



EEB position paper on nanotechnologies and nanomaterials

Small scale, big promises, divisive messages

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Background

Nanotechnologies are a set of technologies applied on the atomic and molecular scale of matter that aim to create materials within that size range. A nanometre (nm) is one billionth, or 10^{-9} of a metre. To put this size into context, a nanometre compared to a metre is the same as a marble to the size of the Earth. Other size examples are a width of an average human hair at 100,000 nanometres, and a strand of DNA at 2.5 nanometres.

Nanotechnologies are part of *convergent new technologies*, which offer synergies between nanotechnology, biotechnology, information technology, and cognitive sciences (such as psychology, neuroscience, biology or computer science). Each of these is currently progressing at a rapid rate, experiencing qualitative advancements, and interacting with more established fields such as mathematics, environmental technologies [1]. Nanotechnology therefore is a catch-phrase for a growing range of activities and uses at the nano-level, although these can be focused more specifically on particles (such as carbon or silver), materials (engineered with nano structures, such as carbon nano tubes that make up carbon nanofibres), and products (from cosmetics to medicines).

From a scientific perspective, nanomaterials cannot be considered as a homogeneous group. Physically and structurally they represent very different substances from each other and from their 'bulk' (or 'normal'-sized) counterparts. Their chemical composition and reactivity are also highly diverse. Therefore when speaking of the potentials, benefits and costs of these technologies, one must have a specific nanomaterial or production technology in mind in a specific application and/or product. Because of this diversity of applications and technologies, this document refers to nanotechnologies or nanomaterials in plural. Similarly, since many materials already exist naturally at the nanoscale, we focus here on *engineered* (also known as *manufactured* or *synthetic*) nanomaterials, that is, materials that are specifically designed and/or produced at the nanoscale.

Research and development, use and marketing of nanomaterials have been accelerating for the last 10 years, with expected growth of the global market in the next decade of at least 100million Euros. Proponents of these technologies claim that they will bring about improvements, providing new products and services, enabling increased and new human personal abilities, and generally reshaping societal relationships through innovation in many different sectors. Possible applications include better targeted medicines, more efficient energy storage and lighting, better insulation materials or enhanced physical characteristics of natural resources. Results include improved medical treatment with reduced side effects of drugs, lower energy use, increased productivity in some industries, and reduced resource consumption. Nanotechnology, therefore, is also being heralded as

a tool which could help fight climate change, reduce our ecological footprint and enhance development. However, the commercially available products to date in most cases have brought about very limited societal benefits, including products of dubious importance such as stain-free fabrics, lighter and stronger tennis rackets and self-cleaning windows.

The optimistic assessments of the benefits of nanotechnologies and materials are reminiscent of the promises made when nuclear energy and biotechnology were first introduced. At the time, they were credited with the potential to solve global energy needs or abolish world hunger. Similarly, many chemicals and substances were welcomed for their benefits before their negative impacts on human health and the environment were identified and understood, including DDT, asbestos and PCBs.

In the wake of these earlier mistakes, civil society groups worldwide are calling for a precautionary approach to the use of nanotechnologies and materials since there is still much we do not know about their environmental and human health impacts. In addition, safety tests performed on bulk materials are not extendable down to the 'nano' level enough to confidently predict safety levels.

Due to the way nanotechnologies push existing scientific and political boundaries, their management involves discussions on some fundamental issues such as size (what is 'nano' level?) and shape (how many dimensions does the nanomaterial have?). Size, in particular, is important since it is the key factor in triggering nano-relevant policy measures, for example in existing or future legislation. Discussions on size are currently taking place in standardisation circles at international level (ISO and CEN), in political arenas such as in the OECD and within environmental NGOs. It is anticipated that existing health, safety and environmental regulatory regimes (particularly REACH) will eventually be amended to better accommodate the regulation of the novel properties of nanomaterials compared to the bulk substance of the same kind. In this case, manufactured nanomaterials will be treated as 'new chemicals', requiring new health and safety assessments and control measures within EU legislation prior to their use in commercial products.

