

TEXTE

53/2015

Reduction of environmental risks from the use of biocides: Environmental sound use of disinfectants, masonry preservatives and rodenticides

TEXTE 53/2015

Environmental Research of the
Federal Ministry for the
Environment, Nature Conservation,
Building and Nuclear Safety

Project No. (FKZ) 3711 63 410
Report No. (UBA-FB) 002023/E

Reduction of environmental risks from the use of biocides: Environmental sound use of disinfectants, masonry preservatives and rodenticides

by

Stefan Gartiser
Hydrotox GmbH, Freiburg, Germany

Michael Burkhardt
University of Applied Science, Institute of Environmental and Process
Engineering UMTEC, Rapperswil, Switzerland

Rita Groß
Öko-Institut e.V., Freiburg, Germany

Maura Calliera
OPERA Research Centre Università Cattolica del Sacro Cuore, Piacenza,
Italy

On behalf of the Federal Environment Agency (Germany)

Imprint

Publisher:

Umweltbundesamt
Wörlitzer Platz 1
06844 Dessau-Roßlau
Tel: +49 340-2103-0
Fax: +49 340-2103-2285
info@umweltbundesamt.de
Internet: www.umweltbundesamt.de

 /umweltbundesamt.de
 /umweltbundesamt

Study performed by:

Hydrotox GmbH
Bötzingen Str. 29
79111 Freiburg, Germany

Study completed in:

September 2014

Edited by:

Section IV 1.2 Biocides
Stefanie Wieck

Publication as pdf:

<http://www.umweltbundesamt.de/publikationen/reduction-of-environmental-risks-from-the-use-of>

ISSN 1862-4804 Dessau-

Roßlau, July 2015

The Project underlying this report was supported with funding from the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear safety under project number FKZ 3711 63 410. The responsibility for the content of this publication lies with the author(s).

Content

1	Introduction.....	1
2	Stakeholder survey.....	2
3	Defining the objectives of sustainable development.....	2
3.1	Approaches of sustainable development.....	2
3.2	The view of stakeholders on sustainability of biocide use.....	5
3.3	Results from the national and European workshops.....	6
4	Elements and measures of sustainable use.....	9
4.1	Risk mitigation measures.....	9
4.2	Training/Education.....	11
4.3	Requirements for sales of biocides.....	13
4.4	Awareness programmes and information.....	14
4.5	Equipment for biocide application.....	16
4.6	Further measures to reduce emission during application.....	18
4.7	Measures to reduce emission during service life.....	18
4.8	Measures to reduce emission during restore and end-of-life stage.....	19
4.9	Specific measure to protect the aquatic/terrestrial environment.....	20
4.10	Reduction of biocide use in sensitive areas.....	20
4.11	Handling and storage of biocides and their packaging and remnants.....	21
4.12	Specific measures to avoid resistance.....	22
4.13	Integrated pest management (IPM) and best practices.....	22
5	Indicators.....	24
5.1	Objectives.....	24
5.2	Results from the stakeholder survey.....	26
5.3	Recommendations for a first set of indicators.....	27
5.3.1	Introduction.....	27
5.3.2	Criteria to select the indicators.....	29
5.3.3	Conclusions.....	33
6	Risk communication.....	33
6.1	Principles of risk communications.....	33
6.2	Behavioural studies for improving sustainable use of biocides.....	36
6.3	Learnings about risk communication from other biocide projects.....	38

6.4	Product-type specific aspects on risk communication concerning biocides	39
6.4.1	Disinfectants	40
6.4.2	Masonry preservatives.....	40
6.4.3	Rodenticides.....	41
6.5	Suggestions for communication campaigns on sustainable use of biocides	43
6.5.1	Communication campaigns to stimulate professional training	43
6.5.2	Communication campaigns to raise awareness.....	45
7	Package of measures.....	47
7.1	Comprehensive measures covering all PT.....	47
7.2	Product type specific measures	48
8	Recommendation and outlook.....	50
9	References.....	55

Annex I	Legislative background
Annex II	Case study on PT 2
Annex III	Case study on PT 3
Annex IV	Case study on PT 7 / 10
Annex V	Case study on PT 14

List of Figures

Figure 1:.....	Sustainability models	4
Figure 2:.....	Development of indicators	30

List of Tables

Table 1:.....	Indicators for the environment	31
Table 2:.....	Indicators for human health	32
Table 3	Indicators for social development.....	32
Table 4:.....	Product type specific measures supported by stakeholders	XI

List of Abbreviations

BAT	Best Available Techniques
BPR	Biocidal Products Regulation
BREF	Best Available Technique Reference Documents
CLP	Regulation (EC) on Classification, Labelling and Packaging of Substances and Mixtures No 1272/2008
DBP	Disinfection by-Products
DLG	Deutsche Landwirtschafts- Gesellschaft (German agricultural association)
EMA	European Medicines Agency (until 2009 EMEA)
GAP	Good Agricultural Practices
HACCP	Hazard Analysis and Critical Control Points (Regulation (EC) No 852/2004)
IPM	Integrated pest management
IPPC	Integrated Pollution Prevention and Control
MRL	Maximum Residue Level
NAP	National Action Plan
NPAP	National Pest Advisory Panel (UK)
PBT	Persistent, Bioaccumulative and Toxic
PT	Product Type
QAC	Quaternary Ammonium Compounds
REACH	Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorisation and Restriction of Chemicals
RCN	Risk Communication Network
RMM	Risk mitigation measure
SGAR	Second Generation Anticoagulant Rodenticides
STP	Sewage treatment plant
SUD	Sustainable Use Directive 2009/128/EC
UK	United Kingdom
WBGU	German Advisory Council on Global Change
WCED	World Commission on Environment and Development

Zusammenfassung

Einführung

Im November 2009 wurde ein Aktionsplan für die nachhaltige Verwendung von Pestiziden durch die Richtlinie 2009/128/EG auf der Grundlage der entsprechenden thematischen Strategie in Kraft gesetzt. Der Aktionsplan hat eine Minimierung von Risiken und Gefahren für die menschliche Gesundheit und die Umwelt zum Ziel. Dies wird durch die Verbesserung von Anwendungskontrollen von Pestiziden, durch Vermarktungsregeln und durch die Förderung von Anbaumethoden mit begrenztem Einsatz von Pestiziden erreicht. Unterstützend sollen „beste Praktiken“ definiert und der integrierte Pflanzenschutz gefördert werden. Zudem sind Verwendungsbeschränkungen für sensible Bereiche vorgesehen. Bisher ist die nachhaltige Verwendung von Pestiziden der Richtlinie 2009/128/EG auf Pflanzenschutzmittel fokussiert. Jedoch ist die Möglichkeit einer Erweiterung des Anwendungsbereiches auf Biozide offen gehalten.

In einem vorangegangenen Projekt wurden „Perspektiven und Anforderungen für die Übertragung der in der Richtlinie 2009/128/EG für Pflanzenschutzmittel vorgeschlagenen Maßnahmen auf den Biozidbereich analysiert (Gartiser et al. 2012).¹ Der Schwerpunkt lag auf Holzschutzmitteln (Produktart PA 8), Insektiziden (PA 18) und Antifouling-Mitteln (PA 21). Im Folgeprojekt wurden Maßnahmen für die nachhaltige Nutzung von Produkten in den Produktarten 2 und 3 (Desinfektionsmittel), 7 und 10 (Konservierungsmittel in Farben, Putz und Mauerwerk) und 14 (Rodentizide) analysiert. Die Vorgaben der Biozid-Produkte-Verordnung (EU) 528/2012 (BPR) und des Deutschen Chemikaliengesetzes sind keine ausreichende Grundlage, um die Nutzungsphase von Biozid-Produkten angemessen zu berücksichtigen. Da jedoch ein bedeutender Anteil der Biozidemissionen in die Umwelt während der Anwendungsphase und Nutzungsphase entstehen, gibt es einen besonderen Bedarf für die Entwicklung von Maßnahmen für ihre nachhaltige Nutzung. Das Forschungsprojekt hatte zum Ziel, die Anwendungsbedingungen und Eintragspfade in die Umwelt von Bioziden der Produktarten 2, 3, 7/10 und 14 zu analysieren und Optionen für eine nachhaltige Nutzung von Bioziden zu entwickeln. Es wurde ein Maßnahmenpaket vorgeschlagen, das mit europäischen Experten diskutiert wurde, um die anstehenden Entwicklungen und Harmonisierungsprozesse auf EU-Ebene zu unterstützen. Weitere Ziele waren die Entwicklung geeigneter Indikatoren, um die Wirksamkeit der Maßnahmen zu überwachen sowie Vorschläge zur zielgruppenspezifischen Kommunikation dieser Maßnahmen.

¹ Gartiser, S., Luskow, H., Groß, R. 2012. Thematic Strategy on Sustainable Use of Plant Protection Products - Prospects and Requirements for Transferring Proposals for Plant Protection Products to Biocides. Final report FKZ 3708 63 400, UBA-Texte 6/2012.

<http://www.umweltbundesamt.de/sites/default/files/medien/461/publikationen/4261.pdf>

Der Abschlussbericht besteht aus einem Hauptbericht und fünf Anhängen. Der Fokus des Hauptberichtes liegt auf den Zielen einer nachhaltigen Nutzung von Bioziden sowie auf Elementen und Maßnahmen, um diese Ziele zu unterstützen. Die Ergebnisse einer breit angelegten Befragung der Akteure sowie zweier Workshops werden vorgestellt. Der Hauptbericht enthält auch eine Analyse möglicher Indikatoren und einen ersten Vorschlag einer Strategie zur Risikokommunikation. Eine Analyse des gesetzlichen Hintergrundes wurde bereits im Vorgängerprojekt erarbeitet (Gartiser et al 2012). Eine kurze Aktualisierung ist im Anhang I wiedergegeben. Die Fallstudien zu den Produktarten 2 und 3 (Desinfektionsmittel), 7/10 (Filmkonservierungsmittel, Mauerwerk-Konservierungsmittel in Außenfarben und Putzen) sowie 14 (Rodentizide) sind in den Anhängen II bis V dargestellt.

Stakeholderbefragung

Im Rahmen des Projektes wurde eine Stakeholder-Befragung durchgeführt. Ziel dieser Umfrage war es, die Einschätzung von Berufsverbänden und Industrieverbänden, der Anwender von Biozid-Produkten, der Formulierer, Behörden, NGOs, Berater und anderer Akteure hinsichtlich bekannter Auswirkungen von Bioziden, möglicher Maßnahmen für die nachhaltige Nutzung und geeigneter Indikatoren zur Beschreibung der erzielten Fortschritte zu erhalten. Für alle innerhalb dieser Studie berücksichtigten Produkttypen wurden spezifische Fragebögen (auf Deutsch und Englisch) in Zusammenarbeit mit Experten des Umweltbundesamtes entwickelt. Beginnend im Juni 2012 wurden diese Fragebögen an die verschiedenen Interessengruppen per Post oder E-Mail gesendet. Die wichtigsten Ergebnisse dieser Umfrage sind in den Fallstudien über eine nachhaltige Verwendung von Bioziden in PA 2, PA 3, PA 7/10 und PA 14 in den Anhängen des Hauptberichts dokumentiert.

Festlegung der Ziele einer nachhaltigen Entwicklung

Eine häufig zitierte Definition einer nachhaltigen Entwicklung bezieht sich auf das drei Säulen-Konzept, in dem die wirtschaftliche und soziale Entwicklung und der Umweltschutz gemeinsam gestärkt werden. Ziele dieser Säulen sind die Beseitigung der Armut, die Veränderung nicht nachhaltiger Produktions- und Konsumbedingungen und der Schutz und die Bewirtschaftung der natürlichen Ressourcen als Basis der wirtschaftlichen und sozialen Entwicklung. Das Konzept besteht aus einem integrierten Ansatz, in dem die drei Säulen gut ausbalanciert sind. Die Idee dahinter ist, dass die Ziele der drei Säulen einzeln nicht erreichbar sind und nur wechselseitig erreicht werden können.

Das Drei-Säulen-Konzept wurde kritisiert, weil oft die wirtschaftliche Säule die bestimmende ist und das ökonomische Wachstum einer nachhaltigen Nutzung von Ressourcen entgegenwirken und somit zu einer erhöhten Umweltverschmutzung führen kann (Abbildung 1). Inzwischen hat auch die UN erkannt, dass die Umweltsäule so visualisiert werden sollte, dass sie die Grundlage für die wirtschaftliche und soziale Säulen einer nachhaltigen Entwicklung darstellt, da das Leben auf der Erde von einer gesunden Umwelt abhängig ist.

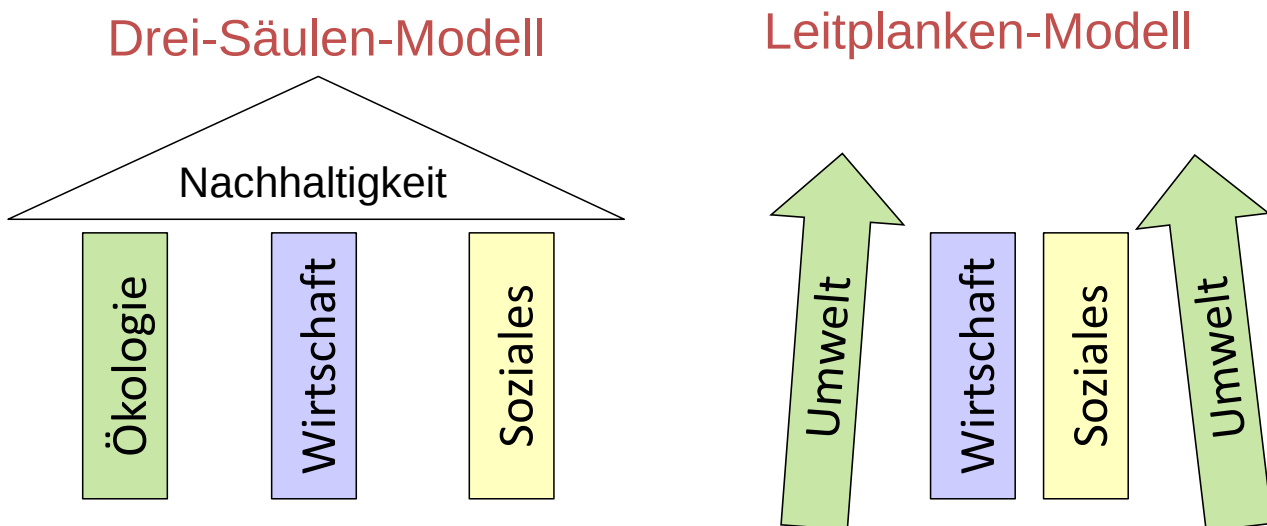


Abbildung 1: Modelle zur Nachhaltigkeit

Die Bundesregierung bestellt im Jahr 1992 den „Wissenschaftlichen Beirat der Bundesregierung Globale Umweltveränderungen“ (WBGU) als unabhängige, wissenschaftliche Institution. Der WBGU entwickelte das "Leitplankenkonzept", das ebenfalls die Umweltsäule der Nachhaltigkeit als Voraussetzung für die soziale und wirtschaftliche Dimension herausstellt (Abbildung 1). Das "Leitplankenkonzept" definiert das akzeptable Ausmaß für anthropogene Eingriffe in die Natur durch die Festlegung von Grenzen innerhalb der eine nachhaltige Entwicklung und der Fortschritt stattfinden können. Globale Trends, die auf Kollisionskurs mit den planetaren Leitplanken sind, werden vor allem im Bereich des Klimawandels und der biologischen Vielfalt diskutiert. Nach Darstellung des WBGU ist das "Leitplankenkonzept" ein Versuch, das Dilemma sich widersprechender sozialer, ökologischer und wirtschaftlicher Ziele durch klare Prioritätensetzung zu lösen.

Basierend auf diesen Annahmen kann eine nachhaltige Verwendung von Bioziden so definiert werden, dass der Einsatz der Biozide der Notwendigkeit, künftigen Generationen einen intakten Planeten zu hinterlassen, auf dem eine gesunde Umwelt die Voraussetzungen für die wirtschaftliche und soziale Entwicklung bietet, nicht zuwiderhandelt. Hierbei sollten die Vorteile einer Verwendung von Bioziden, beispielsweise zur Verbesserung der Hygiene oder des Materialschutzes, mit berücksichtigt werden und allen Menschen zu Gute kommen.

Vorschläge für Kommunikationskampagnen über die nachhaltige Verwendung von Bioziden

Es gibt verschiedene Kommunikationsstrategien für professionelle Anwender und die breite Öffentlichkeit. Professionelle Anwender benötigen für die nachhaltige Verwendung von Bioziden eine Fort- oder Ausbildung. Für Verbraucher sind geeignete Maßnahmen zur Bewusstseinsbildung erforderlich. Allerdings ist die Bereitschaft, an Weiterbildungsmaßnahmen zur Verwendung von Bioziden teilzunehmen, in den verschiedenen Anwendungsbereichen ungewiss. In Bezug auf geeignete Kommunikationsstrategien wird daher die Notwendigkeit gesehen, die Gefahrenwahrnehmung in be-

stimmten Sektoren zu verbessern, um die Durchführung und Teilnahme an solchen Schulungen zu fördern.

Folgende Zielgruppen für die Kommunikationskampagnen wurden identifiziert:

- Arbeitssicherheitsmanager (Baufirmen, Großbetriebe in der Landwirtschaft, Schädlingsbekämpfungs-Unternehmen; etc.)
- Unabhängige Anwender (Schädlingsbekämpfer, Landwirte, Tierärzte, Baufirmen etc.)
- Hersteller
- Fachhändler und Vertriebspartner
- Arbeitnehmer

Wichtige Themen im Rahmen von Kommunikationsstrategien für die breite Öffentlichkeit sind:

- Erläutern von Risiken und möglichen akuten und chronischen Wirkungen auf die menschliche Gesundheit.
- Risikomanagementmaßnahmen in Bereichen, die der breiten Öffentlichkeit und gefährdeten Personengruppen zugänglich sind.
- Maßnahmen, die von Einzelpersonen zur Verringerung der Exposition realisierbar sind.

Es wird als sehr wichtig erachtet, das Bewusstsein der breiten Öffentlichkeit und insbesondere auch der sich in der Nähe einer Biozidanwendung befindlichen Unbeteiligten und Anwohner hinsichtlich der verwendeten Produkte zu stärken und über mögliche Risiken aufzuklären. Zusätzlich sollte die Öffentlichkeit informiert werden, falls die verwendeten Produkte in regelmäßigen Zeitabständen oder durch unterschiedliche Applikationsmethoden angewendet werden. In diesem Fall könnten zusätzliche spezifische Minderungsmaßnahmen von den Betreibern / Arbeitnehmern gefordert sein, um die Expositionsrisiken einzudämmen.

Zu den Zielgruppen, für die ein "hoher Handlungsbedarf" in Bezug auf die Informationen zu Gesundheitsrisiken durch Biozide für bestimmte Produktarten identifiziert wurde, sind die folgenden zu nennen:

- Gefährdete Gruppen: Allergiker, Menschen mit Multipler Chemikalien-Sensitivität, kranke oder ältere Menschen
- Jugendliche: sehr empfängliche Zielgruppe mit besonderer Bedeutung für zukünftige Belange
- Ausländer: Sprachhindernisse
- Personen mit niedrigem Bildungsniveau: vermutlich schwieriger Zugang über Informationsangebote

- Multiplikatoren und Repräsentanten

In Bezug auf die Art des Kommunikationsmaterials für die Sensibilisierungskampagnen war man der Ansicht, dass ein gemischter Ansatz an die unterschiedlichen Zielgruppen angepasst werden sollte. Die verschiedenen Akteure wiesen Videos in Verbindung mit papierbasierten Informationsmaterialien (Broschüren, Poster, etc.) die höchste Wirkung zu. Auch Rundfunk- und Fernsehübertragungen sollten in Betracht gezogen werden, um eine breite Verteilung der Informationen innerhalb der Zielgruppen zu erzielen. Die in dem Projekt befragten Stakeholder wiesen der alleinigen Förderung von Web-basierten Informationsplattformen überwiegend eine begrenzte Effizienz zu.

In Bezug auf Informationsverbreitung und Bewusstseinsbildung stimmten die Teilnehmer überein, dass die für die breite Öffentlichkeit bestimmten Informationen objektiv, ausgewogen und wissenschaftsbasiert sein müssen. Hierbei sollte nicht nur auf ökologische und gesundheitliche Aspekte im Zusammenhang mit der Verwendung der Produkte eingegangen werden, sondern auch Aussagen vermittelt werden, warum die Produkte eingesetzt werden und worin ihr Nutzen besteht.

Maßnahmenpaket

Unter den Maßnahmen, die alle Produktarten betreffen, liegt es auf der Hand, dass der Anwendungsbereich der Richtlinie zur nachhaltigen Verwendung von Pestiziden, die bisher nur für Pflanzenschutzmittel umgesetzt wird, erweitert werden könnte, um auch Biozide einzuschließen.

Initiativen zur Harmonisierung und Standardisierung von Geräten für die Biozid-Anwendung sollten befürwortet werden. Die Maschinenrichtlinie 2006/42/EG sollte dahingehend geändert werden, dass sie auch Geräte und Anlagen für bestimmte Biozidanwendungen einschließt.

Die Einbeziehung von Bioziden in den Anwendungsbereich der Verordnung (EG) Nr. 1185/2009 über Statistiken zu Pestiziden, die bisher nur Pflanzenschutzmittel berücksichtigt, wird empfohlen. Diese Daten werden dringend für die Entwicklung geeigneter Indikatoren und die Festlegung von Zielen für die nachhaltige Nutzung benötigt.

In der Richtlinie 98/83/EG über die Qualität von Wasser für den menschlichen Gebrauch, könnte der Begriff "Pestizid" so erweitert werden, dass er sich sowohl auf Pflanzenschutzmittel, wie auch auf Biozid-Produkte bezieht, um auch Desinfektionsmittel oder Filmkonservierungsmittel zu berücksichtigen. Ebenso würde die Berücksichtigung der Begriffs "Biozide" in der deutschen Oberflächenwasserverordnung (OGewV) die Überwachung von Biozidemissionen in Oberflächengewässern fördern, auf deren Basis geeignete Reduktionsmaßnahmen entwickelt werden könnten.

Es könnten auch Höchstgehalte von Biozidrückständen in Abfällen definiert werden, um das Ende des Lebenszyklus von Bioziden zur berücksichtigen. Die Richtlinie 86/278/EWG über den Schutz der Böden bei der Klärschlammausbringung in der Landwirtschaft könnte dahingehend geändert werden, dass auch andere Schadstoffgruppen als Schwermetalle, wie z.B. Biozide, berücksichtigt werden. Der Europäische Aktionsplan zu "Nachhaltige Produktion und Konsum für eine nachhaltige Industrie-

politik" könnte dahingehend angepasst werden, dass auch Biozidanwendungen in privaten und industriellen Bereichen berücksichtigt werden.

Eine ausführliche Darstellung möglicher Maßnahmen zur Förderung einer nachhaltigen Verwendung von Desinfektionsmitteln (PA 2, 3), Film- und Mauerwerks-Konservierungsmitteln (PA 7/10) und Rodentiziden (PA 14) ist in den Fallstudien (Anhang II-V) wiedergegeben.

