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A New Role for Transparency

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Arms control has traditionally dealt with limiting the means of destruction. When the greatest threat to security came from the potential for organized violence inflicted by an external enemy against a state, arms control logically sought to limit that danger. But as the threats to security have become more diffuse, policy-makers will need to draw on a wider repertoire of tools to reduce the potential destructiveness of less organized threats, and even emerging unintended dangers.

Over the past few decades, arms control has contributed a tool to international diplomacy that may address some of these growing threats. That tool is transparency. Transparency refers here to the provision of information by an actor about its own activities and capabilities to other actors. More and more, transparency is a norm – that is, a standard of behaviour to which actors are held, one that has become increasingly entrenched in international security relations, politics, business practices, and policies of environmental protection.[1] It has roots in many areas, from the spread of democracy to the demands of globalized business to the requirements under arms control for states to provide other states with vast quantities of information about their military capabilities and organizations.

This new norm contributed significantly to the end of the Cold War through the verification provisions and confidence-building measures associated with arms control in the 1980s, but its future role will be even more important.[2] In a world characterized by multipolarity, the diffusion of some forms of power from state actors to other types of actor, the proliferation of both weapons of mass destruction and precision guidance technologies, the widespread breakdown of political authority, and the distribution of environmentally toxic materials on a unprecedented scale, protecting humanity and the planet will demand even higher levels of transparency in regard to who has access to which materials and technologies and who is doing what with them.

It has been proposed that transparency could serve as the cornerstone of non-proliferation and broader cooperative security efforts.[3] But this raises many questions about what information should be made available, to whom, and for what purposes. One way to work through these questions is by making comparisons with another issue area where transparency already has started to play a crucial role (at least within the United States): the

prevention of environmental toxification. Proliferation and environmental toxification share characteristics beyond the grave risks they pose to human well-being, risks that are not being adequately addressed by current policies.[4] Both involve the need to regulate substances that are widely, legitimately, and necessarily used in economic transactions (sometimes even the same substances). In both cases, moreover, centralized control systems which exclusively involve states will not suffice.

Thinking about how to use transparency measures to address proliferation and toxification requires a long-term perspective, because the solutions to proliferation and toxification require a substantial incubation period. Achieving the necessary degree of transparency will require a norm change. New norms do not emerge spontaneously: particularly at the international level they are often the product of concerted effort sustained over long periods.[5]

This essay looks at the problems of proliferation and toxification over the long term, describes why these problems will require a transparency-based approach, and analyses what that approach should entail. The next section examines the trends likely to alter and intensify the nature of the proliferation threat, as well as to increase demand for environmentally hazardous products and production processes that could result in toxification. The paper then discusses specific characteristics of the problems of proliferation and toxification and argues that the traditional strategies used to address these dangers – denial of access to dangerous materials and after-the-fact countermeasures – will prove inadequate in the new context. Next, it shows that alternative policies that rely on the public revelation of information about economic transactions and processes can alter behaviour more effectively than can more familiar types of regulation. The paper concludes with a discussion of the prospects for applying the transparency-based approach to proliferation and toxification at the international level.

The Trends[6]

If no policy changes are made, in the next two to three decades the world could become a much more hazardous place, with new dangers emerging from a diffuse set of actors and sources. In particular, over the next few decades, the dangers posed by the proliferation of weaponry and by environmental toxification may increase significantly. Although these are usually thought of as two quite different problems, they share many root causes. In the short term it may be possible to ignore them, or to manage them using current policies, but in the long term, to the year 2025 or so, several trends will combine to make current policies unworkable.

The information revolution is leading to widespread and rapid dissemination of knowledge about weapons of mass destruction and other weaponry. Much of the technology required for precision targeting is embedded in widely diffusing civilian information technology. Although the Clinton administration may be right that no rogue state will have the technological capability to launch a missile attack on the United States in the next fifteen years, the next thirty years could tell a very different story. By 2025, capabilities for weapons of mass destruction and for precision guidance of delivery systems are likely to be widely diffused.

Over the same period, given population pressures and rising income levels, demands for industrial products (with their associated environmental costs) will increase dramatically. By 2025, the planet will be far more crowded than it is today, with at least two billion additional people, and perhaps as many as four billion more.[7] By comparison, the current world population is about 5.8 billion people.[8]

These developments will take place in a world threatened by political instability. Most of the swollen population will be poor, with about 95 per cent of population growth occurring in poor countries and largely in the poorer segments of those societies. Most will live in cities, often in megalopolises which will have grown too fast to keep up with the demand for basic infrastructure such as sewage, roads, decent housing, and water.[9]

Disparities between rich and poor will be accentuated. Although most people's incomes will rise, income disparities between rich and poor will grow even more rapidly, because the rich are starting off at a much higher base. If China grows at a per capita rate of 7 per cent a year from now until 2025 (a rate better than the best sustained per capita growth rate ever seen, South Korea's 6.5 per cent), and the United States continues to grow at the per capita rate of 1.5 per cent, the difference in per capita income would widen from $24,500 to $35,271. Under this scenario, which exaggerates China's likely growth relative to the U.S., incomes would continue to diverge until 2041.

This is likely to be a politically fragmented world, divided by much more than national boundaries. There are hundreds if not thousands of identifiable ethnic and other groups with a reasonable claim to at least a degree of self-determination.[10] Growing numbers of such groups are clamouring for at least some of the attributes of statehood, although relatively few have the wherewithal to survive as independent polities.[11] Whatever the political organization of the future turns out to be, it will lack the relative clarity of the nation-state system as we have traditionally understood it.

