SIVECO) -Platforma N-WATCHDOG, Model Experimental , EM (SIVECO), PARTEA I - Proiectarea si realizarea intefetei de comanda a platformei, asimilarea si instalarea resurselor de date.
IV. Dezvoltarea, testarea si livrarea Modelului experimental N-WATCHDOG EM. - Integrarea feedbackului si finalizarea unei versiuni de referinta PoC pentru a servi la specificatiile produsului final EM si la dezvoltare, Partea a II-a - Dezvoltarea si implementarea modelului experimental N-WATCHDOG, Partea a II-a - Definirea si testarea scenariilor de simulare a situatiilor de criza - Importanta implementarii N-WATCHDOG pentru diverse entitati si potentiale beneficii - Diseminarea rezultatelor N-WATCHDOG către comunitatea ştiinţifică şi către potenţialii beneficiari	- Platforma N-WATCHDOG, Model Experimental , EM (SIVECO), PARTEA II - realizarea si integrarea in platforma a modulelor executabile ale aplicatiilor, testarea si finalizarea produsului. - Scenarii de test pentru simularea situatiilor de criza (IFIN-HH, UPB). - Raport cu privire la functionalitatile sistemului N-WATCHDOG si la potentialele beneficii ale implementarii unui astfel de sistem (Raport tehnic SIVECO) - N-WATCHDOG e-Book (IFIN-HH, UPB)

In rezumat, proiectul a promis si realizat trei produse cu functiuni interne diferite, dar de utilitate comparabila in relatia cu stakeholderii si beneficiarii potentiali:

- ✓ ***Un Demonstrator de concept*** (*Proof of Concept* - PoC) menit sa piloteze pana la finalizare dezvoltarea Modelului Experimental (EX), dar si produs de portofoliu al Coordonatorului, IFIN-HH, in perspectiva post-Proiect;
- ✓ ***Modelul Experimental*** insusi - reper de destinatie al Proiectului, dar si produs de portofoliu si perspectiva al business-partenerului SIVECO; si
- ✓ ***O carte electronica*** - *N-Watchdog e-Book*, servind nevoia de organizare concluziva a volumului de cunostinte si unelte de aplicatie realizate, dar si nevoile de diseminare si promovare a produselor, precum si ca instrument de informare si instruire nemijlocita.

Astfel privit, N-WATCHDOG trebuie a fi inteles *ca un concept de 'problem solver'* (sistem de solutionare a problemelor), operationalizat in diferite expresii folositoare.



Conceptul N-WATCHDOG - produsele si stakeholderii/beneficiarii potentiali.

2. Gradul de atingere a rezultatelor estimate

Realizatorii apreciaza ca toate obiectivele, impreuna cu livrabilele asociate au fost realizate la nivelul termenilor de referinta prevazuti. Atat modelul experimental cat si demonstratorul de concept implementeaza un set de aplicatii acoperitor pentru misiunea asumata prin Proiect, distribuite intre patru module executive.

N-WATCHDOG, Termeni de referinta

Solutiile alese pentru punerea in opera a conceptului vor avea in vedere urmatoarele cerinte, frecvent formulate de actorii institutionali si personalul de specialitate din domeniul securitatii nucleare, pregatirii pentru situatii de urgenta si administrarii raspunsului la crize:

Sa se constitue intr-o trusa de instrumente minimalista, capabila insa de o acoperire cuprinzatoare a nevoilor unei analize extinse dincolo de limitele conventionale ale evaluarii radiologice, la evaluarea anticipativa a vulnerabilitatilor induse în populatie, comunitati si valori materiale, sociale, strategice.

Sa prezinte o functionalitate orientata spre anticipare, oferind prognoze de situatie în mod '24/7' pe diferite durate, în mod orar sau mai frecvent.

Sa realizeze o structura operativa unitara si coerenta, articuland termeni-sursa – amestecuri de nuclizi si parametri de emisie, cu modele de dispersie în 'vecinatatea apropiata' ca si în 'vecinatatea indepartata' (Near/*Far-Field*) a surselor de emisie radioactiva, utilizand modele potrivite situatiilor.

Sa poata adresa, practic, orice sursa fixa sau incidentala de emisie radioactiva de pe Glob, asigurand generarea expeditiva de harti din resurse digitale (DEM) asimilate si date GIS rezidente, eliminand nevoia stocarii masive si, inerent, incomplete, de material cartografic ante-preparat.

Sa poata procura prompt prognozele meteorologice necesare modelelor de advectie-difuzie atmosferica, de pe site-uri Internet publice de profil.

Sa poata lucra independent de opinia/implicarea agentului poluant (*'Polluter-unbiased mode*'), folosind termeni sursa postulati, scalabili, acceptati in literatura; sau inferand termeni sursa din informatii sumare, indirecte privind starea centralei (*plant status*); sa poata, totodata, utiliza si termeni sursa specificati de managementul facilitatii nucleare - in situatiile in care acestia sunt disponibili (*'Polluter-biased mode*').