Eine kurze Zusammenfassung der Maßnahmen mit höchster Akzeptanz, denen mindestens 50% aller befragten Akteure eine hohe und mittlere Effizienz zugewiesen haben, ist in Tabelle 1 dargestellt:

Tabelle 1: Produktartspezifische Maßnahmen, die von den Akteuren unterstützt werden

	PA 2	PA 3	PA 7/10	PA 14
Fort- und Weiterbildung				
Erarbeitung von Hygiene- und Desinfektionsplänen sowie von Arbeitsanweisungen, die auf die Erfordernisse von Desinfektionsmaßnahmen angepasst sind.	X			
Beratung der Kunden durch Hersteller (einschließlich Sicherheitsdatenblätter, technische Merkblätter und Gebrauchsanleitungen).	X	X		
Innerbetriebliche Fortbildung von Mitarbeitern.		X		
Vermittlung von Maßnahmen zur nachhaltigen Anwendung und Nutzung z.B. bei der Ausbildung zum Landwirt.		X		
Förderung (freiwilliger) Weiterbildungsmaßnahmen für (private) Anwender z.B. zur umweltverträglichen Anwendung und Entsorgung.		X		X
Zertifizierung beruflicher Verwender, Vertreiber und Berater im Rahmen von Fort- und Weiterbildung.		X		
Umsetzung der "Standards" für die nachhaltige Nutzung und Entsorgung als Teil der Berufsausbildung, z.B. für Maler.			X	
Förderung der Weiterbildung für Architekten bezüglich einer nachhaltigen Nutzung von biozid-haltigen Farben und Putzen während der Anwendungs- und Nutzungsphase.			X	
Vermittlung von „Regeln“ zur umweltverträglichen Anwendung und Entsorgung im Rahmen der beruflichen Weiterbildung, z.B. für angelernte Arbeitskräfte.			X	
Schulungen zur Schädlingsbekämpfung, um ein ausgebildeter/-zertifizierter professioneller Anwender zu werden.				X
Harmonisierte Ausbildungsregelungen für weitere Nutzergruppen wie Landwirte und Jagdaufseher.				X
Aufbau weiterer Weiterbildungsstrukturen wie Ausbildungskurse durch Unternehmen der Schädlingsbekämpfung, der Hersteller und anderer Organisationen. Durchführung von Tagungen und Konferenzen der Berufsverbände der Schädlingsbekämpfer.				X
Vermittlung von Maßnahmen zur nachhaltigen Anwendung und Nutzung im Rahmen der Ausbildung z.B. bei Schädlingsbekämpfern				X
Wissenstransfer zur nachhaltigen Verwendung von Desinfektionsmitteln in Ausbildung und Weiterbildung z.B. von Pflegepersonal oder Reinigungspersonal.	X			
Auflagen an den Verkauf und Kontrollmechanismen				
Verbot bestimmter Produkte und Anwendungen für nicht-berufliche Anwender (Verbraucher).	X			
Zertifizierung beruflicher Verwender, Vertreiber und Berater im Rahmen von Fort- und Weiterbildung. Zertifizierung von Hygieneberatern, Herstellern oder Wiederverkäufern.	X	X		
Verkaufsbeschränkungen für private Anwender	X			X

	PA 2	PA 3	PA 7/10	PA 14
Entwicklung eines Klassifizierungssystems für umweltverträgliche Desinfektionsmittel.	X	X		
Verkauf von Produkten über den Einzelhandel an private Verbraucher reglementieren, z.B. durch Verkauf von Haushaltsdesinfektionsmitteln über Apotheken.	X			
Verkauf von Produkten über das Internet reglementieren, z.B. durch Minimalanforderungen an Informationsmaterial (PA 3) oder Verkaufsbeschränkung für Privatanwender (PA 14).		X		X
Nachweis der Beratung professioneller Anwender durch den Hersteller, wie mit biozidbehandelten Farben und Putzen umzugehen ist (Sicherheitsdatenblatt, Technisches Datenblatt).			X	
Verkaufsbeschränkung von Produkten mit gerinnungshemmenden Rodentiziden (insbesondere der 2. Generation), Verwendung von gebrauchsfertigen Ködern (keine Konzentrate), Köder nur zusammen mit Köderstationen ausbringen.				X
Beschränkung der Gebindegröße für Privatanwender (um Restmengen zu minimieren).				X
Information und Sensibilisierung				
Bereitstellen von Informationen zu „Besten Praktiken“ und zur sicheren Verwendung (PA 2, 3) sowie zur guten Praxis und sicheren Entsorgung von biozidhaltigen Produkten für Verbraucher des do-it-yourself-Bereichs (PA7/10)	X	X	X	
Bereitstellen von mehrsprachigen Informationen zu „Besten Praktiken“ bei der Anwendung und zur sicheren Entsorgung für berufliche Anwender.			X	
Förderung von (freiwilligen) Trainingsmaßnahmen für Anwender, z.B. zur umweltverträglichen Nutzung und Entsorgung.		X		
Förderung von Web-basierten Informationsplattformen.		X		X
Informationen für Schädlingsbekämpfer und Landwirte durch Web-basierte Informationssysteme und Fachzeitschriften, mit allen Informationen zur Schädlingsbekämpfung, einschließlich Empfehlungen zur Durchführung professioneller Ratten-bekämpfungskampagnen.				X
Jährliche Konferenzen und Tagungen, die durch Verbände der Schädlingsbekämpfung organisiert werden und die Möglichkeit des Informationsaustauschs zwischen Herstellern, professionellen Anwendern und Behörden / Wissenschaftlern ermöglichen.				X
Zeitschriften, die von Landwirten, Hobbygärtnern oder Konsumenten gelesen werden als Verbreitungsmedium des Wissens über die nachhaltige Verwendung von Bioziden nutzen.				X
Kontrolle der Anwendung				
Erstellen von Hygieneplänen, Desinfektionsplänen und Arbeitsanleitungen für bedarfsgerechte Desinfektionsmaßnahmen.		X		
Verzicht auf die tägliche Routinedesinfektion von Fußböden im öffentlichen Gesundheitswesen.	X			
Ersatz von Klimaanlage mit Umlaufsprühbefeuchtern durch Dampfbefeuchter.	X			
Optimierung der Desinfektion durch Vorreinigung.	X	X		
Qualitätssicherung und Überwachung.	X	X		
Ersatz von schlecht abbaubaren/eliminierbaren Desinfektionsmitteln durch (in Kläranlagen) rasch abbaubare Wirk- und Hilfsstoffe.	X	X		
Obligatorische Prüfung und Kontrolle von mit Bioziden ausgerüsteten Materialien.	X			
Entwicklung von technischen Normen und Richtlinien für die Reinigung von Instrumenten und Geräten.	X	X		
Entwicklung von Standard und Richtlinien für private Anwender, wann Desinfektionsmaßnahmen gefordert sind und wie sie durchgeführt werden sollten.	X			
Ersatz von Desinfektionsmaßnahmen durch thermische oder chemo-thermische Prozesse (PA 2). Ersatz von Desinfektionsmaßnahmen durch thermische Prozesse (Verbrennung, Ausbrennen, Heißluftsterilisation, Dampfdesinfektion, Selbsterhitzung (PA 3)).	X	X		

	PA 2	PA 3	PA 7/10	PA 14
Begrenzung der Gebindegröße für private Anwender zur Minimierung von Restmengen.	X			
Routineprüfung der Belastung mit Bakterien in relevanten Bereichen.		X		
Obligatorische Verwendung stabiler, nicht manipulierbarer sicherer Köderboxen.				X
Sorgfältige systematische und sichere Anwendung/Platzierung von Ködern an relevanten Punkten.				X
Berücksichtigung der Prinzipien der integrierten Schädlingsbekämpfung und der Kriterien bester Praktiken.				X
Maßnahmen zur Emissionsreduktion während der Nutzungsphase				
Sammlung und Entsorgung von Restmengen		X		
Zwischenspeicherung von Abwasser in Sammel tanks und nachfolgender Transport und Behandlung in kommunalen Kläranlagen.		X		
Anaerobe Behandlung von Gülle für die Biogasproduktion.		X		
Vermeidung von Stoßbelastungen durch Ableitung konzentrierter Lösungen.		X		
Ableitung von Reinigungs- und Desinfektionsabwasser in den Güllebehälter.		X		
Organisiertes Einsammeln und Entsorgung von Restmengen durch Anordnung der Behörden.			X	
Risikoabklärung bei Anwendung im Freien (u.a. durch sicheres Platzieren der Köderstellen).				X
Einsammeln toter Nagetiere und Köderreste nach der Kampagne sowie Sicherstellung der Entsorgung (einschließlich der Restmenge).				X
Keine präventive permanente Köderung mit Antikoagulantien.				X
Kein Monitoring (als Nachweis eines Wiederbefalls) mit Ködern aus Antikoagulation. Stattdessen Verwendung nicht-toxischer Köder, Fallen oder anderer Monitoringmethoden.				X
Einrichtung von Puffer- und Sicherheitszonen neben Oberflächen-gewässern.				X
Anwendungsverbot für Produkte an sensiblen Standorten (Gewässernähe, Trinkwasserschutzgebiete, etc.)				X

Aus- und Weiterbildung:

Die Ausbildung ist von entscheidender Bedeutung für die nachhaltige Verwendung von Bioziden durch berufliche Anwender. Für Verbraucher sind hingegen Maßnahmen zur Bewusstseinsbildung gefordert. Bei der Erarbeitung von Ausbildungsprogrammen sollten bestehende Lehrpläne oder Fortbildungsprogramme berücksichtigt werden. Eine Priorisierung von Biozid-Anwendungen, für die Fortbildungsmaßnahmen in Betracht gezogen werden, ist erforderlich. Als Hauptbereiche wurden Schädlingsbekämpfungsmittel (Rodentizide, Insektizide), Produktarten mit einem hohen Produktionsvolumen wie allgemeine Desinfektionsmittel (PA 2) sowie Anwendungen in geschlossenen Räumen, die zu Emissionen in Kläranlagen führen, identifiziert.

Die Priorisierung von Ausbildungsinitiativen sollte auch mit bestehenden produktart-spezifischen Leitfäden zur „Guten fachlichen Praxis“ verknüpft werden. Die Frage, ob Fortbildungsmaßnahmen verpflichtend eingeführt werden sollten oder nicht, müsste weitergehend analysiert werden. In den Fortbildungsmaßnahmen sollten auch Grundsätze der guten Betriebsführung, der guten landwirtschaftlichen Praxis, der integrierten Schädlingsbekämpfung oder andere Leitfäden zur „Guten fachlichen Praxis“ integriert werden. Während die Aus- und Fortbildung im Bereich der Desinfektion (PA 2) oder Nagetier-Kontrolle (PA 14) bereits etabliert ist, wurde für die Anwendung

von biozidhaltigen Fassadenbeschichtungen und -putzen ein Mangel an Fortbildungsangeboten festgestellt.

Die Verwendung von Antikoagulantien der zweiten Generation als Rodentizid sollte in allen Mitgliedstaaten auf speziell ausgebildete professionelle Anwender mit Zertifikat beschränkt werden. Die Zertifizierung der Tests sollte von neutralen Behörden vorgenommen werden und nicht alleine von den Ausbildungseinrichtungen. Darüber hinaus sollte die Teilnahme von Schädlingsbekämpfern, Landwirten und Jagdaufsehern an regelmäßigen Fortbildungsveranstaltungen verpflichtend sein. Es wurde beklagt, dass es für biozide Anwendungen, im Gegensatz zum Pflanzenschutzbereich, derzeit keine Rechtsgrundlage gibt, um Anforderungen für die obligatorische Ausbildung und Zertifizierung beruflicher Anwender einzuführen. Für bestehende Lehrpläne besteht keine Notwendigkeit, Weiterbildungsmaßnahmen zu implementieren. Stattdessen sollten Elemente der nachhaltigen Verwendung von Bioziden in diesen Lehrplänen verankert werden.

Verkaufsbeschränkungen:

Hinsichtlich möglicher Verkaufsbeschränkungen von Bioziden ist insbesondere das Selbstbedienungsverbot zu nennen. Wenn die Verwendung eines Biozids durch die breite Öffentlichkeit untersagt ist, besteht die Möglichkeit, Verkaufsbeschränkungen im Zuge nationaler Regelungen zu etablieren. Es besteht die Option, Biozid-Verkäufer, Anwender und den Verkauf von Produkten, die nicht für die allgemeine Anwendung gedacht sind, zu registrieren, wie es in Belgien realisiert wird. Die Ausbildung von Händlern, die Biozid-Produkte für die berufliche Anwendung vertreiben, mithilfe zertifizierter Weiterbildungen wäre eine weitere potentielle Maßnahme.

Die Lieferkette einiger Biozid-Produkte, wie z.B. Desinfektionsmittel für die Hände, für Flächen oder Wäsche (Einsatzzweck menschliche Gesundheit) könnte dahingehend festgelegt werden, dass der Vertrieb über Apotheken an die breite Öffentlichkeit erfolgt. Hierdurch könnte eine Beratung hinsichtlich der korrekten Anwendung und allgemeiner Hygieneanforderungen erfolgen. Der freie Verkauf aller Rodentizide an private Verbraucher, z.B. durch Selbstbedienung in Baumärkten oder über das Internet sollte eingeschränkt werden. Bisher gibt es für einige Produkte lediglich Beschränkungen in der Anwendung, aber keine Verkaufsbeschränkungen. Generell sollten Biozidprodukte, für die nur eine professionelle Anwendung vorgesehen ist, mit einem Verkaufsverbot belegt werden, damit ein freier Verkauf, z.B. über das Internet ausgeschlossen wird. Einschränkungen der Selbstbedienung oder des Fernverkaufes könnten auch vom Ergebnis der Produktzulassung abhängen.

Programme zur Bewusstseinsbildung:

Die Entwicklung und Etablierung von Sensibilisierungsprogrammen ist eine wichtige Maßnahme zur Unterstützung der nachhaltigen Nutzung von Bioziden, insbesondere für Verbraucher. Web-basierte Informationsplattformen sollten mit unterstützenden Instrumenten wie Printmedien, Rundfunk- und Fernsehsendungen ergänzt werden.

Applikationsgeräte:

Die Verfügbarkeit geeigneter Geräte für die Anwendung von Bioziden ist ein wichtiges Werkzeug für die Minimierung der Exposition und die genaue Dosierung von Bioziden. Initiativen zur Harmonisierung und Standardisierung der Geräte für die Biozid-Anwendung gibt es nur in rudimentärer Form. Es sollten Werbebeschränkungen erlassen werden, um zu vermeiden, dass Spritzgeräte für die Ausbringung von z.B. Holzschutzmitteln, beworben werden, obwohl der Formulierer des Holzschutzmittels diese Applikationsform nicht für sein Produkt vorsieht. Die Integration solcher Spritzgeräte in die Maschinenrichtlinie unter Angabe der erlaubten Anwendungen würde eine bessere Rechtssicherheit schaffen. Dies würde es auch ermöglichen, dass Geräte für die großflächige Biozid-Ausbringung mittels Sprühkanonen und Sprühen aus der Luft durch Hubschrauber zur Kontrolle des Eichenprozessionsspinner in gleicher Weise bewertet würden wie ähnliche Pflanzenschutzgeräte.

Obwohl die Geräte während der Produktzulassung bewertet werden, besteht eine erhebliche Unsicherheit, wie spezifisch die Bewertung dieser Ausbringungsgeräte während der Produktzulassung erfolgt. Es gibt keine rechtliche Befugnis, bestimmte Geräte ebenso einzufordern, wie dies für Pflanzenschutzmittelgeräte möglich ist. Daher sollte eine systematische Bewertung der bestehenden Standards für die Ausbringungsgeräte durchgeführt und die Maschinenrichtlinie 2006/42/ EG dahingehend geändert werden, dass Maschinen und Geräte für die Anwendung von Bioziden mit identifizierten Risiken einbezogen werden.

Nutzungsphase und Ende des Lebenszyklus:

In der Richtlinie 2009/128/EG sind keine Instrumente zur Reduktion von Umweltemissionen während der Nutzungsphase berücksichtigt. Allerdings wird bei Bioziden zur Konservierung von Materialien (PA 6-10) und bei Antifoulingmitteln (PA 21) ein erheblicher Anteil der Gesamtemissionen während der Nutzungsdauer durch Auswaschung der behandelten Materialien oder der Entfernung von Beschichtungen freigesetzt. Emissionen aus Farben und Putzen (PT 7/10) können durch eine verbesserte Produktqualität mit geringerer Auswaschbarkeit von Bioziden reduziert werden. Für Farben und Putz an Außenfassaden könnte ein Klassifizierungssystem entwickelt werden, um eine vergleichbare Einschätzung des Umweltverhaltens zu ermöglichen. Zu den Restgehalten an Konservierungsmitteln in behandelten Beschichtungen am Ende des Lebenszyklus liegen keine Daten vor. Farbeimer mit Farbresten werden i.d.R. von den Unternehmen zur Entsorgung wieder zurückgenommen. Privatanwender können die Behälter zu den öffentlichen Sammelstellen zurückgeben. Leere Farbeimer werden mit dem Hausmüll entsorgt. Das Auswaschen von Pinseln und Walzen wird nicht mehr empfohlen. Die sichere Entsorgung von Rodentiziden (d.h. Köderreste) und toten Nagetieren ist ein wichtiger Aspekt jeder Schädlingsbekämpfungsmaßnahme und eine der effizientesten Maßnahmen, um negative Umweltauswirkungen durch Rodentizide zu reduzieren.

Spezifische Maßnahmen zum Schutz der Umwelt:

Unter den spezifischen Maßnahmen zum Schutz der aquatischen und terrestrischen Umwelt sind die Anforderungen der Wasserrahmenrichtlinie sowie das Konzept der

Trinkwasserschutzzonen zu nennen, die sowohl für Pflanzenschutzmittel als auch für Biozide gelten. Der Hauptemissionspfad für Desinfektionsmittel der PA 2 erfolgt über die Kanalisation zu kommunalen Kläranlagen. Die Vermeidung von Stoßbelastungen, die Neutralisation der Wirkstoffe oder die verpflichtenden Abwasserableitung zu einer gut funktionierenden kommunalen Kläranlage können als Risikominderungsmaßnahmen betrachtet werden.

Für Film- und Mauerwerk-Konservierungsmittel (PT 7/10) ist die Einrichtung von Schutz- und Puffer-Zonen für Oberflächengewässer oder von dezentralen Abwasserbehandlungsanlagen für den Regenabfluss geeignet, die diffuse Freisetzung in die Umwelt zu verringern. Im Hinblick auf den Einsatz von Rodentiziden unterstützt der Einsatz von Köderboxen sowie die Verwendung von Bitterstoffen oder Farbstoffen den Schutz der terrestrischen Umwelt und von Nichtzielorganismen.

Die Identifizierung weiterer prioritärer Stoffe und deren Überwachung in der Umwelt ist eine Voraussetzung für die Festlegung von Umweltqualitätskriterien.

Die Reduzierung der Verwendung von Bioziden in sensiblen Bereichen, wie Natura-2000-Gebiete, kann für einige Biozidanwendungen erforderlich sein. Es wurden mehrere Außenanwendungen von Bioziden identifiziert (z.B. PA 2, 7, 8, 10, 11, 14, 18, 21), die überwiegende Verwendung von Bioziden erfolgt für die meisten PAs jedoch im Innenbereich. In öffentlichen Bereichen wie Krankenhäusern oder Restaurants kann ein Biozideinsatz zur Schädlingsbekämpfung und zum Hygienemanagement gesetzlich vorgeschrieben sein. In diesen Fällen sollte die richtige Verwendung von Bioziden durchgesetzt werden. Da sensible Bereiche bei der Produktzulassung nicht speziell adressiert werden, würde eine Richtlinie zur nachhaltigen Nutzung von Bioziden Maßnahmen den Schutz dieser Bereiche erleichtern.

Integrierte Schädlingsbekämpfung und Leitfäden zur „Guten fachlichen Praxis“:

Zu den Grundsätzen der integrierten Schädlingsbekämpfung und den Leitfäden zur „Guten fachlichen Praxis“ in der Biozid-Anwendung gehört die Berücksichtigung von präventiven und/oder nicht-bioziden Maßnahmen. Die Entwicklung und Förderung von Leitfäden zur integrierten Schädlingsbekämpfung ist eines der vielversprechendsten Instrumente für die nachhaltige Verwendung von Bioziden. Für Desinfektionsmittel im Lebensmittelbereich kann die Anwendung des HACCP-Konzeptes zur Gefahrenanalyse und zu kritischen Kontrollpunkten als Beispiel für ein Hygienemanagementsystem angeführt werden, das einen ähnlichen Ansatz verfolgt wie die integrierte Schädlingsbekämpfung. Für Film- und Mauerwerkskonservierungsmittel (PT 7/10) sind vergleichbare Konzepte nicht bekannt.

Während für den Einsatz von Desinfektionsmitteln im Bereich der öffentlichen Gesundheit (PA 2) und der Veterinärhygiene (PA 3) zahlreiche Leitfäden zu guten und besten Praktiken zur Verfügung stehen, gibt es einen Mangel an solchen Dokumenten für die Anwendung und den sicheren Umgang mit Farben und Putzen, die Biozide enthalten. Hier werden lediglich technische Merkblätter und allgemeine Informationen durch die Formulierer angeboten. Daher wurde eine Reihe von Merkblättern zu besten Praktiken für die verschiedenen betroffenen Akteure durch

eine Ad-hoc-Arbeitsgruppe im Rahmen dieses Projektes entwickelt. In Bezug auf die Bekämpfung von Nagetieren (PA 14) gibt es eine Vielzahl von Dokumenten aus Behörden, Industrie und Berufsverbänden, die Elemente der integrierten Schädlingsbekämpfung und der guten Praxis beschreiben.

Indikatoren zur Beschreibung des erzielten Fortschritts bei der nachhaltigen Nutzung von Bioziden:

Derzeit stehen keine geeigneten Indikatoren zur Verfügung, um den erzielten Fortschritt bei der nachhaltigen Verwendung von Bioziden zu beschreiben. Es liegen nur begrenzt Daten über Verkäufe und den Verbrauch von Bioziden und deren Verwendungsmuster sowie über Monitoringergebnisse in Umweltmedien vor. Die Einbeziehung von Bioziden in den Anwendungsbereich der Verordnung (EG) Nr. 1185/2009 über Statistiken zu Pestiziden, die bisher nur Pflanzenschutzmittel umfasst, wird empfohlen. Diese Daten werden dringend für die Entwicklung geeigneter Indikatoren und die Definition von Zielen der nachhaltigen Nutzung benötigt.

Von Seiten der Akteure wurden insbesondere Indikatoren betreffend der Verbrauchsdaten für bestimmte Produktarten (PA 2), Expositionsmessungen an Arbeitsplätzen (PA 3), der biozidspezifischen Überwachung von Kläranlagen und Oberflächenwasser (PA 7/10) und der Ermittlung von Vergiftungsfällen von Nichtzielorganismen (PA 14) als wichtig eingestuft. Die Auswahl geeigneter Indikatoren hängt direkt mit der Festlegung von Risikominderungsmaßnahmen und den Instrumenten zum Erreichen der Ziele einer nachhaltigen Nutzung zusammen. Somit sollten beide Themen (Maßnahmen und Indikatoren) gleichzeitig entwickelt werden. Zunächst sollten die gemeinsamen Ziele identifiziert werden, dann sollten geeignete Maßnahmen festgelegt werden, um die Ziele zu erreichen. Parallel dazu ist eine Reihe von Indikatoren zur Beschreibung wirtschaftlicher, sozialer und ökologischer Aspekte auszuwählen. Von Seiten der Industrie wird eine Bestandsaufnahme der bestehenden Verwendung von Bioziden begrüßt, um Schwerpunkte der Handlungsfelder zu identifizieren. Die Industrie ist jedoch nicht damit einverstanden, lediglich die Verbrauchsmengen von Biozidprodukten zu erfassen. Stattdessen sollten die Risiken, die Exposition und die Vorteile des Biozid-Einsatzes mitberücksichtigt werden.

Optionen für die Umsetzung:

Die Entwicklung eines Aktionsrahmens für eine nachhaltige Verwendung von Bioziden auf europäischer Ebene wird empfohlen, um die Umsetzung geeigneter Maßnahmen zur Reduzierung von Risiken von Bioziden für die Umwelt und die menschliche Gesundheit zu ermöglichen. Diese Maßnahmen könnten durch die Schaffung einer neuen Richtlinie über die nachhaltige Verwendung von Bioziden oder durch Erweiterung der bestehenden Richtlinie 2009/128/EG realisiert werden. Bestimmte Maßnahmen könnten auch auf nationaler Ebene umgesetzt und dann in einen nationalen Aktionsplan aufgenommen werden (u.a. Beispiel Verkaufsbeschränkung in Belgien). Im Rahmen einer Studie für die Europäische Kommission zu Artikel 18 der BPR werden derzeit die bestehenden nationalen Maßnahmen dahingehend analysiert, ob sie in einer allgemeinen Strategie für die nachhaltige Nutzung von

Bioziden auf europäischer Ebene umgesetzt werden könnten. Auch vor dem Hintergrund der künftigen Unionszulassung von Biozidprodukten wird eine weitere Diskussion mit der Industrie, die eine Harmonisierung und Vergleichbarkeit der Anforderungen auf europäischer Ebene fordert, stattfinden.

Summary

Introduction

In November 2009 a framework action plan for achieving a sustainable use of pesticides was established by Directive 2009/128/EC on the basis of the corresponding Thematic Strategy. It aims at minimising hazards and risks for human health and the environment. This is accomplished by improving the controls of pesticide application, their distribution and by encouraging cultivation methods with limited use of pesticides. This shall be achieved by supporting „good practices” and by integrated pest management as well as by use restrictions in sensitive areas. Up to now the sustainable use of pesticides Directive (SUD) has focused on plant protection products. However, the possibility for extending the Directive to biocides is kept open.

