

Update to the WSC Essential Considerations for the Regulation of Chemicals Used in Semiconductor Manufacturing and Products

This paper reflects the views of the World Semiconductor Council (WSC) including SIA in China, SIA in Chinese Taipei, SIA in EU, SIA in Japan, SIA in Korea, SIA in the U.S.

In 2012, the World Semiconductor Council (WSC) published a [statement in support](#) of balanced regulatory approaches regarding the role of chemicals in the semiconductor manufacturing supply chain. While many of the challenges at the time persist, today's landscape requires new considerations based on the actions of companies and policymakers. The speed of innovation in the semiconductor industry necessitates the use of unique chemistries, and the global regulatory framework must enable progress, ensure business continuity, and protect the environment. The associations of the WSC reaffirm and provide updates to the 2012 considerations.

The global semiconductor industry supports the goals of the sound management of chemicals throughout the life cycle while promoting continued innovation in the design and manufacture of semiconductors. The process used to manufacture semiconductors is highly complex and requires advanced manufacturing equipment, highly controlled environments, and the use of specialized chemicals to produce these complex products. Semiconductors are a basic “building block” of the modern economy and are the enabling technology that contributes to improvements and solutions in communications, health care, energy efficiency and environmental protection, climate change mitigation, automotive and transportation, education, entertainment, and other vital sectors of the economy, as well as national security.

Accordingly, policy on chemicals management for the semiconductor industry must recognize the critical nature of these products and the importance of continued innovation in this industry.

Chemicals play a critical role in semiconductor manufacturing. We recognize that some of these chemicals pose ESH challenges. We devote the best of science and technology to ensure chemicals can be used safely. When hazardous chemicals are used it is due to their unique functionality and because there are no viable alternatives. We promote international cooperation in our industry regarding chemical management, utilizing scientific evidence and assessing potential health impacts and risks as the basis for effective workplace and environmental protection, including identifying and implementing suitable alternatives. Teams of environmental experts, technologists, and industrial hygienist work together to adopt and implement risk-based programs to fully assess the ESH impact of proposed new chemicals and gases. This assessment includes how chemicals are used, reused, and disposed. These programs are continuously updated to include the most current information available. The industry uses chemicals in ‘enclosed processing systems’ which isolates chemicals from employees and the environment, thus reducing exposure risk and environmental emissions to de minimis levels. These efforts provide a safe, healthy work environment for our employees, the communities we operate in, and society as a whole. Efforts are constantly ongoing to reduce emissions, optimize processes, and identify and implement alternatives where practical.

Minimal quantities of chemicals are contained in the semiconductor product itself, and the inherent characteristics of the products, under normal or reasonably foreseeable operating conditions, do not allow for releases of chemicals to the environment or exposure to product users. The industry is a recognized leader in promoting high standards for environmental, safety, and health in its operations and products.

Because of the essential role of chemicals in the production of semiconductors, the major global semiconductor trade associations that comprise the World Semiconductor Council (WSC) support sound chemicals management by our companies and balanced regulatory approaches based on the following principles:

Address key principles when regulating chemicals

The regulation of chemicals should be informed by science. Initiatives to ban or restrict chemicals should take into account the combined use hazard and risk of exposure rather than inherent hazard alone. If limits on a chemical are necessary, such restrictions should take into account essential uses and the availability of potential substitutes and the environmental impacts of potential substitutes, provide for appropriate exemptions based on the quantities of use and potential for exposure, and allow for sufficient time to phase-out existing uses and develop suitable alternatives. With respect to the use of chemicals within a fabrication facility, any potential restrictions should account for the deployment of engineering controls, administrative controls, and personal protective equipment (PPE), which together minimize or eliminate possible worker exposures.

Provide Exemptions and Adequate Timelines for Development of Substitutes

When chemicals need to be replaced or restricted, the process for approving new chemicals, new uses of chemicals, and alternatives to existing chemicals should recognize the timeline for integrating chemicals into the complex, highly precise semiconductor manufacturing process. The material development cycle in the semiconductor industry typically is 10-15 years, consisting of fundamental research, hazard and risk evaluation, demonstration and integration with manufacturing equipment (and sometimes the development of new manufacturing equipment), and production. Where chemicals already used in manufacturing and/or manufacturing equipment need to be replaced, ample time must be provided to develop substitutes for these chemical uses, and to scale them up for use in high-volume manufacturing. Moreover, restrictions on the use of chemicals should provide for appropriate exemptions that account for critical, currently unavoidable uses and the availability of substitutes.