Sa poata acomoda scenarii de eveniment alternative (*'what if' scenarios*) pentru aceleasi prognoze meteorologice din rezerva stocata si de a trata emisii multiple din diverse surse, sau provenind din diferite episoade de emisie ale aceleiasi surse.

Sa asigure versatilitate in functionare, prin rularea modelisticii si resurselor de vizualizare în mod *standalone* (pe *desktop*), urmata de comutarea sistemului în mod *web-server* si publicarea rezultatelor asamblate in Rapoarte de situatie ('SitRep'), incluzand bilanturi Input/Output comp

Sa asigure robustete operationala, prin stocarea de prognoze meteo în perioade de disponibilitate Internet si efectuarea de evaluari chiar si atunci can

Sa ofere o interfata-utilizator prietenoasa, inteligibila si flexibila, cu toate elementele de input si rezultatele intermediatre ale fazelor executiei secvential acumulate, permanent 'la vedere'. *(user-friendly*).

Sa dispuna de o consistenta baza de resurse rezidente asigurand independenta in functionare si siguranta disponibilitatii serviciilor, incluzand harti digitale de elevatie (DEM); date GIS; librarii de date fizice, date de reglemetare si cunostinte specifice.

Sa sprijine utilizatorii printr-o 'Biblioteca virtuala', conceputa ca o selectie actualizabila de documentatie, rezidenta si *online*, de insemnatate speciala în administrarea situatiilor de urgenta nucleara.

Sa prezinte o evidenta si efectiva dimensiune educationala, adresand atat *stakeholderii* domeniului Securitate Nucleara si Sustenabilitate Energetica, cat si diversele medii socio-profesionale interesate.

De remarcat faptul ca, in intentia originala aprobata in anul de inceput al Proiectului (2014), N-WATCHDOG se limita doar la problematica centralelor nucleare si a dispozitivelor de dispersie a radioactivitatii. Cu incepere din anul 2015 insa, evolutiile internationale ce au adus in prim-planul atentiei chestiunea terorismului nuclear ca posibilitate reala au determinat realizatorii proiectului sa introduca si sectiunea dedicata bombelor atomice improvizate (*Improvised Nuclear Devices - IND*) precum si - datorita unor elemente de similitudine intre modelele fizice implicate - si chestiunea dispozitivelor explozive conventionale improvizate.
In continuare se prezinta scurte introduceri in vocatia modulelor, in forma in care acestea apar in versiuni ale aplicatiilor realizate.

My Plant

MY PLANT commits Watchdog to look at the regular nuclear power safety issues from the perspective of the Nuclear Operators; the Regulators; the Emergency Responders; and the Governance, overall. These actors would seek to determine to what extent the risks posed and the vulnerabilities induced by nuclear facilities may affect their operational conduct; safety policies; consequent investments; and political stand. From a Watchdogging perspective, this is to look 24/7 at WHERE the radioactive emissions of the facilities go; forecast their area of influence; give a quantitative expression to the potential effects in terms of territory and people exposed; assess whether or not these are consequential and warrant alert and/or response.

Analysts may choose between:
- A SINGLE, USER-ASSISTED ASSESSMENT of the area of influence of a nuclear facility, selected from the 186 nuclear power plants worldwide covered by the code; or
- A 24/7 WATCH OF A PLANT's AREA OF INFLUENCE, cycling the assessment in an unassisted, automatic fashion, on an initial User input and timing.

My Place

MY PLACE commits Watchdog to look at the regular nuclear power safety issues from the perspective of the of the citizen. It addresses the 'Little Me' - the ordinary people who have lived through, or only heard about Three Mile Island, Chernobyl, Fukushima fearing for their lives, well-being and future.
For these, Watchdogging would be like KNOWING around the clock whether going with their lives and business at certain places make them vulnerable to the long arm of the nuclear facilities spotting a good share of the Globe. In other words, having available a Personal N-Watcher as a foretelling gadget, of sorts.

The code places its results in a comparative perspective: scalable exposure from nuclear facilities defaulted on normal operation vs. exposure from a normal daily life, leaving to everyone the interpretation of the findings.

RDDs*

INCLUDING 'BLACK SWANS', i.e. low-probability-high consequence disruptive events in the list of Nuclear Safety concerns is central to the new paradigm initiated in the aftermath of the Chernobyl accident (1986), further aggravated by the Fukushima event (2011); and highlighted by the prospects of nuclear terrorism looming ahead. On this line, the code addresses the explosive and incendiary Radioactive Dispersion Devices (RDD), deemed by the International Atomic Energy Agency as being, potentially, 'extremely harmful', so that 'the reduction of the threat of radiological weapon attack by terrorist groups (...) is one of the priority tasks of the IAEA.'

Both explosive and incendiary RDD events need special models warranting a separate treatment.