These developments are more than likely. The fragmentation of political identity is already well under way.[12] The population surge will occur because the parents of that population are already born. Income disparities

will grow unless the economies of the rich countries collapse. Nonetheless, because most people in that rapidly expanding population are becoming absolutely (even if not relatively) richer, demands for the products of industrial economies – cars, houses, clothes, televisions – will soar, introducing vast quantities of ill-regulated pollutants.

In short, nearly a billion people will be added to the world's population each decade, most relatively poor but all needing food to eat, a place to live, resources to consume, and a job. Their political loyalties will be fickle and are unlikely to be based on a strong sense of national identity. They may not be much moved by pleas to constrain their own still relatively low standards of living for the sake of protecting the environment. Most will live in cities, readily accessible to demagogues, for whom external enemies have historically provided an inviting target. And the information revolution will ensure both that most of the poor will be aware of the disparities in standards of living and that information on all kinds of weapons, including weapons of mass destruction, will be widely available.

One solution would be sustainable economic development adequate to improve standards of living and to create stable middle classes in most societies. Yet even under the best of circumstances, there are good reasons to believe that humanity is unlikely to grow its way out of its troubles quickly, and almost surely not quickly enough to avoid the problems described in this piece. Environmentally sustainable means of development may be possible but are not yet well developed. Furthermore, too many parts of the world lack the political and institutional infrastructure needed to develop or adopt environmentally benign new technologies at a sufficient rate and to channel capital appropriately.[13]

Thus, these trends set the conditions for greater supply of and demand for both the means of violence and environmentally hazardous materials. Diffuse, sub-state violence may emerge from frustrations and resentments inherent in inequitable development, and that violence could take the form of precisely targeted attacks on rich-country targets. It would hardly be unprecedented for demagogues to rise to power by blaming the problems of their followers on external targets. With targeting information provided by global positioning satellites and other readily available information, the currently remote targets of the rich countries may not be so inaccessible, even to sub-state actors. And not all rich-world targets will be far away. As the economy becomes increasingly globalized, firms based in one country could be badly hurt by attacks on their foreign direct investments.[14] And most if not all parts of the world will be living through the results of an uncontrolled chemistry experiment on the consequences of introducing tens of thousands of untested chemicals into planetary cycles.

Characteristics of the Problems

The apparently disparate problems of proliferation and toxification share several characteristics that make them amenable to similar solutions. Both involve the use of materials that are embedded in legitimate economic activities that cannot be readily halted, a kind of 'dual-use' problem that goes far beyond the difficulties familiar from the use of fissile materials for nuclear power. Nuclear proliferation concerns involve a relatively small number of actors and a still relatively small quantity of dangerous materials. But when proliferation is expanded to include chemical and biological weapons and delivery systems, the quantity and diversity of materials and technologies that must be viewed as part of the threat increase by orders of magnitude. Both proliferation and toxification involve increasing quantities of potentially dangerous materials or technologies because of increasing demand for those legitimate products. Both involve large numbers of actors, private and governmental, who are buying and selling these potentially dangerous materials and/or technologies on a daily basis. Success in addressing these dangers may require instituting some system of control over vast numbers of economic transactions, without stifling the economic vitality on which global well-being ultimately depends.

There are, of course, differences between control of proliferation and environmental regulation. Most important is that externalities in the environment are truly consequences that are unintended and unwanted by everyone. Companies would be quite happy to eliminate all hazardous substances from their production processes were it technologically feasible and economically profitable to do so. In the case of proliferation, however, someone wants that 'externality', meaning that there is a market for it. In the environmental case, the problem is solely one of preventing firms from free-riding, using less expensive but more hazardous technologies and substances than their competitors. In the proliferation case, it will be necessary to avoid both free-riding and deliberate circumvention of whatever control regime exists.

Yet the similarities outweigh the differences. Both will require controlling the damaging externalities of perfectly legitimate, indeed essential, economic transactions. There is likely to be very limited resources or political support for traditional regulation. Somehow, it will be necessary to permit commerce in potentially hazardous substances and technologies among many decentralized actors.

Proliferation

The dangers posed by proliferation of arms, particularly weapons of mass destruction, are well understood. Such weapons, if used, would cause

massive devastation, and the more actors possessing them, the greater the risk of use. The mere possession of such weapons, even if they are not used, may greatly exacerbate regional tensions, destabilizing already volatile situations and enhancing the power of pariah states or terrorist groups. Even a single use of a nuclear weapon would break a taboo that has held for more than fifty years, in itself a powerful restraint on actors considering the use of nuclear weapons.

The proliferation threat is escalating with the diffusion and evolution of technology. The very capability to attack targets which enabled the United States to win the Gulf War so handily grew out of commercially developed technologies. It is true that no other country will come close in the foreseeable future to matching the US capability for what William Perry has described as the 'reconnaissance strike force', which includes command, control, communications, and intelligence, precision-guided munitions, and defense suppression.[15] But even lacking this full spectrum of capabilities, many countries and sub-state actors could strike out with lethal effectiveness at civilian targets, using widely available technology to locate targets, possibly combined with primitive but effective weapons of mass destruction. In short, given the realities of global economic integration, many more actors, both state and others, have or will obtain access to the technologies underlying weapons of mass destruction or the means of guiding weapons across great distances and landing them precisely on target.

Toxification

The degree of danger from environmental toxification, by contrast, is only just now being recognized. Toxic substances of all kinds are flooding the planet, the inevitable concomitant of existing industrialization practices. Toxification refers to the accumulation of toxic substances in individual biological organisms or in the biosphere generally from anthropogenic materials flows. This accumulation can have a variety of unpleasant effects, ranging from neurological harm to a single organism (as in lead poisoning) to the disruption of entire ecosystems.

