Food for Thought ...

A Replacement-first Approach to Toxicity Testing is Necessary to Successfully Reauthorize TSCA

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Summary

The Toxic Substances Control Act is the principal US law governing industrial chemicals. Over the past three and one half decades, it has become clear that a considerable toxicological information gap exists about chemicals in commerce. The current provisions of the US TSCA law have failed to fill, and perhaps even exacerbated, that gap.

For at least the past 5 years, bills have been introduced before the US Congress to reauthorize TSCA. Filling the toxicological information gap has been one of the driving forces for this call for substantial change. This article describes efforts to modernize TSCA, with an emphasis on the new provisions that would be put into place if the legislation became law. The article shows that only by implementing a "replacement-first" strategy – a strategy that is not currently incorporated into TSCA reauthorization efforts – can TSCA modernization efforts potentially fill the toxic data voids.

Keywords: TSCA, US law, reauthorization, chemicals

1 Introduction and background

1.1 TSCA and toxicity testing in the US

In the United States, the problems of chemicals in the environment and their potential effects on human health came into focus in the 1960s and 1970s. Although federal (national) and state laws did address some issues raised by chemicals in the environment (such as laws covering the use of pesticides), before the passage of TSCA in 1976 there was no comprehensive US federal law governing the introduction of chemicals in commerce. Like many of the federal environmental laws first enacted in the US in the 1970s and 1980s, the Toxic Substances Control Act[1] was drafted during a time in the United States when environmental problems were high on the US public's social and political agenda (Lazarus, 2004).

TSCA sought to correct the indiscriminate use of chemicals in the environment by obligating the US Environmental Protection Agency (EPA) to identify potentially toxic chemicals, evaluate their characteristics, and regulate their use (Anderson et al., 1984). According to the law, the EPA's Administrator must consider environmental, economic, and social impacts of any EPA action to regulate, with language requiring EPA to engage in a balancing analysis that incorporates these factors when it makes decisions. TSCA's core provisions, which are now over 35 years old, have never been amended (Environmental Law Institute, 2008; Schierow, 2008).

At the time of the passage of TSCA, the EPA estimated that there were approximately 60,000 chemicals used in commerce (Schierow, 2008). Obtaining toxicological information about these compounds was no doubt seen as a daunting task when the law was passed. To further complicate matters, TSCA divided the universe of chemicals into two groups – "existing" and "new" chemicals.

Existing chemicals are defined as chemicals that were in commerce prior to the law's enactment in 1976. TSCA states that these chemicals can remain in commerce unless EPA can show that they pose a hazard. In practical terms, EPA bears the burden of showing that existing chemicals are potentially dangerous before it can begin the process of collecting information about their hazards. This creates a situation that has been described by one former high-ranking EPA official as a "catch-22" – it is necessary to suspect that a chemical is hazardous before information about the chemical can be collected to show that it might be hazardous (Schierow, 2008, quoting Congressional testimony by then Assistant Administrator Lynn Goldman; Dennison, 2009).

[1] Toxic Substances Control Act, 15 U.S.C. §§ 2601-2629.

In contrast, for "new" chemicals (those being introduced to commerce for the first time or for a new use of an existing chemical), a manufacturer must bring to EPA data that it believes will assist EPA in assessing the chemical's potential adverse effects. While the manufacturer, not EPA, bears the burden of providing evidence about the compound, there is no specific requirement to test the compound for toxicity (Locke and Myers, 2010; Environmental Law Institute, 2008).