* Radioactive Dispersion Device

INDs*

THIS APPLICATION ADDRESSES AN ISSUE for a long time deemed on the verge of the unthinkable. It dwells on what became known as 'Improvised Nuclear Devices (IND)' - a euphemism for a backyard-built atomic bomb. To quote a knowledgeable source, 'The unthinkable is probably inevitable. At some time in the future a terrorist group will detonate a nuclear explosive in a major metropolitan area.(...) Terrorist possession of a nuclear weapon will result in its use against a 'highest-value' target –
most likely a large city with major economic value, cultural and/or religious significance, and a dense population
in which high casualties will result [Harney R.C.(2009)].

Drawing upon such references, the code offers a minimalistic abacus to assess effects on communities of nuclear blasts of, mainly, IND-grade.

* Improvised Nuclear Device

IEDs*

THE NOTION OF A WORLD AT THE MERCY OF TERRORISM - unimaginable before 9/11 - became an issue to contemplate ever since and jumped to the frontline of virtually all agendas after the fateful year 2015 booking carnages from Paris to Africa and the Far East.

According to the Interpol, 'Europe is currently facing the most significant terrorist threat in over 10 years. The Paris attacks on 13 November 2015 indicate a shift towards a clear international dimension of Islamic State to carry out special forces style attacks in the international environment. This and the growing number of foreign fighters are posing new challenges for EU Member States. The threat of further terrorist attacks in Europe remains high. Therefore there is a great need within the European Union to strengthen our response to terror, to suspected terrorist networks and foreign fighters, and have an improved strategic understanding of threats. [Europols European Counter Terrorism Centre, https://www.europol.europa.eu/].

Drawing upon such references, in mind with the relative similarity of the models involved, and looking at the current taxonomy of the terror hits targeting communities, the code offers a minimalistic abacus to assess effects on structures and people, of ordinary (chemical) blasts.

Listing this under 'OTHER' would also hint to authors' intention to look beyond the project of origin and keep a code section open to, perhaps, additional applications addressing the safety and security of the citizen, as the need may occur.

* Improvised Explosive Device

Modulele executive ale platformelor sunt servite de o serie de utilitati si resurse de date fizice, precum si de un sistem generic de informatii geografice ce poate fi customizat in raport cu preferinte ale utilizatorilor. Intre utilitati un rol esential il indeplinesc *motoarele de achizitie si pre-procesare de prognoze meteorologice* din resurse web publice; si *motorul de generare a termenilor sursa* ai emisiilor radioactive din instalatii nucleare:

DATA ENGINES

THE METEO FORECASTS MANAGER governs the relationship and file traffic between the three forecast repositories of the code: (1) the Work Forecast Folder feeding the code assessment engines; (2) the Forecasts Store designed to timely amass a reserve of relevant forecasts while the code is idle in regard with its basic missions; and (3) the Forecasts Vault working as a backup for the Store.

Manager's chief function is to draw upon publicly-open web sites in order to obtain weather forecasts over time-windows spanning 8 to 72 hours of relevant data for the area of influence of nuclear power plants. In so doing, it demonstrates one basic conduct by the N-WATCHDOG system, which consists in building up a reserve of prognostic data at such times when Internet services are locally available, to have data ready for use as input for the system's apps even when the web is, for various reasons, unavailable, including and especially under emergency.

The Manager also provides for viewing forecast files; moving files between the work, store and vault folders; and clearing the folders at user's will.

THE SOURCE TERM UTILITY addresses the front end of a radiological assessment. The notion itself covers two issues: (a) the nuclide mix assumed to escape from the defense-in-depth barriers containing the radioactivity in a nuclear/radiological facility or device; and (b) data of critical importance featuring the radioactivity ejection out into the environment, generally boiling down to a 'plume, or cloud rise'.

Users should get acquainted with the subject matter (module's Help), then try their hand in devising source terms themselves.

DATA NUCLEAR DATA FOR ITS PURPOSES, N-WATCHDOG handles 157 nuclides, most of which fission products of nuclear reactors, each characterized by 62 features of relevance in assessing their health and environmental impact in either normal, or abnormal operation of a nuclear facility. The respective library holds also comprehensive knolwledge elements that are of prime consequence in a nuclear or radiological emergency, derived from authoritative sources resting with national regulatory bodies and the International Atomic Energy Agency. While the nuclear data library is constantly called upon in different phases of an assessment, this utility allows an independent, off-session access to such material, a fact which is thought conducive to experts' memory refreshing on the one side; and the familiarization of 'laymen'-stackeholders with the stuff at the origin of Nuclear Safety concerns, on the other side. Visiting this section is recommended.	NUCLEAR PARK THIS WIDGET provides factual and geographic information on 186 nuclear power plants - in operation, on cold halt, in decommissioning, or decommissioned already - covered by N-Watchdog. While the factual material is resident, thus being always available, the maps - to be obtained from widget's menu - will get in display only if you are online. Try it - to assess a plant one should first know several things about it, among which the type of reactor and the power installed...