In a preceding project, prospects and requirements for transferring the measures proposed in the SUD for plant protection products to the biocide area have been analysed (Gartiser et al. 2012)². The focus was on wood preservatives (product type (PT) 8), insecticides (PT 18), and antifouling agents (PT 21). In the follow-up project measures for the sustainable use of products in product types 2 and 3 (disinfectants), 7/10 (preservatives in paints, renders, and masonry preservatives) and 14 (rodenticides) have been analysed. Up to now the Biocidal Product Regulation (BPR) and the *German National Chemical Act* do not sufficiently consider the use phase of biocidal products. However, a significant proportion of biocides is released to the environment during the application phase and service-life. Thus, for biocides there is a particular need of developing measures for their sustainable use. The research project aims at analysing the use pattern and environmental exposure pathways of biocides assigned to product types 2, 3, 7/10 und 14 and to develop prospects for a sustainable use of these biocides. A package of measures was proposed and discussed among European experts in order to support to the upcoming development and harmonization processes at EU level. Further objectives were to develop appropriate indicators for controlling the efficiency of the measures and to propose options for communicating these measures to different target groups.

The final report consists of a main report and five Annexes. The main report focuses on the objectives of a sustainable use of biocides as well as on elements and measures proposed to support these objectives. The results of a broad stakeholder survey and two workshops are presented. The main report also includes an analysis of potential indicators and a first proposal of an appropriate risk

² Gartiser, S., Lückow, H., Groß, R. 2012. Thematic Strategy on Sustainable Use of Plant Protection Products - Prospects and Requirements for Transferring Proposals for Plant Protection Products to Biocides. Final report FKZ 3708 63 400, UBA-Texte 6/2012.

<http://www.umweltbundesamt.de/sites/default/files/medien/461/publikationen/4261.pdf>

communication strategy. An analysis of the legislative background has been provided in the preceding project (Gartiser et al 2012). A short update is presented in Annex I. The case studies on product types 2 and 3 (disinfectants), 7/10 (film and masonry preservatives in exterior paints and renders) and 14 (rodenticides) are documented in Annexes II - V.

Stakeholder survey

Within the framework of the project a stakeholder survey has been conducted. The objective of this survey was to obtain the view of professional and industrial associations, users, formulators, authorities, NGO's, consultants and others on known impacts of biocides, potential measures on sustainable use and on suitable indicators describing the achieved progress. For all PT's considered within this study product-type specific questionnaires (both in German and English) have been developed in cooperation with experts from the *German Federal Environment Agency*. Starting in June 2012 these questionnaires were sent to various stakeholders by mail or e-mail. The main results of this survey are documented in the case study reports on a sustainable use of biocides applied in PT 2, PT 3, PT 7/10, and PT 14 in the Annexes of the main report.

Defining the objectives of sustainable development

One definition of sustainable development often cited refers to the three pillar concept where economic development, social development and environmental protection are mutually reinforced. The objectives of these pillars are poverty eradication, changing unsustainable patterns of production and consumption and protecting and managing the natural resource base of economic and social development. The concept consists of an integrated approach where the different pillars should be well balanced. The idea behind is that the three pillars are not achievable independently and could only mutually be enforced.

The three pillar concept has been criticised because often the economic pillar has been predominant and economic growth might counteract to a sustainable use of resources and hence increase environmental pollution (Figure 1). Meanwhile the UN recognises that the environmental pillar should be visualised as providing "the foundation for the economic and social pillars of sustainable development, because life on earth is conditioned upon a healthy environment".

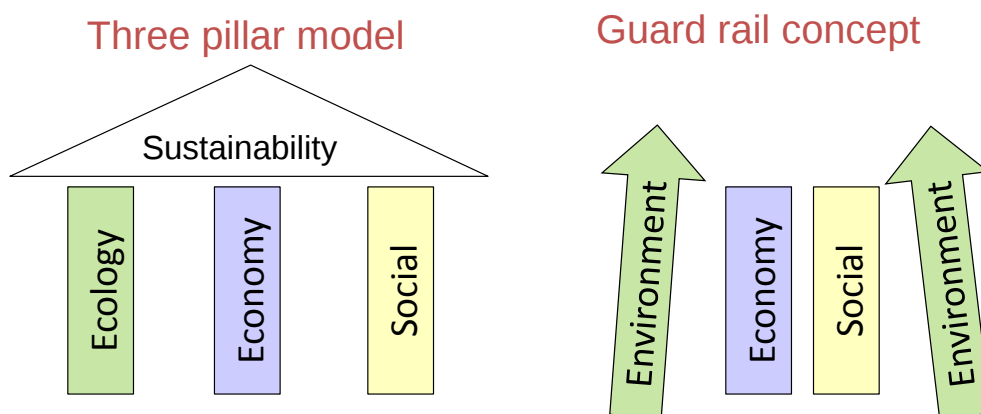


Figure 2: Sustainability models

In 1992 the German federal government set up the *German Advisory Council on Global Change* (WBGU) as an independent, scientific advisory institution. The WBGU developed the “Guard Rail Concept” which also focuses on the environmental pillar of sustainability as a prerequisite for the social and economic dimension (Figure 1). The “guard rail concept” defines the acceptable dimension for anthropogenic intervention in nature by setting limits in which development and progress can take place sustainably. Global trends that are on a collision course with the planetary guard rails are especially discussed in the field of climate change and biodiversity. According to the WBGU the “guard rail concept” is an attempt to resolve the dilemma between social, environmental and economic goals by setting clear priorities.

Based on these assumptions a sustainable use of biocides may be defined as a use that does not counteract the need to pass an unspoilt planet on to future generations, in which a healthy environment is conditional for the economic and social development. The benefits of the use of biocides for achieving, e.g. a better hygiene or material protection should be taken into account and should be distributed equally between all people.

Suggestions for communication campaigns on sustainable use of biocides

There are different communication strategies for professional users and the general public. Professional users need training or education to understand sustainable use of biocides. For consumers measures used for awareness raising are appropriate. However, the willingness to participate at training activities for the use of biocides in various sectors is uncertain. Hence in terms of communication strategies we identified a need to raise awareness in certain sectors, in order to promote organisation and attendance to such training courses.

The following target groups for the communication campaigns were identified:

- Work safety managers (construction companies; large scale farms; pest control companies; etc.)
- Independent operators (pest controllers; farmers; veterinarians; masonry contractors; etc.)
- Manufacturers
- Resellers and distributors
- Workers

Prioritised subjects of communication strategies for the general public are:

- Explaining risks and potential acute and chronic effects on human health
- Risk management measures in areas used by the general public and vulnerable groups
- Measures realisable by individuals to reduce exposure

Indeed, it was considered extremely important to make the wider public and in particular bystanders and residents conscious of products used and their impact. Additionally, the public needs to be aware if the used products are applied in regular time intervals or by multiple application methods. This could require specific mitigation measures in addition to those that should already be implemented by the operators/workers in order to reduce the risks of exposure.

Among the target groups that were identified for having a “high need for action” in terms of the information requirements on the risks of biocides of certain PTs to their health, the following relevant groups are mentioned:

- Vulnerable groups: allergy sufferers, people with multiple chemical sensitivity (MCS), sick or older people.
- Young people: highly susceptible target group of importance for the future
- Foreign citizens: any language obstacles
- People with low level of education: probably more difficult to access via information offerings
- Multipliers and representatives

In terms of the format of the communication material for the awareness raising campaigns, it was felt that a mixed approach should be adopted that suits to different target audiences involved. Stakeholders identified video materials as having the highest impact together with paper based information material (leaflets, poster, etc.). Radio and television broadcasting should also be considered in order to reach a wide distribution of the information within the target audiences. Stakeholders questioned in this project mainly attributed a limited efficiency to the promotion of web-based information platforms.

Relating to information and awareness raising, participants agreed that the information given to the general public must be objective, balanced and science-based. It should not only cover environmental and health aspects relating to the use of products, but should also include messages explaining why they are used and what their benefits are.

Package of measures

Among the measures covering all PTs it is on hand that the SUD, which so far only has been implemented for plant protection products, could be amended to cover also biocides.

Initiatives for harmonisation and standardisation of the machinery for biocide application should be approved. The Directive on Machinery 2006/42/EC should be amended to include machinery and equipment for the application of certain biocides.

The inclusion of biocides into the scope of the Regulation (EC) No 1185/2009 concerning statistics on pesticides, which so far only covers plant protection products, is recommended. These data are urgently needed for the development of suitable indicators and the definition of the objectives for sustainable use.

In Directive 98/83/EC on quality of water for human use, the term “pesticide” could be extended to refer to both, plant protection products and biocidal products, in order to cover also disinfectants or film preservatives. Similarly, the consideration of the term “biocide” in the German surface water regulation (OGewV) would be an appropriate mean for monitoring emission of biocides into surface water. This could provide a basis for the development of suitable reduction measures.

Maximum residue levels of biocides in waste could be defined in order to cover the end of life phase of biocides.

The Directive 86/278/EEC on the protection of soil, when sewage sludge is used in agriculture, could be amended to cover other contaminants than heavy metals, such as biocides.

The European “Sustainable Consumption and Production and Sustainable Industrial Policy Action Plan” could be adopted to cover also biocides used in the private and industrial sector.

A detailed presentation of potential measures, for supporting a sustainable use of disinfectants (PT 2, 3), film and masonry preservatives (PT 7/10) and rodenticides (PT 14) is given in separate case studies (Annex II-V).

A short summary of measures which received the highest acceptance of at least 50% of all stakeholders which attributed high and medium efficiency to them is presented in Table 1:

Table 1: Product type specific measures supported by stakeholders

	PT 2	PT 3	PT 7/10	PT 14
Further training and education				
Development of hygienic plans, disinfection plans and work instructions adjusted to the needs of disinfection measures.	X			
Advice to clients by manufacturers (including safety data sheets, technical leaflets, instructions for use).	X	X		
Instruction of co-workers in the company.		X		
Knowledge transfer on a sustainable use of disinfectants during education and training, e.g. of farmers.		X		
Funding of (voluntary) training measures for (private) users, e.g. on environmental sound use and disposal.		X		X
Certification of professional users, distributors and consultants within further education and training.		X		
Implementation of "standards" for sustainable use and disposal as part of professional training, e.g. for painters			X	
Promotion and further education training for a sustainable use of paints and plasters containing biocides during application and utilization phase for architects.			X	
Placement of “standards” for sustainable use and disposal as part of training, e.g. for semi-skilled workers.			X	
Training courses on pest control to become a trained/certified professional user.				X
Harmonised training schemes for other user groups such as farmers and gamekeepers.				X
Further educational structures such as training seminars organised by pest control companies, manufacturers and other organisations, or formative meetings and				X

	PT 2	PT 3	PT 7/10	PT 14
conferences organised by pest control associations.				
Knowledge transfer on a sustainable use of rodenticides during education and training, e.g. of pest control workers.				X
Knowledge transfer on a sustainable use of disinfectants during education and training, e.g. of nursing staff or cleaning staff	X			
Requirements for sales and control mechanisms				
Prohibition of certain products and applications for nonprofessional users (consumers).	X			
Certification of professional users, distributors and consultants within further education and training. Certification of hygiene consultants of manufacturers / retailers.	X	X		
Restrictions on the marketing for consumer.	X			X
Development of a classification system for environmental sound disinfectants.	X	X		
Regulation of sales of products through retail trade to the general public, e.g. through the sale of household disinfectants in pharmacies.	X			
Regulation of sales of products via el internet, e.g. through minimum standards of information requirement (PT 3) or restriction of any sales to private users (PT 14)		X		X
Proof of advice/consulting on handling paints and plasters containing biocides for professionals by the manufacturer (safety, technical data sheet)			X	
Sales restrictions of products containing anticoagulant rodenticides (especially SGAR), only ready-to-use products (i.e. no concentrates); bait products only in combination with bait stations.				X
Limitation of the container size for private users (to minimize residual amounts)				X
Information and awareness raising				
Providing information on "best practices" and safe use (PT 2, 3). Providing information on good practice for use and safe disposal of products containing biocides for customers in the DIY-sector (PT7/10)	X	X	X	
Providing multilingual information on "best practice" for the safe application and disposal for professional users.			X	
Funding of (voluntary) training measures for users, e.g. on environmental sound use and disposal.		X		
Promotion of web-based information platforms.		X		X
Information for pest control operators/farmers such as web-based support/information systems and professional journals providing all kind of information related to pest and rodent control, including recommendations for the performance of professional rodent campaigns				X
Annual conferences and meetings organised by pest control associations providing the opportunity for information exchange between manufacturers, professional users and authorities / academia.				X
Journals read by farmers, hobby gardeners or private consumers as distribution pathways for the dissemination of knowledge on sustainable use				X
Surveillance of applications				
Development of hygienic plans, disinfection plans and work instructions adjusted to the needs of disinfection measures.		X		
Renunciation of daily routine disinfection of floors in public health areas	X			
Replacement of air conditioners with rotary spray through steam humidifier	X			
Optimization of disinfection by previous cleaning	X	X		
Quality Assurance and Control.	X	X		
Replacement of poorly biodegradable / eliminable disinfectants (in sewage treatment plants) by rapidly degradable active ingredients and additives.	X	X		
Mandatory testing and control of biocide treated materials	X			
Development of technical standards and guidelines for the cleaning of instruments and equipment.	X	X		
Development of standards and guidelines for private users, when disinfection	X			

	PT 2	PT 3	PT 7/10	PT 14
measures are required and how they should be used.				
Replacement of disinfection measures by thermal and thermochemical processes (PT 2). Replacement of disinfection measures by thermal processes (incineration, flame treatment, hot air sterilization, boiling, steam sterilization, self-heating (PT 3)	X	X		
Limitation of the container size for consumer users to minimize residual amounts	X			
Routine examination of bacterial load in the relevant areas,		X		
Mandatory use of stable, tamper-resistant and secured bait boxes				X
Well-planned, systematic and safe application/placement of baits at relevant points.				X
Consideration of the principles of IPM and criteria of best practice				X
Measures to reduce emissions during the use phase				
Collection and disposal of residual amounts.		X		
Intermediate wastewater storage in collection tanks followed by transport and treatment in municipal sewage treatment plants		X		
Anaerobic treatment of liquid manure for biogas production		X		
Avoidance of peak loads through discharge of concentrated solutions.		X		
Discharge of wastewater from cleaning and disinfection to the liquid manure tank		X		
Organized collection and disposal of residual amounts mandated by public authorities			X	
Risk investigation for outdoor uses (e.g. safe placement of bait boxes).				X
Adequate disposal of dead rodents and remnant baits after the treatment campaign.				X
No preventive permanent baiting with anticoagulant baits.				X
No monitoring (for signs of (re)infestation) with anticoagulant baits. Instead, non-toxic baits, traps or monitoring devices should be used for rodent monitoring.				X
Establishment of buffer and safeguard zones along surface waters				X
Use restrictions in sensitive areas (e.g. public parks and gardens, drinking-water protection areas, etc.).				X

Education and training:

Education and training is of decisive importance for the sustainable use of biocides by professional users. For consumers only measures for awareness raising are appropriate. Training programs should consider existing education curricula or training schemes. A prioritisation of biocide applications for which training should be considered is required. Main areas identified were pest control agents (rodenticides, insecticides) and high production volume PTs such as general disinfectants (PT 2) or indoor uses which lead to emissions to sewage treatment plants. Prioritisation of training initiatives should also be linked with existing best practices which generally are PT specific. The question whether training should be mandatory or not need to be further analysed. Training should integrate good housekeeping principles, good agricultural practices, integrated pest management or other best practices depending on the trained PT use. While education and training is already well established for disinfection (PT 2) or rodent control (PT 14), a lack of training possibility for the application of façade coatings and renders containing biocides is complained. The use of second generation anticoagulant rodenticides should be restricted to “trained professional users with a license” in all Member States. The certification of the competence tests should be carried out by neutral authorities and not alone by the

training provider. Furthermore, the participation of pest controllers, farmers and gamekeepers, at regular training events should be mandatory. It was complained that in contrast to the plant protection area there is no legal basis to implement requirements for obligatory training and certification for biocidal uses. For existing apprenticeship curricula there is no need to implement further training measures. Instead, elements of sustainable use of biocides should be considered in these curricula.

Restrictions on sales:

Restrictions on sales of biocides specifically addressed the prohibition of self-service. Sales requirements can be regulated nationally if public use is prohibited. There is an option for the registration of biocide sellers, users and sales for those products not allowed for public use as it is being realised in Belgium. The certification of competence of distributors of biocidal products intended for professional use only is another potential measure. The supply chain of some biocidal products such as disinfectants for hands, surfaces or laundry (intended for human health purposes) could be prescribed by distributing these products via pharmacies to the general public in order to obtain advice on the application of these products and on general hygiene requirements. The free sale of all rodenticides to private consumers, e.g. through self-service in building stores or via the internet should be restricted. Up to now there are only use restrictions for some products. Generally, internet sales of professional biocidal products to consumers should be forbidden. Restrictions of self-service or remote selling might also depend on the outcome of product authorisation.

Awareness programmes:

The development and establishment of awareness programmes is an important instrument for supporting sustainable use of biocides, especially for consumers. Web-based information platforms should be complemented with supporting tools such as print media and radio and television broadcasting campaigns.

Application equipment:

The availability of appropriate equipment for the application of biocides is an important tool for minimising exposure and for precise dosage of biocides. Initiatives for harmonisation and standardisation of the machinery for biocide application only exist in rudimentary form. Advertising restrictions should be established for avoiding that spray equipment is promoted for uses which are not recommended by the formulators, such as wood preservatives. The integration of such sprayers into the Machinery Directive indicating the allowed applications would provide more legal certainty. This would also allow that the equipment for large scale biocide applications such as spray canons and aerial spraying from helicopters for the control of oak procession moths would be evaluated in the same way as similar plant protection equipment.

While the equipment is considered during product authorisation there remains considerable uncertainty how specific the evaluation of the equipment during product

authorisation works. There is no legal power to request for specific equipment as it is the case for plant protection products. Thus, a systematic evaluation of existing standards for the equipment should be performed and the Directive on Machinery 2006/42/EC should be amended to include this machinery and equipment for the application of biocides with identified risks.

Service and end of life stages:

The SUD does not consider instruments for reduction of environmental emissions during service life. However, for biocides used for preservation of materials (PT 6-10) and antifouling agents (PT 21), a considerable proportion of total emissions arise during service life, through leaching from treated materials or the removal of coatings. Emissions from paints and renders (PT 7/10) may be reduced by improved product quality with lower leachability of biocides. A classification system should be developed for outdoor façade paints and renders to allow a comparison of their environmental performance.

No data exist about the preservatives contained in treated coatings at the end of life. Paint buckets with residuals are taken back to the companies and disposed. Private users can return the containers to public collection points. Empty buckets are disposed of with household waste. Washing of brushes and rollers is not recommended anymore. The safe disposal of rodenticides (i.e. remnant baits) and rodent bodies is an important aspect of any pest control operation and considered as one of the most efficient measures to reduce negative environmental impacts by rodenticides.

Specific measures to protect the environment:

Among specific measures to protect the aquatic and terrestrial environment, the requirements of the Water Framework Directive as well as the concept of drinking water protection zones apply to both, plant protection products and biocides. The main emission pathway for PT 2 disinfectants is via the sewer system to municipal sewage treatment plants. Avoidance of peak loads or neutralisation of the active substance or obligatory discharge of the wastewater to a well-functioning municipal sewage treatment plant may be considered as risk mitigation measures.

For film and masonry preservatives (PT 7 / 10) the establishment of protection and buffers zones to surface waters or decentralized treatment plants for runoff might control diffuse release to the environment.

With regard to the use of rodenticides the use of bait boxes or the inclusion of bittering agents and dyes help to protect the terrestrial environment and non-target organisms.

The identification of further priority substances and their monitoring in the environment is a prerequisite for setting environmental quality criteria.

The reduction of biocide use in sensitive areas, such as Natura 2000 sites, may be required for some applications. Several outdoor applications of biocides have been identified (e.g. PTs 2, 7, 8, 10, 11, 14, 18, 21), but the prevalent use for most PTs is indoors. Considering public areas such as hospitals and restaurants

biocide use may be a legal requirement for pest control and hygiene management. The correct use of biocides in these areas should be enforced. Because sensitive areas are not specifically addressed during product authorisation a sustainable use directive would facilitate measures to protect these areas.

Integrated pest management and best practices:

Integrated pest management and best practices in biocide application include the consideration of preventive and/or non-biocidal measures. The development and promotion of IPM guidance for pest control is considered one of the most promising instruments for the sustainable use of biocides. For disinfectants the Hazard Analysis and Critical Control Points (HACCP) as a preventive approach for food safety may serve as an example for a hygiene management tool, comparable to IPM, whereas for masonry and film preservatives (PT 7/ 10) no such concepts exist.

While for public health disinfectants (PT 2) and veterinary hygiene disinfectants (PT 3) numerous good and best practice documents are available, there is a lack of such documents describing the application and safe handling of paint and plaster that contain biocides, except technical data sheets and informal guidance documents offered by formulators. As a consequence a set of leaflets on best practice for different stakeholder groups has been developed by an ad-hoc working group task force within this project. With respect to rodent control (PT 14) there is a multitude of documents from authorities, industry, and professional associations describing the elements of integrated pest management (IPM) and criteria of good practice.

Indicators describing progress in sustainable use:

To this date, there are no suitable indicators available for describing progress in the sustainable use of biocides. There exist only limited data on sales and consumption of biocides, the use pattern, and monitoring data in environmental media. The inclusion of biocides into the scope of the Regulation (EC) No 1185/2009 concerning statistics on pesticides, which so far only covers plant protection products, is recommended. These data are urgently needed for the development of suitable indicators and the definition of the objectives of sustainable use.

The stakeholders attributed the highest priority to indicators describing consumption data for specific product types (PT 2), exposure measurements on workplaces (PT 3), biocides specific monitoring of effluents from sewage treatment plants and surface water (PT 7/10), and the indication of poisoning cases of non-target organisms (PT 14). The selection of appropriate indicators is directly related to the choice of mitigation measures and approaches to achieve the objectives of sustainable use. Thus, the two topics (measures and indicators) have to be discussed concurrently. Firstly, the common goals to be addressed should be identified, secondly appropriate measures to achieve the goal should be defined, and thirdly, a set of indicators describing economic, social and environmental aspects should be selected. Industry supports an inventory of the existing uses to

identify action areas, but disagrees on monitoring solely the consumption volumes of biocidal products while demanding for the consideration of risk as well as exposure and benefits of biocidal use.

Options for the implementation:

The development of an action framework on sustainable use of biocides on European level is recommended in order to enable the implementation of appropriate measures, for the reduction of risks of biocides to the environment and human health. These measures could be implemented by establishing a new Directive on a sustainable use of biocides or by amending the existing one on pesticides. However, certain measures could be implemented also on national level and then be included in a national action plan (e.g. example of sales restriction in Belgium). Within the study according to Article 18 of the BPR for the European Commission existing national measures are currently being analysed whether they could be implemented in a general strategy on sustainable use of biocides at European level. There will be an ongoing discussion with industry who requests the harmonisation and comparability of requirements on a European level - also against the backdrop of the future Union authorisation of biocidal products.

1 Introduction

In November 2009 a framework action plan for achieving a sustainable use of pesticides was established by Directive 2009/128/EC on the basis of the corresponding *Thematic Strategy*.³ It aims at minimising hazards and risks for human health and the environment. This is accomplished by improving the controls of pesticide application, their distribution and by encouraging cultivation methods with limited use of pesticides. This shall be achieved by supporting „good practices” and by integrated pest management as well as by use restriction in sensitive areas. Up to now the sustainable use of pesticides Directive (SUD) has focused on plant protection products. However, the possibility for extending the Directive to biocides is kept open.

