

Regional Environmental Impacts of NAFTA on the Automotive Sector*

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NAFTA and the North American Auto Industry

To most casual observers, the North American Free Trade Agreement (NAFTA) is a set of rules for tariff and border barrier elimination, and a formidable array of institutions for dispute settlement and management through which major differences between and among the United States, Canada and Mexico get resolved once acute conflict erupts. However behind this high profile edifice and the dramatic disputes within it lie NAFTA's invisible system of governance, based on its co-operative instruments for regulatory communication, capacity building, convergence and coalition-building (Rugman and Kirton 1998; Kirton and Fernandez de Castro 1997). These institutions constitute a core part of a new environment of "complex institutional responsiveness", based on new forms of business organisation, government regulatory behaviour and institutionalised international governance (Rugman et al 1999; Rugman and Kirton 1999). For firms, governments and environmental non-governmental organisations (ENGO's) alike, they offer improved rules-based mechanisms to combat environmental regulatory protectionism when conflicts erupt. More importantly, they provide instruments of proactive co-operation, aimed at reducing regulatory barriers before conflicts arise. In doing so they create a wider regulatory regime that directly strengthens firms competitiveness through international commerce, while simultaneously protecting and enhancing the natural environment.

The activities of firms and governments in the North American automotive industry in the leadup to, and during the first five years of operation of, NAFTA show many of these new co-operative instruments being created and employed. The variety and vigour with which automotive firms are mobilising these instruments reflect the fact that the conditions of complex institutional responsiveness are most advanced in this sector. The "big three" North American assemblers have built on the highly integrated regional production system they first constructed in the 1960s across the U.S.-Canadian border, to move towards partnerships on a global scale, as the 1998 Chrysler-Daimler Benz merger shows. It is in this industry that many of the new techniques of just-in-time inventory, lean production, and tiering of the parts chain were first pioneered.

Automobiles, and their impact on the atmosphere through emissions from their operation, have long been at the forefront of the move to more stringent environmental regulation in North America, Europe and Asia (Vogel 1995; Vogel and Rugman 1997). As the dominant industry

sector in the North American manufacturing economy, the automotive industry has also been the subject of many of the most important changes in the new NAFTA regime (Berry 1995; Weintraub and Sands 1998).

The firms in the North American automotive industry have focused their energies in the post-NAFTA era on the highly co-operative end of the array of instruments that the environment of complex institutional responsiveness offers. Firms have not primarily looked to their national governments to settle, manage or prevent their international disputes, nor even to NAFTA's intergovernmental institutions to assist in this process or lead the way in regulatory convergence. Rather, the firms have preferred anticipatory private sector action to adjust in advance to NAFTA's environmental requirements, and to manage the continuing political debate over NAFTA in subsequent years. They have relied on private sector processes for transborder environmental regulatory convergence, both within individual MNEs operating throughout the region, and on an industry-wide basis across the Canada-U.S. border. Finally they have emphasized high level regulatory convergence aimed at pollution prevention and total systems integration rather than reactive environmental control or remediation on an uncoordinated basis within segmented industry sectors. Moreover, despite NAFTA's protectionist rules of origin for automotive production, and the resulting fear that industry would create a "fortress North America" behind these barriers, the thrust toward high level environmental regulatory convergence has been outward looking, with a single global regime as the industry goal. The high and rapidly increasing degree of North American industry integration has thus been used as a platform to seek broader multilateral standards.

Despite fears that NAFTA would generate a regulatory "race to the bottom", auto firms have not moved to Mexico to produce and operate cars with lower environmental standards. Nor has producing throughout a seamless North America to meet the existing, highest level California environmental standards been their core strategy. Rather they have supported the flexible, comprehensive and integrated, environmental standards that complement the multilateral standards of the fully global market place. The North American automotive industry is thus moving to pioneer, in their corporate and political actions, strategies that take account of the realities of a world of complex institutional responsiveness.

The North American automotive industry also provides clear evidence that these new instruments are not only available to firms but that their use can produce successful, competitiveness-enhancing outcomes. An industry once faced with the bankruptcy of major firms such as Chrysler, and antiquated production techniques, as overseas rivals raised the prospect of global overcapacity, had by the late 1990s met the challenge of Japanese imports and produced a vibrant sales performance within North America and abroad. They did so notwithstanding the fact that environmental equipment, largely mandated by regulations, cost an estimated average of U.S. \$ 2,000 per vehicle, with a further U.S.\$ 200. set to come.

In the realm of environmental regulations the U.S.-owned automobile firms have encouraged the Mexican government since 1993 to adopt vehicle emission and ambient air quality standards closely modeled on those of the United States. They encouraged the Canadian government in 1997 to announce new regulations to match the U.S. standards for emissions and on-board diagnostics. They have thus far contained the potential fragmentation of the market arising from

a proliferation of diverse sub-national state and provincial emission standards. They have led the Canadian government to ban the fuel additive Methylcyclopentadienyl Manganese Tricarbonyl (MMT) (following the U.S. lead years before), to have the Mexican government initiate studies of its harmful effects and to prevent the U.S. oil industry from using the additive, even though U.S. judicial action has once again made it legal.