COMMUNITIES THE STATIC VULNERABILITY ASSESSOR determines the slow-varying component of the vulnerability presented by a community falling in the area of influence of a nuclear facility, as determined on a running time basis by N-WATCHDOG. An aggregated Static Vulnerability Index (SVI) is evaluated in relation with a number of variables reflective of the demography, infrastructure, economics, social and strategic aspects featuring the community, as well as of the local Administration's capability to limit/mitigate effects of an actual exposure to radiations. In conjunction with the Dynamic Vulnerability Index (DVI) - a quantity derived from the radiological exposure of communities to the effects of radioactive releases, SVI articulates the Vulnerability Matrix of the case assessed. In its graphic expression, the matrix locates every community in the XY plane underlied by SVI in the abscissa and DVI on the coordinate axis - both conveniently normalized on a 0-100 adimensional scale. Such synthetic and synoptic information is believed to be of assistance in (a) dispatching repsonse resources in case of emergencies; and (b) building up statistics on the vulnerability of communities in the area of influence of nuclear facilities.

Importante pentru functionalitatea plateformei software sunt si instrumentele de vizualizare, de management al fisierelor si de comunicare, descrise pe scurt in continuare.

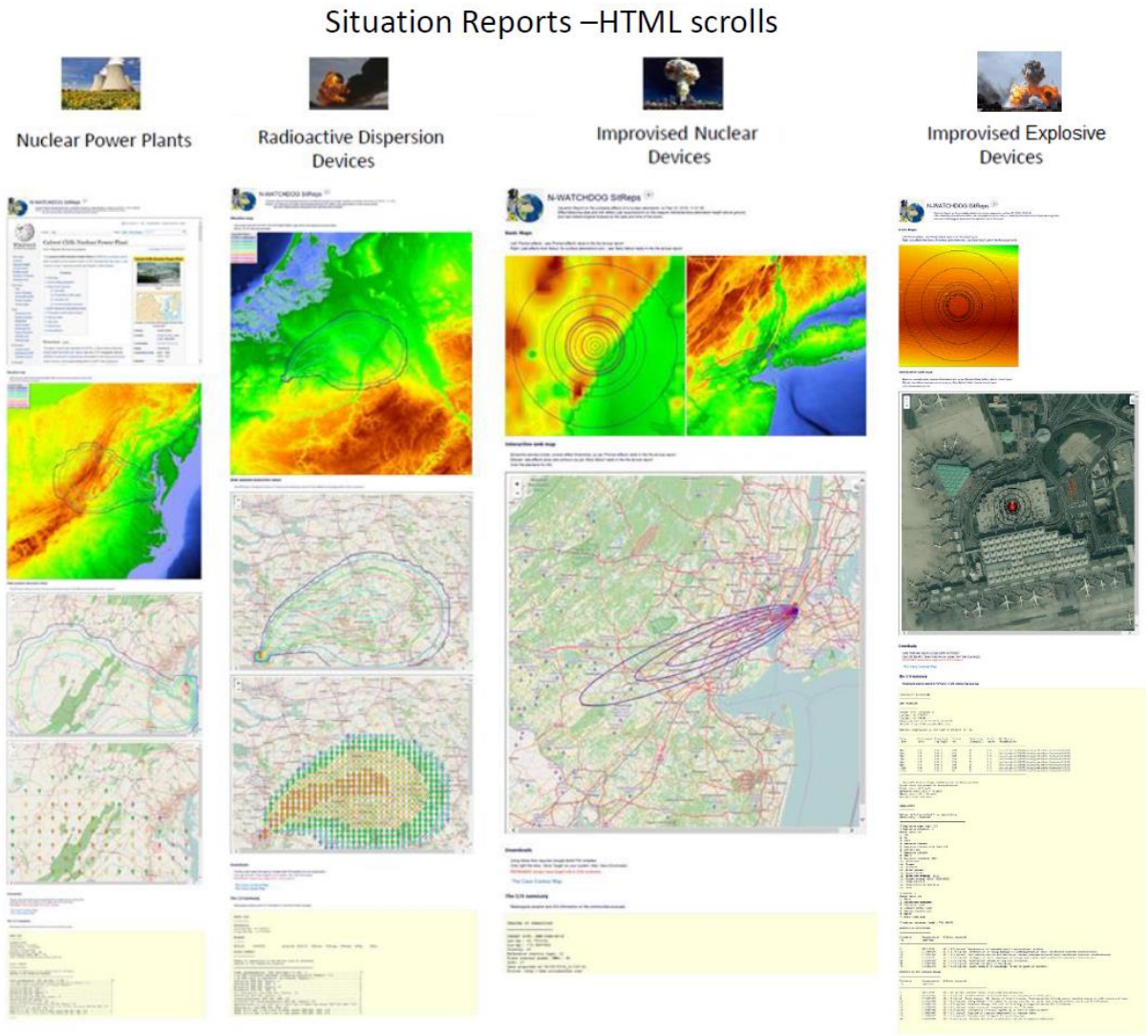
O biblioteca *run-time* oferind lecturi de referinta in domeniu ('*Readings*'), directionari utile ('*Links*') si unele piese video documentare ('*Media*') agrementeaza ambianta de lucru.

