**Sustainable Development**

Sustainable development was famously described in the Brundtland Report in 1987 as development that “meets the needs of the present without compromising the ability of future generations to meet their own needs.” Sustainable development is generally understood to encompass economic, environmental and social components.

Governments and public and private organizations around the world have recognized the importance of not only being aware of sustainable development as a concept, but also implementing it on a practical level (as reflected in the proceedings of the United Nations Conference on Environment and Development in Rio de Janeiro (“Earth Summit,” in 1992), the World Summit on Sustainable Development in Johannesburg (2002), and the United Nations Conference on Sustainable Development (“Rio+20,” in 2012)). ISO is following this path, encouraging all Technical Committees to take sustainable development into account in the development of international standards, and is currently developing guidance on this topic (ISO Guide 82 Guide For Addressing Sustainability In Standards).

**Sustainable Development and Nanotechnology**

There is widespread promise that nanotechnology can make significant contributions to sustainable development in a wide range of sectors, including:

- Medicine;
- Public health;
- Energy;
- Transportation;
- Electronics;
- Agriculture;
- Advanced materials; and
- Environmental protection.

This (admittedly incomplete) list suggests that nanotechnology can advance public health through improved drugs, medical devices, and other applications such as water purification, help address concerns about climate change and the preservation of natural resources by enhancing energy efficiency, increase agricultural productivity and the ability to preserve foods, and create lighter and stronger materials for such critical functions as housing and transportation. Initial research also suggests that nanotechnology applications might be used for purposes of protecting the environment, such as wastewater treatment and the cleanup of contaminated sites.

Another aspect of evaluating nanotechnology from the perspective of sustainable development is the risk to human health and the environment that may be posed by the development and
use of nanotechnology. The toxicity of most nanomaterials has yet to be fully understood and much remains to be learned. It is also very difficult, given current methods, to accurately and consistently measure and evaluate potential exposures to nanomaterials under various use scenarios. The speed, scientific validity, and transparency with which these issues can be addressed will be central to the credible development and acceptance of nanotechnology.

Nanotechnology should also be considered in light of the social and economic components of sustainable development. For example, one issue to consider is whether the benefits of particular nanotechnology applications will go largely to the better-off sectors of society or can be used to improve the life chances of those who are currently living in difficult conditions. This question goes not only to the nature of the technology and the applications, but also to their cost and accessibility to a wide range of groups.

**Sustainable Development and TC 229**

Members of TC 229 should take specific steps to take sustainable development into account in their work, not only because of policy direction of ISO, but also because of the potentially valuable relationship between sustainable development and nanotechnology outlined above. Nanotechnology has potential to make significant contributions to the implementation of sustainable development strategies that can benefit the human condition and the environment. Further, explicitly linking nanotechnology to sustainable development in a practical way can lend credibility to nanotechnology and be helpful in gaining the public acceptance and trust of this new technology.

In simple terms, taking sustainable development into account may help stakeholders get nanotechnology “right the first time” and avoid mis-steps that could result in the promise of nanotechnology not being fully realized. Similarly, demonstrating that the work of TC 229 will contribute to nanotechnology applications that support sustainable development should enhance the acceptance, use, value and stature of the documents produced by TC 229, as well as encourage participation in TC 229 by diverse stakeholders.

The members of TC 229 (and each individual Working Group) should take the concepts of sustainable development into account at all levels of their work, including the development and implementation of strategies, the selection and approval of proposed new work items, and the content of specific standards and other documents. Given the limited resources and time at their disposal, members of TC 229 should ensure that their priorities consider sustainable development, and that their work not focus solely on issues of greatest technical or academic interest. The eventual use of the standards and the degree to which they may provide widespread benefits to the larger population, particularly those who are poor and otherwise vulnerable, should be taken into account. Further, members of TC 229 should promote the participation in their work by diverse stakeholders who may be able to effectively discuss the broad spectrum of views that typically come under the umbrella of sustainable development.
Questions On Sustainable Development and Nanotechnology For Members of TC 229

What follows are a series of questions that should be regularly addressed by members of TC 229 and each of its Working Groups when developing or revising strategy, evaluating new work item proposals, or doing the actual work of writing standards. These questions are organized around the three “legs” of sustainable development: environment, society and economy. It is recommended that these questions be considered and discussed during initial meetings to ensure that any relevant sustainable development issues are integrated into all stages of the work on particular documents.