However, despite this success in the practice of complex institutional responsiveness, firms in the North American automotive industry have yet to fully exploit the opportunities provided by the NAFTA regime. In particular, the firms have been slow to mobilise the power of the NAFTA institutions to enhance their global competitive position, or even to successfully manage regional disputes such as the Canadian government ban on MMT (Soloway 1999a, 1999b). This reluctance to regard governments as partners rather than antagonists, or to form Japanese-style or European-type alliances with governments, has impeded the ability of automobile firms to develop flagship relationships across five partner networks (Rugman and D'Cruz 1996). To be sure, there are several Canadian success stories, led by Magna, who have formed modified flagship relationships with the "big three" and their tier one suppliers. Moreover, small Canadian environmental services firms have been able to exploit firm-specific, locational, taxation, and regulatory advantages to assist the US-based "big three" meet their domestic environmental regulatory requirements at much reduced cost. However many smaller Canadian parts firms have been slow to move into the new, globally-oriented production system.

The new era of global competition requires a more comprehensive response than that exhibited to date. Governmentally -- secured regulatory convergence, even as a codification of regimes pioneered by private sector processes, offers the certainty and sanctions that come with the full force of law. Inter-governmentally agreed regulations through the NAFTA institutions would provide firms with a stronger, region-wide home base from which to compete globally. And a NAFTA-based, governmentally backed coalition would strengthen the hand of North American firms in the looming multilateral debates to define the regulations for the world cars of the future. The need to move in these directions is compelling as global overcapacity in the auto industry emerges, and as the cycle of booming demand in North America in the 1990s approaches its end.

The NAFTA Environmental Regime

There are three broad forces that affect the environmental regulation and performance of the North American automotive industry in the NAFTA era.¹

The first is an intensified move to full scale rationalisation and integration of the industry on a regional rather than national basis, with a corresponding production incentive to have a uniform set of relevant environmental standards in all three countries and across all their subfederal jurisdictions.² The second is a new wave of high level regulatory harmonisation. Here NAFTA's consciousness-raising, institutions, dispute settlement mechanisms and incentives have prevented any regulatory 'race to the bottom' but instead inspired a 'push to the top', driven and guided largely by the anticipatory and voluntary efforts of industry and its stakeholders. The third is the rapid spread of this push to high-level harmonisation from the assembly to the original

equipment manufacture (OEM) parts and then aftermarket sectors, and from manufacturing standards, to fuel standards and then inspection, maintenance and other operating standards.

First, NAFTA is leading to the full integration and rationalisation of the North American auto industry on a regional rather than national basis. It is doing so by absorbing the historically protected Mexican market into the long integrated U.S.-Canada production system, and by drawing the latter ever more tightly together. As one leading analyst put it: "It is now appropriate to talk of a North American auto market".³ Although delayed by the 1995 peso crisis in Mexico and the paucity of new "big three" investment in Mexico in NAFTA's first few years, this process of full rationalisation is clearly proceeding. With it, and the move to just-in-time inventory and the tiering of the parts chain, comes an increasing interconnection and rationalisation that will lead industry to seek and secure from governments tighter regionally harmonised environmental standards.⁴

Second, the environmental consciousness unleashed by NAFTA is leading to a new wave of high level harmonisation of environmental and safety regulations. There is an emerging North American community beyond industry whose citizens in the partner countries are calling for more open, environ-mentally-responsible practices on the part of actors in all three countries. Canada as well as Mexico is rapidly moving up to, and occasionally ahead of, the U.S.-wide and even pathfinder Californian level of environmental regulation. In contrast to those who feared that NAFTA would lower standards, there are demands for, and the supply of, the latest generation of automotive emission, fuel technology, and inspection and maintenance standards.

Third, this high level environmental harmonisation is extending from original equipment manufacturer (OEM) assemblers and parts producers to the fuels and aftermarket sectors. Thus, there is a slowly emerging total systems approach to environmental protection that includes consequential action on fuels and fuelling, inspection and maintenance, pollution prevention, and international co-operation.

The centrality of the automotive industry to the core environmental challenges of NAFTA are clear. Cars and trucks are the single leading source of air pollution on the North American continent. (Marchi 1997) In highly populated and industrialised areas such as southern Ontario, Canada's heartland, auto emissions account for up to 80% of benzene, 60% of nitrogen oxides, 55% of volatile organic compounds, and 4% of sulphur oxides released into the air. In Canada as a whole, a full 80% of this automotive pollution comes from only 20% of the vehicles -- the older, poorly-maintained ones, as each such car or truck produces the same amount of pollution as 25 new vehicles.

The Environmental Regulatory Regime Before NAFTA

Prior to NAFTA, the United States, Canada and Mexico possessed a substantially integrated automotive industry (for assemblers and original equipment manufacturers (OEM) parts producers). Yet it contained as well a substantially varying set of environmental regulations and enforcement patterns. The result was that larger, U.S. based and owned manufacturers generally applied higher U.S.-level standards in Canada and Mexico in their ongoing industrial practices. They often sought and often secured from these governments a common set of standards based

on those prevailing in the much larger U.S. market. However several factors created an inconvenient and prospectively expanding, more costly differentiation. These factors included the different standards-setting systems in the three countries, production in Mexico for the domestic Mexican market, separate high California standards in the United States, and the move toward more specific state and provincial systems.

The Foundation of Regulatory Uniformity

Before NAFTA took effect, there was considerable regulatory uniformity across the United States, Canada and Mexico. Proximity, openness, a common geography (relative to Europe and other regions), the sheer size of the U.S. market and policy instruments such as the 1965 Canada-U.S. automotive pact, the 1982 U.S.-Mexico La Paz Agreement, and the 1990 Canada-U.S. Air Quality Agreement, had produced a substantial degree of environmental convergence relevant to the automotive industry. This convergence was most advanced in the case of the highly contiguous and long highly integrated Canada-U.S. relationship (Molot 1993). However the process also developed quickly between the United States and Mexico as the latter country opened to trade during the 1980s and saw automotive products replace oil as its dominant traded good with the United States.