In a preceding project, prospects and requirements for transferring the measures proposed in the SUD for plant protection products to the biocide area have been analysed (Gartiser et al. 2012). The focus was on wood preservatives (product type (PT) 8), insecticides (PT 18), and antifouling agents (PT 21). In the follow-up project measures for the sustainable use of products in product types 2 and 3 (disinfectants), 7/10 (preservatives in paints, renders, and masonry preservatives) and 14 (rodenticides) have been analysed. Up to now the Biocidal Product Regulation (BPR) and the *German National Chemical Act* do not sufficiently consider the use phase of biocidal products. However, a significant proportion of biocides is released to the environment during the application phase and service-life. Thus, for biocides there is a particular need of developing measures for their sustainable use. The research project aims at analysing the use pattern and environmental exposure pathways of biocides assigned to product types 2, 3, 7/10 und 14 and to develop prospects for a sustainable use of these biocides. A package of measures was proposed and discussed among European experts in order to support to the upcoming development and harmonization processes at EU level. Further objectives were to develop appropriate indicators for controlling the efficiency of the measures and to propose options for communicating these measures to different target groups.

The structure of this report is as follows:

- The main report focuses on measures proposed to support a sustainable use of biocidal products which mainly are derived from the case studies types 2 and 3 (disinfectants), 7/10 (film and masonry preservatives in exterior paints and renders) and 14 (rodenticides). The objectives of a sustainable use of biocides are analysed in chapter 3. Here the view of stakeholders is presented, derived from an extended questionnaire survey. Two workshops on a national and European level have been organised within the project. About

³ http://ec.europa.eu/environment/newprg/archives/strategies_en.htm

50 experts from authorities, industry and NGOs participated. The summary of these workshops are presented in chapter 3.3 of the main report. Further information can be obtained from the *German Federal Environment Agency*. In chapter 4 of the main report, elements and measures which support a sustainable use, are analysed while using a structure adopted from the SUD. The main report includes an analysis of potential indicators (chapter 5) and a first proposal of an appropriate risk communication strategy (chapter 6).

- An analysis of the legislative background has been provided in the preceding project (Gartiser et al 2012). A short update is presented in Annex I.
- The case studies on product types 2 and 3 (disinfectants), 7/10 (film and masonry preservatives in exterior paints and renders) and 14 (rodenticides) are documented in Annexes II - V and are shortly summarised in the main report. For the case studies on wood preservatives (PT 8), insecticides (PT 18), and antifouling agents (PT 21) reference is given to Gartiser et al (2012).

These Annexes can be found as downloads on the UBA-homepage.

2 Stakeholder survey

Within the framework of the project a stakeholder survey has been conducted. The objective of this survey was to obtain the view of professional and industrial associations, users, formulators, authorities, NGO's, consultants and others on known impacts of biocides, potential measures on sustainable use and on suitable indicators describing the achieved progress. For all PT's considered within this study product-type specific questionnaires (both in German and English) have been developed in cooperation with experts from the *German Federal Environment Agency*. Starting in June 2012 these questionnaires were sent to various stakeholders by mail or e-mail. The main results of this survey are documented in the case study reports on a sustainable use of biocides applied in PT 2, PT 3, PT 7/10, and PT 14 (see Annex I-IV). The questionnaires are available on request from the *German Federal Environment Agency*.

3 Defining the objectives of sustainable development

3.1 Approaches of sustainable development

The term "sustainable development" has attained worldwide reputation for describing the future perspectives of mankind. One definition of sustainable development often cited is that from the *Brundtland Commission*, named after the chairwoman of the *World Commission on Environment and Development* (WCED) in the Brundtland report "Our Common Future" (WCED 1987):

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

With respect to contaminants the Brundtland report states that “The prevention and reduction of air and water pollution will remain a critical task of resource conservation. Air and water quality come under pressure from such activities as fertilizer and pesticide use, urban sewage, fossil fuel burning, the use of certain chemicals, and various other industrial activities. Each of these is expected to increase the pollution load on the biosphere substantially, particularly in developing countries. Cleaning up after the event is an expensive solution. Hence all countries need to anticipate and prevent these pollution problems, by, for instance, enforcing emission standards that reflect likely long-term effects, promoting low-waste technologies, and anticipating the impact of new products, technologies, and wastes” (WCED 1987).

In 1992 the Rio Summit of the United Nations resulted in the “Rio Declaration” which describes 27 principles for achieving a sustainable development around the world, in the “Agenda 21 action plan”. This is ought to be implemented in every area of human impact on the environment. Chapter 19 of the Agenda 21 outlines the principles for chemical safety and sound chemicals management. These objectives were strongly reaffirmed at the World Summit on Sustainable Development (WSSD) held in Johannesburg, South Africa, in 2002.

The UN-Millennium declaration from September 2000 includes environmental sustainability as one of eight millennium development goals and demands that “we must spare no effort to free all of humanity, and above all our children and grandchildren, from the threat of living on a planet irredeemably spoilt by human activities, and whose resources would no longer be sufficient for their needs.” The principles of sustainable development including those set out in Agenda 21 are reaffirmed. Among other issues the reduction in emissions of greenhouse gases, the full implementation of the convention on biological diversity, and the development of water management strategies for a sustainable exploitation of water resources are asked for.

One definition of sustainable development often cited refers to the three pillar concept where economic development, social development and environmental protection are mutually reinforced. The objectives of these pillars are poverty eradication, changing unsustainable patterns of production and consumption and protecting and managing the natural resource base of economic and social development. The concept consists of an integrated approach where the different pillars should be well balanced. The idea behind is that the three pillars are not achievable independently and could only mutually be enforced (UN 2002).

The three pillar concept has been criticised because often the economic pillar has been predominant and economic growth might counteract to a sustainable use of resources and hence increase environmental pollution (Figure 1). Meanwhile the UN recognises that the environmental pillar should be visualised as providing “the foundation for the economic and social pillars of sustainable development, because life on earth is conditioned upon a healthy environment” (UNEP without year).

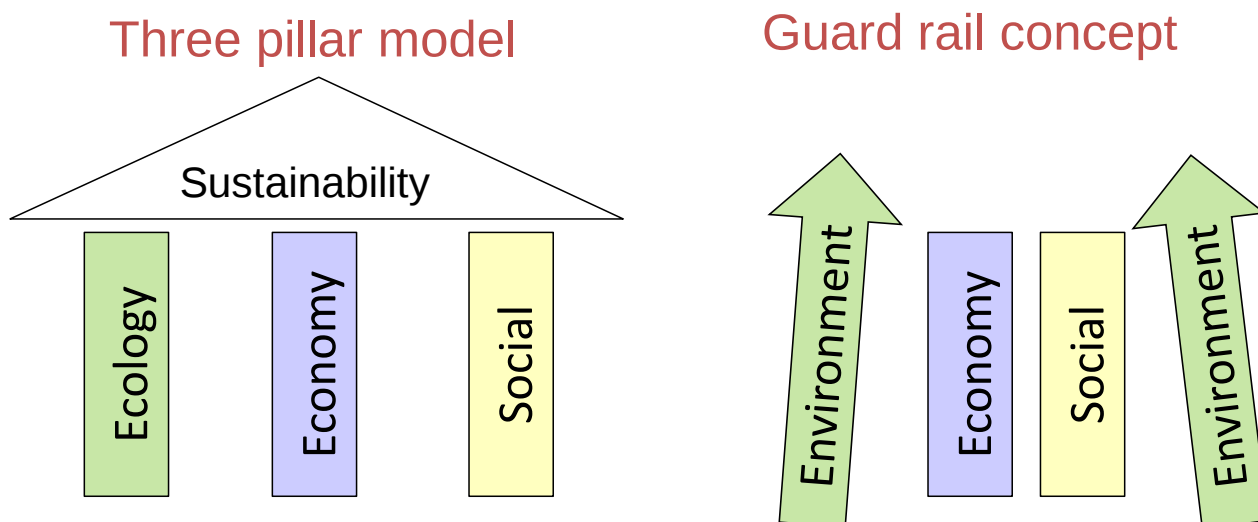


Figure 3: Sustainability models

In 1992 the German federal government set up the *German Advisory Council on Global Change* (WBGU) as an independent, scientific advisory council. The WBGU developed the “Guard Rail Concept” which also focuses on the environmental pillar of sustainability as a prerequisite for the social and economic dimension (Figure 1). The “guard rail concept” defines the acceptable dimension for anthropogenic intervention in nature by setting limits in which development and progress can take place sustainably. Global trends that are on a collision course with the planetary guard rails are especially discussed in the field of climate change and biodiversity (WBGU 2011). According to the WBGU the “guard rail concept” is an attempt to resolve the dilemma between social, environmental and economic goals by setting clear priorities. Water for example, is not only a commodity, but also a foodstuff. It is essential to define the sociocultural and ecological framework and the non-sustainable limits (the “guard rails”) within which water must be used efficiently in order to optimise the general welfare of humans everywhere. The very scarcity of water resources requires an efficient search for beneficial freshwater use within the guard rails. The Council recommended several measures such as defining minimum standards for the drinking water supply, carrying out extensive monitoring programmes, determining critical stress limits and ecological services of aquatic systems, research on pollutant groups, accumulation of contaminants in aquatic habitats, inventory of the biodiversity of aquatic habitats, and investigation of the impacts of introduced species (WBGU 1997).

In analogy to the national and global guard rails, guard rails can also be identified at regional level. This concept can be combined with the bioregional management by designating areas for placing under protection or restriction on use defines ‘sustainability limits’ which must not be exceeded (WBGU 2001).

Based on these assumptions a sustainable use of biocides may be defined as a use that does not counteract the need to pass an unspoilt planet on to future

generations, in which a healthy environment is conditional for the economic and social developments. The benefits of the use of biocides for achieving e.g. a better hygiene or material protection should be taken into account and should be distributed equally between all people.

3.2 The view of stakeholders on sustainability of biocide use

With respect to the understanding of stakeholders on a sustainable use of disinfectants they provided several proposals on possible definitions, which mainly depend on the PTs considered.

Most stakeholders of disinfectants (PT 2, 3) referred to the three pillar concept where the economic component (optimized usage of disinfectants to achieve the hygiene requirements), the social component (human health aspects, reduction of exposure of users during application) and environmental protection are of equivalent importance. According to the stakeholders, sustainable use comprises the following elements:

- Defining hygienic requirements for a targeted application of disinfectants.
- Reduction of disinfection measures to the minimum necessary.
- Use of biodegradable ingredients while avoiding unnecessary additives such as fragrances.
- Correct dosage preferably by technical means such as automatic mixing and avoidance of over- and under-dosage.
- Providing a reasonable proportion of benefits of disinfectants to human health compared to their risks and disadvantages.
- Use of disinfectants which on the long range is ecologically and economically reasonable.
- Successful disinfection of target pathogens with the minimum application rate while avoiding negative impacts to the environment and residues in food.
- Use of appropriate, effective, economic, resource- and environmental-friendly products which are non-hazardous to human health.

Some stakeholders also gave very important hints on environmental impacts through specific uses of disinfectants such as the discharge of conditioned swimming pool water after the winter period where huge amounts of Quaternary Ammonium Compounds (QAC) may be released to surface waters.

Stakeholders working with film and masonry preservatives (PT 7 and 10) highlighted technical improvements as part of sustainability. In particular, longer service life of materials is pronounced several times as a key for sustainability by the reduced need of resources. The three pillar concept was only mentioned by the NGO. Manufacturers of biocides, formulators of PT 7 and 10 end-products and professional associations referred to the following aspects of sustainable use of biocide during application:

- Ground covering.
- Application of paints and plaster under dry weather condition.
- Façade protection from water and moisture contact during drying phase.
- New application techniques to limit spilling.
- Proper disposal of paint and plaster residuum.
- Providing guidelines for professional as well as for private users.
- Education and training program.

Stakeholders who returned the questionnaires for PT 14 mainly listed elements of an integrated pest management when asked for their understanding of a sustainable use of rodenticides. According to them sustainable use of rodenticides comprises:

Effective reduction and control of rodents while minimizing impacts on non-target species and the development of resistance.

- Preventive measures.
- Safe placement of baits.
- Collection and disposal of dead rodents.
- Good documentation of rodent control campaigns.
- A pain free death of target organisms.

These elements may be described as integrated pest management and may also include alternative (physical) control measures.

According to a joint statement of the chemical industry, chemical traders and distributors they support a responsible and sustainable use of biocidal products, giving consideration to the three components of sustainability and to the benefits of biocides. This is understood to mean that biocidal products are used

- to achieve optimal results and a long-term efficacy of the treatment;
- while reducing potential risks to health and environment to a minimum;
- in a well-targeted manner;
- in their intended field of use.

Hence, it is important to use biocidal products as specified by the manufacturer. In addition to the analysis of effects on the environment, also impacts on health and hygiene standards should be considered besides economic activities and the competitiveness of the companies (VCI and VCH 2014).

3.3 Results from the national and European workshops

National workshop

A German speaking workshop was organised at the *German Federal Environment Agency* in Berlin on 13 - 14 June 2013. The main goal of this workshop was to

discuss measures proposed for a sustainable use with the stakeholder groups. As the uses are quite different the discussion was split into PT-specific working groups.

Industry suggested that the improvement of the hygiene status (germs and rodents) should be included as an additional objective of sustainable use. Not only the risks of biocides, but also their benefits should be considered. From part of the occupational insurance associations a targeted use of biocides such as disinfectants was demanded and supposed to be imbedded within a quality assurance management system such as ISO 28000 "Safety management systems for the supply chain" (production, information management, packaging, storage, transport) was demanded for. For the biocidal product types which were discussed in the workshop (PT 2, PT 3, PT 7/10 and PT 14), the predominant use that was identified was "professional use" compared to "consumer use". Nevertheless, the use of biocides in the private or "do-it-yourself" sector was considered critical. The following priority cross-border measures were identified:

- Prepare a guide on misleading advertising by manufacturers and authorities.
- Sales restrictions for biocides (prohibition of self-service for disinfectants and rodenticides).
- Improving information / risk communication on biocides and their prevention.
- Regulation of internet trading.
- Improvement of qualification through expert knowledge and best practices laid down in national regulation.
- Training of the customers and purchase personal.
- Improvement of monitoring (e.g. by annual reporting of market surveillance from all federal states).

It would be desirable if the existing legal possibilities on enabling regulations (e.g. on good practice, expertise, sales) would be used and respective regulations would be developed.

European workshop

A European workshop on "Reducing negative impacts of biocide use on the environment - Towards an efficient EU legislation" was held on 31st March and 1st April 2014 in Berlin. Around 50 experts from authorities, industry and NGOs from 12 nations as well as one representative of the European Commission participated.

Among the conclusions of the workshop it was stated that there is a need to provide at least further guidance on a sustainable use of biocides. In contrast to PPP, which show a seasonal occurrence, biocides can be found continuously in the aquatic system during the whole year. The environmental impact of certain biocides may have been underestimated. Almost all participants of the workshop agreed that guidance for a sustainable use would have to be specific for either PTs and/or

specific uses. Additionally, there is an important need for environmental monitoring and cross-linking with product authorisation (concept of monitoring system for the EU). Because consumption data and an overview on uses/sales are missing, the European Commission is asked to check the possibility to include biocides in the statistic regulation.

There was general agreement on the need of proper training and education programs for professional users. Moreover, the need to improve general awareness was deemed necessary also for professional users. Training programs only for certain PTs (e.g. PT 14) or uses may be appropriate. However, there was no agreement whether training should be mandatory or not. Similarly the importance of implementing codes of best practices was recognised, but also with no agreement on whether it should be mandatory or not. There is a need for independent advisory services for the users. Advice exclusively offered by suppliers only is not considered sufficient. There is a need to regulate unnecessary uses but it remains unclear how this could be achieved. The Commission is asked to check whether it is possible to include risk/benefit analysis in product authorisation to achieve the minimum use necessary.

Sales requirements can be regulated nationally if the public use is prohibited. For example, in Belgium a registration of biocides sellers, users and sales for those products which are not allowed for public use will be required. Moreover, a prohibition of self-service is important at least for some PTs (e.g. PT 14, 18). Possible sales restrictions for biocidal products containing substances with potentially adverse effects on the environment (and possibly human health, e.g. substances under discussion as candidates for substitution) are demanded.

There was partial agreement considering the approval and maintenance of the equipment. As a first step those uses for which the equipment should be assessed need to be identified. There is a need to get first an overview of the used machinery before deciding on further measures. Conditions on machinery could also be implemented within product authorisation. There is a link to good practice/training (safe handling, filling, cleaning) of the equipment. These provisions might not be feasible for industrial applications. The Commission is asked to check the possibility to elaborate the report on the inclusion of biocides in Machinery Directive with regard to machinery for pesticide application.

There was general agreement that sensitive areas should be protected, but the question left open whether such uses should be restricted within product authorisation or whether there is a need for further legislation. Treated articles for example cannot be considered during product authorisation. There is a need to distinguish between public areas and nature and water protection sites. For public areas such as hospitals an enforcement of correct use is required (duty of control of certain pests). For protection sites the objective is the minimisation or restriction of uses (e.g. prohibition of antifouling agents in freshwater).

4 Elements and measures of sustainable use

Articles 5-13 of the SUD specify measures to reduce risks and impacts of pesticide use on human health and the environment. Article 14 promotes the use of integrated pest management (IPM) and of alternative approaches or techniques such as non-chemical alternatives to pesticides. In the preceding study on the sustainable use of biocides it has been analysed, that most of these measures may be transferred to biocides (Gartiser et al. 2012). Additionally, the service life of biocidal products should be considered in addition to the use phase. Emissions of biocides used for preservation of materials (PT 6-10) and as antifouling agents (PT 21) predominate during service life by leaching, removal of coatings or treated articles (Gartiser et al. 2013). In this chapter the transferability of these measures for disinfectants (PT 2, 3), film / masonry preservatives (PT7/10), and rodenticides (PT 14) is summarised alongside the results of the questionnaire survey, while details are found in the corresponding case studies (Annex I-IV). The view of the participants from the national and European workshops on specific measures is considered in the subchapters, but for details reference is given in the workshop protocols.

4.1 Risk mitigation measures

It has to be distinguished between general risk mitigation measures (RMM) and specific RMM. **General RMM** refer to the application of best practices, good housekeeping etc. and may support a sustainable use of biocides. **Specific RMM** are derived from the environmental risk assessment and may be quantified and considered by changing the input parameters. These are applied during product authorisation for specific products based on the results of the risk assessment.

Disinfectants:

A further project on behalf of the German Environment Agency laid emphasis on specific RMM for disinfectants proposed by producers, industrial/professional users, and authorities and analysed them with focus on environmental risks. In this context RMM guidance documents have been developed which are discussed among competent authorities (Gartiser and Jäger 2013). The project revealed that many disinfectant active substances are inactivated during use or are readily biodegradable. Most disinfectants are designed to be inactivated in municipal sewage treatment plants. The formation of disinfection by-products (DBPs) should be considered in the assessment of all biocidal products with oxidising active substances. The benefit of consumer use of PT 2 disinfectants is controversially discussed among hygienists who argue that untrained consumers often do not apply disinfectants effectively. Many specific RMM related to disinfectants focus on human health aspects. Some disinfectants, especially aldehydes, may cause allergic contact dermatitis and are classified as skin sensitisers (R43). Therefore, substitution of aldehydes is one major objective in occupational health strategies and may cause increasing use of other active ingredients with lower biodegradability.

Preservatives for wood, masonry, façade paints and renders

At the European workshop the problem with imported articles such as treated or painted wood has been addressed. While the inclusion directives, e.g. for wood preservatives, may implement RMM such as “do not use near water bodies” this refers to in-situ treatment, but is not enforceable for treated wood or similar articles, especially when imported. Thus use area restrictions may have to be considered also for treated articles. With respect to masonry preservatives, façade paints and renders (PT 7/10) suitable specific RMM during the application phase is the use of plastic sheets covering the ground. Freshly treated surfaces should be protected from rain during the drying period. In particular, paints and renders should be applied under dry weather conditions with limited condensation. New application techniques might reduce uncontrolled spilling, however, new technologies are lacking. Whenever roller, brushes etc. are cleaned with water, contaminated wastewater should be managed in sewage networks, which are connected to STP. Alternatively, the wastewater is collected and treated off-site. Further, proper waste management on the construction site is required. Promising general RMM during service life of façade paints and renders are an improved architecture of buildings with sufficient roof overhang, storm water treatment, systems limiting condensation, moisture transport (uptake and rapid drying), any performance avoiding large differences in surface temperature on façades, or the application of top coats without biocides on preserved renders to reduce leaching. Any method aimed to exposure or orientation specific use of biocides (e.g. more biocides at north façade, less at south) is not practicable due to missing coordination on construction sites. Coatings without biocides (mineral coatings) seem to be promising alternatives for polymeric coatings. The procedure of application of biocide free products is different from those of the most common products delivered in wet-state and restricts their widespread use.

Rodenticides:

For the evaluation of anticoagulants used as rodenticides (PT 14) a guidance document on risk mitigation measures was published by the European Commission (2007) which outlines a common approach for both Annex I inclusion and product authorisations. The paper includes a number of suggestions to mitigate the risk arising from the use of anticoagulants used as rodenticides. Due to the fact that the risks of anticoagulant rodenticides cannot be mitigated by specific RMM alone, the document contains general RMM additionally. These suggestions refer inter alia to the category of users, the area of use, the composition and formulation of the products, the packaging, pack size and labelling as well as codes of good practice. In the inclusion directives of second generation anticoagulant rodenticides (SGAR) being persistent, liable to bioaccumulate and toxic (PBT), the nominal concentration of the active substance in the products and its use as tracking powder have been restricted. All available RMM such as the restriction to professional users, setting an upper limit to the package size and laying down obligations to use tamper resistant and secured bait boxes should be applied.

4.2 Training/Education

Measures concerning training and education only apply to professional users. For consumers only measures for awareness raising are appropriate (see chapter 4.4).

Options for further training of users:

At the European workshop there was a consensus that further training of the users of biocidal products is necessary. Competent authorities suggested a prioritisation of biocide applications for which training should be considered. Main areas identified were pest control agents (rodenticides, insecticides), high production volumes of PTs such as general disinfectants (PT 2) or indoor uses which lead to emissions to sewage treatment plants (STP). However, for biodegradable substances the product volume alone might not be the right driver. Prioritisation of training initiatives should also be linked with existing best practices which generally are PT specific. Industry argued that one should be careful in transferring measures developed for the PPP sector to the biocide area. Industry agreed on training, but not on obligatory certification, because, e.g. nurses are educated. For existing apprenticeship curricula there is no need to implement further training measures. Instead, elements of sustainable use of biocides should be considered in the curricula. These existing training schemes should only be adopted if necessary. It should carefully be analysed for which uses and/or product types the training is needed and whether it should be mandatory or voluntary. It was also mentioned that a mutual qualification standard of professional users could be helpful, since the requirements on the educational level of professional users might be different in Member States.

Disinfectants:

For the application of disinfectants in health care facilities such as hospitals (PT 2) legal rules exist from authorities and the occupational insurance associations which require training and instruction of users and supervision by qualified persons. Several professional training schemes exist covering the health care area, air-conditioning experts or swimming water treatment.

The use of disinfectants for veterinary hygiene purposes usually is combined with cleaning and pest control of insects and rodents. These elements should be integrated in good housekeeping principles as described, e.g. in the BREF on “Rearing of Poultry and Pigs” (July 2003) or the “Good Agricultural Practices” (GAP). There are education schemes on universities for agricultural scientists and also for agriculturist/farmers. The European Commission developed an “Animal Health Strategy” for the European Union (2007-2013) which aims to achieve a modern and appropriate animal health framework; better prevention, surveillance and crisis preparedness, supporting science, innovation, and research. It is mentioned that successful biosecurity includes procedures for cleaning and disinfection. The strategy also comprises training support in Member States for safer food (European Commission 2007).

Participants from the national workshop suggested that for disinfectants environmental issues should preferably be mediated during the apprenticeship and in-house training. For this the curricula (e.g. for nurses) need to be revised within federal states. A certification/qualification of distributors/sellers in the private sector would be desirable, but it would be better if these products are not offered at all to an untrained general public. For professional uses the purchasers and users should be trained.

Masonry preservatives, façade paints and renders:

With regard to film and masonry preservatives until now standards and guidelines educating the user in sustainable use and disposal are entirely lacking.

Nevertheless, there is a common practise of separate waste containers on construction sites. Most stakeholders were not aware of training opportunities that focus on the handling of paints and renders containing biocides. Others remarked that different training opportunities are offered by manufacturers of biocides, associations, and technical schools. The topic should be included in an education block with focus on environmental impact during professional education and promoted as information on best practice.

The professional associations and guilds do not offer training on the handling of biocidal products. Such training courses could improve the flow of information to the company executives. Training of painters and plasterers were rated as very effective by all participants. Technical training of spray application would ensure an appropriate application of the products.