These questions should be viewed as general guidelines to encourage open dialogue about sustainable development as standards and other documents are being written: not every question is applicable to every project undertaken by TC 229, and it should not be viewed merely as a checklist to be filled out at the beginning of the process. Further, these questions do not exhaust the complex topic of sustainable development: there is a vast amount of literature on sustainable development that is publicly available for those who wish to get into the subject matter in greater detail.

There is no single “correct” answer to any of these questions, whose purpose is largely to increase awareness of, and promote an ongoing discussion about, sustainable development among the members of TC 229 as they do their work. For example, the dialogue generated by these questions might involve a discussion about the balancing of legitimate sustainability concerns (e.g., a particular standard might promote uses that will benefit public health or energy efficiency, while at the same time be based on using non-renewable resources or may pose certain health or environmental risks). On the other hand, a conclusion that none of these questions are relevant or applicable should not be lightly reached and, if such a conclusion is reached, a decision to continue to work on the project should be clearly explained.

Note that while each of these questions refers to work on a “standard,” they are intended to apply to the full range of documents that may be produced by TC 229, including “technical specifications” and “technical reports.”
I. **ENVIRONMENTAL CONSIDERATIONS**

1. **Will the standard promote the use of nanotechnology to protect the environment?**

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
</tr>
</thead>
</table>

   If yes, in what way?
   ________________________________________________________________
   ________________________________________________________________

   If not, please explain why not.
   ________________________________________________________________
   ________________________________________________________________

   Other observations or comments:
   ________________________________________________________________
   ________________________________________________________________

2. **Will the standard promote the use of nanotechnology to conserve/preserve natural resources, or the use of renewable resources?**

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
</tr>
</thead>
</table>

   If yes, in what way?
   ________________________________________________________________
   ________________________________________________________________

   If not, please explain why not.
   ________________________________________________________________
   ________________________________________________________________

   Other observations or comments:
   ________________________________________________________________
   ________________________________________________________________
3. Will the standard assist implementing organizations to improve their environmental performance (operations, services or products) or prevent pollution (including preventing or reducing the generation of waste)?

Yes ☐ No ☐ N/A ☐

If yes, in what way?
___________________________________________________________________________
___________________________________________________________________________

If not, please explain why not.
___________________________________________________________________________
___________________________________________________________________________

Other observations or comments:
___________________________________________________________________________
___________________________________________________________________________

4. Will the standard promote the scientific understanding of the hazards of (including human or ecological toxicity) or exposures to nanomaterials (whether human exposures or environmental fate and transport)?

Yes ☐ No ☐ N/A ☐

If yes, in what way?
___________________________________________________________________________
___________________________________________________________________________

If not, please explain why not.
___________________________________________________________________________
___________________________________________________________________________

Other observations or comments:
___________________________________________________________________________
___________________________________________________________________________
5. **Will the standard promote technologies whose implementation may cause environmental harm?**

   Yes [ ]  No [ ]  N/A [ ]

   If yes, in what way?
   ________________________________________________________________
   ________________________________________________________________

   If not, please explain why not.
   ________________________________________________________________
   ________________________________________________________________

   Other observations or comments:
   ________________________________________________________________
   ________________________________________________________________

6. **Will the standard include provisions relevant to environmental protection?**

   Yes [ ]  No [ ]  N/A [ ]

   If yes, in what way?
   ________________________________________________________________
   ________________________________________________________________

   If not, please explain why not.
   ________________________________________________________________
   ________________________________________________________________

   Other observations or comments:
   ________________________________________________________________
   ________________________________________________________________
7. If the work involves the development of a standard test method, will the environmental aspects of such activities be taken into account (e.g., selection of test specimens, non-destructive test methods, recycling, waste management, etc.)?

Yes ☐ No ☐ N/A ☐

If yes, in what way?
___________________________________________________________________________
___________________________________________________________________________

If not, please explain why not.
___________________________________________________________________________
___________________________________________________________________________

Other observations or comments:
___________________________________________________________________________
___________________________________________________________________________

8. Will a life cycle approach be used in developing the standard, including consideration of applications and any potential long-term human or environmental impacts (adverse or beneficial)?