Ongoing discussions have preliminarily set nano aspects in terms of size ranging from 1-100nm, in one or more dimensions. Thus materials that fall outside this size range – even if they are not much bigger but still exhibit novel, nano-specific behaviour – will not be assessed as nanomaterials. Therefore, they will not be subject to new health and safety assessments where substances have previously been approved for use in their bulk form, for example, in REACH. Inappropriate metrics that apply to larger materials will thus be used to measure exposure or commercial use quantities. Hence it is particularly important not to set too narrow a size-based definition of nanomaterials or preferably, to also focus on charge, shape, surface characteristics etc., which are also important to determine potential toxicity of a nanomaterial.

Regarding human exposure to nanomaterials, relevant studies¹ have shown that some nanostructures are hazardous to human health. For example, nanomaterials have been shown conclusively to penetrate human lung tissue and enter blood vessels and cells, increasing the risk of cardiovascular disease [2], and to enter the brain through the nose and olfactory nerve.

Furthermore, nanomaterials may be eco-toxic after being discharged into the environment as their small size allows them to be easily internalised in organisms (whether human or animal). These materials may mimic biological molecules and hence disrupt their function, as has already been observed with certain nanostructures such as fullerenes and carbon nanotubes, which have been demonstrated to have toxic effects on cells and animals [3].

¹ Examples of studies showing human health impacts : http://www.env-health.org/IMG/pdf/HEAL_Nano_Fact_Sheet_April_2008-2.pdf, pp. 2-3.

Beyond the possible negative human health and environmental impacts associated with nanomaterials, it is also important to note that nanotechnology raises important social issues and other ethical challenges. Proponents suggest that a nanotechnology-enabled “revolution” will bring far-reaching changes to economic and social relations. The United States’ National Nanotechnology Initiative, a programme coordinating nanotechnology research and development, predicts: “*If present trends in nanoscience and nanotechnology continue, most aspects of everyday life are subject to change*” [4]. Yet to date there has been a dearth of critical discussion about public interest issues associated with the predicted nanotechnology “revolution” and in particular what role civil society should have in decision-making on its development and use.

Nanotechnologies are the latest in a continuing effort to use convergent technologies to drive forward innovation and competitiveness. In this respect, they are often compared with biotechnology due to similarities in using scientific developments at the atomic or sub-atomic level to purposefully (even, unpredictably) alter the behaviour of a 'conventional' product.

The poor political handling of biotechnology (and in particular genetically modified organisms) since the 1990s, has done little to create public confidence in governing bodies. The ongoing political disputes at European level illustrate how current governance structures are not well-designed to accommodate public contribution to decision-making on controversial issues. Through various opinion-gathering efforts since the mid-1990s², the public has shown an acceptance for some uses of biotechnology - particularly those with direct benefit to the individual which are used in the more controlled environment of a laboratory – whereas there was concern about releases of genetically modified organisms into the environment.

Despite public opinion, Europe’s leaders still find it difficult to take decisions preventing the growing of genetically modified crops in Europe. Competitiveness coupled with lack of proof of the dangers posed by biotechnologies are overriding decision factors, rather than genuinely seeking public opinion within an official decision-making context or following public opinion expressed during official consultation processes or direct actions. The precautionary principle is also not implemented, despite the uncertainty created by different studies that provide proof of impacts ranging from none to alarming. Instead, the pressure to remain competitive on technological developments has influenced governmental decision-making more than the protection of the public from unpredictable and potentially dangerous technological developments. This is due to the unquestioned paradigm that technology equals innovation that brings growth and progress. What is needed is a new approach towards technological innovation, including the development of nanomaterials, one that promotes progress based on public choice of which technologies are acceptable and should be employed.

Similarly, the drives for technological innovation and competitiveness have been key factors in the development of multiple types and uses of nanotechnologies and nanomaterials. Indeed, more than 800 nanotechnology-based products have already been identified on the market globally³, before there has been any serious effort by government institutions to assess how to deal with these new materials. Examples are in cosmetics, clothing, foods, beverages, and nutritional supplements.