TOOLS: viewing, file management, communications

THE VIEWER offers a panoramic desktop perspective of the code application results currently in store - all executive modules considered. Every case is featured by all output expressions that the User encounters throughout the code runs. These include: - Textual content reflective of numerical data an descriptive information; - Desktop maps holding dose contours and grids overlayed on topographic maps generated from resident DEM resources and GIS librariries, rendered via MS Windows API GUI and the OpenGL technology. Always available because independent on the Internet; - Browser-based dose contours and grids overlayed on canvases offered by web mapping services, such as OpenStreets, Thunderforest, ESRI, rendered via the Leaflet technology. - 'World' 3D perspectives over output contours, grids and overlays, via Google Earth or ESRI's ArcGIS EARTH. Consulting the archive is especially recommended for training introductory sessions and also for giving potential clients exploratory tours over the Watchdog capabilities and informative power.	THE MAILER is intended as a workaround for delivering N-Watchdog output to authorized Clients of the code services in case the networks and/or the Internet is not available. When called, the code will zip in a single file the entire batch of files pertaining to a selected case of interest to the Client, deposit it in the OUTBOX folder of the platform and keep it ready for delivery by whatever means appropriate (media courier etc.). Of course, the zip file can also be e-mailed as soon as the web access is restored. The OUTBOX folder may also be seen as a space for keeping a compressed archive for your work.
THE CLEANER offers to delete cases (i.e. the entire batch of files pertaining to them) from the platform, to ease the hard disk load. Once deleted, the cases (files) are irretrievable. TO BE USED WITH CAUTION!	THE SERVER is your gateway to the remote authorized N-Watchdog Clients of the code services, not having the code on their desktops. The platform-embedded facility conveys case Situation Reports only. The Clients will access the SitReps on their browsers via a specific URL tagged with server's IP, which would work as an equivalent of a password. On servers featuring dynamic IPs, the current URL will have to be made known to Clients whenever the serving system is switched on. Operators working on static IP systems will update Clients only in the event that the IP is changed. Valid Client browser should support WEBGL. Currently convenient are MS Edge, IE 11, Chrome, Firefox, Opera.

LIBRARY

READINGS THIS WIDGET includes a body of information believed to be supportive in understanding the N-WATCHODOG philosophy; scope; history; and the Law and Science behid the code.
LINKS THIS WIDGET directs the Users to a series of actors and contributors of relevance within the N-WATCHDOG scope.
MEDIA THIS WIDGET is for Users' intellectual entertainment. Find time to sit back, see and listen - it may help you to forge yourself a personal AND INFORMED opinion on the issues.



Colaj ilustrand modulele executive ale platformelor conceptului N-WATCHDOG:
N-WATCHDOG PoC si N-WATCHDOG-EX.

3. Impactul rezultatelor obtinute

Conceptul N-WATCHDOG in diferitele sale expresii s-a dovedit, pe parcursul Proiectului, efectiv in cateva directii apreciate de autori drept importante.

Instrumente de productie

Demonstratorul de concept realizat de IFIN-HH si testat *in extenso* de partenerii UPB si SIVECO a fost consacrat, sub denumirea N-WATCHDOG pB ca instrument de lucru permanent al Departamentului de Fizica Vietii si Mediului al institutului, in indeplinirea misiunilor privind supravegherea radiologica a mediului si ca sistem suport de analiza si decizie in situatii de accident nuclear sau urgenta radiologica. Platforma va functiona ca produs

in continua dezvoltare, in regim *'perpetual beta*' (pB), avand in vedere resurse ale Programului-nucleu.

Pentru viitorul apropiat se preconizeaza:

(a) realizarea unei versiuni *short-hand* bazata pe modulul *'My Plant'*, operata complet pe un server dedicat; si

(b) diversificarea versiunilor N-WATCHDOG *e-Book* prin realizarea unei versiuni complete HTML (plus dependente) de uz direct pe browsere ale clientilor, precum si a unei adaptari pentru operarea pe un server propriu, dedicat.

Resurse de portofoliu

A fost intotdeauna intelegerea implicita a partenerilor ca, atat N-WATCHDOG pB cat si N-WATCHDOG EX vor fi tratate ca resurse de portofoliu pentru activitati viitoare ale dezvoltatorilor respectivi. In acest sens, conform profilului sau de activitate, IFIN-HH se va axa pe identificarea posibilitatilor de accesare a unor proiecte in competitiile nationale si internationale - primii pasi fiind intreprinsi la data curenta (septembrie, 2017) in call-urile PNCDI III - 'Proiecte complexe realizate in consortii CDI - PCCDI' si 'Solutii'.

Orientarile SIVECO S.A. sunt reflectate in sectiunea 4.4. *Importanta implementarii N-WATCHDOG pentru diverse entitati si potentiale beneficii* a raportului Etapei a IV-a a Proiectului.

Vizibilitate

Participantii apreciaza ca activitatea desfasurata pe parcursul Proiectului a adus o contributie semnificativa la cresterea vizibilitatii expertizei nationale in literatura si comunicarea academica domestica si internationala de profil. Un aport deosebit in aceasta privinta l-a adus echipa Universitatii Politehnica din Bucuresti, ce s-a distins atat printr-o prezenta activa in publicatiile de specialitate, cat si prin frecventa si calitatea manifestarilor stiintifice cu participare internationala pe care le-a organizat si gazduit.