In the event that EPA decides to require a manufacturer to test a compound, EPA must follow a cumbersome regulatory mechanism for establishing testing. EPA must first make either a hazard finding or an exposure finding for the individual chemical it wants tested. A hazard finding is made if the chemical poses an unreasonable risk of injury to health or the environment or if there is insufficient data to predict its health or environmental effects and testing is necessary to develop data on such effects. An exposure finding is made if the chemical will be produced in substantial quantities and it can either enter the environment in substantial quantities or humans will receive substantial exposure to the chemical. In addition, EPA must find that there is insufficient data about the compound and testing is necessary to develop data on these potential effects on humans or the environment. After making either a hazard finding or an exposure finding, EPA must then, by regulation, require testing aimed at helping the agency determine whether or not the chemical poses an unreasonable risk of injury to health or the environment. Under US environmental law, this is called issuing a TSCA section 4 test rule (Environmental Law Institute, 2008; Schierow, 2008).

In short, unless EPA is able to require that the manufacturer test a compound through its regulatory process, the TSCA statute itself does not demand testing for either new or existing chemicals before they are used in commerce. And if EPA exercises its authority under TSCA to demand testing, it must follow a time-consuming and burdensome set of procedures. As a result, as of 2008 there have been only 254 TSCA section 4 test rules issued by EPA for individual chemicals over the more than 30 years of the TSCA program (Schierow, 2008; Denison, 2009). During this time, approximately 21,500 new chemicals were added to the EPA chemical inventory (Schierow, 2008). Additionally, other actions to collect toxicity data, including voluntary programs such as the High Production Volume (HPV), have been undertaken by EPA, often in cooperation with industry. While it is likely that many, and perhaps most, of the chemicals used in commerce are not extremely hazardous – especially if exposure is limited – there is widespread agreement that we are largely ignorant of what, if any, adverse effects might exist for that vast majority of compounds (Environmental Defense Fund, 1997; NRC, 2006).

1.2 TSCA and the toxics information gap

As early as 1984, the US National Academy of Sciences recognized that a substantial information gap existed for chemicals in commerce. At that time it estimated that there was "no toxicity information available at all" for 82% of chemicals in commerce (NRC, 1984). This gap in toxics information has not narrowed since then. More than 22 years later, another National Academy of Sciences Committee concluded:

> "TSCA authorizes EPA to review existing chemicals, but toxicity and exposure information on them is typically so incomplete that it does not support the review process. EPA can require testing if it determines that a chemical meets a specific set of criteria; however, *in vitro* and whole-animal tests are rarely required. Thus, the basis for establishing priorities and requiring testing for industrial chemicals in the United States has not progressed much over the last 20 years." (NRC, 2006)

The TSCA "master list" of chemicals in commerce now stands at more than 80,000 compounds (Schierow, 2008). It is clear that the TSCA statute, as presently written and administered, does not contain effective and efficient legal tools for toxicological information gathering (Locke and Myers, 2010). EPA is aware of the limitations of its current testing systems and lack of toxicity data (EPA, 1998). The situation has been amplified in recent years by at least two important trends. First, the sci-

Tab. 1: Projected options for toxicity testing

Adapted from *Toxicity Testing in the 21st Century: A Vision and a Strategy* (NRC, 2007).

Option I ***In Vivo***	**Option II** ***Tiered In Vivo***	**Option III** ***In Vitro/In Vivo***	**Option IV** ***In Vitro***
Animal biology	Animal biology	Primarily human biology	Primarily human biology
High doses	High doses	Broad range of doses	Broad range of doses
Low throughput	Improved throughput	High and medium throughput	High throughput
Expensive	Less expensive	Less expensive	Less expensive
Time consuming	Less time consuming	Less time consuming	Less time consuming
Relative large number of animals	Fewer animals	Substantially fewer animals	Virtually no animals
Apical endpoints	Apical endpoints	Perturbations of toxicity pathways	Perturbations of toxicity pathways
	Some *in silico* and *in vitro* screens	*In silico* screens possible	*In silico* screens

ence of toxicology increasingly relies upon analyses of molecular and cellular mechanisms and their study has been the subject of much of the work in this field (Hartung, 2010a; Hartung and Leist, 2008). Second, the EPA and several other US federal agencies have acknowledged the need for a new paradigm in toxicity testing and are building the scientific foundations to implement it (Collins et al., 2008; Judson et al., 2009).