Rodenticides:

Several European countries restrict the use of second generation anticoagulant rodenticides (PT 14) to “trained professionals/users with a license”. Furthermore, in these countries the pest controllers are obliged to participate in regular trainings. Training schemes are widely offered in the EU, mainly to professional pest control technicians, but these schemes need to be extended to other user groups, such as farmers and gamekeepers, and should be harmonised. In Germany the topics that should be included in the trainings are specified during the product authorization. Stakeholders attributed highest efficiency to the measure “knowledge transfer on a sustainable use of rodenticides during education and training, e.g. of pest control workers”.

It was complained that in contrast to the plant protection area, so far, there is no legal basis to implement requirements for obligatory training and certification for biocidal uses of rodenticides. The certification of the competence tests should be carried out only by (neutral) authorities and not alone by the training provider.

In summary, there are several ongoing national activities for education and training of professional users, established by professional associations, research institutes, and authorities, but it seems that there is a lack of exchange of knowledge and expertise among stakeholders and among Member States.

4.3 Requirements for sales of biocides

Disinfectants:

Disinfectants for the health care area and other professional uses (PT 2) are distributed via the formulators and other suppliers which often also offer support in hygiene management. One optional measure could prescribe that the qualifications of these distributors should be certified, according to the requirements of Directive 2009/128/EC. Disinfectants for consumer uses are freely available on the market. Another option consists in that some biocidal products, for example disinfectants for hands, surfaces or laundry (intended for human health purposes) could be distributed via pharmacies to the general public in order to obtain advice on the application of these products and on general hygiene requirements.

Misleading advertisement of improper uses should be avoided and any label claim should be verifiable. Treated articles with any claim of antimicrobial properties should be tested for their efficacy for avoiding non-proven advertising statements. Advertising and label claims are also important instruments of risk communication (see chapter 6.4).

Disinfectants for veterinary purposes (PT 3) are mainly supplied by agricultural wholesale companies or consultants of the formulators or distributors which often offer advice for hygiene measures and the application of disinfectants or even offer the establishment and maintenance of complete hygiene managements systems. Consumer use disinfectants for the surroundings of pets are supplied by pet shops or building centres. The certification of suppliers and/or consultants may support a sustainable use of these products.

Masonry preservatives, façade paints and renders:

Currently a negligible proportion of paints and renders containing biocides (PT 7/10) is distributed through *do-it-yourself* or online shops. Main customers are professionals from craft business with a strong supplier-to-customer relationship. According to stakeholders the proof of advice and consulting on how to handle paints and renders containing biocides for professionals by the manufacturer (safety, technical data sheet) would be the most promising measure for supporting sustainable use.

Rodenticides:

Up to now there are no sales and distribution restrictions for rodenticides in Germany which are sold to both (trained) professional users and to the general public, mainly in construction and hardware stores and via the internet. In stores rodenticides are offered on open shelves (i.e. self-service) without sales advice by trained employees. Since January 2013, products containing the active ingredients Difenacoum or Difethialone require a general reference on the package that the use is not allowed by non-professional users. In other Member States as well as in the U.S.A. there exist restrictions on sales, distribution and packaging for

anticoagulant rodenticides. In principle, similar provisions could also be established into the German Chemical law.

Among the participants of the national workshop there was a consensus that the free sale of rodenticides to private consumers e.g. through self-service in building stores or via the internet should be restricted. Up to now there are only use restrictions on some SGARs, but no sales restrictions for any type of anticoagulant rodenticides. At the European workshop, industry demanded careful PT specific analysis, PT 14 being one example where self-service should be restricted. In contrast, restriction of self-service of e.g. disinfectants in the supermarket for consumer uses would not be reasonable, considering that there exist a lot of every-day-products offered without any training. In Belgium an online registration system will be established for products not intended for public uses where sellers and users register their sales, purchases and use every 3 months. Consequently, when self-service is not allowed for the public, internet sales should be forbidden. There was a broad consensus that internet sales should not be allowed for private users for certain products because there is no guarantee that the user becomes aware of potential risks and that appropriate information provided by the supplier. Restrictions of self-service or remote selling might also depend on the outcome of product authorisation.

The requirements for sales of biocides could be adapted to those proposed for plant protection products as envisaged in the SUD. Some exemptions might apply for biocides where no risks have been identified. The establishment and control of best practices of internet commerce as well as the prohibition of misleading advertisement statements should be considered.

4.4 Awareness programmes and information

The BPR (explanatory note 61) intends supporting an effective communication of information on risks resulting from biocidal products and risk management measures. Article 17 (5) of the BPR refers to “proper use” which *“shall involve the rational application of a combination of physical, biological, chemical or other measures as appropriate, whereby the use of biocidal products is limited to the minimum necessary and appropriate precautionary steps are taken. Member States shall take necessary measures to provide the public with appropriate information about the benefits and risks associated with biocidal products and ways of minimising their use.”*

Since the implementation of the BPR in the German chemical law (ChemG) from August 2013 § 12e , the authorities are required to inform the public about the

- benefits and risks of the use of biocidal products,
- physical, biological, chemical and other measures as an alternative to the use of biocidal products or as a way to minimize the use of biocidal products, and
- competent, proper and sustainable use of biocidal products.

The SUD requires Member States to inform the general public and to promote and facilitate information and awareness-raising programmes. A website developed and run by the German Federal Environment Agency, provides information to the general public about physical, chemical and other measures as alternatives for the use of biocidal products or for minimization of their use where the focus lies on the description of preventive measures (www.biozid.info). It inter alia informs on hygiene measures in private homes without the use of disinfectants (PT 2) and on habitats and living conditions of rodents, while focusing on preventive and alternative control measures. The web-portal is continuously extended. Stakeholder mainly attributed a limited efficiency to the promotion of web-based information platforms which demonstrates that these must be complemented with supporting tools such as print media, radio and television broadcasting campaigns. Thus, other media (print media, broadcast, television) should complement the offerings and specific multipliers such consumer adviser, quality controller or other experts should be specifically addressed.

Manufacturers of paints and renders containing biocides (PT 7/10) reported that they provide product briefings, trainings and in-house training in addition to sales consultancy and post-sales support for customer and professional users. At the national workshop all stakeholders rated the lack of well addressed and clear information as the most important field of activity. Among others it was proposed to improve operating information, e.g. through the use of pictograms, to develop guidelines for the maintenance of buildings and to define work-contracts specifying the envisaged use pattern, e.g. whether the product should be applied in façade coatings or not. Product labelling of the environmental performance was referred to as another option.

Participants of the European workshop confirmed that training for consumers is not manageable or enforceable and that awareness raising and providing information are better options for them. From industry it was stated that non-professional users are aware of risks and take care of their children. Authorities remarked that even users aware of hazards are often not able to assess specific risks associated with the use phase of biocides. A particular gap on information and risk awareness was identified for consumers. Consequently, they should be the main target group for awareness raising programs. Information on alternatives should be provided for all user groups, but for many professional and industrial applications of biocides, information on the correct usage is already available.

Some manufacturers of rodenticides (PT 14) provide web-based support for the performance of professional rodent campaigns. Industry and authorities provide numerous handbooks, fact sheets and leaflets to inform the general public on preventive measures to avoid rat/rodent infestations and pest control in households.

In summary, there are already activities of authorities and industry to promote a sustainable use of biocides through awareness raising. The requirement for member states to develop and establish awareness programmes is an important instrument for supporting sustainable use of biocides. In this context the information provided

by industry and authorities should be critically reviewed, extended, and spread with appropriate media such as the internet, print media, radio and television.

4.5 Equipment for biocide application

Directive 2009/127/EC on machinery for pesticide application as an amendment to the Machinery Directive 2006/42/EC does not cover the application equipment for biocidal products so far but a possible extension of the scope to cover biocidal products should be examined by the European Commission.

The equipment used for the application of public health disinfectants (PT 2) mainly addresses accurate dosing e.g. via dosing pumps. There exist several Technical Committees such as CEN/TC 102 “Sterilizers for medical purposes” or CEN/TC 402 “Domestic swimming pools” or ISO/TC 199 “Safety of machinery”. Next to the design of the equipment for biocide application, also the hygiene design of machinery to be cleaned or disinfected is an important instrument to maintain its function. BS EN ISO 14159 describes hygienic requirements for the machinery such as the construction principles, the choice of materials, the consideration of usage and users as well as directions for use and maintenance.

In Germany some equipment for the application of veterinary disinfectants (PT 3) are tested and certified on a voluntary basis by the German Agricultural Society (Deutsche Landwirtschafts-Gesellschaft DLG, <http://www.dlg.org>). For cleaning of stables, often high-pressure cleaners are applied. Several EN and ISO standards describe the design and safety requirements of high-pressure cleaners and knapsack sprayers. Accurate dosage and safe design of the equipment helps minimizing the total amount used while avoiding spillage.

Paints are applied by brushing, rolling, and spraying whereas renders and mortars are processed by coat spreader and trowel. Brushing, rolling, and spraying are also used for engaging cleaning agents (PT 10) to liberate façades, terraces and footways from microorganisms. Any requirements for equipment are attributed as low or not efficient in the questionnaires. Stakeholders did not support measures concerning the prohibition and restriction of use of certain equipment such as spray applications. They argued that implementation and control of such restrictions would be difficult because of construction sites and the time pressure in construction works. The development of technical standards and guidelines for the cleaning of equipment (brushes, syringes, etc.) was partly supported. At the national workshop participants argued that spray applications should be restricted for private users. From the formulators point of view manufacturers of spray equipment are especially responsible. Do-It-Yourself coating products are explicitly not recommended for spray application by formulators, but the equipment manufacturers explicitly promote this application. The integration of such sprayers into the Machinery Directive, indicating the allowed applications, would provide more clarity in this field. Cleaning of the equipment used for painting was identified as an important exposure route of PT7/10 products and hence the use of one-way brushes or rollers may be an

appropriate measure. The usefulness of the disposal of one-way equipment by incineration was controversial discussed.

Most rodenticides are applied as baits in the form of loose grains, pellets, wax blocks or paste baits. Therefore, the placement in temper resistant bait boxes is of great significance for a sustainable use. Temper resistance of bait boxes should be evaluated through a harmonised test guideline to be developed. However, it is also recognised that bait boxes may be unnecessary, for example in locked buildings, with no public access and no access to non-target animals, in wall and ceiling voids and in sewers. The fumigants aluminium phosphide, carbon dioxide and hydrogen cyanide require specific safety measures and/or apparatus for effective and safe use as biocides.

At the European workshop the German UBA referred to the goal, “to ensure that equipment being placed on the market is state of the art technology” besides the goal “to ensure the condition of equipment already in use is such that adverse impacts on human health and the environment are minimized”. Industry referred to the considerable differences between PTs and applications. For certain sprayers such requirements might be useful, but not for disinfectants. Authorities referred to applications quite similar to agriculture such as large area mosquito control. A lot of experience is needed before amending the Machinery Directive and the state of the art and requirements have to be discussed. During the product authorisation the available information regarding the proposed equipment is taken into account during the exposure assessment. Currently, there are examples of large scale biocide applications which do not fulfil the requirements for PPP (spray canons and aerial spraying from helicopter for the control of oak procession moths). A systematic evaluation of existing standards for the equipment is needed. Such a review might give recommendations regarding the adoption of the Machinery Directive.

Industry agreed on prioritization of equipment but opposed to directly transfer measures from the PPP area to biocide area. From part of the consultants the Commission was asked to prepare a report on the biocidal application equipment which has not been elaborated yet. The question arose, how specific the evaluation of the equipment during product authorisation is. One CA representative answered that authorities so far do not have the legal power to request specific equipment as it is the case for PPP. At the moment some models are used which are over-conservative when assessing human exposure during application. In questionable situations there is no authorisation possible if no measurement data for specific equipment is provided.

According to the NGO the equipment of all PTs which cause exposure should be regularly evaluated separately from product authorisation. All possible equipment cannot be evaluated during product authorisation. Maintenance of equipment in use after approval should also be checked in order to allow its proper use. Thus a certification of all technical equipment is required.

In summary, the availability of appropriate equipment for the use of biocides is an important prerequisite in order to minimise the exposure and to guarantee a targeted dosage. This provides the means for secure and proper use. The Directive on Machinery 2006/42/EC should be amended to include machinery and equipment for the application of biocides. For PT 2 disinfectants the harmonisation and standardisation of the machinery is partly developed through ISO standards while for masonry preservatives (PT 7/10) and rodenticides (PT 14) harmonisation is missing,

4.6 Further measures to reduce emission during application

The disinfection of water with oxidising biocides leads to the inevitable formation of disinfection by-products (DBPs) because parts of the biocides react with organic and inorganic water ingredients. During evaluation of active substances DBP are not specifically addressed at the moment, but it is recommended to consider the formation of DBP during product authorisation. Measures to reduce the formation of DBPs include the removal of precursors such as organic matter through water pre-treatment (e.g. filtration) and/or moving to other disinfection systems such as UV or Ozone. DBPs might also be removed by air stripping, activated carbon, UV light and advanced oxidation.

With respect to film and masonry preservatives (PT 7 / 10) regular checks on construction sites controlling the use and disposal of residues of biocide bearing products could be considered. Stakeholders mainly attributed low efficiency to this measure which would entail personal expenses for authorities.

No further measures to reduce emissions of rodenticides (PT 14) have been identified.

4.7 Measures to reduce emission during service life

Measures regarding the service life are not mentioned in the SUD, which so far only covers PPP, but they have been identified as an important additional phase of the life cycle for biocides (Gartiser et al. 2012).

Masonry preservatives, façade paints and renders:

Emissions during the service life are most relevant for leachable biocides from paints and renders (PT 7/10). One important measure to reduce emissions is improved product quality with reduced leachability of biocides. The leachability is e.g. determined by the physicochemical characteristics of the biocides, the application of biocide free topcoats and the use of encapsulated biocides. Manufacturers state that such technologies and products have already been introduced to the market or are under development. For indoor paints several ecolabels exist, e.g. RAL-UZ 102, which describes low-emission wall paints while excluding the use of film preservatives. Also in Switzerland a classification system for indoor paints has been established (www.stiftungfarbe.org). A similar classification system could also be developed for outdoor façade paints and renders. However, stakeholders did not

support measures which propose the development of a classification system for paints and renders or a declaration of leaching rates on products. Other important measures to reduce PT 7 and PT 10 preservatives consider preventive architecture measures such as the size of the roof overhang.

Rodenticides and disinfectants:

No specific emissions resulting from the service life of rodenticides or disinfectants have been identified. All emissions are attributed to the use phase during application and the end-of-life stage. The only exemptions are treated articles with an antibacterial claim. The active substances might leach during the service life (e.g. silver in textiles during washing). No measures to reduce these emissions have been identified.

4.8 Measures to reduce emission during restore and end-of-life stage

The main emission pathway for PT 2 disinfectants is via the sewer system either to an on-site STP or to a municipal STP. Avoidance of peak loads discharged to biological treatment plants or neutralisation of the active substance are appropriate measures for reducing acute toxicity to activated sludge. Obligatory discharge of the wastewater to a well-functioning municipal STP may also be considered as an appropriate measure.

Gas sterilizers using ethylene oxide, deactivate the active substance after use by catalytic or thermic oxidation or through washing the gas with acid water scrubber system. In the latter it reacts to ethylene glycol (DWA-M 775 2010, US-EPA 1997).

To date there are no studies available which investigated the question how much biocides remain in preservatives treated coatings once these coatings have reached the end of their service life. It can be assumed that with increasing life time the remaining concentration of biocides decreases to negligible amounts. According to participants from the national workshop the disposal of residuals is well organized. Full paint buckets and residual amounts are returned to the companies. Empty buckets are disposed of together with household waste. The washing of brushes and rollers is not recommended anymore. The companies have set up their own cleaning areas. Private users can return their containers to public collection points.

The safe disposal of rodenticides (i.e. remnant baits) and rodent bodies is an important aspect of any pest control operation. The adequate disposal is even considered as one of the most efficient measures to reduce negative environmental impacts by rodenticides. Contaminated rodent bodies shall be disposed via rendering plants. Remnant baits (collected after the treatment campaign or unused in the product package) shall be disposed of via the local/municipal harmful substance collection system. Remnants and carcasses must not be disposed of in the normal household waste.

4.9 Specific measure to protect the aquatic/terrestrial environment

For public health disinfectants (PT 2) and part of veterinary disinfectants (PT 3) the STP is the main intermediate compartment. All measures which refer to STP, such as obligatory treatment in STP or avoidance of peak loads to STP, indirectly protect the aquatic environment. In contrast, disinfectants used for animal housing in stables are mainly released to manure/slurry recipients. A minimum storage time of liquid manure may be considered before spreading to agricultural fields.

For film and masonry preservatives (PT 7 / 10) the potential measures such as, “establishment of protection and buffer zones to waters in which an application must be subject to approval”, “treatment facilities for rainwater runoff”, or “rainwater management plans taking into account the leaching of used paints and renders”, were not supported by most stakeholders.

With regard to the use of rodenticides the protection of non-target organisms and wildlife predators has a great significance. Several studies show exposure to anticoagulants not only in non-target rodents but also in a wide array of wildlife predators (see case study on PT 14). Up to 80% of animals analysed for rodenticides in the UK contained one or multiple second generation anticoagulant rodenticides (van den Brink & Elliott 2012). Measures described in the previous sections such as the use of bait boxes or the inclusion of bittering agents and dyes help to protect the terrestrial environment and non-target organisms.

4.10 Reduction of biocide use in sensitive areas

Sensitive areas such as of drinking water catchments, Natura 2000 sites, playgrounds, schoolyards, lakes, etc., may be specifically affected by the use of biocides. The SUD also refers to public areas such as hospitals, schools and kindergartens (or generally indoor) which are considered as sensitive areas. Some examples are large-scale controls of mosquitoes or oak procession moths by insecticides (PT 18), disinfectants for fish farms (PT 2) or cooling water treatment (PT 11). Antifouling agents (PT21) applied by private users can be released to water protection sites especially in marinas. Similarly to plant protection products the use of biocides should be restricted to the minimum necessary in areas used by the general public or by sensitive populations, but also in areas assigned to the conservation of wild birds, natural habitats and of wild fauna and flora. In this context, the aquatic environment and drinking water can also be regarded as sensitive areas. From an environmental point of view no direct outdoor uses of biocides of PT 2, 3, 7/10 or 14 in sensitive areas have been identified. However, indirect emissions might occur. General disinfectants of PT 2 are mainly discharged to STP, veterinary disinfectants of PT 3 were applied in animal breeding facilities, which per se should be restricted in Natura 2000 sites. Leaching of film and masonry biocides could lead to a contamination of remote (sensitive) areas through the transport of storm water, while rodenticides spread outdoors in the surroundings of buildings might lead to secondary poisoning of protected wild birds or other vertebrates. Use restrictions of rodenticides in sensitive areas (e.g. public parks and

gardens, drinking-water protection areas, etc.) may be considered but should be compared to the risks of rodents as an important vector of diseases.

At the European workshop the general opinion of pest control manufacturers was that the definition of sensitive areas should not be transferred from the SUD, covering the PPP, to the biocide area one to one. For public areas including hospitals and restaurants, biocide use should not be limited, but rather correctly used in order to prevent the occurrence of the pest. This is an important aspect of sustainable use and is different to PPP, where the minimization of the use in public areas is intended. Hence, a balanced approach which takes the risk-benefit ratio into account is required. Authorities agreed that there might be a legal duty to defend public areas from infestation. Thus, a reasonable use of biocide products is sometimes a legal requirement. The NGO suggested that sensitive areas and vulnerable groups need specific protection which is not considered during product authorisation. Authorities also mentioned that during product authorisation, sensitive areas are not specifically addressed. With a SUD for biocides, authorities would have an option to consider such areas.

4.11 Handling and storage of biocides and their packaging and remnants

The general rules for storage and transport of chemicals as described in national guidelines such as TRGS 510 should be considered.⁴ Most aspects concerning the handling and storage of pesticides as well as their packaging and remnants also apply to biocides.

- Use of appropriate sizes of containers to minimize remnants. Oversizing of packages should be avoided
- Restriction of the use of concentrates in order to avoid exposure during the mixing and loading stages, where the risk of spillage and leakage is increased
- Restriction of the marketing of concentrates to professional users only. Marketing of ready-to-use products to non-professional users.
- Use of water soluble packaging for preparing working solutions while avoiding direct contact and enabling accurate dosing
- The establishment of a recycling system for packaging used for biocides.

The disposal of product residues and packages by municipal collection systems for hazardous substances should be promoted. For some applications, the packages might be returned to the supplier, following the example of plant protection products.

⁴ TRGS 510 Storage of hazardous substances in non-stationary containers. <http://www.baua.de/en/Topics-from-A-to-Z/Hazardous-Substances/TRGS/pdf/TRGS-510.pdf>

4.12 Specific measures to avoid resistance

The widespread use of antiseptic and disinfectant products has caused concern on the development of microbial resistance, in particular cross-resistance to antibiotics. An assessment of the “Scientific Committee on Emerging and Newly Identified Health Risks” concluded that some resistance mechanisms are common to both biocides and antibiotics. In particular, the use of Triclosan, Chlorhexidine, and QAC was linked to the development of resistance to antibiotics. To address these concerns an urgent need for quantitative data on exposure to biocides, standards and methods to evaluate the ability to induce/select for resistance, and environmental studies on resistance and cross-resistance to antibiotics following the use and misuse of biocides, was recognized (SCENIHR 2009). The main preventive measure against the development of resistance to disinfectants is the avoidance of application errors and of sublethal concentrations of the active substances. Routine change of disinfectants may also be considered. NGOs demanded that active substances with known resistance should not be allowed for consumer uses.

Some rats and mice have become resistant to anticoagulant rodenticides. Resistance management strategies involve the identification of strategies for avoiding the development of resistance in susceptible rodent populations. And also for managing resistance to the anticoagulants when it is suspected or identified. Various documents and leaflets describe resistance management strategies. Advice and information on anticoagulant resistance in a particular area can be obtained from the national rodenticide resistance expert committee or action group. At the national workshop stakeholders stated that because resistance in rats has been found mainly in agricultural areas, it is important to train farmers for the sustainable use of rodenticides. Therefore, Farmers Associations should distribute, clearly formulated application notes for rodenticides to farmers, and offer training courses for a sustainable use of rodenticides.

4.13 Integrated pest management (IPM) and best practices

Integrated pest management (IPM) is a decision making process which uses principles, practices and procedures applied to improve pest-control results. IPM integrates knowledge of pest biology, environment and available technologies including the use of biocides. The IPM definition of the US National Pest Management Association (NPMA) specifies 5 steps: Inspection of pests, identification of pests and specific conditions, establishment of threshold levels (pest-population level that can be tolerated), definition of appropriate control measures, and evaluation of the effectiveness of the measures. The IPM principles proposed for a sustainable use of plant protection products include further provisions, namely the routine monitoring of harmful organisms, the preference for non-chemical methods, the application of anti-resistance strategies and the reduction of use to the minimum necessary.

Disinfectants:

For disinfectants the Hazard Analysis and Critical Control Points (HACCP) as a preventive approach to food safety may serve as an example for a hygiene management tool, comparable to IPM.

The careful use of disinfectants is essential to minimise risks for human health and the environment. In many application areas for public health disinfectants (PT 2) and veterinary hygiene disinfectants (PT 3) good and best practice documents and training courses have been developed by authorities and professional associations. Maintaining good hygiene practice and good housekeeping is a prerequisite for disinfectants being effective. Hygienic design of the equipment and the facility helps minimising the amount of disinfectants. The method of life cycle assessment could be applied to compare different options for selected disinfection areas. For example, few studies exist that compare different options for laundry washing processes for microbiologically contaminated laundries (40°C, 90 °C, chemo-thermal treatment at 70°C). This demonstrates that other aspects of environmental impacts should also be considered for a sustainable use.

Masonry preservatives, façade paints and renders:

By contrast most stakeholders involved in masonry preservatives (PT 7/10) were not aware of any documents on best practices and standard documents that describe practical application and safe handling of paint and plaster containing biocides except technical data sheets and informal guidance documents offered by manufacturers of end-products. Available documents available include technical leaflets and guidance documents of industry and topic specific literature and journals.

Rodent control:

The application of IPM principles is considered as the most promising measure for rodent control (PT 14) and may include measures described above, such as training, equipment, and resistance management. With respect to rodent control (PT 14) there is a multitude of documents from authorities, industry, and professional associations describing the elements of integrated pest management (IPM) and criteria of good practice. The rodenticide industry in the UK initiated the Campaign for Responsible Rodenticide Use (CRRU) which focuses on the code of good practice for the responsible use of rodenticides in rural areas.