The extent of the threat is unknown, and at this point unknowable, but the signs are ominous. The environmental and health effects of the more than 50,000 chemicals produced annually for use in industrial processes remain largely unexplored. Even information about who is producing potentially hazardous chemicals, where and in what ways they are being used, or how the products are being disposed of, is at best difficult to find. No one has a comprehensive overview that would make it possible to track products containing hazards or to monitor the processes that produce them.

The levels of toxic material flows being introduced by human activity go

well beyond anything seen in nature, often by orders of magnitude.[16] Moreover, it is not only the levels but the total accumulation that matters. Many of the substances persist for decades if not centuries. Heavy metals such as lead, mercury, and other potent toxins, for example, were widely used for decades before their hazards became known, and these elements do not decompose into less dangerous substances. Even once the hazard is known, the economic utility of many hazardous substances can make it difficult to restrict the pollution. Much of the world still burns leaded gasoline. The best-known example of toxification may be the destruction of stratospheric ozone by man-made chlorofluorocarbons (CFCs), chemicals which until recently were widely used as refrigerants, aerosol propellants, and industrial cleansers. It was largely accidental that the harmful effects of CFC use were discovered in time for a global ban to prevent real catastrophe. It is thought possible that toxification has played a part in the decline of German forests, the demise of coral reefs around the world, and the sudden decimation of many species of frog.

The Limits of Traditional Solutions

The phenomena of proliferation and toxification will be among the most serious threats to human well-being for at least the next several decades. Yet neither traditional strategies aimed at denying access to certain goods and technologies nor other conceivable alternatives hold much promise for abating these threats.

Neither American nor broader global interests are well served by the current policy debates on proliferation and toxification. The debate assumes that the options for proliferation policy are limited to incremental changes to existing policy (a combination of diplomatic efforts aimed at dissuading potential proliferators and export controls to deny key technologies and materials to hold-out states) and/or the development of military countermeasures to deal with proliferation once it occurs. But existing policy could only be effective if the sole proliferators of concern were states, if states had full knowledge of and control over their imports and exports, and if controlling exports of a limited set of goods and technologies could prevent the proliferation of all the weapons systems and technologies of concern.

The debate over toxification policy is much less developed, having begun in earnest only with the United Nations Conference on Environment and Development in 1992. Follow-up efforts related to environmental toxification are still at a very preliminary stage. Within the United States, clean-up efforts have been harshly criticized on all sides, as epitomized by the notoriously controversial Superfund programme which was too

expensive, often ineffective, and overwhelmed by the difficulty of determining whom to hold accountable for the contamination of specific sites.

A strategy that emphasizes broad-based denial of access to potentially dangerous products cannot adequately deal with either proliferation or toxification. It is useless to address toxification, because no state or reasonably small group of states controls the supply of hazardous substances used in industrial production. Even in those cases where supply could be controlled, denial of access would mean undercutting essential economic activities involving feedstock chemicals. With regard to proliferation, the denial approach has already accomplished most of what it can achieve in restraining proliferation. Much of the success of the nuclear non-proliferation regime, for example, has depended on two factors: cooperation among a small number of supplier states who restricted their nuclear exports to other countries, and the existence of technological bottlenecks stemming from the difficulty of acquiring either highly enriched uranium or plutonium to make a bomb. Neither condition still holds, even in the nuclear area. The problem of proliferation no longer consists merely of a small number of supplier states exporting nuclear goods and technologies to recipient countries. The world is awash in weapons-usable plutonium, much of it not under effective international control, and the number of existing or potential near-term suppliers of nuclear materials and technology has sharply increased. This renders inadequate the centralized, generally coercive application of regulations aimed at denying access to certain goods and technologies. Other kinds of weapons proliferation, including chemical, biological, and technologies related to delivery systems, have even fewer choke points at which controls could be applied.

The denial strategy cannot be made effective by simple extension. The sheer number of goods and substances whose exports would have to be restricted dwarfs any previous efforts at denial-based controls. No relatively short list of forbidden exports could suffice. With regard to proliferation, the threats increasingly lie in the area of computer technologies, chemicals, and biotechnology; goods and technologies with both civilian and military uses and no ready distinction between them. To give just one example, the Chemical Weapons Convention, which came into force in spring 1997, covers more than three dozen chemicals, with provision made for adding to the list.[17] Moreover, scores of states and thousands of firms are now numbered among the suppliers of all the goods and technologies of concern. With regard to toxification, there are over 50,000 chemicals used in production processes, of which only a few hundred have been adequately tested for their environmental and health effects. In this area, we do not even yet know what needs controlling. Clearly, simply banning all trade in dual-

use technologies and all products containing hazardous or potentially hazardous substances is not the answer.

A *post hoc* approach has problems as well. The US Department of Defense has established a Counterproliferation Initiative that aims to equip United States forces to face adversaries who possess nuclear, biological, or chemical weapons. The initiative incorporates development of new technologies and new military strategies aimed at current or likely proliferators. Unfortunately, rather than deterring proliferation, this approach could effectively reinstate an arms race, this time against unknown opponents who may see the policy as an incentive to proliferate so as to be able to confront – or deter – the United States. And, of course, a counter-proliferation strategy is only useful after proliferation has occurred. A *post hoc* response to toxification is even more unattractive. Many pollutants of concern, such as heavy metals, cannot be effectively cleaned up once they have been dispersed into the environment, and the effects of many others are simply unknown.

A Growing Role for Transparency

In time, transparency measures may be able to do what denial strategies and countermeasures alone cannot. By allowing legitimate uses (and emissions) of the goods and substances of concern to be easily traced, transparency would make the task of would-be proliferators harder, and it would make assessing responsibility for the unwanted side-effects of toxic substances much easier. Perhaps most important, it can enlist the potent force of public opinion, while imposing much less of a regulatory burden than would exist under alternative policies.