Ensure an Efficient and Timely Chemical Review and Approval Process

The material development cycle in the semiconductor industry typically is 10-15 years. A key enabler of this overall development process is an efficient, timely, and predictable approval process for new chemicals and new uses. Considering the growing global semiconductor supply chain, as well as increasing process complexity, policies should support the ability for chemicals manufactured in one region to be used at a fab in another region. Such transborder regulatory predictability helps ensure technology roadmaps can be achieved globally.

Balance Disclosure with Respect for Confidential Business Information

The semiconductor industry relies on the specialized use of chemicals for continued innovation. Disclosure of chemical manufacturing use information to promote transparency must be balanced by the need to protect confidential business information. Disclosure of information on materials in products should leverage the internationally agreed standards and industry initiatives (e.g., IEC 62474 Materials Declaration Standard) and ensure protection of confidential business information.

Recognize industry initiatives, standards, and research supporting the use and control of chemicals in manufacturing

Initiatives related to the use and control of chemicals in manufacturing processes should recognize the existing regulations and management practices that minimize releases and occupational exposure. Our industry has demonstrated responsible control of the uses of chemicals for the protection of our worker's health. We have comprehensive industry-agreed standards and guidelines for safety protocols for semiconductor manufacturing equipment. We share this information through conferences, conventions, and consortia. Company technical experts also work closely with researchers at universities around the world on projects to advance the state of the science in semiconductor manufacturing.

Approaches to the sound management of chemicals in electronic products should promote a global market and be based on relevant international standards, including the use of international test methods and laboratories. Such measures will enable the environmental management of chemicals while also facilitating trade and economic development, improving efficiency and avoiding duplication of effort, and protecting intellectual property. Accordingly, product regulations should recognize existing regulation, international standards, and voluntary initiatives to address substances of concern in products.

Recognize Successful Voluntary Initiatives

Initiatives on chemicals should recognize and support the ongoing voluntary activities of industry. For example, the WSC successfully achieved environmental goals in two areas:

- 1) The semiconductor industry was the first industry to establish a voluntary, global GHG reduction goal, and, in 1998, the EPA recognized the World Semiconductor Council (WSC) as part of its first Climate Protection Award in honor of the semiconductor industry's efforts to commit to a 10% reduction in emissions of perfluorocarbons (PFCs). In 2011, the WSC announced it surpassed its goal and achieved a 32% reduction in absolute PFC emissions compared with the baseline.
- 2) Over the past two decades, the semiconductor industry successfully phased out intentional uses of perfluorooctanyl sulfonate (PFOS) and perfluorooctanoic acid (PFOA), two "long-chain" PFAS identified by the scientific community as presenting environmental and health concerns, and therefore the semiconductor industry no longer has a need for exemptions from global regulations on intentional uses of these two substances.

The associations of the WSC continue to collaborate on the reduction of PFC emissions and other greenhouse gases, as well as the management of PFAS and other chemicals.

Flexible Systems are Needed to Support Rapid Product and Technology Changes

Governments, industry, and other stakeholders should work in partnership to address information regarding hazard and risk associated with emerging technologies that may become critical to new innovations. As ESH challenges are identified with new innovations, governments, industry, and others should work through consultation groups to develop solutions. For example, one method that the semiconductor industry uses to address new technologies is through roadmapping initiatives that recognize the need for the concurrent



development of increased environmental, safety, and health solutions along with advances in manufacturing technology.

Ensure Globally Consistent Regulations and Efficient Implementation

Global chemical regulations should be harmonized to the greatest extent possible to prevent trade barriers and ensure the free flow of products. Regulations should be written so they can be efficiently implemented. Administrative requirements should be kept to a minimum and compliance assurance should utilize self-certification methods employing international standards.