As one scientist involved in research in neurotoxicology at EPA has noted, progress in this field has been very slow and is hampered by the gaps in understanding the biological bases of neurotoxicological diseases, which has translated into inadequate testing (Crofton, 2008). This view was substantiated by an external review of EPA toxicity testing commissioned by the EPA and carried out by the US National Academy of Sciences (NAS), National Research Council (NRC). In 2007, the NAS/NRC published a report, *Toxicity Testing in the 21st Century: A Vision and a Strategy* (NRC, 2007). This report set out a new paradigm for how chemicals should be tested based on advances in toxicology. Over the next two decades, the NAS/NRC envisions the emergence of a system of toxicity testing that will utilize high throughput methodologies, human cell lines, and the study of the perturbation of pathways of toxicity that underlie the progression toward disease endpoints. It also envisions the abandonment of the current animal-intensive, low throughput, patchwork system in favor of a program that will be more predictive, cheaper, faster, and more scientifically robust. Table 1, adapted from this report, shows this as a series of choices: "option I" (what is in place today) to "option IV."

2 Discussion

2.1 What is a replacement-first strategy?

The suggestion for a "replacement-first" strategy is based on the 3Rs – refinement, replacement, and reduction – which are the principles that underlie the internationally accepted philosophy and practice of humane science in toxicity testing, biomedical research, and all laboratory work involving animals. The 3Rs were first systematized in *The Principles of Humane Experimental Technique*, a 1959 study commissioned by the Universities Federation for Animal Welfare in the United Kingdom. The authors of this study, Dr W. M. S. Russell and Mr. R. L. Burch, pointed out that "the growth of medical and veterinary research ... has brought about a vast increase in the numbers of non-human animals employed as subjects of experiments." They also noted "... It is widely recognized that the humanest treatment of animals, far from being an obstacle, is actually a prerequisite for successful animal experiments" (Russell and Burch, 1959). Russell and Burch's definition of humaneness focused on the elimination of pain, distress, stress, and the preservation of well-being for experimental animal subjects.

Russell and Burch's treatise includes, as a starting point, a very basic definition of the 3Rs:

> "*Replacement* means the substitution for conscious living higher animals of insentient material. *Reduction* means reduction in the number of animals used to obtain information of given amount and precision.
>
> *Refinement* means any decrease in the incidence or severity of inhumane procedures applied to those animals which still have to be used." (Russell and Burch, 1959, p. 64) (emphasis added)

The treatise devotes a chapter to a more detailed explanation of each of the three 3Rs, pointing out areas of overlap and places where additional research is needed. Today, more than 50 years later, Russell and Burch's basic definition is still accepted and has been adopted internationally.

In the United States, the most recent authoritative statement of the 3Rs is found in the National Academy of Sciences *Guide for the Care and Use of Laboratory Animals. (8th edition)*. According to the *Guide*:

> "*Replacement* refers to methods that avoid using animals. The term includes absolute replacements (i.e., replacing animals with inanimate systems such as computer programs) as well as relative replacements (i.e., replacing animals such as vertebrates with animals that are lower on the phylogenetic scale).
>
> *Refinement* refers to modifications of husbandry or experimental procedures to enhance animal well-being and minimize or eliminate pain and distress. While institutions and investigators should take all reasonable measures to eliminate pain and distress through refinement, IACUCs should understand that with some types of studies there may be either unforeseen or intended experimental outcomes that produce pain. These outcomes may or may not be eliminated based on the goals of the study.
>
> *Reduction* involves strategies for obtaining comparable levels of information from the use of fewer animals or for maximizing the information obtained from a given number of animals (without increasing pain or distress) so that in the long run fewer animals are needed to acquire the same scientific information. This approach relies on an analysis of experimental design, applications of newer technologies, the use of appropriate statistical methods, and control of environmentally related variability in animal housing and study areas" (NRC, 2011, p. 5).