² The most recent project providing examples of such public opinion-gathering exercises and results can be found at <http://www.participationinscience.eu/psx2/>

³ As of August 2008 reported by the Project on Emerging Nanotechnologies at <http://www.nanotechproject.org/>

EU Policy Development on Nanomaterials: an unfinished and conflicting story

In its attempts to avoid the regulatory mistakes made in the management of earlier technological developments, the European Commission recognised the need for regulation of risks from nanotechnologies in its Communication on Nanotechnologies [5]. The communication states, “*Appropriate and timely [nanotechnology] regulation in the area of public health, consumer protection and the environment is essential, also to ensure confidence from consumers, workers and investors.*” Also in 2004, the United Kingdom’s Royal Society and Royal Academy of Engineering made very explicit recommendations for the precautionary management of nanotoxicity’s risks: “*nanomaterials should be treated as new chemicals under REACH; be subject to new safety assessments prior to their inclusion in consumer products; factories and research laboratories should treat nanomaterials as if they were hazardous; and until the environmental impacts of nanomaterials are better known, their release into the environment should be avoided as far as possible*”.

Furthermore, the European Commission adopted a Nanotechnology and Nanoscience Action Plan in June 2005, aiming to increase “investment and coordination of research and development”. The Action Plan proposed doubling the nanotechnologies research budget compared with the Sixth Framework Programme for research, which expired in 2006. In September 2007, the European Parliament supported doubling the funding allocated to nano-related research in the new Seventh Framework Programme. It set aside an indicative budget of 3.4 billion Euros for research in nano sciences, nano technologies, materials and new production technologies. Yet only about 5% of this money is dedicated directly to closing fundamental knowledge gaps (such as the impacts of enhanced nanomaterials in biological processes) and assessing health and environmental risks.

In 2006, SCENIHR⁴, an EU Scientific Committee, published its opinion on engineered nanomaterials at the request of the Commission. The Committee recognised the systemic failure of existing chemicals regulatory frameworks to manage the risks of nanomaterials, underlining that existing regulations do not require manufacturers to treat nanomaterials as new chemicals. Therefore no requirement exists for specific safety testing of nanomaterials prior to putting these, or products containing these, materials on the market. This means that if a nanomaterial has already been subject to safety assessment in bulk form – as most have – there is no trigger for a new safety assessment. SCENIHR concludes “*current risk assessment methodologies require some modification in order to deal with the hazards associated with nanotechnology and in particular that existing toxicological and ecotoxicological methods may not be sufficient to address all of the issues arising*” [6]. The Committee also recognised that the use of tonnage by existing chemicals regulations as the dose metric for exposure is inappropriate for nanomaterials that can be toxic even in smaller amounts. It recommended that number of particles and total surface area be used instead.

In May 2008, the Commission published its assessment of the current legislative apparatus with relevance to nanomaterials, concluding that no new legal acts are necessary to assure the adequate regulation of all the new materials and applications in products that are and will be available on the market. Yet, the Commission also stresses the need to prioritise

⁴ SCENIHR is the EU’s Scientific Committee on Emerging and Newly Identified Health Risks. It provides opinions on questions concerning emerging or newly identified risks and on broad, complex or multidisciplinary issues requiring a comprehensive assessment of risks to consumer safety or public health and related issues not covered by other Community risk assessment bodies.

“improving implementation of current legislation... by in the first place reviewing current documents that support implementation, such as implementing legislation, standards, and technical guidance with regard to their applicability and appropriateness to nanomaterials” [7]. The test and risk assessment methods, which are currently under-developed and non-standardised, were identified as priorities.