In practice, the sheer size and integrated nature of the automotive industry led to a high degree of environmental management and international convergence on the part of the major assemblers and parts manufacturers. In both their demands on government, and their adoption of internal environmental management systems, pollution control equipment and technology, these large firms sought and largely secured uniform and high level standards. They did so in response to: corporate conviction; customer demands; concerns about corporate reputation; insurance and liability considerations; public pressures; and anticipated regulatory developments in all three countries. This was especially true in Canada, which, led by Ontario, sent 85% of its automotive production to the United States and hosted almost 20% of continental automotive assembly activity. However the Mexican industry was also substantially integrated with that of the United States. The automotive industry by the 1990s had become the single most important sector in two way U.S.-Mexican trade. Indeed, most of overall U.S.-Mexican trade comes from intra-corporate shipments by the big three (General Motors, Ford and Chrysler) and U.S. parts producers. By 1995 the United States exported \$394 million in vehicles and \$6.7 billion in parts to Mexico, while importing \$7.8 billion in vehicles and \$10.5 billion in parts. (U.S. Commerce 1995; USTR 1997).

Because the auto industry also dominated the three transborder foreign direct investment relationships in the region, and because these links were growing prior to NAFTA, the pressures for regulatory convergence in policy and practice steadily strengthened. This process was reinforced as parts of Canada, notably the lower Fraser Valley and Southern Ontario, began to acquire visible environmental problems similar to those in demographically and industrially dense parts of the United States. Such problems triggered the deep pro-environmental consensus of Canadians to spur their governments and companies to greater action. (Kirton 1994).

Differing Systems and Standards

Yet there remained important differences among the three countries. These arose not only in regulatory levels and particular standards, but more importantly in constitutional and legal approaches to regulation, in federal-subfederal divisions of responsibility, and in testing and certification procedures. In Mexico, power for environmental regulation was heavily concentrated in the federal government, based on a statist regulatory model often applied to national monopoly industry suppliers producing only for a highly protected national market, and unreinforced by voluntary, private sector driven, standards-setting involving environmental NGOs and other stakeholders. In the United States there prevailed a litigation-based regulatory-enforcement approach, with power shared between federal and state governments, and a heavy reliance on voluntary standards setting by thousands of associations outside government (such as the American National Standards Institute). In Canada, where an estimated 70% of responsibility for environmental regulation lay with provincial governments, there flourished an administrative consensus approach. It featured minimum litigation, based in part on multistakeholder-consensus-oriented standards setting, centred in the five major quasi public umbrella standards-setting organisations, operating under the auspices of the Standards Council of Canada.

Beyond differences in government systems, there were three broad economy-based exceptions to the prevailing pattern of high-level, harmonised industry performance. The first was in still substantially protected Mexican industry, and among the smaller parts and aftermarket producers. They faced the additional challenge of integrating into increasingly outsourced but multi-tiered supplier systems. The second came from the fuels sector. Their products were increasingly consequential for the ability of assemblers with fuel-sensitive electronic on-board diagnostic systems to meet higher emissions standards. Yet they wielded greater relative size and influence, regional power, monopoly claims and less modern capacity in Canada and Mexico than in the United States. The third came in operating rather than manufacturing standards. Here the differences among and responsibilities of local authorities were greater, and the temptation to make ad hoc adjustments for protectionist and political purposes more intense.

The Separated Mexican Parts Sector

The largest initial challenge came in the parts and aftermarket sector. Here the unbalanced capabilities across the three countries made it difficult for many firms, especially in Mexico, to match the rising levels of expected environmental performance, even with assistance from the larger firms they supplied.⁵ In particular, Mexican parts producers, which represented almost half the Mexican auto industry, were relatively small in size and lagging in technology.⁶ To survive in an era of NAFTA-intensified regionalisation and increasingly globalised production, these Mexican auto parts firms needed economies of scale, technological infusions, and total quality and environmental management systems. As NAFTA started many started to receive government credits and sought to forge strategic alliances with foreign firms. Particularly among the 100 largest and most dynamic Mexican firms, the process of NAFTA-inspired modernisation began in earnest. Led by the export-oriented engine plants largely established by the Big Five assemblers in northern Mexico in the early 1980s, the parts industry became more export-oriented. The 750 maquiladoras producing auto parts in Mexico, many U.S.-owned and associated with assemblers, expanded their operations. In 1993 there were about 100

international joint ventures in auto parts, bringing in badly need foreign capital and technology.⁷ In the four years to 1993, many Mexican suppliers received awards for reaching international quality standards.⁸ There remained much room for this segment of the auto industry to increase its exports to, and thus competitively move the environmental standards prevailing and coming in the U.S. market. Only 10% of Mexican parts production in 1992 was exported, primarily to the United States.

The second economy-wide exception came in the related sector of fuels. Having done so much to produce automobiles with few emissions, manufacturers had reached the point where their production of "clean cars," replete with reliable onboard diagnostic systems (OBS) for emissions control, required "clean fuels" to function properly. They thus looked to a reluctant gasoline industry to remove such additives as MMT and components such as sulphur, benzene, and olefin, that fouled their OBS and created harmful emissions directly. In this quest for a total systems approach to environmental enhancement, however, difficult issues of inter-industry co-ordination and the regional interests that lay behind it came to the fore.

The third exception came in the slow move to embrace operating standards, such as inspection and maintenance and fuelling procedures, into the total systems approach. Such an extension brought into the mix many new and smaller players, with less experience in adapting to regulation by government. As a result, formidable issues of co-ordination and burden sharing arose.