Russell and Burch demonstrated that the philosophy of humaneness, and the actions required to create a culture of humane science, are prerequisites for achieving high quality research. Because toxicity testing is a scientific endeavor, humane science must, by logical extension, also underlie successful toxicity testing strategies.

Fifty-seven years after the publication of Russell and Burch's ground-breaking work, the US NAS/NRC published *Toxicity Testing in the 21st Century: A Vision and a Strategy* at the request of EPA. The Committee noted that EPA's current toxicity testing approach relies primarily on whole animal toxicology and the evaluation of clinical signs or pathological changes that indicate disease. This strategy is time-consuming and resource intensive. As a result, it is not well suited to meeting the toxicity challenges that confront EPA, which include large numbers of untested chemicals. A review of EPA's TSCA regulatory program affirms these points (Locke and Myers, 2010; Environmental Law Institute, 2008).

Citing breakthroughs in toxicological research and the molecular approach that modern toxicology has embraced, the report

recommends that EPA adopt a system of toxicity testing based on high throughput systems and an analysis of toxicity pathways. This testing would eventually be carried out primarily in cell lines (see options III and IV, Tab. 1). The report suggests that this vision and strategy is achievable over two decades. In terms of Table 1, EPA would move from Option I to Options III and IV during these next 20 years. The NAS/NRC believes that this new strategy, once in place, will improve risk-based decision-making, predictive assays, and public health decision-making. As an added benefit, toxicity testing under this new program will be conducted more quickly, with less expense, and with fewer animals (NRC, 2007).

The NAS/NRC vision directly mentions Russell and Burch only once, noting that the "... Continued use of relatively large numbers of animals for toxicity testing also raises ethical issues and is inconsistent with emphasis on reduction, replacement, and refinement of animal use" (NRC, 2007, p. 43). Its vision and strategy, however, are based on four principles, at least one of which incorporates humane science: depth of testing, breadth of testing, animal welfare, and conservation of testing resources. A careful examination of the NAS/NRC vision and strategy show that it advocates an evolution in toxicity testing that, if fully implemented, would substitute virtually all animal use with non-animal tests. In this regard, it is consistent with, and an advocate for, the replacement R, as defined by Russell and Burch in 1959: "... the substitution for conscious living higher animals of insentient material." It is also consistent with the definition of absolute replacement in the *Guide for the Care and Use of Laboratory Animals*: "... methods that avoid using animals."

2.2 TSCA reauthorization in the US Congress

A TSCA reauthorization effort has been underway in the US Congress for several years. It seeks to correct several shortcomings of the current law (Dennison, 2009). Addressing the lack of toxicity testing data and filling a toxics information gap is one problem the reauthorization seeks to resolve. It is useful to review current TSCA reauthorization efforts to determine how the proposed changes seek to fix such issues.

New Jersey Senator Frank Lautenberg has been a long-time advocate for TSCA reform and is the primary sponsor for the bill that is now before the US Senate. This bill, "The Safe Chemicals Act of 2011[2]," (Senate Bill 847) was introduced on April 14, 2011 and was referred to the Senate Committee on Environment and Public Works. No similar bill has been introduced before the US House of Representatives during the 2011-2012 session of Congress.

The Safe Chemicals Act of 2011 is an ambitious bill. It would amend TSCA by adding or changing over 34 sections, including adding new findings, policies, and goals; reforming provisions on disclosure of data; requiring minimum data sets; and incorporating green chemistry provisions. The bill would shift the burden of proving the safety of existing chemicals from EPA to industry. It would also require companies to develop and submit minimum data sets for chemicals; require EPA to prioritize chemicals based on risk; expedite risk reduction for high concern chemicals; provide greater public access to reliable chemical information; and promote innovation and green chemistry (Safe Chemicals Act of 2011).