Besides the Commission’s regulatory assessment, other European bodies have provided their views on Europe’s regulatory needs. In the UK, a Royal Commission on Environmental Pollution report states that: *“The uncertainty and ignorance that characterise our understanding of the impacts of nanomaterials mean that traditional top-down regulatory mechanisms on their own may not provide protection without adversely affecting innovation. We are likely to have to adopt a wide suite of measures and involve many actors.”* [8]

The Austrian Ministry of Health assessed the case of nanomaterials in food and concluded: *“Precautionary principle should be applied until methods for identification and risk assessment have been developed.”* Most notably, it clearly called for a *“moratorium within a European context”*. [9]

The German Federal Environmental Agency undertook a legal appraisal of nanotechnologies, concluding: *“Analysis of individual legal areas has clearly shown that there are gaps at many points in sectoral environmental law regarding the specific properties of nano materials. ... Official authorities (of the EC and Member States) are committed to the principle of precaution and are therefore called on to act.”* [10]

The Swedish Chemicals Agency’s legal assessment conclusions state: *“The rapid development of the area in combination with the great lack of knowledge about health and environmental risks call for precautionary measures. This is likely to involve complementing the EU regulatory framework with rules for nanomaterials, including rules about the way in and extent to which companies must test nanomaterials’ health and environmental hazards.”* [11]

Despite these calls for implementing the precautionary principle and amending or adding to existing legislation, to date there are no nanotechnologies- or nanomaterials-specific regulations anywhere in the European Union, nor have existing regulations been purposefully modified. A precedent might be set by France if Article 79 of the law proposal commonly known as “Grenelle 2” is approved by French Parliament. The clause concerns mandatory declaration of all substances containing nanoparticles, including their identity, quantities and uses [12].

Instead of heeding recommendations for a legislative approach, the Commission has taken the lead on developing a voluntary Nanotechnology Code of Conduct for European Research [13], with the intention of extending or modifying it to suit industrial research and production. However, there seems to be no clear approach or knowledge on how to progress the Code to cover industrial activities.

EEB’s vision for responsible management of nanomaterials

Seeing nanomaterials within the wider context of technological innovation, EEB thinks their management should be based on the fundamental principles of sustainable development and the precautionary principle. Before we consider some of these principles in more detail, we should return to the wider issue of technological innovation.

Technological developments and their uses provide us with opportunities to reduce negative environmental and health impacts, and to enhance our well-being through improved quality of life and longevity. However, given that a key driving force in technological innovation is competitiveness, the uses and benefits of some innovations can be deemed questionable. In a consumerist and mostly market-saturated society, innovation

can be more a driver for profit than a “real” innovation stemming from a true need. In an increasingly over-burdened and resource-constrained world, the need to reposition economics within ecological limits, and therefore to have sustainability questions oversee technological developments, exists more than ever.

This directly leads to questions about the necessity of governance mechanisms on the sustainability assessment of technologies, sustainability objectives and targets in eco-innovation and on the continuing development of sustainable industrial policy. Discussions on these elements are relatively recent at EU level and EEB’s involvement in nanotechnology policy development represents a practical example of these wider issues. Much more work is needed to improve environmental and human health protection and to build governance structures based on the premise of public participation in decision-making, the precautionary principle and cradle-to-cradle product sustainability.

In 2006, a broad coalition of civil society, public interest, environmental and labour organisations developed and agreed on the Principles for the Oversight [14] of Nanotechnologies and Nanomaterials to safely and responsibly guide the governance of all aspects of nanotechnology. EEB supports these principles and proposes them as the basis on which the EU should oversee the control and future development of nanotechnologies (and for all forms of technological innovation), as minimum requirements for acceptable and appropriate governance structures.

Precautionary principle

Nanotechnologies and nanomaterials work at the level of the building blocks of matter for all human-made and living systems, a scale at which only nature has been working until last century. The disturbances that nanomaterials can inflict, whether as release into the environment or in human or animal bodies, could be difficult or impossible to control. Although there is insufficient definitive, there is enough convincing preliminary evidence today to suggest that the development and use of nanomaterials may bring particular health and environmental problems to mean that a call for precautionary measures is not excessive. The consolidated version of the EU Treaty mentions the precautionary principle in Article 191 devoted to the environment⁵. Also in many international conventions to which the EU is a signatory the precautionary principle has been described as: “*Where an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically*” [15].

