

Exposure in industry: WiSE tool for prevention advisors

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Overview

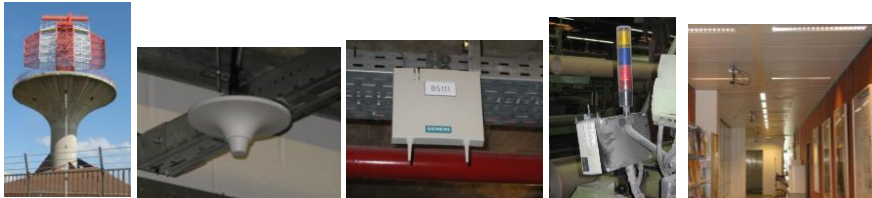
- Context and goal
- Risk analysis of EM-fields
- Source classification based on risk
- Structure of software tool
- Conclusion
- Demo



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- Electric equipment generates electromagnetic waves
 - Equipment for wireless communication



- BUT also other sources generate RF radiation



Context and goal

- **Goal of tool: to provide**
 - Guide for prevention advisers
 - Electric and magnetic field values as function of distance around different equipment
 - Comparison with exposure limits of EU-directive
 - Category to which a machine/equipment belongs
 - Specific actions that can be taken to satisfy EU-directive

- This tool has no intention to replace measurements

Overview

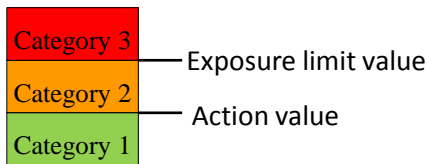
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- **Assessment of risk:**
 - Comparison with the EU-directive
 - action levels
 - limit values
 - Define safety rules
 - safety distances
 - deactivation during maintenance
 - ...
 - Advise employees
 - Satisfy EU directive

- Context and goal
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- **Source classification based on risk**
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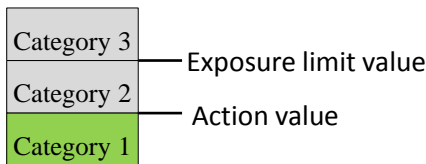
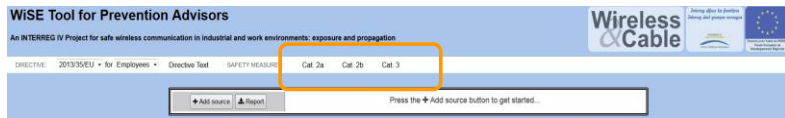
Classification based on risk

- Working environments / equipment can be divided into 3 categories (based on a study of Bolte and Pruppers)
 - Category 1
 - Under normal conditions the action values will not be exceeded
 - Category 2
 - Action values can be exceeded but the exposure limit values will not be exceeded under normal conditions
 - Category 3
 - Exposure limit values can be exceeded



Classification based on risk

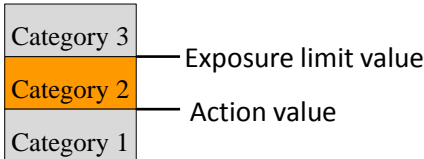
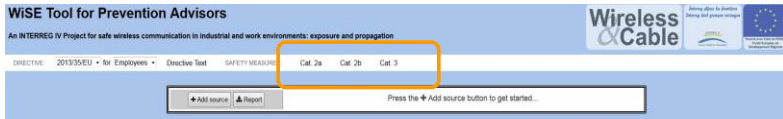
- Depending on the category actions must be taken to minimize EM-field levels



- Category 1: No measures need to be taken



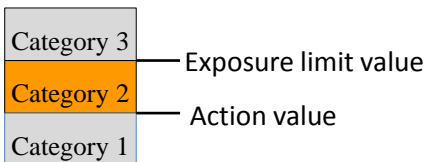
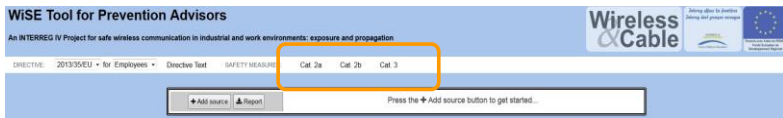
- Depending on the category actions must be taken to minimize EM-field levels



- Category 2a: only brief instructions are needed e.g. keeping a safe distance



- Depending on the category actions must be taken to minimize EM-field levels

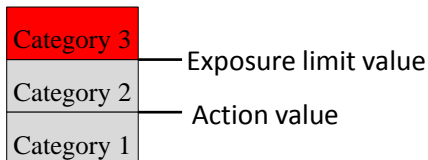
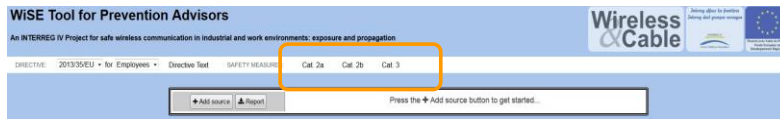


- Category 2b: Technical measures are needed e.g. shielding, fence around appliance.