While a complete analysis of this proposed legislation is beyond the scope of this article, it is useful to focus on the provisions of the bill that most directly impact toxicity testing or seek to fill the toxics information gap described earlier. In particular, this article will focus on four key areas where a replacement-first strategy would greatly aid in carrying out the proposed purposes of the bill. These key areas are:

a. Added findings, policies and goals, and changed definition of toxicity
b. Minimum data set requirements, especially tiered data
c. Prioritization and classification of chemicals
d. Specific requirements to reduce animal-based testing

a. Added findings, policies and goals, and changed definitions

Section 3 of the proposed Safe Chemicals Act of 2011 would amend TSCA section 2 to add a series of new findings. These include a specific finding about data gaps:

> "... more than 3 decades after the enactment of this Act, people and the environment in the United States are still exposed to thousands of chemicals whose safety has not been adequately reviewed and may harm health and the environment." (Safe Chemicals Act of 2011, section 3(a)(3))

Section 3 also includes as a new statement of purpose for TSCA, stating that the law should "... improve the quality of information on chemical safety and use." (Safe Chemicals Act of 2011, section 3(b)(5)). Taken together, these new provisions show explicitly that the Safe Chemicals Act of 2011 was meant to take on the toxic ignorance problem that has been so clearly documented in the scientific, policy, and legal literature.

Section 4 of the Safe Chemicals Act of 2011 would amend section 3 of TSCA, by adding several new definitions and changing currently existing ones. It defines the meaning of the term "toxicological property" as:

> " ... actual or potential toxicity or other adverse effects of a chemical substance or mixture, including actual or potential effects of exposure to a chemical substance or mixture on (A) mortality; (B) morbidity, including carcinogenesis; (C) reproduction; (D) growth and development; (E) the immune system; (F) the endocrine system; (G) the brain or nervous system; (H) other organ system; or (I) any other biological functions in humans or nonhuman organisms."

This clause is very broad, and indicates that the bill intends for EPA to cast a wide net in assessing the potential harm that could result from chemical exposure. The comprehensive list of apical endpoints is followed by a final clause that seems targeted at the pathways and perturbations approach advocated by the NAS/NRC vision and strategy. Specifically, adoption of the pathways

[2] Safe Chemicals Act of 2011, S. 847 (April 14, 2011 version). http://thomas.loc.gov/cgi-bin/bdquery/z?d112:s.847: (last accessed 20.10.2011).

and perturbations concepts from the NAS/NRC report as part of this definition would improve and sharpen it.

b. Minimum data sets and testing of chemicals

As discussed earlier in this article, TSCA currently does not require testing of any compound, or set out a minimum data set. The Safe Chemicals Act of 2011 would amend section 4 of TSCA to add a specific requirement that EPA establish, by regulation, a minimum data set for chemical substances. The changes in this section would require that the minimum data set provide for varied (or tiered) data so that a screening-level risk assessment could be carried out. This amendment to TSCA specifically states that EPA must "encourage and facilitate the use of alternative testing methods and testing strategies to generate information quickly, at low cost, and without the use of animal-based testing, including toxicity pathway-based risk assessment, *in vitro* studies, systems biology, computational toxicology, bioinformatics, and high-throughput screening" (Safe Chemicals Act of 2011, section 4(a)(1)(B)). Other changes to this section discuss testing methodologies, and specifically include "*in-vitro* tests" in the list of test methods that the EPA can demand.

Adding this "alternatives" language to this bill has several advantages. First, replacement alternatives can be very useful in sorting and tiering compounds (Chandler et al., 2011; Hartung, 2010b). EPA and other US federal agencies are working diligently on several methodologies listed in this section, and EPA might soon be in a position to embrace replacement alternatives for these activities. EPA has already used replacement alternatives to make a decision about the toxicity of dispersants used in cleaning up the 2010 Gulf of Mexico oil spill (Judson et al., 2010). Second, the bill explicitly recognizes the value and role of replacement alternatives in a new and improved TSCA program.