Un impact direct si permanent este de asteptat din partea subsistemului educational *N-WatchDogWiki*, (http://nwatchwiki.aii.pub.ro/tiki-index.php) - un wiki semantic pentru educarea publicului larg cu privire la vulnerabilitatile induse in teritoriu de obiectivele nucleare.

eLSE

INTERNATIONAL SCIENTIFIC CONFERENCE
eLearning and Software for Education

Bucharest

April 21st - 22nd 2016

The purpose of the annual international scientific conference on "eLearning and software for education" is to enable the academia, research and corporate entities to boost the potential of the technology enhanced learning environments, by providing a forum for exchange of ideas, research outcomes, business case and technical achievements.

eLSE 2016
Register

Supporting Organizations

Media Partners

Nuclear Security Summit 2016
March 31 April 1, 2016, Washington D.C., U.S.A.

PROJECT N-WATCHDOG

SERVING AN EMERGING PARADIGM
IN NUCLEAR SAFETY PERCEPTION AND PRACTICE

N-WATCHDOG is a cooperative R&D endeavor undertaken by Horia Hulubei National Institute of Physics and Nuclear Engineering IFIN-HH, Bucharest; SC SIVECO Romania SA; and the University Politehnica of Bucharest, within PNCDI-II - The Research, Development and Innovation National Plan II, Program Partnerships in Priority-Domains, Collaborative Projects of Applied Research, under the monitoring and financing by The Executive Unit for Financing the Higher-Education, Research, Development and Innovation System - Contract No.298/2014.

The goal of the project is to create a coherent, multidisciplinary, stakeholder-oriented and practical software platform for monitoring vulnerabilities induced in people, natural environment, infrastructure and assets by nuclear facilities and events, with a pronounced preoccupation for precautionary, anticipatory assessment and early warning. The product will take the solution sought from a Proof of Concept (PoC) to an Experimental Model (EM) seen as the final deliverable of the Project and feeding prospects of marketability beyond.

Horia Hulubei National Institute of Physics and Nuclear Engineering, Bucharest, Romania

De notat este si prezenta unei contributii a Proiectului la *Nuclear Security Summit*, 31 Martie-1 Aprilie, Washington D.C., ca semnal de angajare a cercetarii nationale intr-o noua zona sensibila a dezbaterii tehno-politice a zilelor noastre, dominata de problematica vulnerabilitatii infrastructurilor, a amenintarilor la adresa securitatii cetateanului si a societatii.

Concluzie

Instrument de productie, resursa de portofoliu cu perspective de dezvoltare si valorificare, agent de sporire a vizibilitatii, mediu de informare si instruire – sunt calitati care, impreuna, *pot desemna conceptul N-WATCHDOG insusi drept cea mai semnificativa realizare a Proiectului*.

In incheierea acestui raport concluziv, participantii la Proiect tin sa exprime apreciere fata de initiativa 'Proiecte colaborative de cercetare aplicativa' ce s-a dovedit inspirata si eficienta, reunind competente diferite dar complementare intr-o sinergie al carei nivel de productivitate si performanta ar fi fost altfel greu de atins. Totodata, adresam multumiri Unitatii Executive pentru Finantarea Invatamantului Superior, a Cercetarii Dezvoltarii si Inovarii pentru administrarea competenta a intrgului demers PCCA si consilierea acordata participantilor.

ANEXA: Proiectul N-WATCHDOG, 2014-2017 Publicatii, comunicare

Etapa I, 2014

A.D. Ionita, A. Olteanu, *Data Acquisition, Processing and Visualization for Early Warning Information Systems*, IEEE International Symposium on Fundamentals of Electrical Engineering 2014 (ISFEE 2014), November 28-29, 2014, DOI: 10.1109/ISFEE.2014.7050608, INSPEC Accession Number: 14949343.

A.D. Ionita, A. Olteanu, *Domain specific models, knowledge and tools to support multiple learning styles for engineering students*, Revue Roumaine des Sciences Techniques – Série Electrotechnique et Energétique, Volume: 59, Issue: 4, 2014, Pages: 423-432, WOS:000346950200009.

Vamanu D.V., Slavnicu D.S., Vamanu B.I., V.T., Acasandrei and Gheorghiu D. *Safety risks in spent nuclear fuel air transportation - a 'black swan' anatomy*. Romanian Reports in Physics, Volume 66, No. 2, 2014

Vamanu D.V., Acasandrei V.T., and Vamanu B.I. *Safety risks in spent nuclear fuel road transportation: 'black swans' by malicious intent*. Romanian Reports in Physics, Volume 66, No. 3, 2014

Vamanu B.I. and Acasandrei V.T. *Terms of reference for assessing nuclear and chemical emergencies in view of preparedness and response – an outlook*. Rom. Journ. Phys., vol. 59, nos. 9–10, p. 952–975, 2014.