Transparency can serve three quite different purposes. Most familiar in arms control is its *deterrent* effect: signatories to treaties refrain from violating the accords because the verification provisions make the likelihood of being caught and punished unacceptably high. Also increasingly familiar is the role of transparency in providing *reassurance*: a means by which actors can prove that they are not misusing goods and technologies. Much less known in arms control, but beginning to emerge in the environmental field, is the *revelatory* effect of transparency. As will be described below, the institution of transparency requirements can provide actors with information about the consequences of their own activities, information they would never have obtained without the requirement to do so but which, once gathered, can spur dramatic changes in the actors' behaviour. The Russian government might not have been aware of the degree to which its fissile material was unsafely stored without Washington's prodding and assistance, but once made aware, both

governments found improving the situation to be in their mutual interest.

The growing acceptance of transparency could act as the basis for creating transparency systems which could serve all three goals, tracking the goods and substances of concern throughout their life cycles. They would rely primarily on self-reporting, requiring producers to provide information about the ultimate consequences of their production. In the case of dual-use technologies, firms wishing to export such items would have to provide information about the end-user. With regard to toxification, producers would be required to report not only on their emissions of hazardous substances as wastes, but on the presence of hazardous constituents (above a threshold) in the goods they produce. Such tracking would make it possible to follow a hazard throughout its life cycle.

Similarly, it may be possible to label a wide range of products and substances in such a way that they can be tracked throughout their life cycles. Los Alamos National Laboratory has developed tags that cannot be duplicated or tampered with which could be attached to a product or container. (The tags were intended to help verify compliance with the Conventional Armed Forces in Europe Treaty, so that permitted numbers of tanks and other systems could be labelled and readily distinguished from those not so labelled. The treaty's verification provisions in the end did not require the use of the tags, and they are still sitting on the shelf at Los Alamos.) Along the same lines, chemical co-tracers could be added during the manufacturing process to chemical substances which would make it possible to identify the point of origin of the chemicals.

This system could not rely solely on state-to-state negotiation. Ideally, the system would enlist the cooperation of suppliers and consumers alike to make transfers of goods and technologies far more transparent. As has been increasingly the case with arms control negotiations, at the least the relevant producers would have to be willing participants. And because such a vast range of goods and substances are now relevant to proliferation and toxification, a very significant proportion of the world's economic actors should be included.

While only a few very large firms have the resources to maintain control of their hazardous or dual-use products throughout their life cycles, information-revolution technology is making it feasible for a wide range of producers to monitor where those products go. With currently available or easily developed technologies, for example, miniature computerized tracking devices could be attached to virtually any product. This regulation by transparency would permit most economic activities to take place unhindered, but would require that they be conducted in a way that is readily monitored. Producers would be responsible for recording what hazardous constituents or dual-use technologies are contained in their products and

where they go. Such transparency would make it possible to detect early efforts to acquire weapons capabilities or to dump large quantities of hazardous substances without interfering with legitimate trade. It would also greatly facilitate pollution prevention.

It requires a change of mindset to recognize that producers have an obligation to provide information concerning the contents of their products, the uses to which their products are put and the ways in which their products are disposed of. It is this normative change that will be necessary for a transparency-based approach to work. Encouraging precedents provide hope that such a norm change is not unfeasible. Nuclear power producers have long recognized a special responsibility to account for their highly dangerous materials. Chemical producers have taken some steps down this road as well, as evidenced by the Chemical Manufacturers' Association's strong support for the highly intrusive verification provisions of the Chemical Weapons Convention. As in these cases, producers can recognize that effective and reasonable regulation of the hazardous materials they use can stave off public demands for harsher regulation later on. Producers in countries that are particularly likely to impose national regulations may support international regulation as a means of levelling the economic playing field for themselves.

Indeed, the CWC provides a most compelling example of the possibilities of transparency. Any regime of reasonably effective constraints on chemical weapons capabilities requires an unprecedented degree of transparency simply because the substances at issue are ubiquitous. The same chemicals that have revolutionized agriculture and medicine in this century can be used to make chemical weapons. Because these substances are so widespread and so thoroughly integrated into the fabric of the international economy, with a few exceptions they cannot simply be banned. Instead, the verification net must be cast both wide and deep, covering an enormous range of chemicals and imposing stringent verification requirements.

The CWC divides chemicals into three categories known as 'schedules'. Each category is subject to different verification provisions. Schedule 1 chemicals are either directly usable as weapons or easily transformed into weapons, and have few if any other uses. Each party is allowed to maintain one small-scale production facility to conduct medical, pharmaceutical, and protective research with Schedule 1 chemicals, stockpiling a total of no more than one ton of these substances.[18] Such facilities will be subject to monitoring and on-site inspection as deemed appropriate by the Organization for the Prohibition of Chemical Weapons, the body established by the Convention to implement its terms.[19] Schedule 2 chemicals are generally precursors to Schedule 1 substances or are otherwise toxic, but

have some recognized limited commercial uses. Facilities producing Schedule 2 chemicals will be subject to inspection if their production levels exceed certain thresholds.[20] Schedule 3 substances are those that can directly be used as chemical weapons or are precursors to Schedule 1 or Schedule 2 chemicals, but are produced in large commercial quantities. Again, facilities that produce these substances in sufficiently large amounts will be subject to regular inspection.[21] In addition, under certain conditions there can be very short notice challenge inspections 'of any facility or location in the territory of or in any other place under the jurisdiction or control of any ... state Party'.[22] These will take place according to a system of 'managed access' intended to allow states to protect sensitive national security or commercial proprietary data, while enabling the inspectors to determine whether the convention has been violated.[23] Despite the intrusiveness of these inspection requirements, the US manufacturers of the chemicals covered by the treaty, who were deeply involved in the negotiations, have been among its strongest supporters.

Centralized Control?