If the bill, as currently written, were enacted into law, these new provisions might be helpful in moving chemical testing in a replacement focused direction. Certainly, the wording used in these provisions echoes both the vision and strategy of the NAS/NRC report as well as the new findings and goals expressed in earlier sections of the bill. A major weakness exists in these provisions, however, and in the bill generally, that should be corrected. The bill merely states that EPA should "encourage and facilitate" replacement alternatives. This hortatory phrasing stops short of what is needed. To reach the goals of this new TSCA law, EPA should be required to develop and use alternatives. More specifically, this bill should require EPA to implement the NAS/NRC vision fully (and later in the bill, another NAS/NRC report is specifically referenced, so adding an additional reference to the Toxicity Testing report would not be new or unprecedented)[3]. The language in the bill focusing on apical endpoints would benefit from redrafting so that the pathways underlying the endpoints, instead of the endpoints themselves, were emphasized.

c. Prioritization

In 1976, EPA faced the daunting task of trying to build a TSCA program to assess the toxicity of approximately 60,000 chemicals in commerce. Today, EPA faces an equally intimidating prospect – the assessment of more than 80,000 compounds. Recognizing this problem, the Safe Chemicals Act of 2011 would add a provision to TSCA section 6 focusing on prioritization and risk management (Safe Chemicals Act of 2011, section 7, amending TSCA section 6). Under this new section, EPA would be required to develop and publish a list of compounds divided into three priority classes. Priority class 1 would contain chemicals that EPA determines require immediate risk management. Priority class 2 would consist of chemicals that EPA determines require a safety standard determination. The third priority class would contain those chemicals that require no immediate action. A US interagency committee would be established to make recommendations to EPA regarding prioritization.

Under this bill, a safety standard determination is a decision by EPA that no harm will result to human health or the environment from aggregate exposure (i.e., combined exposure from all sources) to the chemical. It is the responsibility of the manufacturer of the chemical to provide information to EPA so the agency can make a safety standard determination.

This new prioritization requirement is central to resolving one of the key problems of the current TSCA program, and directly confronts the toxics information gap. Replacement alternatives are well suited to the prioritization decisions that will be needed if this provision were to become law, for the same reasons that replacement alternatives are well suited to tiering and sorting. A successful prioritization program will require replacement alternatives, which can be deployed inexpensively, quickly, and in a high throughput format to aid in decision-making.

Replacement alternatives will also be very useful for manufacturers, who bear the burden of providing information to EPA to carry out safety standard determinations on those compounds placed in category 2. EPA will thus need to be ready to accept, and understand the strengths and limitations of, these alternatives in evaluating chemical safety. This section of the bill could benefit from a specific provision or provisions that acknowledge the need for replacement alternatives in assuring success in prioritization, and also by adding a specific requirement that the interagency committee contain at least one member with expertise in replacement alternatives for toxicity testing.

d. Specific requirements to reduce animal testing

Section 30 of the Safe Chemicals Act of 2011 addresses the need to minimize the use of animals in testing chemical substances and mixtures. Section 30 is divided into four major subsections. The first subsection (subsection a) requires EPA to take action to minimize the use of animals in testing, including: encouraging and facilitating the use of existing data; reducing or replacing animal testing; grouping chemicals (if scientifically appropriate) so that the testing of one chemical substance can serve as a

[3] The Safe Chemicals Act of 2011 section 7, referencing the National Academy of Sciences/National Research Council "Science and Decisions" report.

surrogate for decision-making about the group; forming industry consortia to avoid duplicative testing; submitting parallel data from animal and non-animal tests; and funding 3Rs research and validation studies. The second subsection (subsection b) establishes an interagency science board on alternative testing methods. This board will be composed of members of various federal agencies. Its purpose is to provide independent advice and peer review to Congress and EPA on the use of alternatives and the implementation of this section. This group must issue a report one year after it is formed that lists testing methods for reducing animal use. This report must be updated and reissued every three years.