The Economic Impact of NAFTA on Auto Trade

The integration of the North American automotive industry increased substantially in the years since NAFTA has taken effect (Doh 1998; Ramirez de la O 1998). Total vehicle and parts trade between the United States and Mexico doubled from 1991 to reach \$25 billion in 1995. From 1993 to 1996 U.S. exports of vehicles and parts to Mexico increased 11 percent. U.S. exports of vehicles alone increased more than 500%. As the President's July 1997 report on NAFTA's impact concluded: "...with the growth in U.S.-made vehicle sales to Mexico, the opportunities for sales of U.S. aftermarket parts in Mexico should rise" (USTR 1997:48). Consistent with this view is the fact that U.S. exports of parts themselves were 25% higher in the first quarter of 1997 than in the first quarter of 1993. The U.S. share of Mexico's parts imports rose steadily, from 66.3% in 1993 to 71.7% in 1996.

During the same period, U.S. imports of vehicles and parts from Mexico doubled.⁹ Because U.S. imports of Mexican-assembled vehicles contain more than 50% U.S. made parts, a figure which is rising under NAFTA, there is clearly a trade-induced integration taking place. This will intensify as NAFTA eliminates the previous requirement to use Mexican-made parts. U.S. imports of Mexican parts directly rose 58.4% from 1993 to 1996. The result is a strong NAFTA-produced incentive for parts manufacturers in both the United States and Mexico to meet the highest environmental standards demanded by their customers.

Trade specialisation has not yet extended in a major way to increased foreign direct investment (Kirton 1998). There has thus far been a paucity of new foreign direct investment into Mexico, in part because major companies have been wary of providing evidence to support the 'giant

sucking sound' argument featured so prominently in the initial U.S. NAFTA debate. In the first three years after NAFTA came into force, the big three invested U.S.\$ 39.1 billion in plant and equipment in the United States but less than one-tenth of that amount (\$3 billion) in Mexico. However, even this increased U.S. investment is assisting the process of rationalisation and region-wide uniformity in environmental performance.¹⁰

The impact of NAFTA on the Canadian automotive industry has been more clearly beneficial, as NAFTA built on and reinforced the earlier integration of the 1989 Canada-US Free Trade Agreement (FTA) of 1989 and the Auto Pact before it. (Kumar and Holmes 1998) The cyclical downturn of the early 1990s and the rationalisation pressures of the FTA left the Canadian parts industry in a much stronger position to take advantage of the tiering of the industry and the booming US demand in the 1990s. NAFTA's adjustment of rules of origin requirements further strengthened the position of Canadian located OEMs. As a result the Canadian industry has flourished in the 1990s and done much to propel the economic recovery of Canada as a whole.

The Post-NAFTA Regime

During its first five years, the NAFTA regime has engendered a rapid upward Canadian and Mexican environmental harmonisation based on U.S. standards for automotive emissions and fuel use, the adoption of U.S.-like inspection and maintenance programs at the subfederal level, and the spread of U.S.-pioneered pollution prevention programs to the NAFTA neighbours.¹¹ This process is most advanced in the case of the uniquely interdependent United States-Canadian relationship, but is also evident in the United States-Mexican case. Yet there have to date been very limited moves toward direct, inter-governmentally guided, Canada-Mexico harmonisation or fully trilateral (as opposed to U.S.-centric hub-and spoke) convergence or harmonisation. Moreover the role of the NAFTA institutions and dispute settlement mechanism in the convergence process has thus far been secondary in the core manufacturing and fuels areas of central interest to the automotive industry.

The United States Experience

Air pollution and quality is central to the environmental performance of the North American automotive industry. In the United States, the primary relevant regulatory framework is set by the U.S. Clean Air Act which specifically regulates six elements central to atmospheric pollution -- ozone, particulate matter, nitrogen dioxide, carbon monoxide, sulphur dioxide, and lead.¹² Revisions to the standards take place every five years to account for evolving scientific information.

Despite the enhanced competitive pressures brought by NAFTA, and the advent of a Republican majority opposed to stringent environmental regulations in the 1994 mid-term elections, the United States has continued to increase its environmental standards.¹³ In November 1996, the U.S. Environmental Protection Agency (USEPA) proposed new National Ambient Air Quality Standards (NAAQS) for ground level ozone and particulate matter, based on epidemiological and human toxicological data. Despite considerable criticism, they were adopted in June 1997. The ozone standard will thus rise from .12 ppm measured over one hour to .08 ppm measured over eight hours in 2000 with full compliance coming several years after. (The equivalent 1994

Mexican standard is .11 ppm over one hour per year.) Particulate matter standards will remain for larger particles (PM-10) and be imposed on smaller particles (2.5 microns or smaller), with plans to meet such standards required by 2002. The new standards will push the number of non-attainment areas in the United States from 106 to about 250 counties, with many of the additions coming along the Canada-U.S. Great Lakes border. Municipal authorities in Detroit in particular claimed they were unable to meet such standards without severe economic cost.

Increasing U.S. air quality standards are also affecting the U.S. automotive industry more directly. The EPA moved in 1998 to Tier 2 emission and diagnostic standards and then proceeded, on June 1, 1999, to define the next level to be in force by 2004. The states of Massachusetts and New York have been before the courts seeking to join California in having the right to set their own, higher vehicle emission standards. The move to an integrated, total systems approach has also led to impetus for an increase in fuel standards, as seen in the introduction of a new sulphur standard on June 1, 1999. One sign of the upward trend has been the unwillingness of fifteen U.S. petroleum producers and the State of California to take advantage of a recent administrative law ruling allowing the use of gas additive MMT, which U.S. EPA had banned starting in 1977 and which California still outlaws. U.S. petroleum producers representing over 80% of the market are refusing to use MMT while U.S. EPA tests its health affects.