Clearly, states must play a key role in establishing a transparency-based system. Indeed, one way to proceed would be to create a centralized international system. The information from monitoring systems would be recorded in an international registry that would note the producer, the consumer, and the end use of a wide range of goods and substances. On the proliferation side, such a registry could then be used to determine whether an importer was attempting to acquire a surreptitious weapons capability a piece at a time, as Iraq so successfully did prior to the Gulf War. With regard to toxification, the registry would enable governments to track concentrations of hazardous products and emissions, information that could prove invaluable as more becomes known about the effects of currently untested chemicals and their interactions. Information in the registry would be subject to verification by national inspections, or the information provided by self-reporting could be gathered and to some degree verified by an international institution.

This transparency would bolster the effectiveness of a denial strategy, making any export-licensing system far more effective and efficient. Export licenses for dual-used goods and technologies could be denied if a suspicious pattern were detected long before a full weapons capability could be developed.[24] The centralized system would provide a valuable database and could allow states to coordinate their exports *de facto*.

But, as described above, a denial strategy can at best play only a small part in controlling proliferation and toxification. The centralized use of the information gathered through required transparency may improve the

effectiveness of the denial strategy, but not enough to overcome its fundamental flaws. Furthermore, a proposal to establish another bureaucratic layer regulating international trade or national economic activity is unlikely to meet with a warm response anywhere.

Moreover, efforts to establish and maintain the registry could be fatally undermined by the free-rider problem, as the example of the current effort to expand the scope of multilateral nuclear safeguards illustrates.[25] Following the revelations about the extent of the clandestine Iraqi nuclear programme that ensued in the wake of the Gulf War and the concerns over the North Korean programme, the International Atomic Energy Agency (IAEA) adopted voluntary transparency measures to increase information about its members' nuclear programmes. A more radical proposal to increase the effectiveness and efficiency of its safeguards system, however, is running into a problem all too familiar to international institutions: no one wants to pay for it. In brief, as the IAEA Board of Governors has debated how to go about implementing improvements in the safeguards system that would cost the IAEA itself money, almost all members have argued in favour of the improvements. However, the members all seem to want someone else to bear the cost. While all states, other than those that hope to gain a surreptitious nuclear weapons capacity, would benefit from the existence of a more reliable centralized system of gathering information about the nuclear programmes of most of the world's countries, each state recognizes that others have that interest and therefore hopes that the others will pay the costs: the classic free-rider problem.

A Decentralized Approach

Transparency could be used quite differently, however, in ways that would avoid the free-rider problem and would help to compensate for the difficulties of the denial strategy. This alternative would rely on the revelatory power of transparency. Most firms do not seek to contribute to proliferation or toxification. They often do so out of ignorance or competitive pressures. Many companies have little idea where the various hazardous constituents of their waste streams originate and have even found that they can significantly cut costs of production and waste treatment by monitoring their own materials flows more closely. Even more important may be the role of public pressure, a highly effective means of inducing behavioural change among firms.

There are striking examples beginning to emerge in the environmental arena of transparency-based approaches to environmental protection. Until quite recently, American environmental regulation has concentrated more on process than result. It was very difficult and expensive to go out into the field and measure who was emitting what, and even harder to understand

exactly what the environmental consequences of various emissions were. Instead, regulators focused on forcing companies to change their industrial processes, to replace equipment known to produce a lot of pollution with equipment known to cause less pollution. When the Environmental Protection Agency (EPA) goes out into the field, it does not measure pollution around a facility. Instead, it checks to see whether the facility has the permitted equipment and industrial processes in place.

No one has ever thought this was an ideal approach. It is bureaucratic and inflexible. Two alternatives are emerging, both of which rely heavily on the power of information to spur public – not governmental – action. In the first, the government simply requires firms to provide information on emissions or products containing hazards. In the second, non-state actors take it on themselves to use emerging technologies to monitor toxic emissions.

The Right to Know

A decade ago, the United States Congress passed a law, The Emergency Planning and Community Right to Know Act of 1986, requiring manufacturers to report annually to the United States Environmental Protection Agency on the quantities (over a baseline amount) of certain chemicals they have released into the environment or transferred to another facility.[26] That information is compiled in a database called the Toxics Release Inventory (TRI). In addition, a report must be made every time any quantity of hazardous waste greater than a set amount is released. Hazardous waste is waste containing any substance on a list maintained by the Environmental Protection Agency.

The TRI is far from perfect. It reportedly suffers from serious under-reporting and other inaccuracies. It covers only chemicals already known to be toxic, and a fierce political battle is currently raging over EPA's efforts to expand the number of chemicals listed. Yet it has had a dramatic and largely unexpected impact, reducing the emissions of the reported chemicals at the facilities covered by TRI by 44 per cent since 1988, while production of those chemicals rose 18 per cent.[27] In some cases, companies acted to revise their production processes and cut down on emissions because their reports made them aware of the money they were losing through unnecessarily wasteful production processes. In others, the motivation came from the desire to avoid suffering adverse publicity and angering local communities, who were not pleased to learn what was being dumped on them. This has occurred purely through the revelatory effect of the transparency requirement. The law imposed no new limits on the quantities of chemicals that could be released. It merely required companies to announce publicly how much they were in fact releasing.

As is so often the case, while the federal government was acting at the national level, the state of California was going further. In 1986, the same year that the TRI legislation was passed, California voters overwhelmingly approved an initiative called the Safe Drinking Water and Toxic Enforcement Act, better known as Proposition 65.[28] Under this law, the state publishes a list (updated annually) of chemicals known to the state to cause cancer, birth defects or other reproductive harm. Over 550 such chemicals were listed as of 1996. Once a chemical is listed, any business that knowingly exposes anyone to a listed chemical must provide a 'clear and reasonable' warning, through such means as labelling products, posting signs at the workplace, or publishing notices in a newspaper.