Calida B.Y., Gheorghe A.V., Unal R., Vamanu D.V., and Radu C.V. *Complexity-Induced Vulnerability Assessment: How Resilient are Our Academic Programs?* In Infranomics - Sustainability, Engineering Design and Governance. A.V. Gheorghe, M. Masera, P. F. Katina Editors. ISBN: 978-3-319-02492-9 (Print), 978-3-319-02493-6 (Online). *Topics in Safety, Risk, Reliability and Quality, Volume* 24, pp 377-393, 2014.

Vamanu D.V. and Acasandrei V.T., Vamanu B. I. *A preliminary in-house assessment of the public exposure to atmospheric radioactive discharges from ELI operations*. IFIN-HH Internal Technical Report, Aprilie, 2014.

Etapa II, 2015

A.D. Ionita, M. Mocanu**,** *Multiple Modeling Paradigms Applied for Accidental Pollution Management*, Environmental Engineering and Management Journal, issue 9 Volume 14, 2015, Pages: 2051-2060.

A.D. Ionita, A. Olteanu, A. Budu, D. Moraru, I. Prisecaru, *Models and Technologies for Making Aspects of the Dosimetry Education Accessible to Non-Specialists*, The 11th International Scientific Conference eLearning and Software for Education Bucharest, April 23-24, 2015 10.12753/2066-026X-15-053.

A.D. Ionita**,** A. Gurau, *Visual Modeling Environment for Sensor Networks, ISEF 2015 - XVII International Symposium on Electromagnetic Fields in Mechatronics*, Electrical and Electronic Engineering, Valencia, Spain, September 10-12, 2015, ISBN: 978-84-606-9102-0.

D. Dupleac**,** M. Mladin, I.Prisecaru, D.E. Moraru**,** *Overview of the SCDAPSIM/RELAP5 Studies performed at Politehnica University of Bucharest on the CANDU 6 Accident Analysis*, 7th International Conference on Energy and Environment CIEM 2015 Conference Proceedings, 22-23 octombrie 2015, Iasi, Romania.

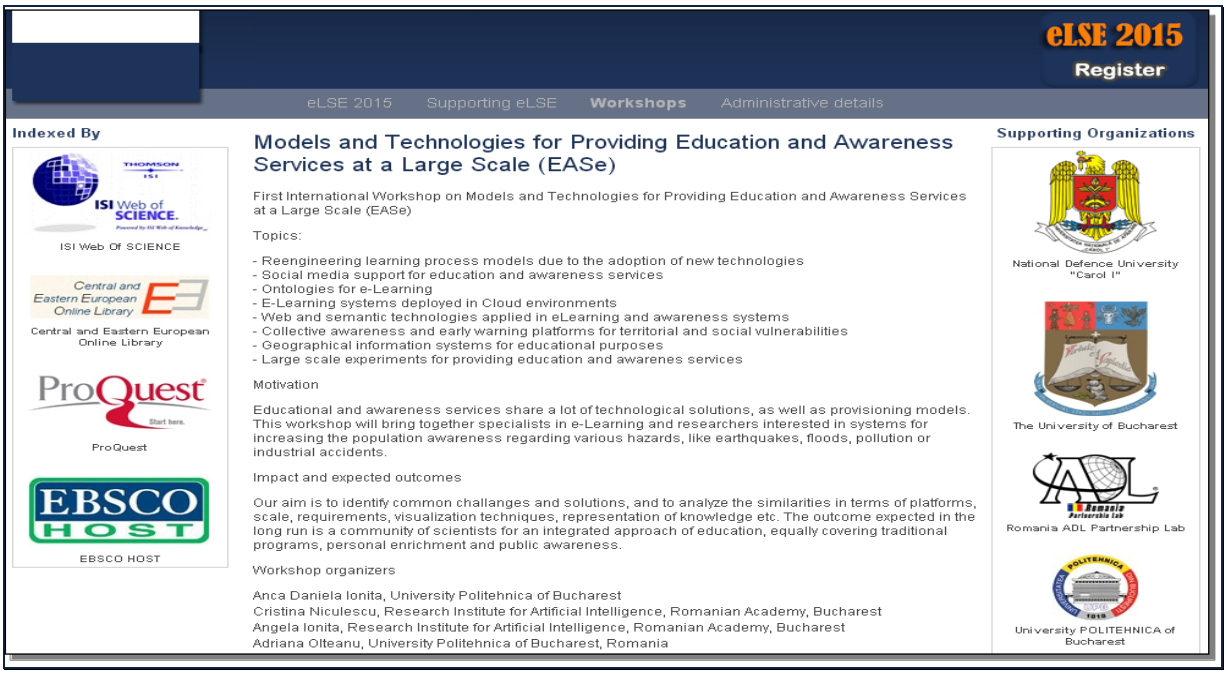
A. D. Ionita, M. Mocanu, *Models of Organizational Change for Modernizing Pollution Warning Services*, In IAENG Transactions on Engineering Sciences: Special Issue for the International Association of Engineers Conferences 2014, Edited by: Sio-Iong Ao, Alan Hoi-Shou Chan, Hideki Katagiri, Li Xu, World Scientific, 2015, ISBN: 978-981-4667-35-7 (hardcover), ISBN: 978-981-4667-37-1 (ebook), pp. 498-510, DOI: 10.1142/9789814667364_0037.