The potential for nanotechnologies and nanomaterials to bring about societal benefits (including positive environmental implications) needs to be proven and balanced carefully with potentially unwanted and unforeseeable impacts. The precautionary principle must be applied because scientific research to-date suggests that exposure to at least some nanomaterials is likely to result in serious harm to human health and the environment. (see endnote 1) Use of the precautionary principle is also essential if responsible governance and management of these new technologies and materials is to be achieved.

⁵ “*Union policy on the environment shall aim at a high level of protection taking into account the diversity of situations in the various regions of the Union. It shall be based on the precautionary principle and on the principles that preventive action should be taken, that environmental damage should as a priority be rectified at source and that the polluter should pay. In this context, harmonisation measures answering environmental protection requirements shall include, where appropriate, a safeguard clause allowing Member States to take provisional measures, for non-economic environmental reasons, subject to a procedure of inspection by the Union.*”

Strict regulatory regime

A modified regulatory regime must be an integral aspect of the continued development of nanomaterials. Current legislation needs to be amended to more explicitly and comprehensively address nanomaterials, and be strictly implemented if the level of safety for human health and the environment provisioned in existing laws is to be guaranteed.

Although existing legislation is said to include nanomaterials in its scope, regulations need to be made clearer to adequately and effectively address the fundamentally different properties of these new materials and the new challenges they present. Ultimately, a new legislative framework needs to be created that is equipped to manage materials and processes such as active nano-systems that are currently on the market or under development, and to be able to address future developments in a manner timelier than what has been done so far.

Environmental and human health protection and safety

Preventing known and potential exposures to nanomaterials that have not been proven safe according to established criteria should be the ultimate aim of effective management of nanomaterials. This is particularly due to the rapid development in the area, the penetration of the new materials into products that are directly put on the market, and the great lack of knowledge about their human health and environmental impacts.

Once entering the environment, manufactured nanomaterials represent a novel class of engineered pollutants which are not currently detectable with existing tools, thereby creating further difficulties in the application of existing environmental protection regimes. Implementing agencies lack tools and mechanisms to detect, monitor, measure, and control manufactured nanomaterials, let alone have the means to remove them from the environment. Current protection controls and measures used in EU environmental laws are designed for “bulk” (‘normal’-sized) material toxicity parameters. The metrics used in existing laws are therefore unsuited to nanomaterials.

Public participation and decision making

The potential of nanotechnologies to transform the social, economic, and political landscape makes it essential that the public fully participate in a deliberative decision-making process. It should be of high priority for national governments (and the EU) to organise public participation initiatives that seek public opinion on the development and use of nanotechnologies, to get a clearer understanding of which, if any, specific technologies (their impacts, benefits, etc.) are acceptable to society and to act on these opinions. Such initiatives are also needed to help shape the governance structures within which future decisions affecting nanomaterials development will be made, including public involvement and decision-making in guiding research and research funding by identifying what is acceptable and beneficial.

Lifecycle approach

Nanomaterial lifecycle assessments – including manufacturing, transport, product use, and end-of-life management – need to be undertaken to understand how statutory systems apply to materials and products and where regulatory gaps exist. This approach has also been requested by the UK Royal Society and the Royal Academy of Engineering [17]. Full lifecycle environmental, health, and safety impacts must be assessed prior to commercialisation.

Inclusion of broader societal impacts

Government policies and regulatory measures need to prioritise developing a more robust sustainability assessment for technologies, particularly focusing on early development long before they get to the near-market stage. The responsible and societally acceptable development of nanomaterials thus entails the elaboration of an independent methodology

framework for risk assessment and management as well as principles for “good governance” for national governments, international organisations and business, as well as, studies on social impacts.

EEB’s demands for sustainable governance of nanomaterials

In EEB’s view, nanomaterials need to be managed according to fundamental principles of sustainable and responsible development. These fundamental principles take as starting points the precautionary principle, a strict regulatory regime, environmental and human health protection and safety, public participation, a lifecycle approach and the inclusion of broader societal impacts in governance mechanisms.