While rollback has been avoided in fuel standards, forward movement has been more difficult. The U.S. automotive and petroleum industries have combined in a joint study to assess standards for low sulphur gasoline, which (like MMT) threatens major damage to on-board diagnostic systems and thus emissions on vehicles. The automotive industry is calling for a low sulphur fuel standard it knows is compatible with the diagnostic and emissions technology it currently has, with the standards it must meet, and with the capacity of petroleum refiners. It has agreed to the petroleum industries' request to determine if new automotive technologies might permit a less stringent low sulphur standard to be imposed. Yet signs of high level regulatory advance have been evident even here. On June 1, 1999 President Clinton announced that new regulations, to be phased in starting in 2004, would cut US sulphur standards in gasoline from the prevailing national average of 340 ppm to the California standard of 30 ppm. Although the administration gave flexibility to small independent refineries, they set aside oil industry arguments that higher levels should be allowed in those parts of the US where air quality was higher.

This increasingly integrated approach to pollution control is also propelling a spread and rise in automotive inspections and maintenance systems, pioneered by California several years ago. In the face of rising frustration from motorists facing the 'yo-yo' of being forced back and forth between state inspection stations who find them non-compliant and service centres who conduct inadequate repairs, a consensus has emerged that the solution lies in enhanced certification and training among those conducting the repairs. The primary bottleneck is the lack of well-trained and well-paid technicians, amidst the booming California economy (Moore 1997). Yet the spread of such systems to other states also raises costs to consumers and some aftermarket producers.¹⁴

If an integrated approach to automotive emission control requires a lateral link to fuel standards and a forward link to inspection and maintenance, it has also inspired a backward link to pollution prevention in the plants and processes that assemble the vehicles and produce their

parts. In September 1991 USEPA, the U.S. Motor Vehicle Manufacturing Association (MVMA) and the State of Michigan initiated the Auto Industry Pollution Prevention Project (Auto Project) which led to a program to reduce the release of persistent toxic substances into the Great Lakes. This effort built on the work of individual companies following the pollution prevention strategy prepared by the U.S. President's Commission on Environmental Quality.¹⁵

The Canadian Experience

As NAFTA took effect, Canada also moved to higher level environmental standards and a tighter integration with the U.S. policy, regulatory and industry system. Since 1993, Canada has raised its automotive emissions and a few fuel standards to, and in at least one once case beyond, U.S. levels, by explicitly adopting evolving U.S. regulations as the new Canadian standard. It has also assisted the spread of U.S.-pioneered inspection and maintenance and pollution prevention programs.

In spring 1996, Sergio Marchi, Canada's environment minister announced that a priority for his portfolio was the introduction of "new car emission standards, new fuel efficiency rules and new encouragement for alternative fuels".¹⁶ He also promised to follow the Canadian Council of Ministers of the Environment's (CCME) call for Canada to harmonise with anticipated U.S. standards for low emission vehicles or for moving independently if the United States did not proceed. On March 3, 1997 Minister Marchi announced that the federal government was tightening emission standards for cars and trucks, by harmonising in 1998 its regulations with those of the federal government in the United States. This would reduce emissions of hydrocarbons by 30% and of nitrogen oxide by 60%.¹⁷ Canada would also require manufacturers to equip new vehicles in the 1998 model year with diagnostic systems that can monitor emissions, and bring emissions regulations to new types of vehicles (such as motorcycles), fuels (such as methanol, liquefied petroleum gas, and natural gas), and processes (including exhaust, evaporative and refuelling emissions).

Minister Marchi further urged the provinces, who have responsibility for cars once they are on the road, to follow British Columbia's 'Aircare' program-me of mandatory car and truck inspection and repair. Such a move would reduce by half the pollutants emitted into congested southern Ontario. Finally, the Minister pointed to one of the inescapable physical incentives for environmental regulatory harmonisation, by noting that half the smog in Canada's core, the Windsor-Quebec corridor, is produced in the United States.¹⁸ He thus called for the 1990 Canada-U.S. Air Quality Agreement on acid rain to be expanded to regulate smog, air toxins, and inhalable particulate matter, with a goal of reducing imported pollution by 50% by the year 2010.¹⁹

Because high level controls on auto emissions require similar controls on fuel quality, Canadian action on high-level harmonisation moved seamlessly to fuel standards and thus to the petroleum industry. Here, however, even compared to the United States, progress was slower, industry resistance greater, and NAFTA, through its investment provisions, a prospective initial obstacle rather than an aid to forward movement. Yet the functional need for a total systems approach to meet the higher emission control standards did rapidly lead to continental convergence here as well.

The first post-NAFTA case of Canadian harmonisation on prevailing U.S. fuel standards was the Canadian federal government's move in 1996 to ban international and interprovincial trade in MMT (Soloway 1999a, 1999b). This substance was first introduced in 1977 to replace lead as an octane-enhancer in gasoline. (Vogel and Rugman 1997). In an early sign that pressures for convergence are arising in the third, Canada-Mexico, leg of the NAFTA triangle, the Canadian move led Mexico, where MMT was still legal, to initiate an evaluation of its effects. The subsequent decision by the dispute settlement mechanism under Canada's Internal Agreement on Trade to declare the Canadian government ban illegal demonstrates the difficulties that arise when the crude regulatory instruments of old, rather than the new co-operative processes offered by the NAFTA institutions, are relied on to deal with the environmental regulatory challenges of the present and future.