The third subsection (subsection c) requires EPA to consult with the interagency board established in section 30(b) to develop a strategic plan to improve the development and implementation of alternatives. The report is to be focused on test methods that can be used to carry out safety standard determinations. Every two years, EPA must submit to Congress a report that describes progress and discusses studies undertaken to implement this section.

The fourth and last subsection (subsection d) contains provisions for adapting or waiving required animal-based testing at the request of a chemical manufacturer. To waive animal testing, it must be shown that the animal test is not applicable because the chemical substance does not have the property for which the animal test is given, the specific endpoint is not technically practical, or the chemical substance cannot be tested at a concentration that does not cause pain, distress, severe irritation, or corrosion.

If enacted in its present form, the Safe Chemicals Act of 2011 would be the first environmental law provision to explicitly include a section addressing the reduction of animal-based testing. For that reason alone, this section is innovative. For US law, it represents a changed approach to testing that, for the most part, is aligned with the three Rs. To more effectively implement a replacement-first approach, however, this section should be changed so that EPA is required to do more than "encourage and facilitate" non-animal testing. It should require the development and use of non-animal tests and provide funding for EPA and other federal governmental agencies to strengthen their programs in computational and *in vitro* toxicology. In other words, the bill should contain "technology-forcing" provisions to chart a clear path to the use of non-animal toxicology as soon as the development of science allows. Also, the criteria contained in subsection d should be expanded so that replacement alternatives can be substituted for animal toxicity tests based on scientific rationales, such as validation, or a demonstration that a replacement test, or series of tests, is as, or more, predictive than the animal-based test.

3 Analysis and conclusions

The need for the replacement of animal toxicity testing for TSCA is not a new idea. When the US Congress was discussing the enactment of TSCA in the 1970s, the issue of toxicity testing, and in particular the evolution of toxicity testing and innovation in testing methods, was vigorously debated (H. R. Rep No 94-1341 (1976)[4]).

As Representative Andrew Mcguire stated at the time:

> "Recent developments in the field of toxicological testing have centered on the emergence of low-cost, short-term bacteriological and mammalian cell tests for mutagenicity. These tests show great potential for cutting down on the cost to all companies of testing their products to show what degree of hazard, if any, may be posed by their products." (Congressional Record, 1976[5])

Ultimately, Congress decided not to require EPA to use any particular type of toxicity testing. Congress determined that EPA should have the flexibility to choose the best methodologies available for testing. Representative Mcguire did add a provision to TSCA (now TSCA section 27) that authorized EPA and other federal agencies to conduct research on, and give grants for, continued research into the field of low cost and efficient testing methods (Environmental Law Institute, 2008).

These deliberations provide evidence that Congress expected TSCA testing methods to change. More to the point, Congress appeared to understand that as science advanced, TSCA would likely rely less and less on animal toxicology. Statements made during these deliberations also show that Congress fully expected EPA to employ a replacement-first strategy. Because of advances in toxicological methods and thinking, and the vision and strategy for testing laid out in the NAS/NRC report, moving away from animal testing and toward a new toxicological science is now an achievable goal.

From the perspective of protecting public health and creating an environment in which the best scientific testing is nurtured and used, the NAS/NRC vision clearly shows that a replacement-first strategy is consistent with, and offers the best chance for, improving toxicity testing and reducing the toxics information gap. The Safe Chemicals Act of 2011 is a good step in that direction. In particular, section 30 of this bill is an important and ground-breaking provision that acknowledges the desirability of reducing animal testing. Still, the bill needs to be strengthened so that the move toward a replacement-first approach is clear. More assertive language is necessary to both (1) implement key provisions of the NAS/NRC toxicity testing vision and strategy, and (2) affirm the replacement-first approach that the vision and strategy contains. Without these changes, it is not likely that TSCA reauthorization efforts will be able to fulfill one of their key goals – reducing the gap in toxicity information that has plagued public health decision-making for more than 30 years.

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