Classification based on risk

- Depending on the category actions must be taken to minimize EM-field levels



- Category 3: extensive measures needed e.g. factory reorganization

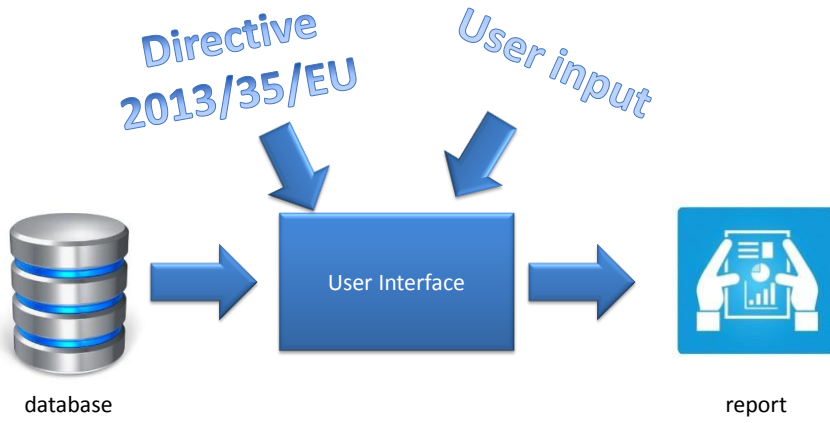


Overview

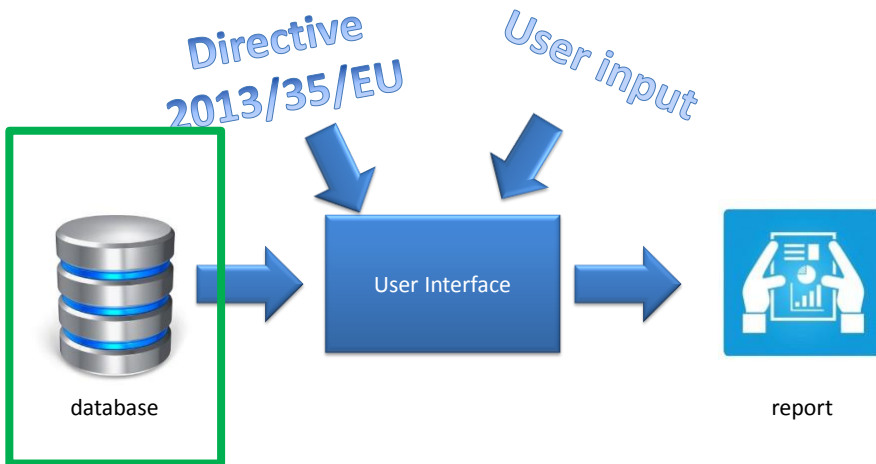
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Structure of tool



Structure of tool

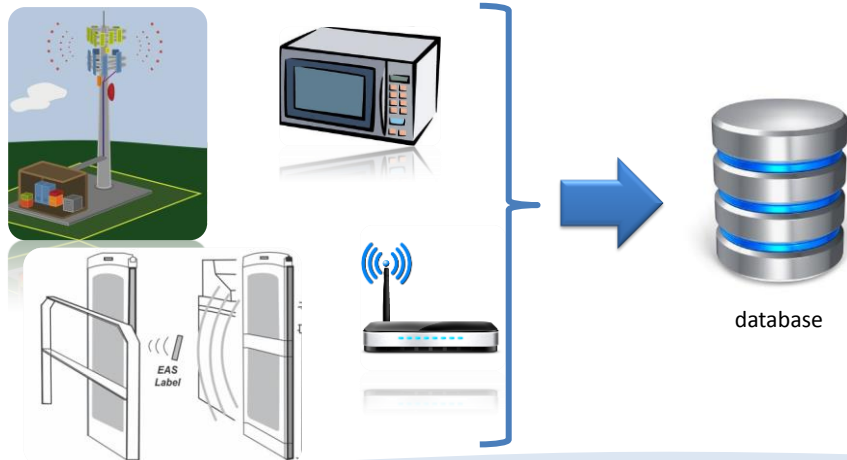


WISE Wireless Safety for Employees **Software tool: appliance list**

An INTERREG IV Project for safe wireless communication in industrial and work environments: exposure and propagation