Yes ☐ No ☐ N/A ☐

If yes, in what way?
___________________________________________________________________________
___________________________________________________________________________

If not, why not?
___________________________________________________________________________
___________________________________________________________________________

Other observations or comments:
___________________________________________________________________________
___________________________________________________________________________
II. **SOCIAL CONSIDERATIONS**

1. **Will the standard promote the use of nanotechnology to protect public health?**

   Yes [ ]  No [ ]  N/A [ ]

   If yes, in what way?
   
   

   If not, please explain why not.
   
   

   Other observations or comments:
   
   

2. **Will the standard promote nanotechnology that will benefit disadvantaged populations (e.g., that are poor, have few resources or limited access to higher-cost goods, technology or infrastructure)?**

   Yes [ ]  No [ ]  N/A [ ]

   If yes, in what way?
   
   

   If not, please explain why not.
   
   

   Other observations or comments:
   
   

3. Will the standard take into account the safety of end users of nanotechnology, including the safety of sensitive populations (e.g., the young or elderly)?

Yes [ ]  No [ ]  N/A [ ]

If yes, in what way?
___________________________________________________________________________
___________________________________________________________________________

If not, please explain why not.
___________________________________________________________________________
___________________________________________________________________________

Other observations or comments:
___________________________________________________________________________
___________________________________________________________________________

4. Will the standard promote the safe handling of nanomaterials and occupational protection of those working in the nanotechnology sector?

Yes [ ]  No [ ]  N/A [ ]

If yes, in what way?
___________________________________________________________________________
___________________________________________________________________________

If not, please explain why not.
___________________________________________________________________________
___________________________________________________________________________

Other observations or comments:
___________________________________________________________________________
___________________________________________________________________________

5. Will the standard promote nanotechnologies whose manufacture or use may pose risks to workers, users or the public?

Yes [ ] No [ ] N/A [ ]

If yes, in what way?

___________________________________________________________________________
___________________________________________________________________________

If not, please explain why not.

___________________________________________________________________________
___________________________________________________________________________

Other observations or comments:

___________________________________________________________________________
___________________________________________________________________________

6. Have the stakeholders who may be affected by the operations and activities covered by the proposed standard been identified?

Yes [ ] No [ ] N/A [ ]

If yes, in what way?

___________________________________________________________________________
___________________________________________________________________________

If not, please explain why not.

___________________________________________________________________________
___________________________________________________________________________

Other observations or comments:

___________________________________________________________________________
___________________________________________________________________________
7. Do the participants in the standards writing project represent a diverse range of views or backgrounds (e.g., government, industry, consumers, workers, academia, professionals, etc.)?

Yes [ ] No [ ] N/A [ ]

If yes, in what way?
___________________________________________________________________________
___________________________________________________________________________

If not, what measures might be taken to bring other views to the table?
___________________________________________________________________________
___________________________________________________________________________

Other observations or comments:
___________________________________________________________________________
___________________________________________________________________________
III. **ECONOMIC CONSIDERATIONS**

1. **Will the standard promote the elimination of trade barriers (including non-tariff barriers to trade)?**
   
   Yes [ ] No [ ] N/A [ ]
   
   If yes, in what way?
   ________________________________________________________________
   ________________________________________________________________
   
   If not, please explain why not.
   ________________________________________________________________
   ________________________________________________________________
   
   Other observations or comments:
   ________________________________________________________________
   ________________________________________________________________

2. **Will the standard promote technologies and practices that are affordable to small and medium-sized enterprises or lesser developed economies?**
   
   Yes [ ] No [ ] N/A [ ]
   
   If yes, in what way?
   ________________________________________________________________
   ________________________________________________________________
   
   If not, please explain why not.
   ________________________________________________________________
   ________________________________________________________________
   
   Other observations or comments:
   ________________________________________________________________
   ________________________________________________________________
3. Will the standard promote innovation and new technologies and practices?

Yes [ ] No [ ] N/A [ ]

If yes, in what way?

___________________________________________________________________________
___________________________________________________________________________

If not, please explain why not.

___________________________________________________________________________
___________________________________________________________________________

Other observations or comments:

___________________________________________________________________________
___________________________________________________________________________

4. Will the standard promote technologies that increase efficiency, including energy-efficiency?

Yes [ ] No [ ] N/A [ ]

If yes, in what way?

___________________________________________________________________________
___________________________________________________________________________

If not, please explain why not.

___________________________________________________________________________
___________________________________________________________________________

Other observations or comments:

___________________________________________________________________________
___________________________________________________________________________