The ban on MMT was followed by a similar move to reduce the level of sulphur in Canadian gasoline.²⁰ In early 1997 Cabinet passed new Diesel Fuel regulations requiring, as of January 1, 1998, all on-road vehicles to use diesel fuel no more than .05% by weight of sulphur (the current Mexican standard).²¹ Minister Marchi also said he planned to come forward with a plan and a timetable to reduce the sulphur content of gasoline. At the time Canada's average level of sulphur content of gasoline was 360 parts per million (PPM) compared to a slightly lower level of 340 ppm as a national average in the US, and a standard of 30 in California (the trend setter for automotive emission regulations). The proposed level in Europe was 150 PPM.

The Canadian regulation came from Sergio Marchi's successor as Minister of the Environment, Christine Stewart, in June 1999. At that time Canada set a new level at the California standard of 30 ppm by the year 2005, or one year later than the new US date. However, Canada moved more rapidly than the US by setting an interim target of 150 ppm during a 30 month run up period starting in 2002. In doing so it set aside the concerns of some of Canada's largest refiners, Esso and Petro-Canada, whose gasoline in the largest urban market of Toronto contained close to 700 ppm.

The emerging total systems approach to automotive environmentalism involves, as its third component, enhanced mandatory inspection and maintenance programs. Here the impact of NAFTA's informal pressures toward high level harmonisation are also evident. States and provinces have begun to co-operate to adopt similar programs, and create transnational, subgovernmental coalitions for more advanced measures. The immediate pre- and post- NAFTA period has seen extensive U.S.-Canada/state-provincial co-operation on environmental, emissions and automotive standards (including co-operation relating to the introduction of zero emission vehicles). In contrast, trilateral, subfederal co-operation has been slower to develop in operating transportation standards. (Munton and Kirton 1994; Kirton and Munton 1996).

The movement is clearly evident in Ontario. The government of Premier Michael Harris, while generally averse to new regulation, moved in 1998 to adopt a variant of the 'Aircare programme' pioneered in British Columbia.²² The Canadian assembly industry prefers a uniform system across Canada and the continent; one with a central repository for test data that the assemblers can challenge in regard to warranty claims. Such a system (INM 240) could steer the bulk of the work to the OEM dealerships.²³ The Ontario government was inclined to adopt a more

decentralised, 'repair grade' model, under which any properly licensed, equipped and trained service station could perform the inspection.

Canada has also moved to implement pollution prevention. The Canadian effort on pollution prevention, paralleling that of the United States, began in May 1992, when an agreement among the federal and provincial governments and the Canadian Motor Vehicle Manufacturing Association (MVMA) (creating the Canadian Automotive Pollution Prevention Project) made the automotive industry the first to enter a voluntary pollution prevention agreement.²⁴ Virtually from its inception, discussions were held with its U.S. counterpart.²⁵ The two task forces quickly committed to biannual meetings to co-ordinate their activities and formalise communication. In December 1994 they hosted a joint suppliers' forum, the North American Auto Supplier Environmental Workshop. The joint program, which reinforced the significant achievements secured in each country, was re-examined in the summer of 1996. Neither the Commission for Environmental Co-operation (CEC) nor other NAFTA institutions were involved in the venture. Nor was there any move to extend the co-operative activity to include Mexico.

Mexico

The pattern of upward high-level harmonisation is also visible in Mexico. In Mexico, transportation is the leading cause of CO₂ emissions from fossil fuel consumption, accounting for 37% of the total. It is a major contributor of atmospheric pollution overall. Current projections indicate that Mexican CO₂ emissions in the year 2005 will be 40% higher than their 1990 level. (Sheinbaum and Viqueria 1996). Tentative evidence further suggests that the acidity (pH) of rain in Mexico City from mobile and stationary emissions have been rising from 1987 to 1993.

Mexico acquired its first federal laws and regulations governing emissions of atmospheric, fluid and solid wastes and noise in 1972. In 1993 it set standards (NOM-CCA-001-ECOL/193 (DOF 1993)) regulating water quality, including wastewater discharges from industrial facilities such as automotive plants. As of 1997 it had not established any standards for maximum levels of soil pollutants. However it informally followed international (largely European) standards covering organic compounds such as hydrocarbons and inorganic compounds such as mercury and lead.

In contrast, Mexico has moved rapidly to set and raise standards for air quality. At the outset of 1994 its Ministry of Health published air quality standards relating to concentrations of atmospheric pollutants.²⁶ By 1998, eight Mexican cities beyond Mexico City had air quality monitoring programs. These focus on total suspended particulates and (in the case of Mexico City and Tijuana) ozone.²⁷ The primary ozone precursors are car exhausts, industrial smoke stacks and electrical generating facilities.

In 1994 Mexico set its first standard on fossil fuel quality used by mobile and stationary sources. In December 1994 its National Ecology Institute (INE) published NOM-ECOL-086-1994 on maximum emission levels for SO_x and NO_x from fuels. These covered the maximum levels of lead, vapour, sulphur, benzene, olefin and ash in gasoline, diesel, natural gas and fuel oil. Improved fuels, such as the super unleaded gasoline premium, were quickly introduced into various regional markets. Driven by such policies, and by the Ministry of Energy's Integrated Fuels Policy, unleaded gasoline jumped from 10% of total gas consumption in 1991 to 58% in

1997. High sulphur diesel fuel, which represented 79% of consumption in 1991, was eliminated in 1993. Low sulphur diesel (0.05%) currently represents 76% of consumption. The Integrated Fuels Policy seeks further investment in desulphurisation and the establishment of environmental standards in other critical zones and areas of the country.