Participants of the German workshop supported the “Best practice of rodent control” developed by authorities, which consists of preventive and structural measures in terms of integrated pest control. Further it considers biocide-free alternatives, for example the use of traps to control house mice and voles and sporadically occurring rats. However, if biocide usage is unavoidable the minimal required biocide amount is recommended. Moreover, the use of first generation anticoagulant rodenticides (warfarin, Chlorphacinon, Coumatetralyl) as the first option of chemical combat is preferred over the use of biocides provided that no information on local resistance are available.

At the European workshop participants agreed that the best practices are important and needed, both general and PT specific best practice (e.g. rodenticides). However, no agreement was found on whether they should be mandatory. Legally binding specific best practice could be defined in conditions of use during product authorisation. There is a need to regulate unnecessary uses but it remains unclear how this could be done. The Commission is asked to check whether it is possible to include risk/benefit analysis in product authorisation in order to achieve the minimum use necessary.

In summary, many elements of IPM principles for plant protection could directly be applied to rodenticides and general hygiene management. Measures based on similar principles could be adopted for disinfectants. The development of alternative control measures for masonry preservatives such as improved leaching behaviour of render or constructive measures to avoid infestation are at the very beginning.

5 Indicators

5.1 Objectives

According to the SUD, the progress in the reduction of risk and adverse impacts from plant protection products uses should be measured through appropriate harmonised indicators. The National Action Plans (NAPs) shall address the different measures decided on and shall include indicators to monitor the use. Harmonised risk indicators will be established at community level but MS can also use their national indicators. The same measurements should be conducted for biocides.

The development of suitable indicators for a sustainable use of biocides is constrained because of the lack of sound data concerning sales and consumption. To date, no complete German overview on poisoning cases with biocides is available, because these data are collected on a federal states level. Poisoning cases of non-target organisms such as pets are not systematically evaluated. Few monitoring data for biocides in environmental media exist so far, but corresponding monitoring programmes including biocides are currently being developed. In contrast, for plant protection products, the Regulation (EC) No 1185/2009 concerning statistics about pesticides certainly will improve the data bases on a European level. Considering also biocides in the Regulation on statistics of pesticides would help to get further use and consumption data of substances with environmental or human concern.

There are several examples and proposals for indicators on the European and national level:

- The European Commission published an analysis of the 'open list' of environment-related headline indicators (European Commission 2002). Among other issues the discharges of pollutants (nutrients, organics, chemicals) into water and exposure / consumption of toxic chemicals have been referred to as indicators. Others are the hazardous waste generated or the pesticides consumption.

- The OECD has developed a set of environmental indicators for agriculture (OECD 2001). Here, next to the consumption of pesticides also different pesticide risk indicators have been defined which show trends in risks over time by combining information on pesticide hazard and exposure with information on pesticide use.
- While the “treated area” is a suitable quantitative unit for plant protection products, for biocides further parameters should be selected. For example, “toxic load” which considers both ecotoxicity and substance volume could be an appropriate indicator for wastewater discharged to surface waters. However, there are also examples of where “treated areas” of biocides could be described, such as large scale mosquito control (PT18) or the area of façades treated with film or masonry preservatives (PT7/10).
- In a broader context, the OECD has defined 10 major domains for environmental indicators, which cover climate change, air quality, waste generation, freshwater quality and resources, forest, fish, and energy resources, as well as biodiversity (OECD 2008). These indicators are used to review the environmental performance in OECD member states, to monitor the integration of economic and environmental decision making, and to analyse environmental policies (OECD 2001). For monitoring the sustainable use of biocides, these documents may provide further ideas for suitable environmental indicators.
- The national indicators proposed for implementing the SUD, in the German NAP, are classified according to the OECD framework “Driving forces, Pressures, States, Impacts and Responses” (DPSIR) which has been adopted by the European Environment Agency. The framework describes the interactions between society and the environment. The analysis of a working group established at the Julius Kühn-Institute revealed indicators, which can immediately be applied due to the availability of data, indicators which are under development and indicators which are not considered being practicable (JKI 2010). For example, the availability of active substances to counter specific pests, the consumption rate of pesticides, and the number of monitored analytical data exceeding the EQS/limit values are considered as suitable indicators. The trend of risk indices (in Germany the SYNOPSIS-index) can be combined with quantitative targets such as reduction of the risk potential from the use of plant protection products by 25%.

The definition of suitable indicators is also being discussed with industry, which e.g. demands to consider also the benefit of plant protection agents.

The project partner OPERA, which is involved in supporting member states in the successful implementation of the SUD in 2011, realised a workshop on indicators and quantitative targets concerning plant protection products, to meet the objectives of the sustainable use. Here, also indicators such as the number of sprayer inspections, the number of reported incidences of spray drift, the number of

reduced spray drift nozzles sold, and the number of farmers attending training courses have been proposed (Capri and Marchis 2011).

5.2 Results from the stakeholder survey

In the stakeholder survey the following indicators were reported with highest priority (by order of priority) for monitoring the progress achieved by a sustainable use of biocides:

PT 2

- Collection of consumption data for specific product types
- Occurrence of allergens against cleaning agents and disinfectants
- Biocide specific monitoring of effluents from sewage treatment plants (overlapping with other use areas possible)

PT 3

- Exposure measurements on workplaces during the use of disinfectants
- Biocide specific surveillance of groundwater and drinking water (e.g. number of values exceeding 0.1 µg/L)
- Surveillance of biocide residues in food products

PT 7 / 10

- Biocides specific monitoring of effluents from sewage treatment plants
- Biocides specific monitoring of surface waters (overlapping with other use areas possible)
- Biocides specific monitoring of groundwater and drinking water (overlapping with other use areas possible)

PT 14

- Indication of poisoning cases of non-target organisms
- Enquiry on the proportion of consumer uses of rodenticides
- Survey among professional / consumer user

The complete analyses of the stakeholder survey is documented in the case studies (see annex II-V). Apparently, each PT requires its specific indicators.

In the preceding study, missing data on the quantities of biocidal active substances and products produced or sold, were complained (Gartiser et al. 2012). According to the BPR⁵, industry should provide data on the likely tonnage to be placed on the market. Although the evaluation of these data in the COWI study (2009) revealed very useful information about the biocide market, the figures are too aggregated to allow for an interpretation of use patterns. For substances for which no environmental monitoring data are available, a modelling-based approach, to assess potential exposure, needs to be implemented for selecting priority substances in water policy. Information, such as the overall tonnage used, the proportion of this tonnage going to particular uses, and emissions from these uses may be used as input parameters (Lepper et al. 2008).

The establishment of maximum residue levels (MRL), for residues of active substances in food or feed besides environmental quality standards and limit values, for environmental compartments and biota and their surveillance, are further indicators on the sustainable use of biocides. It is expected that the development of MRLs will be relevant for active substances used in PT 3, 4, 5, 18, 19 and 20.

The primary objectives of sustainable use should be to reduce risks. A reduction of the amount of biocides consumed is not the best indicator for sustainable use but could easily be calculated. The SUD encourages MS to set quantitative objectives in their NAP, among them the reduction of use of pesticides if the reduction of use constitutes an appropriate means to achieve risk reduction.

Some MS have already started developing indicators for sustainable use of biocides on the national level and these approaches should preferably be harmonised at EU level (Gartiser et al. 2012).

5.3 Recommendations for a first set of indicators

5.3.1 Introduction

The research project aims at analysing, identifying and evaluating the criteria for the selection of appropriate indicators in order to report and control the efficiency

⁵ See BPR Annex II, Title 1, point 7.5. and Annex III, Title 1, point 7.5.

of the measures proposed for sustainable use of biocides, and options for communicating these measures to different target groups, as has been proposed for pesticide for the SUD. The general motivation for the implementation of the measures of the SUD in the biocide sector is to achieve environment and health improvements or other societal benefits by a more sustainable use of biocides, by reducing the risk and impacts of biocides in the use phase.⁶ The SUD requires Member States to develop a national legislative framework to transpose the EU Directive and elaborate NAPs to reach the objectives set by the SUD. Therefore regional, national and international authorities need tools for the evaluation of domestic policies and international obligations.

By analogy with the SUD, a package of measures shall be drafted and introduced for biocides used in the private, professional (incl. commercial) and industrial sector, in an updated or new action plan and indicators, or better, a transparent system for reporting and monitoring the progress made in achieving the objectives of the biocide sustainable use, is required.

The objective of the sustainable use of biocides needs to be seen in the wider context of sustainability and, as for plant protection products, indicators should neither be used to substitute existing procedures nor to quantify risks in a strict sense but should help national regulatory institutions to estimate general trends in risk reduction and to judge the effectiveness of their programmes.

The indicators used should hence provide relevant information in risk management activities by evaluating the progress made in shifting use patterns, towards alternative or preventive measures or use patterns taking into account the risk assessment during product authorisation that concluded positively on the safety of a particular product.

This means that the indicators should capture the progress generated by better application techniques; the effects of mitigation measures; the effects of shifting towards alternative or preventive measures or less harmful substances; evaluate the additional costs incurred by shifting the technology; etc.

Therefore a set of criteria is needed which would lead to the selection of indicators. The proposal has to be pragmatic, focused and easy to apply; it is necessary to apply tools that can describe the complexity of the systems through simple and not expensive input datasets, collectable for a large area in an easy way. This will allow the assessment of trends in risk reduction within the member states (MSs), the identification of trends in the use of certain active substances

⁶ The main objective of the project is the reduction of environmental risks from the use of biocides. Human health and social protection goals are not analysed. As a sustainable use of biocides covers also human health and social protection goals these subjects cannot be separated when defining measures, indicators, and communication strategies.

and the identification of priority items or good practices in order to reduce the risks and impacts.

In many real contexts it is economically difficult to collect all the necessary data for a large number of products, because these data are not available or it is necessary to quantify them in an analytical and expensive way. In this framework it is quite difficult to use “performance” indicators on changes in driving forces and pressure in order to follow the progress on sustainable use of biocides.

There is the need for the knowledge of “behaviours or indirect indicators”, which enable to detect the progress. Indicators of the “state” of the environment, such as monitoring data in water or groundwater (as for example for construction products), should be viewed as “indirect measuring device of progress” and for this they are comparable to the performance indicators and thus can be linked to policy response. The same applies to behavioural changes of professional users or biocides consumers, or improvement of machinery and equipment for the application of biocides in order to facilitate the harmonisation of dosage and application apparatuses for biocides as examples.

The understanding of behaviours and how to influence them and, in turn, how this understanding could contribute to the development of measures that can help shape the behaviours could be a valuable indirect approach.

The difficulty of defining such a set of indicators is to find the best set of data which describe, as accurately as possible, the shift in the random behaviour of the users, the shift in their knowledge and awareness, as well as the efficiency of the various mitigation measures put in place.

5.3.2 Criteria to select the indicators

The choice of mitigation measures, approaches and possible solutions to implement the objectives of the sustainable use of biocides, is very much related to the indicators. Therefore, the two topics (measures and indicators) have to be discussed concurrently. Any set of indicators selected should reflect a minimum number of economic, social and environmental aspects, to cover all implications and effects of the measures.

In our proposed approach the focus should be on the most appropriate measure that will deliver the greatest benefit, along with selecting the risk indicator that can quickly and clearly identify which tools are working most effectively and are best capable of achieving the desired effects for each individual Member State.

Posing the right question must precede the selection of indicators. This means that the goals have to be defined and the measures need to be described in order to achieve the corresponding goals, as showed in the figure below.

The criteria are driven by the goals and the methods to reach the goals which can be different for the different targets.

In order to establish a harmonised set of indicators with economic, social and environmental aspects, the following steps are suggested.

- For each topic (humans, environment, economic and maybe social, if possible), first identify the common goals necessary to be addressed.
- After defining the goals choose the suitable measures to be implemented in order to achieve the goal.
- To select good indicators, one should identify the key elements for which the indicators are needed. Among the existing economic, social and environmental indicators, choose those relevant for the corresponding measure. Indicators need to be defined how they should be quantified, and what purpose they might fulfil.
- Due to economic reasons, existing indicators would need to be utilised where possible. However, where existing risk indicators are not sufficient to provide adequate information, new indicators may be required.

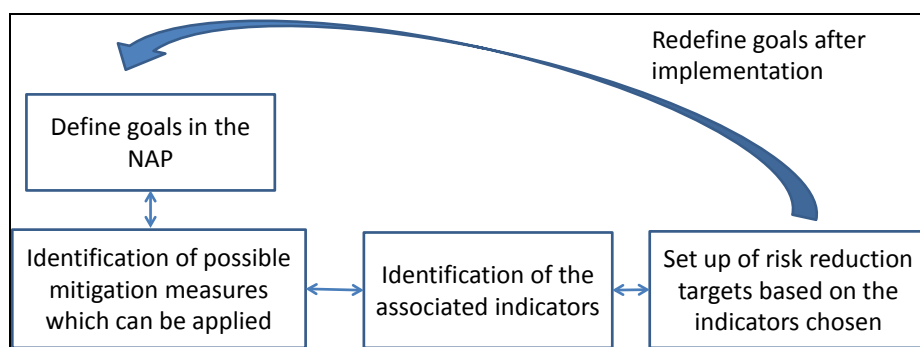


Figure 4: Development of indicators

The challenge is the selection of indicators reflecting trends over time in a dynamic perspective. Users have to be able to update indicator data, for a non-static analysis, since the risk and its perception might differ from year to year. Due to the continuous new knowledge and more refined test systems, risk prevention and its criteria of measurement, should be adapted to the progress of the techniques and science. In order to overcome this problem, it should clearly be stated during the continuous education, training programs and communication strategy that risk indicators and their outcome are not final and might always be improved or modified and goals could be redefined.

Due to the complexity of reality, it is extremely difficult to identify indicators which reflect only one aspect of use or one aspect of the technological process. A particular risk associated with the use of biocidal products might be, and if applicable, should be reduced by using a number of different measures. Therefore, one indicator may often describe the risk reduction result of more than one mitigation measure. In the tables below we have identified the possible mitigation

measures which can be applied and then the associated indicators, reported with highest priority by stakeholders.

Therefore the tables below are a hypothetical example of how MS may consider to achieve a certain level of risk reduction through the appropriate selection of a measure and its corresponding indicator.

At this stage of the work, we have not identified targets. The most coherent procedure, to establish quantitative risk reduction targets, is to assign benchmark values over time, to the most significant of the indicators selected, to monitor risk reduction.

Table 1: Indicators for the environment

Main Goals	Measures	Indicators	PT mainly covered
Lower risk for water/Aquatic organisms	Reduction of the level of residues in groundwater	-Gap to threshold values of residues in groundwater compared with threshold values for drinking water -Methods adopted to reduce leachability.	3, 7/10
	Reduction of the level of residues of effluents from sewage treatments plant (STP)	-Level of residues of effluents from sewage treatments plant -Numbers of methods activated to reduce disinfection by products -Number of inspections of municipal STP -Number of enforcement and control inspections.	2, 3, 7/10
	Reduction of the level of residues in surface waters	-Level of residues in surface waters compared with environmental quality criteria or risk based residue limits -Reports of Collection and disposal of residual amounts.	2, 3, 7/10
	Establishment of buffer and safeguard zones along surface waters	-Level of residues in surface waters compared with environmental quality criteria or risk based residue limits.	14, 7/10
	Use restrictions in sensitive areas (drinking water protection areas)	-Level of residues in groundwater compared with environmental quality criteria. and threshold values for drinking water	3, 14, 7/10
	Training on Integrated Pest Management (IPM) programmes	-Number of people attending courses and implementing IPM programmes -Numbers of decision /support information systems activated.	14, 3
	Certified professional operator schemes and knowledge of proof tests	-Number of certifications issued -Number of company with established quality management systems	2, 3, 14, 7/10
	Training scheme and course	-Attendance of training schemes	2, 3, 14, 7/10
	Improve technological process	-Number of recycling systems for packaging used for biocides activated -Replacement of disinfection measures by thermal processes	2, 3, 14, 7/10
	Reduce point source contamination	-Number of Attendance of training scheme -Number of tanks, containers etc. collection and disposal scheme activated	2, 14
Lower risk for soil and Increase of biodiversity	Establishment of buffer and safeguard zones along surface waters	-Presence of indicator species in field margins	3, 14
	Lower use in protected areas	-Training of farmers on biodiversity	3, 14

Main Goals	Measures	Indicators	PT mainly covered
		-Residues in soil	
	Increase the presence of indicators species	-Biocide specific monitoring in predators and environmental media. -Evaluation of statistics on poisoning cases of non-target organisms and resistance.	3, 14
	Reduce point source contamination	-Number of Attendance of training scheme. -Number of collection and disposal scheme activated.	2, 14
General reduction of environmental risks	Improve readability of labels or increase information availability	- Numbers of products not allowed to be sold to the general public -Availability of different language versions of safety instructions	

Table 2: Indicators for human health

Main Goals	Measures	Indicators	PT mainly covered
Lower risk for consumer	Providing information on "best practices" and safe use.	-Attendance of training schemes -Numbers of publications from associations and experts, and journals.	All
	Development of PT specific plans and work instructions	-Number of reports to poison control centres and health authorities	All
	Improve readability of labels or increase information availability	- Numbers of products not allowed to be sold to the general public -Availability of different language versions of safety instructions	All
	Reduced use of substances of particular concern	-Prohibition of certain products and applications for non-professional users -Residues in food and feed (MRLs), and threshold values for drinking water	All
Lower risk for professional users	Limit the exposure on workplaces	-Compliance with professional codes of practice -Number of accidents that require medical attention	2, 3 7/10
	Development of PT specific plans and work instructions	-Number of reports to poison control centres and health authorities	All
	Specialised training and advice	-Attendance of training courses	All
	Certified professional operator schemes and knowledge proof tests	-Attendance of training courses -Recorded use of Personal Protective Equipment (PPE)	2, 3 7/10, 14

Table 3 Indicators for social development

Main Goals	Measures	Indicators	PT mainly covered
Increase awareness and education	Training & education	-Number of training courses -Number of people attending courses -Availability of courses -Number of certifications -Repetition of courses -Number of tools available -Number of guidelines for each PT	All
Better understanding of the motivations and risk attitudes	Incentives to appeal to the range of motivational profiles and risk perceptions	-Participation in recognised professional bodies and adherence to their guides of practice	All

		-Compliance with professional codes of practice	
--	--	---	--

5.3.3 Conclusions

One of the objectives of the SUD is to describe quantitatively step-by-step improvements made from an initial assessment, towards the final objective. As in the case of plant protection products also for biocides the recommendations of the OPERA working group on indicators remain valid, as follows:

- Working with a long list of indicators can be counterproductive and can lose sight of real priorities.
- Adoption of a small and pragmatic set of indicators may better reflect and focus on high priority policy issues.
- Robust core sets of indicators are easier to understand and help to track the progress towards policy goals.
- Linking indicators to goals and targets enables their use in tracking performance and helps link them to policy priorities.
- The correct interpretation of monitoring information is crucial in the appropriate implementation of mitigation measures.
- Indicators continue to be affected by serious technical challenges, particularly related to problems with data availability and quality, and the lack of long-term, consistent monitoring mechanisms that would supply data with adequate temporal and spatial resolution.

6 Risk communication

6.1 Principles of risk communications

Risk communication is a rapidly growing research discipline of its own which has been evolving in the past few decades. This subject is referred to different kinds of risks such as environmental risks, human health risks, risks resulting from ecological disasters, risks of industrial breakdowns or risks from traffic accidents. A risk communication strategy intends to understand and in ~~the~~ people's behaviours in order to minimise certain risks. There are numerous extensive publications on the theory behind risk communication available (Wogalter, 1999, Berry 2004, Sellnow 2009).

“Risk” may be defined as the absence of certainty. If one is absolutely certain of the negative effects of an action, that action has no risk. Uncertainty, therefore, is the “central variable” in the risk perception and communication process. Risk communication is the projection about some harm that may occur in the future, derived from known probabilities of negative consequences, and an attempt to reduce that probability. It is based on a long-term message preparation before a

crisis event occurs. Risk communication is linked with risk perception and risk management. The AIDS awareness campaigns may serve as an example of a carefully controlled and orchestrated risk communication strategy (Sellnow 2009).

The “Committee on Risk Perception and Communication” established at the U.S. National Research Council (NRC) proposed the following definition:

“Risk communication is an interactive process of exchange of information and opinion among individuals, groups, and institutions. It involves multiple messages about the nature of risk and other messages, not strictly about risk, that express concerns, opinions, or reaction to risk messages or to legal or institutional arrangements for risk management.” Thus, risk communication is an interactive process which, by its nature, involves multiple and often competing messages (NRC 1989).

Risk messages:

The basis of risk communication is that appropriate information is available. Thus, as a first step, often an analysis of existing information is performed and information gaps are identified. Risk messages should be accurate, clear, and not misleading. The creditability of the information source is a prerequisite. Risk messages which solely reflect the specific interests of certain groups or organisations are commonly distrusted. The attempt to compare risks quantitatively, e.g. by putting them in relation (e.g. risks from radon exposure at home compared to risks from traffic accidents), often leads to misleading risk messages and should be presented with caution. Risk messages can be controversial because they involve uncertainty and different experts may come to contradictory conclusions. Messages that are understandable by non-experts necessarily present selected information (NRC 1989).

People are increasingly “exposed” to information about risks. Hence ‘poor risk communication’ may have a more detrimental effect on public health than the risks that it was trying to address (Berry 2004).

Among the options how to communicate environmental risks, are “warnings” which are considered a third line of defence against hazards, behind design alternatives and guarding. Classification and labelling of products as well as appropriate instructions for use of products are of decisive importance. At a general level, warnings are intended to improve safety. More specifically, they are intended to influence people’s behaviour and to enable more informed judgments and decisions (Wogalter, 1999).

Communication processes:

In the past, risk communication has been understood as one-way message from experts to non-experts, but it has become evident that one-way messages often have a limited efficiency. Instead, risk communication is understood as an interactive process which includes the exchange of information and opinions among individuals and institutions (NRC 1989). As we know from education experience, the simple exposure to information is not sufficient to translate it to understanding.

Without understanding, information is not knowledge (Sellnow 2009). Many government agencies have a long history of a public information model of communication that stresses the one-way dissemination of information. This linear view of risk communication often fails to reach the people concerned (Sellnow 2009).

For communication of warning messages the “communication model” emphasizes the sender, receiver, channel, and message as factors to be considered. An “information processing model” focuses on the receiver and defines a series of stages through which warning information must pass successfully in order to be effective (Wogalter, 1999).

Experts assume that in future the interactive and dialog-centered risk communication tools through social media such as Facebook or Twitter or own internet platforms will replace more and more the one-way communication strategy (Kalbhenn and Schneider, 2012).

REACH and CLP-Regulation:

Risk communication has become a major aspect of REACH. In 2010, ECHA published a guidance document on the communication of information on the risks and safe use of chemicals (ECHA 2010).

Later, in a study on the communication of safe use of chemicals to the general public was published (ECHA 2012). One objective of the project was to enhance the general public’s understanding of the new CLP-Regulation in order to obtain an adequate hazard perception through awareness raising activities. By 2015, the date when the new CLP pictograms will replace the existing ones, EU citizens should be aware of the risks which are communicated with these pictograms. The study proposed a scheme for training activities aiming to enhance best practice in communication campaigns for the general public and the establishment of a web-site, to promote a better understanding of the new CLP hazard pictograms. The ECHA also launched a “Risk Communication Network” (RCN) as an information exchange platform of competent authorities involved in the communication of risks and safe use of chemicals to the general public. These activities will certainly also be of importance for the risk communication for biocidal products.