To date, the EEB has not been pleased with the European Commission’s unfocused reaction to the development of nanomaterials. The following demands, if implemented, would provide a more credible, coherent and comprehensive approach to the governance of these novel technologies. Such an approach would enable the research community and industry to better target future applications of nanotechnologies within publicly agreed sustainability parameters.

EEB demands that no further market introduction be allowed for products containing manufactured nanomaterials which could lead to exposure of consumers or uncontrolled release in the environment. Such a restriction should be put in place until appropriate impact and safety assessment tests are developed that provide scientific proof that these materials and products are adequately safe to human health and the environment. Those products already on the market should be regulated according to the REACH approach of “no data, no market”, and should therefore be removed from commercial circulation.

The following additional demands would help establish a policy and regulatory framework on nanomaterials:

1. Develop a pre-market registration and approval framework

The fast-moving development of the types and uses of nanomaterials requires a regulatory framework that can anticipate the safe management of future applications in advance of their availability on the market. Such a framework would help to better identify future developments in these materials and their uses, whether at early research stage or in later near-market stage. The framework should require registration of public and private research, test-based assessment and approval of near-market uses of nanomaterials. This information should then be put into a publicly available inventory, as part of a coherent and comprehensive policy framework on nano (see Demand number 3). This would serve to identify what possible future uses of nanomaterials could be developed, systematically assess what products are proposed for placement on the market and would help ensure swifter and more targeted management of these.

We therefore call on the European Commission to create a publicly available inventory for public and private research and demand test-based assessment and approval of materials in near-market-use stage. Such an inventory needs to be one of the elements of a policy and regulatory framework. This EU-wide inventory should be fed into by Member State level inventories, to avoid lack of harmonisation and duplication of efforts, while providing citizens important country-specific information immediately available in their national language.

2. Undertake public consultation on technological innovation, including nanotechnologies and nanomaterials

More attention has been devoted to technological innovation than to social innovation, including public participation in decision-making and the development of more democratic decision-making procedures. In light of increasing focus on innovation, and eco-innovation in particular, as a means of achieving competitiveness, more efforts are needed at EU and national levels to legitimately incorporate public opinion in political decisions. For example, public opinion should be sought systematically on the needs for some innovations, as it should not be assumed that they will all deliver great enough social advantages to justify greater risk exposures.

Some Member States have already begun to hold national “nano” dialogues, with varying levels of public involvement, objectives and scope. At EU level, DG SANCO has held two stakeholder dialogue events and more are planned on a yearly basis, but without clear objectives, a timetable, or a relationship between these events and official decision-making processes. Structured gathering of public opinion of novel technologies and their uses is essential for their sustainable management, particularly in developing a regulatory framework that reflects these opinions. Therefore, an EU-wide public debate, organised at the Member State level, is urgently needed to set clearer parameters for the current uses and future developments of these technologies and materials. This debate should seek public opinion and views on which developments are considered acceptable or necessary and under which conditions. Even if the outcomes are unfavourable towards some of these technologies, the EU must respond to public opinion accordingly. The European Commission needs to work in collaboration with Member States in organising such a debate at the earliest possible moment.

EEB therefore urges the European Commission and the Member States to immediately undertake an EU-wide public debate on nanotechnologies and nanomaterials. This should form part of a wider debate on technological innovation.

3. Put in place an adequate policy and regulatory framework before further market penetration occurs

Given that there is disagreement over the adequacy of existing legislation to address the potential impacts of nanomaterials, it is clear that the European Commission’s regulatory assessment conclusions are not satisfactory and do not provide a solution to closing the regulatory gaps. Experience from REACH (the EU’s most comprehensive chemicals legislation) has already shown the limitations of this legislation in dealing with nanomaterials and that current implementing tools (e.g. test methods, communication of test results, etc.) do not apply at the nano level.