The consequences of Proposition 65 have been as dramatic as those associated with the TRI. Businesses have gone to great lengths to avoid having to give warnings that they are exposing their customers or employees to toxic substances. With no new bureaucracy or enforcement mechanisms, air emissions of some listed chemicals have fallen significantly. Businesses have reformulated production processes and products so that listed chemicals are no longer used: trichloroethylene is no longer used in most correction fluids, toluene has been removed from many nail care products, and foil caps on wine bottles no longer contain lead.

Clearly, the right-to-know approach would not by itself resolve the problem of proliferation. Some sellers and buyers would still have an incentive to conceal what they are doing. Yet the approach would represent a major step in the right direction by making transparent the vast sea of legitimate transactions within which proliferation efforts can currently hide.

Private Action

Surprisingly little is actually known about the quantities of toxic emissions coming from specific facilities. Other than the TRI reports, there are no reporting requirements, and even the TRI reports are not verified through independent measurements. Until recently, the only way to determine how much of a given substance was being emitted by a given facility at a given time was to take air samples back to a laboratory for testing. This left little scope for non-governmental actors, including local community groups, to monitor potential polluters in their midst. Now, the necessary monitoring technologies are becoming available and sufficiently inexpensive that they can be used by non-governmental organizations. For example, optical remote sensing systems that can monitor the emissions of specific pollutants from individual facilities are coming on the market.

Some of these systems are being used by community groups to keep a wary eye on facilities in their neighborhoods. For example, in California a major chemical disaster took place at the Unocal refinery in Rodeo in

August–September 1994. Over the course of sixteen days, 125 tons of caustic catalyst, including heavy metals and organics, sickened 1500 people in the community, some of whom suffer lingering health effects. In response, Communities for a Better Environment, a California non-profit organization, and local citizens obtained an infra-red optical remote sensing system (an R&D model provided by a vendor at a nominal cost), to take on the road to Bay area communities downwind of Unocal and other refineries.

Applying Transparency

These environmental cases in the United States may provide the basis for new thinking about the appropriate roles of governments and other actors in addressing the increasingly diffuse threats of proliferation and toxification. As they suggest, relying solely on the revelatory power of transparency can significantly affect the behaviour of businesses at relatively low cost to the governments, while permitting businesses a great deal of flexibility in finding the most efficient means to reduce or eliminate social harm.

There are several advantages to requiring the public provision of information as a means of controlling the undesirable consequences of legitimate economic activity. Firms that are unwittingly contributing to problems would have the information necessary to stop. Firms would become far more subject to public pressure. And perhaps most important, the transparency-based system would isolate the true problem cases: the firms, states, and groups that are up to no good would find it much harder to take cover in the legitimate economy.

It is not utopian to think that such information would motivate substantial changes of behaviour on the part of business even in the absence of public pressure. Examples abound of companies instituting significant changes on environmental grounds even in the absence of current or impending legal requirements to do so. The collaboration between McDonald's and the Environmental Defense Fund to reduce the use of harmful packaging such as Styrofoam is merely one of the better known cases. In one extreme example, Ray Anderson, the CEO of a carpet-tile manufacturer called Interface, was galvanized into action upon realizing that his own company's business was environmentally unsustainable. The company is now investing heavily in radical energy efficiency, using renewable energy sources, and attempting to produce zero waste. In the most challenging effort, the company is now proposing to lease rather than sell its carpet tiles. When the tiles wear out, the company will take them back and recycle them – a substantial change in usual business practice.[29] Firms might welcome requirements for transparency if by complying with such requirements they could shield themselves from legal liability for unwittingly selling materials to proliferators.

Nonetheless, it is likely that the more profound effect of requiring the release of information comes from the force of public opinion, and here the decentralized approach may have significant benefits. As Emily Goldman argues elsewhere in this volume, compliance on the demand side of a centralized transparency-based regime may prove very difficult, because potential proliferators may perceive their interests in ways that make proliferating more attractive than analyses of economic development needs or military requirements would lead outsiders to assume. If indeed, as she says, the goal of proliferators is to demonstrate sovereignty, the monitoring and enforcement needs of a centralized transparency-based system may be even more daunting than they initially appear. If so, the decentralized approach proposed here becomes even more attractive by comparison. Not only could it greatly increase the numbers of eyes and ears engaged in monitoring, but it could also add a much-enhanced element of social disapproval to the available punishments for buyers and (more likely) sellers of misdirected dual-use technology. Companies can be fined by governments. They can be shamed by their fellow citizens.

As has generally been the case with the information provided by the TRI, non-state actors, particularly non-governmental organizations, will have a crucial role in this decentralized use of transparency. They have the capacity to monitor and advocate action based on information about the behaviour of firms, and indeed this is often their *raison d'être*. Non-governmental organizations dedicated to specific issues often have resources to apply to monitoring that overstretched governments do not, as the frequent lawsuits brought by US NGOs against corporate polluters demonstrate. Information and analysis would not necessarily flow only in one direction, of course. Firms would obviously have an incentive to monitor whether their competitors' products are being used in socially undesirable ways. But the disinterested analysis of NGOs motivated by the promotion of socially desirable behaviour rather than the bottom line would have far greater credibility with the general public.

Problems

The idea of using public transparency as a (partial) means of coping with the growing dangers represented by proliferation and toxification raises some knotty problems. First is the issue of what goods and substances should be covered by the requirement to provide information, and what information should be provided. Businesses are likely to be averse to requirements that are as broad as the numbers of potential dangers would indicate. Both the Toxics Release Inventory and Proposition 65 are restricted to 'listed' chemicals. And despite the Chemical Manufacturers' Association's (CMA) claims of support for the TRI, when the Environmental Protection Agency

tried to double the number of chemicals listed, CMA sued to stop it. (CMA lost the suit, but the case is now on appeal.)