Mexico has also moved to co-operate with the United States for monitoring and controlling air emission standards at the border. In May 1996, the two countries foreign ministers extended the 1982 La Paz Agreement to designate the El Paso-Juarez Valley as a common airshed for International Air Quality Management Basin (IAQMD). In addition, the U.S.-Mexico Border 11 Program, with nine working groups, is seeking to reduce emissions from vehicles idling at border crossings, tracking transboundary hazardous wastes, reducing risks of chemical accidents, and reducing solid wastes from maquiladoras.

The Role of NAFTA Institutions

Thus far these moves to high level harmonisation have come largely from industry and national political pressure, rather than the direct work of NAFTA's institutions.²⁸ This is somewhat of a puzzle, given the explicit responsibilities assigned the Automotive Standards Council (ASC) in the NAFTA text to move rapidly to stringent region-wide automotive emissions standards. Slow progress here is further highlighted by the record of the ASC's sister body, the Land Transportation Subcommittee (LTS) (which is also a subcommittee of the NAFTA Committee on Standards Related Measures) regarding the transportation of dangerous goods.

The LTS has done much to promote high level trilateral harmonisation of regulations for the transportation of dangerous goods. It has already produced a single Emergency Response Guide giving the three NAFTA countries identical procedures to deal with emergencies caused by an accident during the transport of a dangerous substance. It has assisted Mexico in upgrading its relevant standards. And it is moving rapidly to address such difficult issues as bulk packaging, halogenated organic chlorides (HOCs), and manifests for hazardous waste. With a mandate to make the parties standards for the transportation of dangerous goods compatible by the year 2000, based on broader UN standards, it has taken as its vision the development of single North American Dangerous Goods Code. Yet elsewhere the LTS has been far less effective. It has done very little to meet its NAFTA obligation to implement a work program, within three years of NAFTA coming into effect, to render compatible the parties vehicle standards, including emissions, environmental and pollution standards not covered by the work program of the ASC.

Nor has the ASC, which lacks any NAFTA-imposed deadline for action, done much more. (28) The ASC also not taken up its NAFTA authority to address emissions from on-road and non-road mobile sources, even though off-road vehicles may account for up to 30% of all transportation emissions. Yet the ASC's initial consultations with industry identified a list of 17 priority issues that included the full array of emissions, fuels, pollution prevention and operating standards.²⁹ The list of such issues, which involved all three NAFTA countries, included: emission and emission test procedures (especially California emission regulations adopted by British Columbia, and prospectively New England states); alleged Mexican non-enforcement of emission regulations; the safety of MMT in gasoline; the nonavailability of low sulphur fuel in

Canada; and different noise standards in the three countries. None of these problems, however, appeared to have a clear, trade-inhibiting effect.

Compliance and Enforcement in Principle and Practice

Higher level environmental action and international co-operation and convergence is also evident in the area of compliance, inspection and enforcement. Here again it is the broader NAFTA regime rather than the NAFTA institutions or dispute settlement mechanisms directly that are propelling the process. The pre and post NAFTA need to demonstrate NAFTA's environmental effectiveness to the U.S. public had led to a major increase in inspection and enforcement action in Mexico, while the larger need to secure and maintain the open NAFTA market has led the larger firms to readily comply, often on a voluntary and anticipatory basis.

The NAFTA's Dispute Settlement Mechanisms in Action

One striking trend during NAFTA's first three and a half years is the exceptional record of compliance with NAFTA's environmental and overall obligations. There have been relatively few cases taken to NAFTA's three trade and investment dispute settlement panels. The very credibility of the NAFTA dispute settlement process appears to have deterred unfair actions from occurring in the first place. Moreover, the wider array of NAFTA institutions have avoided, managed or politically-settled disputes before they have had to go to the 'NAFTA court'.³⁰ Of the 30 or more cases to 1998 before the Chapter 19 mechanism, none has involved the auto industry. Automotive-related disputes been similarly absent from Chapter 20 cases. They have been involved only through the Chapter 11 case on MMT. Nor have any of the first ten cases taken to the CEC under NAAEC's Article 14-15 process, or either of the first three cases under Article 13, involved the automotive industry.³¹ Given the industry's dominant size and share within North America in both economic and environmental terms, this is a striking finding.

Patterns of National-Level Inspection and Enforcement

In all three countries, the resources available for environmental inspection and enforcement at the national and subfederal level have been challenged by severe budgetary cutbacks to environmental agencies, as governments have moved aggressively to address serious fiscal deficits. Such moves have curtailed the available capacity in Canada and the United States. Yet in Mexico, despite the particularly severe shocks brought by the 1994 peso crisis, the record of environmental inspection and enforcement and compliance has improved markedly.

Since NAFTA took effect, Mexico has done much to augment its capacity for environmental enforcement.³² It has created an environmental crime unit in its Attorney General's office. It has increased the number and quality of its environmental inspectors, especially in important areas such as the transboundary shipment of hazardous waste. Since 1992 over 660 Mexican environmental inspectors have been trained, including 460 from border states. U.S. EPA trained 230 inspectors in 1995 and 220 in 1996 from the U.S. and Mexico.³³ Mexico has also expanded the number of enforcement actions (Steinberg 1997).

The results of these actions are evident in the record of the maquiladoras, where many automotive parts operations are clustered. From 1992 to 1996 Mexico conducted 12,347 inspections and compliance verifications visits in the border, fined 9,884 facilities and partially or completely closed 548 facilities. From 1993 to 1996 there has been a 43% increase in the number of maquiladoras in complete environmental compliance, and a 72% reduction in serious environmental violations in the maquiladoras.³⁴

In addition to government enforcement, Mexico since 1992 has promoted voluntary compliance through a new environmental auditing program. In 1996 274 operations joined the program. By April 1997, 617 facilities had completed environmental audits. Over four hundred had adopted compliance Action Plans generating more than \$800 million in new environmental investments.