- Inventory of electrical equipment



WISE Wireless Safety for Employees **Software tool: appliance list**

An INTERREG IV Project for safe wireless communication in industrial and work environments: exposure and propagation

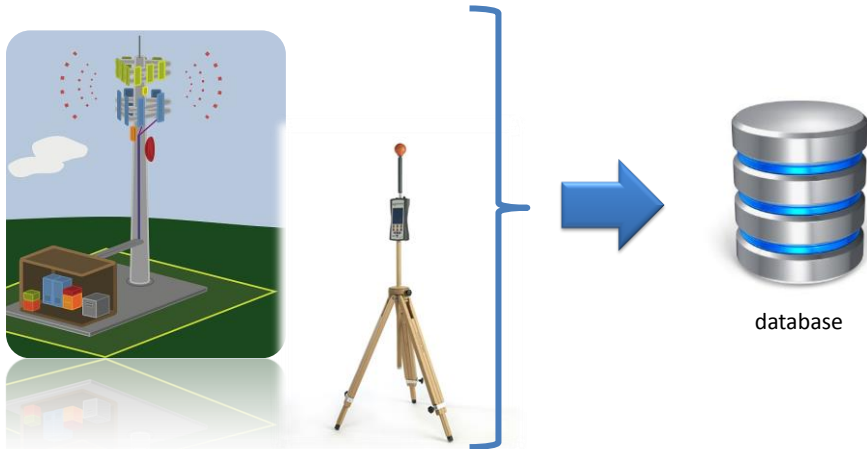


- Categorization of RF equipment
 - based on the sector > category > EM sources

Sector	Category	EM Source
Industry	Base stations	WiFi access points 2.4GHz - 2.5GHz Powers of 100mW
Electricity	Communication links	
Broadcasting	Cordless phone	WiFi access points 5.150GHz - 5.825GHz Powers of 200mW
Telecom	Personal handheld GSM devices	
Radar	Private mobile radios	
Aviation	Tetra	
Medical	WiFi	
Trade & services	Zigbee	
Public transport		
Offices		
Miscellaneous		

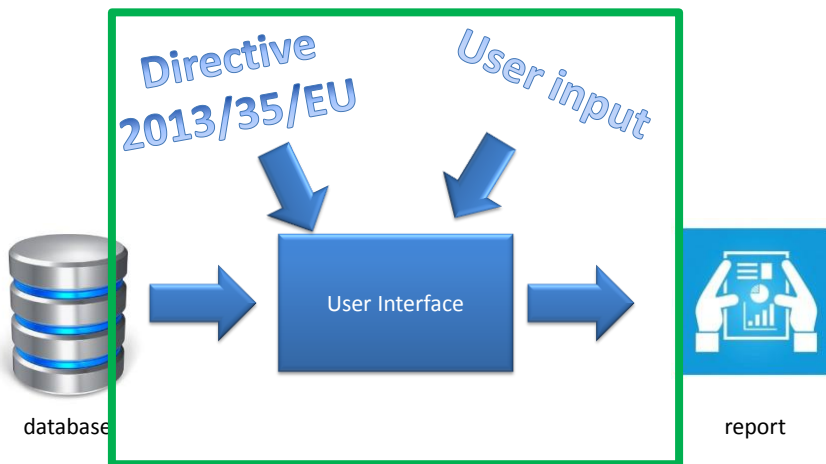


EMF data of sources

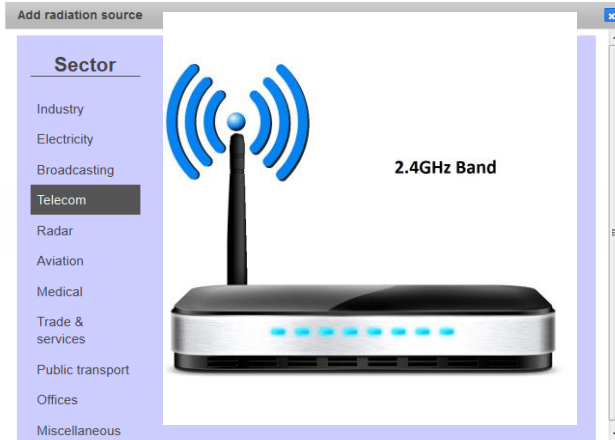


- EMF data
 - Measurements
 - Differences in measurement protocol and equipment depending on the technology, frequency, ...
 - Time consuming
 - Simulations
 - International papers and studies
 - Existing databases