Pharmaceuticals:

A communication strategy for raising environmental awareness in the handling of pharmaceutical drugs was developed by Götz et al. (2012). The widespread occurrence of pharmaceuticals in water bodies including drinking water and the unknown long-term effects of these, require the development of precautionary measures. These include the development of innovative active pharmaceutical ingredients with a better environmental performance, alongside more advanced technical measures for water treatment and the handling of drugs themselves, i.e. the way they are prescribed, sold, used and disposed. Among these behavioural changes of people, e.g. regarding the disposal of unused or expired drugs via the toilets,

plays a decisive role. It was stated that there is the need to promote an awareness of the problem amongst the responsible persons in the health system and the population in order to reduce drug residues in the environment. The preventive measures proposed to cover the overall handling of medications, from the prescription through the usage down to disposal. In Germany around 16% of unused or expired tablets and 43% of liquid drugs are disposed via the toilet. The main reason for this improper behaviour was identified to be the lack of any standard regulation for the disposal of unused or expired drugs and the fact that there is no consistent communication in Germany. Patients should be given a standard message on drug packaging and on the package leaflet that all unused or expired drugs should be taken back to the pharmacy. This should be supported with communication campaigns directed to the different stakeholders. The major players in the health system are doctors, pharmacists and users of pharmaceuticals. A communication strategy should specifically address each of these target groups which can be separated in three sub-groups: The deniers/relativists, the truth-seekers, and the hypersensitives. The communication strategy explicitly refers to the precautionary principle when promoting a sustainable handling of pharmaceutical drugs, given the uncertainties of quantitative risk assessment especially for long term effects. The risk perception depends e.g. on the personal benefit arising from the use of the risk source. People may put themselves voluntarily at a risk, if they see a benefit, e.g. from pharmaceuticals, mobile communications etc., provided that the risks and rewards are distributed in a fair way to the society. Any background information distributed e.g. via flyers should use short messages, understandable for the target groups and easily accessible to people. A scientific or moralising jargon should be avoided. A so-called “public affairs approach” has to be proved as useful in policy advisory work. Public affairs are defined as the strategic management of decision-making processes in the dialogue between politics, business, industry, associations, interest groups and organisations and could be initiated by round table discussion with the major stakeholders. The process of raising people's awareness should take place without triggering a sense of alert, which could lead to overreaction of the hypersensitive group. The consideration of environmental classification of pharmaceuticals, as it is done in Sweden, is another option to strengthen the knowledge of pharmacists to advice their customers accordingly. Here, the classification is expressed as risk levels which are derived from the PEC/PNEC ratios (Wennmalm et al. 2009).

6.2 Behavioural studies for improving sustainable use of biocides

According to the US National Institute of Health NIH, “Behavioural is a term that covers a lot of ground.” It refers to what people do, as well as what drives them to do things, and it involves psychological processes” (NIH 2014). Behavioural sciences have gained wide recognition and interest in the last years, also in European institutions, and in some EU national governments. Policy makers are starting to recognise that a better understanding of people's behaviour can offer useful insights to policy-makers, by generating the evidence required to improve policies.

Behavioural evidence shows, for example, that people are sensitive to the way in which information is presented and that, in making decisions, they do not always behave in mind a 'fully rational' manner. The orthodox assumption has been that people are 'rational'. However, behavioural research has shown that this assumption is unrealistic and has identified a number of consistent behavioural patterns, which systematically violate these assumptions. This also explains the limited effectiveness of some policies in the past.

Deviations from rationality in decision-making are well documented since 1970 and the basis of popularity of applied behavioural science in politics (Kahneman 2012, Thaler and Sunstein (2008). A proper understanding of human behaviour requires reality checks. A behavioural element needs to be recognised and defined in as much detail as possible. According to van Bavel et al (2013) there is a behavioural element to a policy:

- When behaviour change is the main objective of the policy
- When people's behavioural response affects the effectiveness of a given policy, even if the aim of the policy itself may not be to change behaviour.
- In the policy-making process itself. Decision-makers are also subject to biases, heuristics, and a number of other influencing factors (such as social norms and in-group vs. out-group hostilities).

In the case of biocides (as pesticides) the use phase has a great behavioural component. Information on how pesticides are used and on socio-behavioural factors has to be taken into account, in order to avoid risk for human health and environment in the use phase.

The principal aim of the SUD indeed is not to change behaviour but to fill a "gap" of previous directives or normatives aimed to reduce the risk for human and environment posed by PPPs in the use phase. Pesticide risk assessment as currently done is a deterministic and quantitative process that does not addresses socio behavioural aspects. Mitigation measures are considered in order to reduce risk and the authorisation is bounded to good agricultural practices. Despite the process as it is structured at the moment has led to a series of advantages, the "risk community" is now beginning to comprehend that "risk analysis is not just about technical assessment and optimization of the risks as quantified entities.

Risks have social and psychological dimensions, and are shaped by values, beliefs, political systems, and cultural factors" (Kasperson et al.1988) and risk managers may have difficulty in the application of the planned mitigation measures since the economic and socio-cultural context does not allow them.

For biocides, aspects mentioned above may have greater relevance, because many of them have been in use for a long time. In contrast to the plant protection products that have a long history of regulatory frameworks and a very strict risk evaluation and approval procedure, the BPR is relatively new procedure. It could integrate new considerations that also take into account socio economic and

behavioural aspect with the aim to improve the trust and efficiency of the overall risk analysis process. Biocides are also used in very complex environments, which are heterogeneous from the point of view of conditions of use, social and cultural backgrounds. Following the example of plant protection products, similar tools could also be considered for biocides for helping us to understand human behaviours regarding biocides use phases. However due to the great differences between biocide type, these tools should be targeted at specific population groups or user levels, taking into account the specific socio-economic and cultural context and the behavioural schemes should be carefully designed in order to avoid inequality.

Potential cultural differences in risk perceptions and communication preferences also need to be considered. The need to take risk perceptions into account when developing intervention-based policies to reduce exposure to potentially hazardous events has been discussed by Remoundou et al. (2014). However, there is no direct relation between risk perceptions and behaviours, and the gap on the knowledge in this area need to be addressed.

In summary, risk awareness linked to biocides requires that risk assessment and administrative features of management should be accompanied by socio-psychological considerations and measures. Given the differences on product types and the diversity of exposed populations, cross-cultural and interdisciplinary research is essential.

6.3 Learnings about risk communication from other biocide projects

In a German study in 2005 good practice (GP) reference documents were developed for PT 2 „Disinfectants in the private area and public health“, PT 8 „Wood preservatives“, and PT 14 „Rodenticides“ (Gartiser et al. 2005). In this study it was stated that the application patterns can be so different even within one product type, that an operation-oriented description of the GP is more useful than a comprehensive one. The qualification of the user (education, schooling and training, professional certification) as well as the communication of risks was considered to be of decisive importance as adjunct measures for the realisation of and compliance with the GP. The GP reference document should refer to legislation or other regulating documents such as DIN-standards or information sheets from professional associations, in which the basic information is given. For the development of GP for biocidal products the participation of practitioners and experts is required (Gartiser et al. 2005).

Further on, an information system on biocides has been established to provide information on, *“physical, chemical and other measures as alternatives for the use of biocidal products or for minimisation of their use”*, to the general public (www.biozid.info). In the scope of the project, a feasibility study supporting this information requirement was carried out which suggested an information system consisting of a web portal and print media (cross media publishing). For some application areas, an information system, only based on the internet, is not sufficient to reduce the existing information deficits of the involved actors. Here the

internet can, however, be used to address multipliers. Therefore target groups and information content should be determined for each application area of biocides separately and in close cooperation with the stakeholders (Gartiser et al. 2008). In this project, also data/information and a target group analysis have been performed and different options for communication of risks and promotion of the application of alternatives to biocide uses have been elaborated.

The development, availability and dissemination of best practices on biocide uses have been analysed in a study on behalf of the European Commission. Two obstacles on a better exploitation of best practices have been identified: The lack of an EU-wide overview of best practices and that there is little exchange of best practices among the competent authorities and industry (Zamparutti et al. 2010).

Several EU Member States have included biocides along with plant protection products in their NAPs that are currently developed under the SUD for pesticides. In 1998, Belgium adopted a Federal law whose provisions included the development of regular plans to reduce the use of plant protection products and biocides which considers also the promotion of public communication and awareness (Zamparutti et al. 2010).

Biocidal product manufacturers have indicated that the most important method of communicating information to consumers at present is via the product labelling. The results indicate a gap in terms of best practice documents and awareness raising for public users of biocides. Existing guidance is designed for both professional and consumer users. The guidance for professionals is generally more detailed and complex. Among the documents for consumers, one interesting development is the use of interactive games and quizzes as well as videos to aid communication. Among the different political options it was proposed to establish a procurement process. Thus guidelines on best practices on EU-level should be developed in order to increase the availability of best practices. Thereby, better standardisation and harmonisation of best practice should be achieved. Another option was to encourage the development of best practices by stakeholders through a standardisation process, in order to use the communication networks of CEN and national standards authorities. CEN standards are intended for industrial/professional use only. They are available only for a fee which is not considered as a serious obstacle for industrial/professional users but is not appropriate for best practice communication for the public and consumers. The operation of national web sites and helpdesks, to provide information about best practices and training events, was also mentioned (Zamparutti et al. 2010).

6.4 Product-type specific aspects on risk communication concerning biocides

At the national workshop on sustainable use of biocides in June 2013 improved risk communication was often mentioned among the proposed measures for product types PT2/3, PT 7/10, and PT 14. Many of these proposals were also valid for other product types and thus could be considered as general measures to improve risk communication on biocides.

6.4.1 Disinfectants

Improved risk communication on product labels was one of the proposed measures for disinfectants. This concerns misleading advertising of improper uses. It was suggested to develop a publicly accessible guide on misleading advertising claims. Another point of discussion was the verification of labels during the authorisation process which to date is only partially taken into account. Guidance for manufacturers and regulatory authorities, considering the specifications of the requirements of the Biocidal Products Regulation that concern labelling, is missing. As a good example, the regulations of the U.S. EPA were mentioned, where any health-related statements have to be approved by authorities. The consideration of the label as part of the product approval would be a measure that could give manufacturers legal certainty. It was stated that simplified labels for consumers were required, which lead them to a clear decision about where and how safely the biocidal product may be applied. For this, the BPR and related legislation such as the CLP regulation should be revised in a way, that the labels are not overloaded with information that is required by law at the moment. A combination of apps or bar codes would be conceivable in addition to the accompanying detailed instructions for improving application information. The provisions of safety data sheets would overburden consumers, thus the most important information should be included in the instructions for use. This information should be made available to the public together with the summary of the product characteristics.

6.4.2 Masonry preservatives

Stakeholders rated the lack of well addressed and clear information as the most important field of activity:

- Operating information: It was agreed that labels and safety data sheets for biocidal products are not read or understood by the users. Operational information provided by the professional association for construction workers via GIS code are missing for film-protected paints.
- Pictograms: Visual language facilitates communication across language barriers. There is a great diversity of languages on construction sites. Experiences were presented that were made in the Arab region, where pictograms supporting product information are well accepted and understood.
- Maintenance: According to the Painters Association a guideline for the assessment of the risk of microbial growth on facades is available. The procedure leads to a "traffic light" rating (red, yellow, and green). According to several workshop participants the Maintenance Guideline should be stressed more often and perhaps be already implemented in the planning phase of buildings. This measure was perceived as very effective by all participants because it would hold planners, contracting authorities and architects liable.

- Painters' manual of practice: The most important manual guideline in painting and decorating can be extended by a chapter on sustainable use of biocidal products.
- Work contract: Formulators suggested that typical work contracts with customers could explicitly mention whether biocides should be applied in façade coatings or not.
- Labels: A classification of paints and renders similar to the procedure in Switzerland (environmental classification in product categories A, B, C, F, G, see <http://www.stiftungfarbe.org>) was considered as, "worth to be examined", but not considered as a priority in the action plan. A new label would have to be significantly better than the existing labels and not only represent a new variation.
- E-learning: The participants agreed that this tool only mobilises already interested persons. It is more important to bring information directly to the user.
- Guideline on wood protection: The consumer guide for wood preservatives by the BMELV is a good orientation on how to set up a consumer guide for facade coatings.

As one result of the workshop an ad hoc working group has been established, which created five information leaflets. This group consisted of representatives of an NGO, the Federal Environment Agency, painters association, industrial and professional associations, and formulators. The different flyers address painters/plasterers, architects/planners, consumers/NGOs and governmental authorities and contain information on maintenance, the relevance of biocides for masonry preservation, waste disposal and handling of used equipment (e.g. cleaning). The documents⁷ will be distributed via internet portals, together with sold products and presented at training days.

6.4.3 Rodenticides

Risk communication in the context of rodent control is related to the training, education and certification of professional pest controllers, the available information on best practices to be distributed and the way how rodenticides are advertised and distributed on the market. Stakeholders emphasised the following main points:

- Regular obligatory training implies that the user is engaged in weighing up risks and benefits of biocide use. In contrast to plant protection products there is no special certified training course that teaches all user groups about the use of biocides. This means among other things that the trainings

⁷ The documents can be found under <http://www.umweltbundesamt.de/themen/chemikalien/biozide> (only available in German).

set out in the framework of the authorisation procedure have very different (both with reference to its contents and its temporal requirements) levels if the use should not only be restricted to professional pest controllers and consequently inadequate knowledge in the sustainable use of rodenticides may be communicated. Here, setting legal requirements for training and competence levels and their official recognition is regarded as a prerequisite to create a uniform level of quality. Aims of pest control: In the description of the professional image of pest controller and rodent control as a provision of service to clients, it must be clearly communicated that the primary goal of pest control is the long-term and sustainable control of rodent pests and the prevention of (re) infestation, and not only the mere placement of baits.

- Plant protection: Because rodenticides are often used in the agricultural sector and resistance in rats have been found mainly in agricultural areas, it is important to train farmers in the sustainable use of rodenticides. Therefore farmers associations should pass on to farmers, clearly formulated application notes for rodenticides, and training courses for farmers should cover the sustainable use of rodenticides.
- Public/municipal area: Awareness raising at the contracting bodies and auditors in the public/municipal area (e.g. in health, veterinary and order offices) has been identified as an important area of activity to implement sustainable use of rodenticides. The economic approach should be stressed because a targeted and sustainable rodent pest control will result in money savings at the municipal level. Frontrunner communities which have already implemented sustainable concepts should serve as a model here. Environment Agencies (e.g. German UBA) can act as information providers (via email, paper work and presentations) for clients at the local level and convey information about the sustainable use of rodenticides to the public/municipal areas.
- Considering requirements for sale, there was a consensus among the workshop participants that sales to private consumers or via the internet or via self-service building stores should be restricted. The importance of risk communication has been stressed. The distribution of information sheets together with the product have been identified as a possible mean to pass information to the customer. In addition, the development of "Apps" for smartphones has been discussed as a possible measure for risk communication.

The National Pest Advisory Panel (NPAP) of the UK Chartered Institute of Environmental Health (CIEH) has developed documents on the use of rodenticides (PT 14). The guidance itself is available from the NPAP website and is distributed at trade events and informally during the professional activities of its members. One recommendation in the best practice documents is to engage the public in the control of pests, including children and teenagers in schools. NPAP also developed a set of tools for this purpose. Among the communication tools developed is an online game, "Pesky Pests", available on the NPAP web site

(<http://multimedia.cieh.org/npapresources/peskypests/peskypests.html>). In the game, participants are asked to identify 10 common factors that may encourage rodent infestation. Each time a factor is identified, a text box is displayed explaining why this factor, e.g. incorrectly stored food, may attract rodents. Items of good practice, such as a cleaned pet bowl, are also included and explained when identified. The aim is to help pest control professionals to communicate the measures to the public that they can take to prevent infestation or to reduce the likelihood of re-infestation following to treatment. A DVD resource called “Pests on the Menu” has also been produced for public audiences: it provides more information than the simple online game (Zamparutti et al. 2010).

6.5 Suggestions for communication campaigns on sustainable use of biocides

The stakeholder consultation implemented during the project did not focus on communication needs and means, communication strategies being a secondary objective in the project. However, based on expert judgement and parallelism with similar activities carried out by some of the project partners in relation to the sustainable use of plant protection products, we were able to provide a series of suggestions and recommendations on how to frame and develop a communication strategy to stimulate training activities and raise awareness on sustainable use of biocides.

6.5.1 Communication campaigns to stimulate professional training

As it has already been indicated in this report, when analysing the opportunity of imposing training measures for biocides, as it is currently proposed for plant protection products, training and education only applies to professional users. For consumers and the rest of the society only measures for awareness raising are appropriate. However, the uptake of training activities in various sectors of use of biocides is heterogeneous. Hence in terms of communication strategies we identify a need to raise awareness on the need in certain sectors, in order to promote organisation and attendance to such training courses.

We can identify the following target groups for the communication campaigns:

1. Work safety managers (construction companies; large scale farms; pest control companies; etc.)
2. Independent operators (pest controllers; farmers; veterinarians; masonry contractors; etc.)
3. Manufacturers
4. Resellers and distributors
5. Workers

Work safety managers and independent operators:

For the first two target groups, we suggest a communication campaign focused along the following themes:

- Need for training: risks of exposure to human health and environment; available solutions to reduce risk; economic and social impact of incorrect use of biocides
- Minimum topics to be covered by training courses: i.e. risks in the use of biocides; biocide-free alternatives; preventive measures; sustainable use strategies; integrated pests management; mitigation measures; risk to end users; etc.
- Benefits of training: economic gains due to rational use; environmental and social benefits

The most efficient communication materials for these two groups are intuitively considered to be written and video materials distributed through specific professional channels. The information needs to be targeted and specific enough to allow the target people to plan and elaborate training strategies or to evaluate the impact of the training on their work.

Existing networks and training platforms should be fully used for such purposes. Especially for farmers, gamekeepers and veterinarians, full use of the existing advisory services should be made due to their permanent contact with the target groups but also due to the confidence that the farmer attributes to the advice received.

Manufacturers, resellers and distributors:

These target groups would be better addressed by a targeted communication campaign on the following topics:

- The need to support training in sustainable use of biocides: providing the necessary information related to their products; distributing information on mitigation measures; etc.
- Environmental and human health benefits of sustainable use

The most efficient communication channels for these groups would be their professional associations and the communication materials to be used need to address options for strategies to support training on sustainable use in a specific manner. However, it has to be kept in mind that the intention of this group is to sell biocidal products. Thus, the substitution of their products with biocide-free alternatives and preventive measures would not be their main goal.

Although it does not represent a classical communication tool, from similar experiences with plant protection products, we can conclude that a particularly effective strategy is to encourage manufacturers and their respective professional associations, to implement stewardship programs for their products with the highest risk. Professional associations can be stimulated to create voluntary initiatives to encourage sustainable use of biocides.

Workers:

The specific objective of a communication campaign for workers is to convince them to be available for the training courses and also to stimulate them to convince their employers about the necessity of such courses.

Hence the communication materials should be focused on risks for human health and environment as well as about the benefits of implementing mitigation measures and sustainable use strategies.

The most effective communication materials for such groups would be video materials with practical examples as well as clear and simple brochures and leaflets. In the design of such materials special emphasis should be put on pictogram explanation and safety phrases which are commonly used for biocidal products.

6.5.2 Communication campaigns to raise awareness

A consultation was implemented in December 2011 in the framework of the BROWSE project (www.browseproject.eu) with the stakeholders in the sustainable use of plant protection products. The results of that consultation process have been taken here into account keeping in mind similarities, but also differences between plant protection products and biocides. Stakeholders have indicated that a combination of the most appropriate communication techniques should be used to achieve the goals of an awareness raising campaign as requested by the SUD. Developing a mix of communication techniques is essential, especially due to the heterogeneity of audiences that should be addressed (Sacchettini et al. 2012). We consider these recommendations as being relevant also to the topic of sustainable use of biocides.

The above mentioned stakeholder consultation has mainly indicated that for plant protection products:

1. Prioritised subjects of communication strategies for the general public are:
 - Explaining risks and potential acute and chronic effects on human health
 - Risk management measures in areas used by the general public and vulnerable groups
 - Measures realisable by individuals to reduce exposure.

Indeed, it was considered extremely important to make the wider public and in particular bystanders and residents more aware and conscious of products used and their impact. Additionally, the public needs to be aware that the used products might be applied in regular time intervals by multiple application methods. This could require specific mitigation measures in addition to those that should be already implemented by the operators/workers in order to reduce the risks of exposure.

It is recommended that a study for segmentation of the audience and target groups, specific for the situation of Germany, is developed prior to the development of an awareness raising campaign, so as to create the premises for targeting the messages. Such a study can be built on the following elements:

- Focus groups to gain insights on the existing knowledge about the risks generated by the use of biocides; awareness of the potential exposure paths and risk management measures that are implemented;
- Representative survey to generate segmentation of the general population and identification of the priority target groups;
- Analysis of the target groups to identify the most effective communication concepts and channels.

In a study conducted by BfR Wissenschaft and published by Federal Institute for Risk Assessment in 2008 (BfR Wissenschaft, 2008) on the communication on consumer health protection in relation to chemicals, a survey was conducted with representative consumers, academia and industry to identify product categories that need improvement in terms of communication of health aspects to consumers. The need to improve communication to consumers in the area of biocides was considered high by the representatives of the consumers and academics.

Among the target groups that were identified for having a “high need for action” in terms of the information requirements on the risks of biocides of certain PTs to their health, the following relevant groups are mentioned:

- “Vulnerable groups: allergy sufferers, people with multiple chemical sensitivity (MCS), sick or older people;
- Young people: highly susceptible target group of importance for the future

- Foreign citizens: any language obstacles
- People with low level of education: probably more difficult to access via information offerings
- Multipliers and representatives” (BfR Wissenschaft, 2008, Table 4, p24)

The same study recommends that when differentiating between target groups for awareness raising campaigns on the health risks of chemicals, the following criteria should be taken into account:

- The central or peripheral interest in the product of the subjects concerned
 - Consideration of the prior knowledge on the risks generated by the use of the product
 - Distinction between the various groups in the general population (i.e. children, parents, elderly people, foreigners)
2. Stakeholders identified two main categories of factors influencing exposure that need to be carefully taken into account:
- The contact with treated areas and
 - The types of activities in the vicinity of treated areas which can increase the exposure.
3. In terms of the format of the communication material for the awareness raising campaigns, it was felt that a mixed approach should be adopted that suits to different target audiences involved. Stakeholders identified video materials as having the highest impact together with paper based information material (leaflets, poster, etc.). Radio and television broadcasting should also be considered in order to reach a wide distribution of the information within the target audiences.

Relating to information and awareness raising, participants agreed on the importance that the information given to the general public is objective, balanced and science-based. It should not only cover environmental and health aspects relating to the use of products, but should also include messages explaining why they are used and what their benefits are.

Since stakeholders questioned in this project mainly attributed a limited efficiency to the promotion of web-based information platforms, this demonstrates that these must be complemented with other tools such as print media and radio and television broadcasting campaigns.

7 Package of measures

7.1 Comprehensive measures covering all PT

Among the measures covering all PTs it is on hand that the SUD, which so far only has been implemented for plant protection products, could be amended to cover also biocides.

Initiatives for harmonisation and standardisation of the machinery for biocide application should be approved. The Directive on Machinery 2006/42/EC should be amended to include machinery and equipment for the application of biocides.

The inclusion of biocides into the scope of the Regulation (EC) No 1185/2009 concerning statistics on pesticides, which so far only covers plant protection products, is recommended. These data are urgently needed for the development of suitable indicators and the definition of the objectives for sustainable use.

In Directive 98/83/EC on quality of water for human use, the term “pesticide” could be extended to refer to both, plant protection products and biocidal products, in order to cover also disinfectants or film preservatives. Similarly, the consideration of the term “biocide” in the German surface water regulation (OGewV) would be an appropriate mean for monitoring emission of biocides into surface waters followed by reduction measures. This could provide a basis for the development of suitable reduction measures.

Maximum residue levels of biocides in waste could be defined in order to cover the end of life phase of biocides.

The Directive 86/278/EEC on the protection of soil, when sewage sludge is used in agriculture, could be amended to cover other contaminants than heavy metals, such as biocides.

The European “Sustainable Consumption and Production and Sustainable Industrial Policy Action Plan” could be adopted to cover also biocides used in the private and industrial sector.

7.2 Product type specific measures

A detailed presentation of potential measures, for supporting a sustainable use of disinfectants (PT 2, 3), film and masonry preservatives (PT 7/10) and rodenticides (PT 14) is given in separate case studies (Annex II-V).

A short summary is presented in Table 4 which shows measures which received the highest acceptance of at least 50% of all stakeholders which attributed high and medium efficiency to them.