Another problem is the issue of the capacity of some societies to take advantage of the information provided, or even to provide the information. Transparency, to be effective, requires a fair degree of technical and managerial competence widely distributed among the personnel of the state, business managers, and non-governmental organizations. It only works if the necessary information really gets out and if the civil society is able to organize and act in response to the information. This capacity is currently lacking in many parts of the world. Thus, the use of transparency as a means of addressing proliferation and toxification would require assistance in building such capacity.

At the international level, one environmental agreement provides an example of the difficulty of relying on transparency in lieu of regulation. The Basel Convention on Transboundary Hazardous Waste requires shippers of hazardous waste to receive the prior informed consent of any state to which it wishes to export such substances. Some ninety developing countries have signed a protocol noting that they do not wish to receive any hazardous wastes. But this approach is seriously flawed. Few developing countries are in a position to enforce the ban. There are no monitoring or enforcement provisions. In any case, the convention only deals with hazardous materials during one portion of their life cycle, and ignores them when they are serving as (no less hazardous) inputs or products.

A third problem has to do with the difficulty of implementing the transparency approach in a coherent fashion across the board, given the bureaucratic division of decision-making. In the United States, monitoring and control of toxic substances, for example, tends to be divided up bureaucratically according to the medium – air, water, or soil – in which the hazard is found, with the result that incentives are created for cross-media shifting of pollutants rather than their actual control. Similarly, non-proliferation efforts are divided into several different issue areas (biological weapons, chemical, nuclear, and delivery systems such as missiles) with little coordination among the regimes. This division is mirrored in the domestic bureaucratic structure of the United States, rendering it unlikely that anyone in the government will take the lead in creating a monitoring system that provides a comprehensive overview of the problems.[30]

Fourth, as mentioned earlier, some actors will not want to cease their proliferation behaviour, and transparency imposes no active constraints against them. Depending on the adequacy of the transparency regime, a voluntary transparency system could create false confidence and undermine the goal of non-proliferation. Moreover, if the price for international agreement on transparency were to be increased access to dual use materials

and technologies that would otherwise have been at least somewhat constrained by denial measures, the transparency approach might actually make the situation worse.[31]

Conclusion

Once it is widely recognized that proliferation and toxification represent significant and growing dangers, governments will find themselves under increasing pressure to do something about them. Neither the denial strategy nor after-the-fact countermeasures will suffice. This is not to say that the transparency-based approach advocated here is a panacea. A decentralized system that relies on the revelatory power of transparency certainly will not resolve all the dangers of proliferation or toxification. On the proliferation side, the increased requirements for transparency on the part of firms should complement, not replace, the array of measures in place.[32] For the problem of toxification, on the other hand, where there are very few existing agreements, international negotiations may be needed in addition to the transparency measures advocated here. A permissive but transparent system is likely to be far more cost-effective for governments as well as far more appealing to the private sector than would be the expansion of the more heavy-handed approaches to which governments are accustomed.

The transparency system would require willing compliance with demands for information that has long been viewed as legitimately secret. Acceptance of a norm of transparency has already occurred to a degree unpredictable – indeed, unthinkable – a decade ago, both in arms control between sovereign states and, within the United States, regarding the environmental impact of certain economic activities. But many questions remain concerning how a transparency-based regime could balance legitimate rights of privacy and secrecy against societal needs to monitor potentially dangerous goods and technologies and how the necessary broad consensus could be formulated.

The transparency system calls for a substantial change in norms about the responsibilities of producers of legitimate civilian goods. The new norm would require that ignorance no longer be bliss – namely, that producers could not claim lack of knowledge about the harm their products or production processes could do, because they would be legally required to have and share that knowledge. Such a norm change may require altering a mindset that sees transparency as a public good – that is, as a social benefit that everyone wants to receive but to which no one perceives an individual incentive to contribute. Transparency has private benefits to an actor that provides information about itself. Transparency can allow an actor to reassure others about its intentions and performance, thus staving off more

coercive regulation or the possibility of a spiral into a security dilemma. Requirements for transparency can enable firms to discover useful information about themselves without undergoing expenses to which competitor firms are not subject. US leadership will be essential to the creation of this system, and US businesses, who are already subject to some degree of transparency-based regulation, may strongly support the extension of the approach as a means of ensuring a level playing field.

The centralized registry may prove to be the ultimate goal, if all the hurdles can be overcome. But even if they cannot, the provision of information to the general public is in and of itself a useful tool. The TRI and Proposition 65 are good models, far from perfect but also clearly better than the alternatives. Transparency has advantages beyond the confidence-building role familiar from arms control, advantages that will apply both to proliferation and to toxification, or indeed to any issue area where ignorance, intentionally or not, can cause harm.

A fully effective set of policies to stem proliferation and toxification will have to include regulatory measures in addition to transparency, to deal with actors who are not susceptible to the shaming effects of publicity. But transparency alone has dramatic effects and should be pursued even if an effective and coordinated set of policies is not yet feasible. Indeed, transparency, by isolating the bad apples, may contribute to making that wider strategy more acceptable and easier to implement.