Vamanu D.V. and Acasandrei V.T. *An in-house assessment of the public exposure to cumulated atmospheric radioactive discharges from ELI-NP and IFIN-HH facilities*. IFIN-HH Internal Technical Report, December, 2015.

Organizare workshop in conjunctie cu o conferinta internationala [UPB]

First International Workshop on Models and Technologies for Providing Education and Awareness Services at a Large Scale (EASe). Co-located with *The 11th eLearning and Software for Education Conference eLSE 2015*, organized by the Romanian Advanced Distributed Learning Association, Bucharest, April 23th - 24th, 2015. (http://elseconference.eu).

Workshop organizers: University Politehnica of Bucharest, Research Institute for Artificial Intelligence, The Romanian Academy.



Workshop-ul EASe, organizat de UPB:
http://elseconference.eu/pages/view?page=call_for_papers, *Workshops*
http://elseconference.eu/pages/view? page =workshop_on_models_technologies.

Etapa III, 2016

A.D. Ionita, A. Olteanu, R. N. Pietraru**,** *Reengineering Learning scenarios with WEB-based technologies*, The 12th International Scientific Conference eLearning and Software for Education, Bucuresti, April 21-22, 2016**,** DOI 10.12753/2066-026X-16-217.

A.D. Ionita**,** C-T Eftimie, G. Lewis, M. Litoiu, *Integration of Hazard Management Services*, International Conference on Exploring Services Science, Bucuresti, 25-27 mai 2016, DOI 10.1007/978-3-319-32689-4_27. In *Lecture Notes in Business Information Processing*, Editor Springer International.

A.D. Ionita, M. Mocanu**,** *Modeling Framework for Hazard Management Applied to Water Pollution and Radiation Dispersion*, IEEE 12th International Conference on Intelligent Computer Communication and Processing (ICCP), Cluj-Napoca, 8-10 sept. 2016**,** DOI 10.1109/ICCP.2016.7737136.

A.D. Ionita, M. Mocanu, *Architectural Framework for Hazard Warning Systems*, CENTERIS 2016 - Conference on Enterprise Information Systems, Porto, Portugalia, 5-7 octombrie 2016.

A.D. Ionita, D.E. Moraru, A. Budu, I.C. Prisecaru, *Capabilities for Education and Public Awareness within a Research Project on Radiological and Nuclear Vulnerabilities*, 9th annual International Conference of Education, Research and Innovation, Seville, Spania, 14-16 November.

A.D. Ionita, A. Olteanu, R.N. Pietraru, D.E. Moraru, A. Budu, I.C. Prisecaru**,** *Online Learning Content for Power Engineering Students, with Semantic-Based Navigability*, 9th annual International Conference of Education, Research and Innovation, Seville, Spania, 14 -16 November, 2016.

D.V. Vamanu, V.T.Acasandrei. *Project N-WATCHDOG - Serving an Emerging Paradigm in Nuclear Safety Perception and Practice.* Nuclear Security Summit, Washington D.C, 31 March - 1 April, 2016.

Workshop EASe, organizat de UPB

The 2nd International Workshop on Models and Technologies for Providing Education and Awareness Services at a Large Scale (EASe) a fost organizat pe data de 21 aprilie 2016

Etapa IV, 2017

A. Olteanu, A. D. Ionita**,** A. S. Solomon**,** *Curriculum and Learning Content Management Based on Ontologies,* The International Scientific Conference eLearning and Software for Education eLSE 2017, Bucharest, Romania, April 27-28, 2017.

A.D. Ionita, M. Mocanu**,** *Metamodeling Approach for Hazard Management Systems*, 12th International Conference on Software Technologies (ICSOFT 2017), Madrid, Spain, July 24-26.

A.D. Ionita. *Research Experience of Master's Students for Modeling Hazard Management Systems*. 11th International Technology, Education and Development Conference, INTED 2017, Valencia, Spain, March 6-8, 2017, pp. 8865-8870.

A.D. Ionita, A. Olteanu, R.N. Pietraru, I.C. Prisecaru. *Mapping E-Content to Domain Ontology for Education and Awareness of Nuclear Hazards*. 11th International Technology, Education and Development Conference, INTED 2017, Valencia, Spain, March 6-8, 2017, pp. 8819-8824.

Vamanu D.V. and Acasandrei V.T. *Modeling and Simulation of Radiological Dispersion Device Events*. Romanian Reports in Physics. In press, 2017.

Gheorghe A.V., Vamanu D.V., Katina P.F., Pulfer R. *Critical Infrastructures, Key Resources, Key Assets: Risk, Vulnerability, Resilience, Fragility, and Perception Governance*. Springer Series: *Topics in Safety, Risk, Reliability and Quality*. Springer International. In press, 2017.