- Current database status
 - 117 EM sources are categorized
 - Total of 16805 records
 - Total of 7811 measurement points
 - Total of 8994 simulation points



Example: WiFi access point



WiSE Tool for Prevention Advisors

An INTERREG IV Project for safe wireless communication in industrial and work environments: exposure and propagation



Interreg efface les frontières
 Interreg doet grenzen vervagen



DIRECTIVE: 2013/35/EU for Employees Directive Text SAFETY MEASURES: Cat. 1 Cat. 2a Cat. 2b Cat. 3

WiFi access points

Information Safety distances Working conditions

Remarks

In computer networking, a wireless Access Point (AP) is a device that allows wireless devices to connect to a wired network using Wi-Fi, or related standards. The AP usually connects to a router (via a wired network) as a standalone device, but it can also be an integral component of the router itself. 802.11b and 802.11g use the 2.4 GHz ISM band, operating in the United States under Part 15 of the U.S. Federal Communications Commission Rules and Regulations. Because of this choice of frequency band, 802.11b and g equipment may occasionally suffer interference from microwave ovens, cordless telephones and Bluetooth devices. 802.11b and 802.11g control their interference and susceptibility to interference by using direct-sequence spread spectrum (DSSS) and orthogonal frequency-division multiplexing (OFDM) signaling methods, respectively.

Typical operating frequency

2.4GHz - 2.5GHz

Source added to source list



Risk analysis: example

WiSE Tool for Prevention Advisors

Wireless & Cable

An INTERREG IV Project for safe wireless communication in industrial and work environments: exposure and propagation

DIRECTIVE: 2013/35/EU for Employees Directive Text SAFETY MEASURES: Cat. 1 Cat. 2a Cat. 2b Cat. 3

WiFi access points

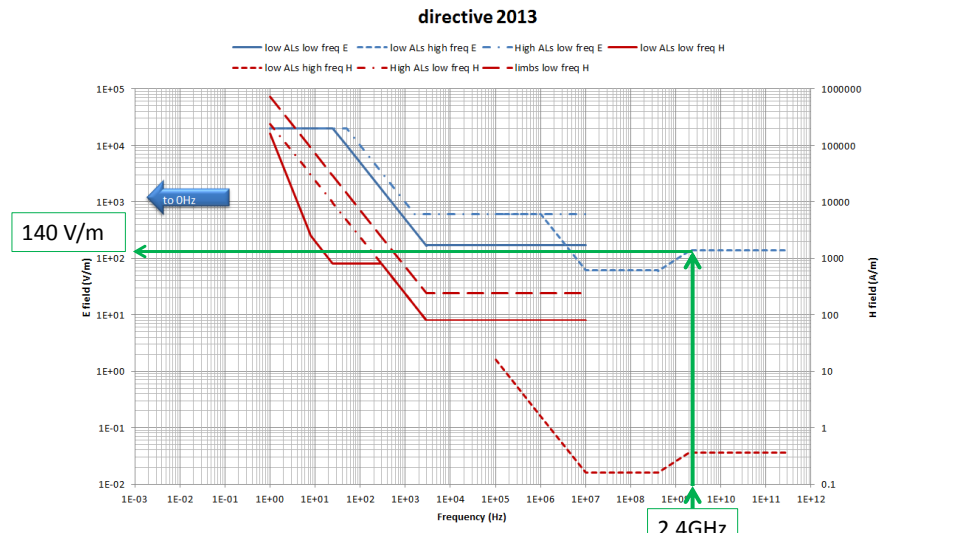
Information **Safety distances** Working conditions