NOTES

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1. There is a rapidly expanding literature on the role of norms in international security. See, for example, Peter Katzenstein (ed.), *The Culture of National Security: Norms and Identity in World Politics* (New York: Columbia University Press, 1996).
2. For a detailed discussion of the norm of transparency in international security, see Ann M. Florini, 'Transparency: A New Norm of International Relations' (Ph.D. diss., University of California, Los Angeles, 1995).
3. Janne E. Nolan (ed.), *Global Engagement: Cooperation and Security in the 21st Century* (Washington, DC: The Brookings Institution, 1994). See particularly the chapter by Antonia Handler Chayes and Abram Chayes, 'Regime Architecture: Elements and Principles', pp.65–130.
4. I am not contending that environmental toxification is necessarily a 'security' issue along the lines of proliferation, only that it poses a demonstrable danger to human well-being on a large scale. For good overviews of the voluminous literature and continuing debate on environment and security, see the annual Reports of the Environmental Change and Security Project, Woodrow Wilson International Center for Scholars.
5. For a discussion of how and why norms change over time, see Ann Florini, 'The Evolution

of International Norms', *International Studies Quarterly*, Vol.40 (1996), pp.363–89. For specific examples of the evolution of norms other than transparency, see: Ethan Nadelmann, 'Global Prohibitions Regimes: The Evolution of Norms in International Society', *International Organization*, Vol.44 (1990), pp.479–526; and Richard Price and Nina Tannenwald, 'Norms and Deterrence: The Nuclear and Chemical Weapons Taboos', in Peter J. Katzenstein (ed.), *The Culture of National Security: Norms and Identity in World Politics*, pp.114–52.

6. I am indebted to the participants in The 2050 Project, particularly John Steinbruner and Allen Hammond, for the general approach and some of the specific information contained in this section.
7. United Nations Population Fund, *The State of World Population 1995* (New York: UNFPA, 1995), pp.16–17.
8. United Nations Population Fund, *The State of World Population 1996* (New York: UNFPA, 1996), p.1.
9. United Nations Population Fund, *The State of World Population 1996* (New York: UNFPA, 1996).
10. Ted Robert Gurr, Barbara Harff, Monty G. Marshall, and James R. Scarritt, *Minorities at Risk: A Global View of Ethnopolitical Conflicts* (Washington, DC: U.S. Institute of Peace Press, 1993).
11. Martha Finnemore, 'Norms, Culture, and World Politics: Insights from Sociology's Institutionalism', *International Organization*, Vol.50, No.2 (Spring 1996), pp.325–47.
12. Jessica Mathews, 'Power Shift', *Foreign Affairs*, Vol.76, No.1 (Jan./Feb. 1997), pp.50–66.
13. Paul Kennedy, *Preparing for the Twenty-First Century* (New York: Random House, 1993); Thomas Homer-Dixon, 'The Ingenuity Gap: Can Poor Countries Adapt to Resource Scarcity?' *Population and Development Review*, Vol.21, No.3, (Sept. 1995), pp.587–612.
14. The rich countries could also face internal threats to their security, a problem of particular salience for the United States. At least some of the conditions prevailing in the poor countries of 2025 may be mirrored in America. If income disparities continue to grow, if urban centres continue to decay into crime-ridden islands of ignorance and despair, if America becomes divided into a society of haves and have-nots, then we may see a return to the riots and assassinations of the 1960s – this time with assault weapons, truck bombs, and possibly even chemical and biological weapons.
15. William J. Perry, 'Desert Storm and Deterrence', *Foreign Affairs*, Vol.70, No.4 (Fall 1991), pp.66–82.
16. Cheryl Simon Silver and Dale S. Rothman, *Toxics and Health: The Potential Long-Term Effects of Industrial Activity* (Washington, DC: World Resources Institute for the 2050 Project, 1995), p.6.
17. Amy E. Smithson (ed.), *The Chemical Weapons Convention Handbook* (Washington, DC: The Henry L. Stimson Center, Sept. 1993).
18. *Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction* (Washington, DC: United States Arms Control and Disarmament Agency, Oct. 1993), Verification Annex, p.125 (hereafter Chemical Weapons Convention).
19. Ibid., p.129.
20. Ibid., p.134.
21. Ibid., p.141.
22. Chemical Weapons Convention, Article IX (8), p.33.
23. Chemical Weapons Convention, Verification Annex Part X, 'Challenge Inspections Pursuant to Article IX', pp.150–61.
24. In 1991, Germany established a national system intended to accomplish this purpose, called Kontroll bei der Ausfuhr (KOBRA). It was an on-line data collection system available to all customs offices in Germany. See Wolfgang H. Reinicke, 'Cooperative Security and the Political Economy of Nonproliferation', in Nolan (ed.), *Global Engagement*, p.183.
25. The following is taken from Stephanie Phillips, 'IAEA Safeguards: A Classic Public Goods Problem' (unpublished manuscript, Jan. 1997).
26. *Emergency Planning and Community Right-to-Know Act of 1986*, 42 U.S.C. sec. 11001–11050.

27. 61 Fed Reg. 51322 (Oct. 1, 1996). Reporting actually began under TRI in 1987, but because of problems in the reporting the first year, EPA uses 1988 as the baseline year for comparisons. The Chemical Manufacturers' Association uses the 1987 data as the baseline, and reports a 49 per cent decrease in emissions since then. 'Responsible Care Communication' Chemical Manufacturers Association, March 10, 1995, URL: http://es.inel.gov/techinfo/facts/cma/cmacommo/html.
28. The following information is taken largely from 'Proposition 65 in Plain English!' URL: http://www.calepa.cahwnet.gov/oehha/docs/p65plain.htm.
29. Donella Meadows, 'A CEO Responds to a Spear through the Heart', *Valley News*, Lebanon, New Hampshire, 28 Nov. 1996.
30. Nolan, 'Cooperative Security in the United States', pp.507–42, esp.pp.531–5.
31. I am indebted to Nancy Gallagher for this point.
32. These include, on the proliferation side, the International Atomic Energy Agency, the Non-Proliferation Treaty, the Chemical Weapons Convention, the Missile Technology Control Regime, and the United Nations Register of Conventional Arms, all of which serve important roles and should be maintained.