Taking the approach of amending existing legislation is already leading to fragmented and incoherent governance, best illustrated with the current revisions of the Novel Foods Regulation and the Cosmetics Directive. Given that nanotechnologies and nanomaterials can be used in many different ways and in different types of products, a policy and regulatory framework which can address these various applications coherently and comprehensively is needed. This framework should also be able to address future developments, as detailed in our demand for a pre-market registration and approval framework.

EEB therefore calls for the development of a nano-specific policy and regulatory framework, addressing existing and future applications. In an interim period, case-by-case amendments to legislation will need to continue, especially to more quickly bring nanomaterials into formal legislative mechanisms.

Such a comprehensive and coherent policy and regulatory framework would need the following:

- An immediate review and revision of existing legislation relevant to nanomaterials.
- The urgent and strict application of the REACH “no data, no market” approach to products containing manufactured nanomaterials that could lead to exposure of consumers or the environment.
- Required pre-market approval for all applications of nanotechnologies and nanomaterials as a central element of the policy and regulatory framework.
- Provide the necessary implementation tools for the coherent and comprehensive management of these technologies and materials. Particular focus and priority is needed on the development of testing methods to identify human health and environmental impacts.
- To develop robust safety assessment standards while recognising the serious limitations of our existing scientific capacity and knowledge to identify potential impacts.
- The Precautionary Principle, the Polluter Pays Principle, and sustainability objectives need to be the basis of the policy and regulatory framework. This would help to guide developments towards more societally beneficial (e.g. solar energy technology) uses than those with questionable benefits (e.g. stain-free fabrics).
- Clarity and coherence on the key aspects of nanomaterials definition, with focus on:
 - Size being defined from 0.3nm to 300nm;
 - Substances having nanomaterial-like properties to be included, even though they fall beyond the official size range;
 - All nanomaterials to be included in regulation, not just those that are insoluble or bioaccumulative, as well as aggregates and agglomerates;
- To immediately start work on the establishment of a mandatory EU label as an identification tool to be placed on products containing manufactured nanomaterials which could lead to exposure of consumers or the uncontrolled release in the environment. Such a label would work on an intermediate basis, before the EU-wide public debate is finalised and a regulatory framework is prepared reflecting the demands of the public on the appropriate identification tools. Public debates should also help to identify what other communication tools are useful to increase and improve public awareness of the issues.

4. Prioritise research funding on the functioning of natural and human systems with respect to possible impacts of nanomaterials on these

Currently, the vast majority of EU nanotechnology research funding focuses primarily on technological development, aimed at enhancing competitiveness and growth. This is unacceptable given the continuing unknowns about nanomaterials and that current product and safety testing does not extend to the nano level. EEB therefore calls for prioritisation of funding and the majority of research being directed toward environmental and human health aspects and strengthening social innovation on public participation in decision-making.

We therefore call on the European Commission to:

- Prioritise research funding in favour of eliminating knowledge gaps, over increasing funding in technological development. A sliding scale starting around 80% and reducing over time to around 15% should be reserved for the environmental, human health and social, economic and ethical implications of nanotechnology. All new projects receiving EU funding should be required to include sustainability assessment, public participation and decision making mechanisms.
- Clearly identify the limitations of existing safety assessment and management tools in relation to nanomaterials. This should be done in conjunction with the research on eliminating knowledge gaps on environmental and human health impacts. In this way,

the research development priorities can be identified based on the gaps between current tools and the demand for existing and future uses of nanomaterials.

- Develop and implement a research strategy identifying a roadmap for improving knowledge leading to the safer development and use of nanomaterials in different applications.
- Further develop sustainability assessment of technologies tools, for their more systematic use in both research and product development. These should also be used in policy developments on innovation and eco-innovation, and sustainable industrial policy.

List of abbreviations:

OECD	Organisation for Economic Co-operation and Development
REACH	Directive for the Registration, Evaluation and Assessments of Chemicals
ISO	International Standards Organisation
CEN	European Committee for Standardization
DDT	Dichloro-Diphenyl-Trichloroethane
PCB	Polychlorinated biphenyl
DG SANCO	Directorate General for Health and Consumers

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