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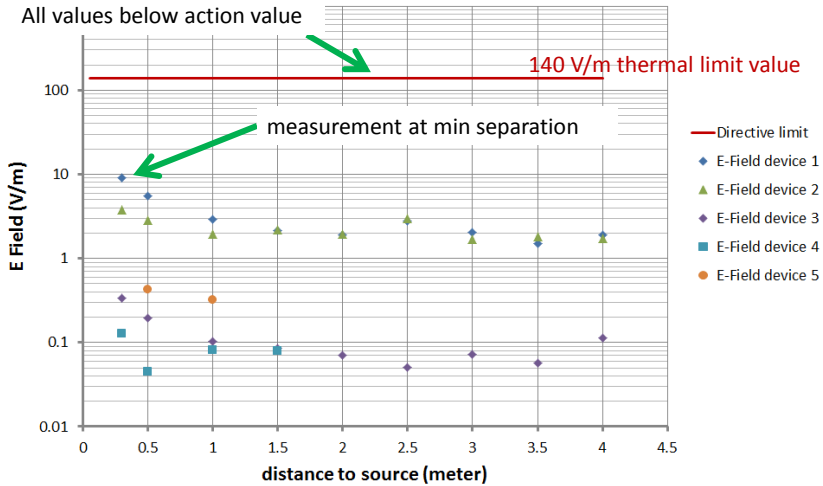


Risk analysis: example



Risk analysis: example

WiFi access point 2.4GHz



Risk analysis: example

- Safety distances tab

WiFi access points

Information **Safety distances** Working conditions

Debug
API call: [link](#)

Legend

Top View

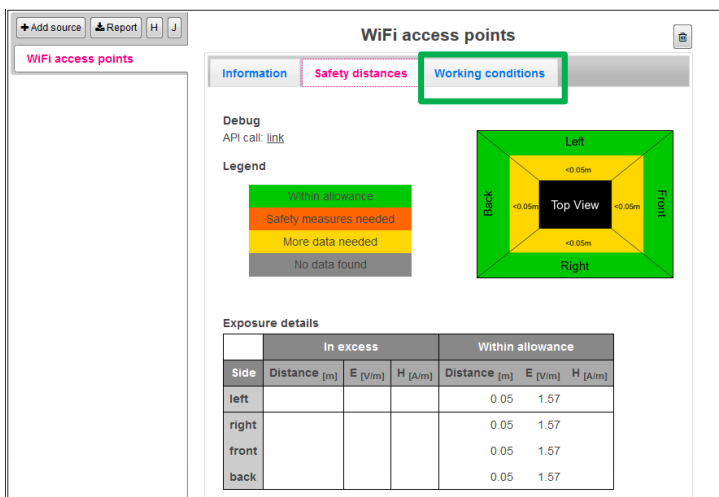
Exposure details

Side	In excess			Within allowance			Directive limits		
	Distance [m]	E [V/m]	H [A/m]	Distance [m]	E [V/m]	H [A/m]	Effect	Electric Field	Magnetic Field
left				0.05	1.57		Thermal 100GHz - 300GHz	140.00 V/m	-
right				0.05	1.57		Sensory (low) 1Hz - 10MHz	-	-
front				0.05	1.57		Sensory (high) 1Hz - 10MHz	-	-
back				0.05	1.57				

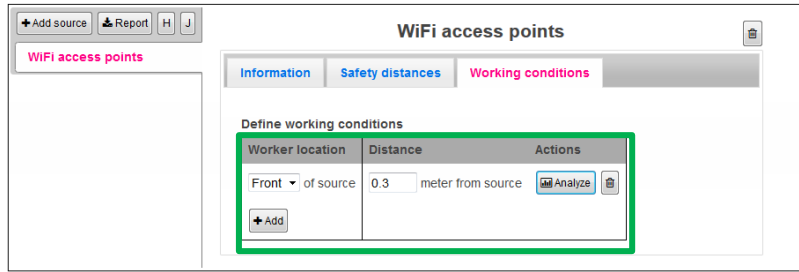
Software tool

- Values exceed directive limits
 - Worst-case data will be presented
→ *overestimation is possible*
- Values do not exceed directive limits
 - Worst-case measurement at min separation is shown