Table 4: Product type specific measures supported by stakeholders

	PT 2	PT 3	PT 7/10	PT 14
Further training and education				
Development of hygienic plans, disinfection plans and work instructions adjusted to the needs of disinfection measures.	X			
Advice to clients by manufacturers (including safety data sheets, technical leaflets, instructions for use).	X	X		
Instruction of co-workers in the company.		X		
Knowledge transfer on a sustainable use of disinfectants during education and training, e.g. of farmers.		X		
Funding of (voluntary) training measures for (private) users, e.g. on environmental sound use and disposal.		X		X

	PT 2	PT 3	PT 7/10	PT 14
Certification of professional users, distributors and consultants within further education and training.		X		
Implementation of "standards" for sustainable use and disposal as part of professional training, e.g. for painters			X	
Promotion and further education training for a sustainable use of paints and plasters containing biocides during application and utilization phase for architects.			X	
Placement of "standards" for sustainable use and disposal as part of training, e.g. for semi-skilled workers.			X	
Training courses on pest control to become a trained/certified professional user.				X
Harmonised training schemes for other user groups such as farmers and gamekeepers.				X
Further educational structures such as training seminars organised by pest control companies, manufacturers and other organisations, or formative meetings and conferences organised by pest control associations.				X
Knowledge transfer on a sustainable use of rodenticides during education and training, e.g. of pest control workers.				X
Knowledge transfer on a sustainable use of disinfectants during education and training, e.g. of nursing staff or cleaning staff	X			
Requirements for sales and control mechanisms				
Prohibition of certain products and applications for nonprofessional users (consumers).	X			
Certification of professional users, distributors and consultants within further education and training. Certification of hygiene consultants of manufacturers / retailers.	X	X		
Restrictions on the marketing for consumer.	X			X
Development of a classification system for environmental sound disinfectants.	X	X		
Regulation of sales of products through retail trade to the general public, e.g. through the sale of household disinfectants in pharmacies.	X			
Regulation of sales of products via el internet, e.g. through minimum standards of information requirement (PT 3) or restriction of any sales to private users (PT 14)		X		X
Proof of advice/consulting on handling paints and plasters containing biocides for professionals by the manufacturer (safety, technical data sheet)			X	
Sales restrictions of products containing anticoagulant rodenticides (especially SGAR), only ready-to-use products (i.e. no concentrates); bait products only in combination with bait stations.				X
Limitation of the container size for private users (to minimize residual amounts)				X
Information and awareness raising				
Providing information on "best practices" and safe use (PT 2, 3). Providing information on good practice for use and safe disposal of products containing biocides for customers in the DIY-sector (PT7/10)	X	X	X	
Providing multilingual information on "best practice" for the safe application and disposal for professional users.			X	
Funding of (voluntary) training measures for users, e.g. on environmental sound use and disposal.		X		
Promotion of web-based information platforms.		X		X
Information for pest control operators/farmers such as web-based support/information systems and professional journals providing all kind of information related to pest and rodent control, including recommendations for the performance of professional rodent campaigns				X
Annual conferences and meetings organised by pest control associations providing the opportunity for information exchange between manufacturers, professional users and authorities / academia.				X
Journals read by farmers, hobby gardeners or private consumers as distribution pathways for the dissemination of knowledge on sustainable use				X

	PT 2	PT 3	PT 7/10	PT 14
Surveillance of applications				
Development of hygienic plans, disinfection plans and work instructions adjusted to the needs of disinfection measures.		X		
Renunciation of daily routine disinfection of floors in public health areas	X			
Replacement of air conditioners with rotary spray through steam humidifier	X			
Optimization of disinfection by previous cleaning	X	X		
Quality Assurance and Control.	X	X		
Replacement of poorly biodegradable / eliminable disinfectants (in sewage treatment plants) by rapidly degradable active ingredients and additives.	X	X		
Mandatory testing and control of biocide treated materials	X			
Development of technical standards and guidelines for the cleaning of instruments and equipment.	X	X		
Development of standards and guidelines for private users, when disinfection measures are required and how they should be used.	X			
Replacement of disinfection measures by thermal and thermochemical processes (PT 2). Replacement of disinfection measures by thermal processes (incineration, flame treatment, hot air sterilization, boiling, steam sterilization, self-heating (PT 3))	X	X		
Limitation of the container size for consumer users to minimize residual amounts	X			
Routine examination of bacterial load in the relevant areas,		X		
Mandatory use of stable, tamper-resistant and secured bait boxes				X
Well-planned, systematic and safe application/placement of baits at relevant points.				X
Consideration of the principles of IPM and criteria of best practice				X
Measures to reduce emissions during the use phase				
Collection and disposal of residual amounts.		X		
Intermediate wastewater storage in collection tanks followed by transport and treatment in municipal sewage treatment plants		X		
Anaerobic treatment of liquid manure for biogas production		X		
Avoidance of peak loads through discharge of concentrated solutions.		X		
Discharge of wastewater from cleaning and disinfection to the liquid manure tank		X		
Organized collection and disposal of residual amounts mandated by public authorities			X	
Risk investigation for outdoor uses (e.g. safe placement of bait boxes).				X
Adequate disposal of dead rodents and remnant baits after the treatment campaign.				X
No preventive permanent baiting with anticoagulant baits.				X
No monitoring (for signs of (re)infestation) with anticoagulant baits. Instead, non-toxic baits, traps or monitoring devices should be used for rodent monitoring.				X
Establishment of buffer and safeguard zones along surface waters				X
Use restrictions in sensitive areas (e.g. public parks and gardens, drinking-water protection areas, etc.).				X

8 Recommendation and outlook

The Directive 2009/128/EC on the sustainable use of pesticides (SUD) has so far been implemented only for plant protection products. No harmonised approach exists for minimising hazards and risks of biocides to human health and the environment during the use phase. In a preceding project the possibilities and requirements for transferring the measures of the SUD to the biocide area were analysed (Gartiser et al. 2013). In the follow-up project, further case studies on disinfectants (PT 2

and PT 3) masonry preservatives and façade coatings (PT 7/10) and rodenticides (PT 14) have been carried out. The study is based on a broad stakeholder consultation and two workshops, one on a national and one on a European level.

Sustainable use of biocides addresses the three pillars of social, environmental and economic sustainability. The social dimension refers to human health, general hygiene conditions in workplaces and residential areas. The environmental dimension refers to the protection of water resources, soil, non-target organisms and biodiversity. The economic dimension refers to the protection of commodities, materials, livestock breeding and industrial processes. The amendment of this three pillar model by the guard rail concept, which sets environmental limits within which development and progress can take place, is recognised.

Education and training:

Education and training is of decisive importance for the sustainable use of biocides by professional users. For consumers only measures for awareness raising are appropriate. Training programs should consider existing education curricula or training schemes. A prioritisation of biocide applications for which training should be considered is required. Main areas identified were pest control agents (rodenticides, insecticides) and high production volume PTs such as general disinfectants (PT 2) or indoor uses which lead to emissions to sewage treatment plants. Prioritisation of training initiatives should also be linked with existing best practices which generally are PT specific. The question whether training should be mandatory or not need to be further analysed. Training should integrate good housekeeping principles, good agricultural practices, integrated pest management or other best practices depending on the trained PT use. While education and training is already well established for disinfection (PT 2) or rodent control (PT 14), a lack of training possibility for the application of façade coatings and renders containing biocides, is complained. The use of second generation anticoagulant rodenticides should be restricted to “trained professional users with a license” in all Member States. The certification of the competence tests should be carried out by neutral authorities and not alone by the training provider. Furthermore, the participation of pest controllers, farmers and gamekeepers, at regular training events should be mandatory. It was complained that in contrast to the plant protection area there is no legal basis to implement requirements for obligatory training and certification for biocidal uses of rodenticides. For existing apprenticeship curricula there is no need to implement further training measures. Instead, elements of sustainable use of biocides should be considered in these curricula.

Restrictions on sales:

Restrictions on sales of biocides, specifically addressed the prohibition of self-service for rodenticides. Sales requirements can be regulated nationally if public use is prohibited. There is an option for the registration of biocide sellers, users and sales for those products not allowed for public use as it is being realised in Belgium. The certification of competence of distributors of biocidal products intended

for professional use only is another potential measure. The supply chain of some biocidal products such as disinfectants for hands, surfaces or laundry (intended for human health purposes) could be prescribed by distributing these products via pharmacies to the general public in order to obtain advice on the application of these products and on general hygiene requirements. The free sale of all rodenticides to private consumers, e.g. through self-service in building stores or via the internet should be restricted. Up to now there are only use restrictions for some SGARs. Generally, internet sales of professional biocidal products to consumer should be forbidden. Restrictions of self-service or remote selling might also depend on the outcome of product authorisation.

Awareness programmes:

The development and establishment of awareness programmes is an important instrument for supporting sustainable use of biocides, especially for consumers. Web-based information platforms should be complemented with supporting tools such as print media and radio and television broadcasting campaigns.

Application equipment:

The availability of appropriate equipment for the application of biocides is an important tool for minimising exposure and for targeted dosage of biocides. Initiatives for harmonisation and standardisation of the machinery for biocide application only exist in rudimentary form. Advertising restrictions should be established for avoiding that spray equipment is promoted for uses which are not recommended by the formulators, such as e.g. wood preservatives. The integration of such sprayers into the Machinery Directive, indicating the allowed applications, would provide more legal certainty. This would also allow that the equipment for large scale biocide applications such as spray canons and aerial spraying from helicopters for the control of oak procession moths, would be evaluated in the same way as similar plant protection equipment.

While the equipment is considered during product authorisation there remains considerable uncertainty how specific the evaluation of the equipment during product authorisation works. There is no legal power to request for specific equipment as it is the case for plant protection products. Thus, a systematic evaluation of existing standards for the equipment should be performed and the Directive on Machinery 2006/42/EC should be amended to include this machinery and equipment for the application of biocides with identified risks.

Service and end of life stages:

The SUD does not consider instruments for reduction of environmental emissions during service life. However, for biocides used for preservation of materials (PT 6-10) and antifouling agents (PT 21), a considerable proportion of total emissions arise during service life, through leaching from treated materials or the removal of coatings. Therefore, in contrast to plant protection products, the service life of biocidal products should be considered in detail in addition to the use phase. Emissions from paints and renders (PT 7/10) could be reduced by improved product quality with lower leachability of biocides. A classification system should be developed for outdoor façade paints and renders to allow a comparison of their environmental performance.

No data exist about the preservatives contained in treated coatings at the end of life. Paint buckets with residuals are taken back to the companies and disposed. Private users can return the containers to public collection points. Empty buckets are disposed of with household waste. Washing of brushes and rollers is not recommended anymore. The safe disposal of rodenticides (i.e. remnant baits) and rodent bodies is an important aspect of any pest control operation and considered as one of the most efficient measures to reduce negative environmental impacts by rodenticides.

Specific measures to protect the environment:

Among specific measures to protect the aquatic and terrestrial environment, the requirements of the Water Framework Directive as well as the concept of drinking water protection zones apply to both, plant protection products and biocides. The main emission pathway for PT 2 disinfectants is via the sewer system to municipal sewage treatment plants. Avoidance of peak loads or neutralisation of the active substance or obligatory discharge of the wastewater to a well-functioning municipal sewage treatment plant may be considered as risk mitigation measures. For film and masonry preservatives (PT 7 / 10) the establishment of protection and buffers zones to waters, treatment facilities for rainwater runoff, or rainwater management plans.

With regard to the use of rodenticides the use of bait boxes or the inclusion of bittering agents and dyes help to protect the terrestrial environment and non-target organisms.

The identification of further priority substances and their monitoring in the environment is a prerequisite for setting environmental quality criteria.

The reduction of biocide use in sensitive areas, such as Natura 2000 sites, may be required for some applications. Several outdoor applications of biocides have been identified (e.g. PTs 2, 7, 8, 10, 11, 14, 18, 21), but the prevalent use for most PTs is indoors. Considering public areas such as hospitals and restaurants biocide use may be a legal requirement for pest control and hygiene management. The correct use of biocides in these areas should be enforced. Because sensitive

areas are not specifically addressed during product authorisation a sustainable use directive would facilitate measures to protect these areas.

Integrated pest management and best practices:

Integrated pest management and best practices in biocide application include the consideration of preventive and/or non-biocidal measures. The development and promotion of IPM guidance for pest control is considered one of the most promising instruments for the sustainable use of biocides. For disinfectants the Hazard Analysis and Critical Control Points (HACCP) as a preventive approach for food safety may serve as an example for a hygiene management tool, comparable to IPM, whereas for masonry and film preservatives (PT 7/ 10) no such concepts exist.

While for public health disinfectants (PT 2) and veterinary hygiene disinfectants (PT 3) numerous good and best practice documents are available, there is a lack of such documents describing the application and safe handling of paint and plaster that contain biocides, except technical data sheets and informal guidance documents offered by formulators. As a consequence a set of leaflets on best practice for different stakeholder groups has been developed by an ad-hoc working group task force. With respect to rodent control (PT 14) there is a multitude of documents from authorities, industry, and professional associations describing the elements of integrated pest management (IPM) and criteria of good practice.

Indicators describing progress in sustainable use:

To this date, there are no suitable indicators available for describing progress in the sustainable use of biocides. There exist only limited data on sales and consumption of biocides, the use pattern, and monitoring data in environmental media. The inclusion of biocides into the scope of the Regulation (EC) No 1185/2009 concerning statistics on pesticides, which so far only covers plant protection products, is recommended. These data are urgently needed for the development of suitable indicators and the definition of the objectives of sustainable use.

The stakeholders attributed the highest priority to indicators describing consumption data for specific product types (PT 2), exposure measurements on workplaces (PT 3), biocides specific monitoring of effluents from sewage treatment plants and surface water (PT 7/10), and the indication of poisoning cases of non-target organisms (PT 14). The selection of appropriate indicators is directly related to the choice of mitigation measures and approaches to achieve the objectives of sustainable use. Thus, the two topics (measures and indicators) have to be discussed concurrently. Firstly, the common goals to be addressed should be identified, secondly appropriate measures to achieve the goal should be defined, and thirdly a set of indicators describing economic, social and environmental aspects should be selected. Industry supports an inventory of the existing uses to identify action areas, but disagrees on monitoring solely the consumption volumes of

biocidal products while demanding for the consideration of risk as well as exposure and benefits of biocidal use.

Options for the implementation:

The development of an action framework on sustainable use of biocides on European level is recommended in order to enable the implementation of appropriate measures, for the reduction of risks of biocides to the environment and human health. These measures could be implemented by establishing a new Directive on a sustainable use of biocides or by amending the existing one on pesticides. However, certain measures could be implemented also on national level and then be included in a national action plan (e.g. example of sales restriction in Belgium). Within the study according to Article 18 of the BPR for the European Commission existing national measures are currently being analysed whether they could be implemented in a general strategy on sustainable use of biocides at European level. There will be an ongoing discussion with industry who requests the harmonisation and comparability of requirements on a European level - also against the backdrop of the future Union authorisation of biocidal products.

9 References

- Berry, D. C. 2004. Risk, communication and health psychology. Open University Press, McGraw-Hill Education, New York
- BfR Wissenschaft, 2008, REACH: Communication on Consumer Health Protection, Federal Institute for Risk Assessment, Press and Public Relations Office, ISSN 1614-3795, ISBN 3-938163-39-9
- BREF 2003. Rearing of Poultry and Pigs. Best Available Techniques reference document (July 2003) http://eippcb.jrc.ec.europa.eu/reference/BREF/irpp_bref_0703.pdf
- Capri, E., Marchis, 2011. A Risk Indicator selection and Quantitative Targets to meet Sustainable Use Directive objectives OPERA Guidelines for implementation. Opera Research Centre, Piacenza, Italy
http://www.operaindicators.eu/assets/files/News/indicators%20%20risk%20paper/Indicators_and_Quantitative_Targets_SUD.pdf
- COWI 2009. Assessment of different options to address risks from the use phase of biocides. Final report on behalf of the European Commission Environment Directorate-General, March 2009, Kongens Lyngby Denmark
http://ec.europa.eu/environment/chemicals/biocides_history/sust_use.htm
- DWA-M 775 2010. Abwasser aus Krankenhäusern und anderen medizinischen Einrichtungen. DVWK-Regelwerk, Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall e.V. (DWA), Hennef, Dezember 2010, ISBN 978-3-941897-62-5 (69 pages)
- ECHA 2010. Guidance on the communication of information on the risks and safe use of chemicals. Version 1, December 2010
http://echa.europa.eu/documents/10162/13639/risk_communications_en.pdf

- ECHA 2012. Study on Communication on the safe use of chemicals to the General Public. Submitted by the Agency according to Article 34 (1) of the CLP Regulation, Helsinki, 20 January http://echa.europa.eu/documents/10162/17203/clp_study_en.pdf
- European Commission 2002. Analysis of the 'open list' of environment-related headline indicators. Report from the Commission to the Council, COM(2002) 524 final, Brussels, 20.09.2002
- European Commission 2007. A new Animal Health Strategy for the European Union (2007-2013) where "Prevention is better than cure". Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions, COM 539 (2007) final http://ec.europa.eu/food/animal/diseases/strategy/index_en.htm
- European Commission 2007. Environmental Risk Mitigation Measures for Anticoagulants used as Rodenticides; ENV B.3/PC D (2007) - 21/03/2007.
- Gartiser, S., Hafner, Ch., Jäger, I., Reihlen, A., Ziesenitz, O., Schneider, K., Kalberlah, F., Oltmanns, J. 2005. Beschreibung der ordnungsgemäßen Verwendung und einzuhaltender guter fachlicher Praxis bei der Verwendung und Entsorgung von Biozid-Produkten. Final report F 1929, Bundesanstalt für Arbeitsschutz und Arbeitsmedizin, (not published)
- Gartiser, S., Hafner, Ch., Jäger, I., Reihlen, A., Schneider, K., Kremers, H., Fiedler, T., Wacker, T, El Atawi, M. 2008. Machbarkeitsstudie zur Unterstützung der Informationspflicht gemäß § 22 BiozidG/ChemG über alternative Maßnahmen zur Minimierung des Biozid-Einsatzes, UBA-Texte 23/2008.
- Gartiser, S., Luskow, H., Groß, R. 2012. Thematic Strategy on Sustainable Use of Plant Protection Products - Prospects and Requirements for Transferring Proposals for Plant Protection Products to Biocides. Final report FKZ 3708 63 400, UBA-Texte 6/2012. <http://www.umweltbundesamt.de/sites/default/files/medien/461/publikationen/4261.pdf>
- Gartiser, S., Jäger, I. 2013. Efficiency and practicability of risk mitigation measures for biocidal products with focus on disinfectants. Final report FKZ 3710 67 406 on behalf of the German Environment Agency, UBA-Texte 30/2013 <http://www.umweltbundesamt.de/uba-info-medien/4487.html>
- Götz, K., Benzing, C., Deffner, J., Keil, F. 2012. Handbook Communication Strategies for Sharpening Environmental Awareness in the Handling of Pharmaceutical Drugs. ISOE-Studientexte, No. 16 / English Version <http://www.umweltbundesamt.de/sites/default/files/medien/publikation/long/4366.pdf>
- JKI 2010. Zusammenstellung möglicher Indikatoren für den Nationalen Aktionsplan zur nachhaltigen Anwendung von Pflanzenschutzmitteln. Julius Kühn-Institut, Institut für Strategien und Folgenabschätzung
- Kalbhenn, M., Schneider, A. 2012. Nachhaltigkeitsorientierte Konsumenten/Innenkommunikation im deutschsprachigen Raum - Status Quo Analyse und Perspektive ihrer Weiterentwicklung. Enquete Kommission Wachstum, Wohlstand, Lebensqualität. Materialie PG 5/6, HuMan - Institut für Humanistisches Management, Wien http://www.bundestag.de/bundestag/gremien/enquete/wachstum/gutachten/materialie_PG_5_6.pdf

- Kahneman, D. 2012. Thinking, Fast and Slow. Doubleday Canada, Random House of Canada limited, April 2012
- Kasperson, R. E., Renn, O., Slovic, P., Brown, H. S., Emel, J., Goble, R.I., Kasperson, J. X., Ratick, S. 1988. The social implication of risk: a conceptual framework. Risk Analysis 8 (2), p. 177-187
- Lepper, P., Daginnus, K., De Coen, W., Deviller, G., Netzeva, T., Pavan, M., Sobanska, M., Worth, A., Paya Perez, A., Eisenreich, S. 2008. Selection of Priority Substances in the context of the European Water Framework Directive. European Commission, Joint Research Centre, 21. May 2008
http://ecb.jrc.ec.europa.eu/documents/QSAR/INFORMATION_SOURCES/PRESENTATIONS/Priority_setting_WFD.pdf
- NIH 2014. About behavioural and social science research. National Institute of Health, Office of Behavioral and Social Sciences Research <http://obssr.od.nih.gov/index.aspx>
- NRC 1989. Improving Risk Communication. National Research Council (NRC), Committee on Risk Perception and Communication. National academic Press, Washington.
<http://www.nap.edu/openbook.php?isbn=0309039436>
- OECD 2001. Environmental indicators for agriculture - Vol. 3: Methods and results. Paris, 400 pages www.oecd.org/dataoecd/24/35/40680869.pdf
- OECD 2001. Environmental Indicators - Towards sustainable development.
http://www.oecd.org/departement/0,3355,en_2649_34283_1_1_1_1_1,00.html
- OECD 2008. OECD key environmental indicators. Paris, 38 pages
www.oecd.org/dataoecd/20/40/37551205.pdf
- Remoundou, K., Brennan, M., Hart, A., Frewer, L. J. 2014. Pesticide Risk Perceptions, Knowledge, and Attitudes of Operators, Workers, and Residents: A Review of the Literature. Human and Ecological Risk Assessment 20 (4), p. 1113-1138
- Sacchettini, G., Calliera, M., Marchis, A., Lamastra, L., Capri, E. 2012. The stakeholder-consultation process in developing training and awareness-raising material within the framework of the EU Directive on Sustainable Use of Pesticides: The case of the EU-project BROWSE; Science of the Total Environment 438 (2012) 278-285
- SCENIHR. 2009. Assessment of the Antibiotic Resistance Effects of Biocides. Scientific Committee on Emerging and Newly Identified Health Risks, 19 January 2009
http://ec.europa.eu/health/ph_risk/committees/04_scenihr/docs/scenihr_o_021.pdf
- Sellnow, T. L., Ulmer, R. R., Seeger, M. W. Little field, R. S. (Communication: A Message-Centered Approach. Springer Science+Business Media
- Thaler, R., Sunstein, C. 2008. Nudge: Improving Decisions about Health, Wealth, and Happiness. Yale University Press New Haven & London
- UN 2002. United Nations Report of the World Summit on Sustainable Development. Johannesburg, South Africa, 26 August - 4 September 2002, United Nations, New York
- UNEP (without year). The Environmental Dimension of IFSD. UNEP Division of Environmental Law and Conventions (DELIC), Issues Brief # 1
<http://www.unep.org/environmentalgovernance/>

- US-EPA 1997. Ethylen oxide commercial sterilization and fumigation operations NESHAP implementation document www.epa.gov/ttnatw01/eo/eoguide.pdf
- van Bavel, R., Herrmann, B., Esposito, G., Proestakis, A. 2013. Applying behavioural sciences to EU policy-making. Scientific and policy report by the Joint Research Centre of the European Commission <ftp.jrc.es/EURdoc/JRC83284.pdf>
- van den Brink, N. & Elliott, J. 2012. SETAC 2012 Berlin Highlights–The Use of Rodenticides, a Nagging Issue on Effectiveness and Risks; <http://globe.setac.org/2012/july/berlin-rodenticides.html>
- VCI and VCH 2014. Sustainable use of biocidal products. Joint position of VCI (German chemical industry association) and VCH (German association of chemical trade and distribution, English translation
- Wennmalm, Å Gunnarsson, B. 2009. Pharmaceutical management through environmental product labeling in Sweden. *Environment International* 35 (2009) 775-777
- WBGU 1997. World in Transition - ways towards sustainable management of freshwater resources. Translated from the German Annual report 1997, Springer-Verlag Heidelberg
- WBGU 2001. World in Transition: Conservation and Sustainable Use of the Biosphere. Earthscan Publications Ltd, London and Sterling, Earthscan Publications Ltd, London and Sterling, translation of the German Report from 1999
- WBGU 2011. World in transition - a social contract for sustainability. Flagship report of the German Advisory Council on Global Change (WBGU), Berlin 17.03.2011, <http://www.wbgu.de>
- WCED 1987. Our Common Future. World Commission on Environment and Development of the United Nations
- Wogalter, M.S., Dejoy, D. M., Laughery, K. R. 1999. Warnings and Risk Communication. UK Taylor & Francis, London
- Zamparutti, T., Goldenmann, G., van der Burgt, N., Vernon, J., Tuffnell, N., Gartiser, S. 2010. Study towards the Development and Dissimination of Best Practice on Sustainable Use of Biocidal Products. Final Report, 3rd October 2010. http://ec.europa.eu/environment/chemicals/biocides_history/sust_use.htm