Software tool

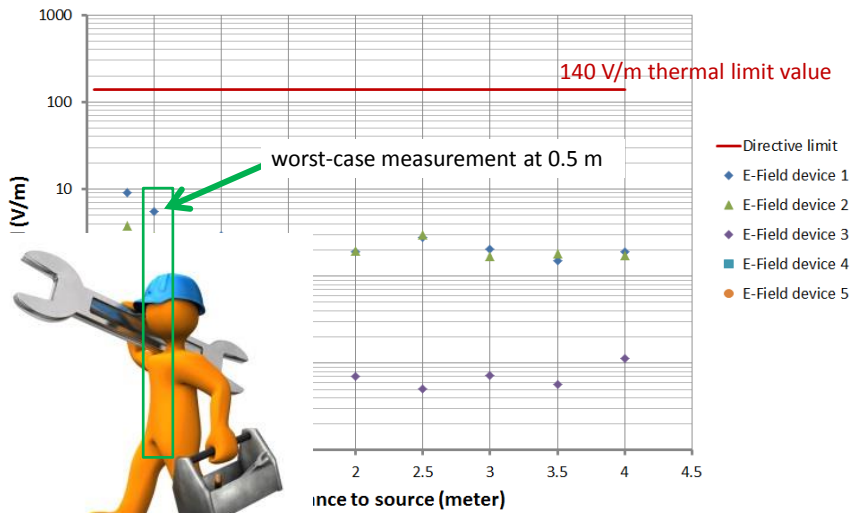


Software tool

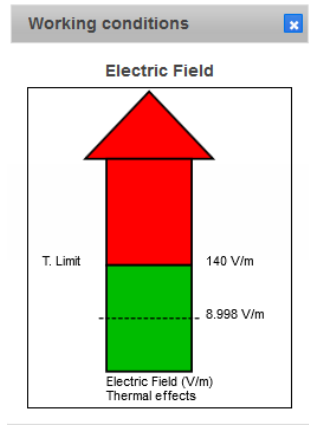


Software tool

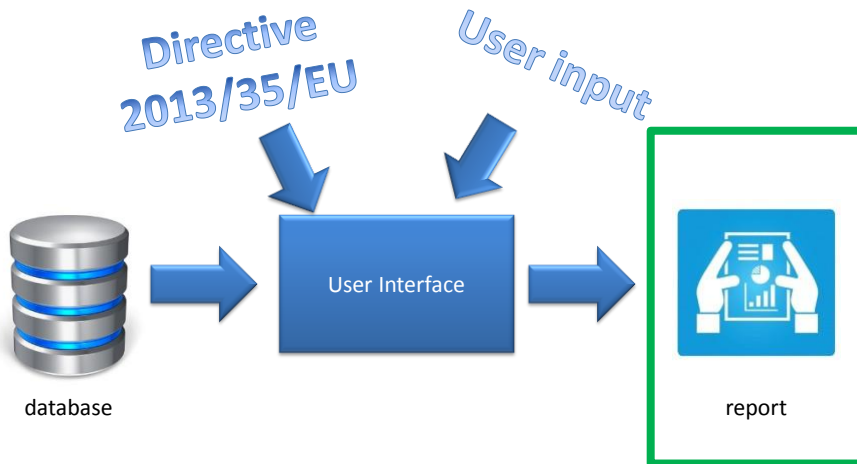
WiFi access point 2.4GHz



Software tool



Structure of tool



Software tool

WiFi access points

Information | **Safety distances** | Working conditions

Debug
 API call: [link](#)

Legend

- Within allowance
- Safety measures needed
- More data needed
- No data found

Exposure details

Side	In excess			Within allowance		
	Distance [m]	E [V/m]	H [µV/m]	Distance [m]	E [V/m]	H [µV/m]
left				0.05	1.57	
right				0.05	1.57	
front				0.05	1.57	
back				0.05	1.57	

Complete source list



Software tool

Opening report.pdf

You have chosen to open:
 report.pdf
 which is: Adobe Acrobat Document
 from: http://wicaser2.intec.ugent.be

What should Firefox do with this file?

Open with Adobe Reader (default)

Save File

Do this automatically for files like this from now on.

OK Cancel



Software tool

- General information on EU-Directive
- Definition of the action values
- Single sheet to asses all defined working conditions
- Detailed information on al selected sources
- Source specific recommendations

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Conclusions

- Software tool is available online:
 - <http://wicaserv2.intec.ugent.be/exposure-demo>
- Ongoing (end project December 2014):
 - Database will be updated continuously
 - Extensive testing of the software tool: YOU!
 - Adding information to the tool (wizard)
- All data sources are cited within the tool
- Any remarks are welcome

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WISE | Wireless Safety
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demo

INTERREG IV
Flanders-Vlaanderen-Mandats
Interreg efface les frontières
Interreg doet grenzen vervagen

<http://wicaserv2.intec.ugent.be/exposure-demo>