To these trends can be added the absence of any known cases of industries migrating to Mexico in order to take advantage of Mexico's allegedly weak pattern of environmental enforcement.³⁵ Together they suggest that, with continued U.S. assistance, there are adequate technical and financial resources for enforcement, especially as Mexican growth is now being vibrantly restored. The record further suggests that Mexico's initial pre-NAFTA increase in environmental inspection, fines and shutdown as part of the NAFTA debate, has been joined by a deep-seated and sustained desire to maintain a high level of environmental enforcement as a matter of national policy. It is also possible that NAAEC's ultimate power to re-impose tariffs in the event of a persistent pattern of environmental non-enforcement, and the increasing value of liberalised NAFTA trade to Mexico's economy has conditioned its authorities into maintaining high standards or economy-wide environmental enforcement, especially in the visible border area.

The costs of compliance do not appear to have placed an undue burden on Mexican or foreign-owned firms in Mexico. The Mexican government gave smaller firms a grace period for compliance when the 1994-5 peso crisis left them unable to meet their legal obligations for environmental improvements. The relatively small amount (3%) that pollution control equipment commands in the overall costs of U.S. and Canadian industry has been overwhelmed as a cost factor by massive exchange rate, interest rate and inflation rate changes in the Mexican economy. The general trend toward greater environmental regulation in the United States temporarily abated after the mid-term Congressional elections in 1994. The absence of large scale U.S. automotive investment in Mexico since 1993 is consistent with this pattern of higher Mexican enforcement and a reduced increase in U.S. costs. But the causes of the investment trend lie primarily in calculations of broad politics rather than specific environmentally-related costs.

Economic Implications of Environmental Policy for the Auto Industry

Although NAFTA's automotive institutions have begun work, it is industry forums for international dialogue and pressure on national governments, together with strong public environmental consciousness, that is driving the process of higher level, region-wide harmonisation. There have thus been minimal costs and substantial benefits to industry in the area of manufacturing standards, as they have largely shaped the regulatory process and reaped the rewards of rapid and pioneering pollution prevention action. Nor has compliance and enforcement provided a major burden to most firms. The major challenges and potential costs to the industry come from the prospective proliferation of different standards in increasingly

smaller state and provincial jurisdictions, in the difficulty of reaching consensus with the petroleum industry on U.S. and thus Canadian (and eventually Mexican) fuel standards, and in the diversity of subfederal inspection and maintenance systems.

The Benefits of a Single Regional Regulatory System

In general, the prevailing trends of regional integration and rationalisation, and high level, continental and eventual region-wide environmental regulatory harmonisation is of major benefit to the industry. It makes all three NAFTA markets more open to the products and services of the other country.³⁶ Region-wide uniformity in industry practice and government regulation is of particular advantage to those smaller and weaker domestic producers and home-based exporters who lack the capacity to absorb the transaction costs to produce separate products and services for segmented markets.³⁷ The move to harmonise Canadian emissions and diagnostic standards with those of the United States in 1998 has thus been strongly and wisely supported by an integrated automotive industry in both countries, who have long recognised the value of 'one standard, one test, one mark'.³⁸

Despite this ideal, there are some remaining consequential challenges across the U.S.-Canadian border. One is uncertainty, as evidenced by the recent debate over emissions standards. While Canada adopted the U.S. 1998 emissions standards, effective September 1997, the industry in both countries was harmed by the uncertainty about the U.S. (and thus the Canadian) regulations for the year 2001. The confidence that the projected 2001 standards would go forward in the United States and thus Canada had largely evaporated, given a dispute over whether the 2001 standards should include a mandatory fuel requirement for sulphur levels.³⁹

Similar issues arose with regard to the dispute over MMT, which some regard as a precursor of the larger political struggle to come over fuel standards. The MMT issue raises the important question of whether the required technology would become available to allow the continued use of MMT, and who will incur the costs of developing the technology required for enhanced pollution control? Will it be the refiners or the OEM's or parts makers or governments?⁴⁰ Will it require aftermarket parts producers to engage in equally expensive product upgrades, or open new markets for their advanced products?

This uncertainty points to the advantages which government regulation can have over the voluntary standardisation that is generally preferred and strongly relied on by industry. Despite its success in the New Low Emission Vehicle (NLEV) and pollution prevention programs, and in maintaining the floor in the case of MMT, voluntary regimes are always subject to the danger of defection. They thus offer less certainty, especially in focusing on future targets and timetables, than mandatory government regulation. The prospects of defection are increased when solutions involve not only the highly concentrated automotive industry, but the more diffuse set of actors from the petroleum industry who may seek allies (the Pemex monopoly in Mexico, and the relatively powerful petroleum industry in Canada) in NAFTA partner countries.⁴¹

The Challenge of Subfederal Differentiation

The greatest challenge and potential cost flows from the threat of further subfederal differentiation and the adoption of different and higher standards in increasingly smaller jurisdictions and markets. This trend threatens to impose significant additional costs on the automotive industry, already incorporating about U.S. \$2,000. worth of environmental equipment into each car, with an additional US\$200. to come from the 2004 US emission standards mandated in 1999. It further threatens to weaken its ability to compete internationally (especially with European Union rivals) in the rapidly emerging era of the global car. Even in the core area of automotive manufacturing emissions standards, Massachusetts and New York have gone before the courts seeking permission to follow California in setting their own local standards. Any success would destroy a system in which the United States maintained only two standards (federal and California ones). It would encourage the legally more powerful Canadian provinces led by British Columbia to reproduce this proliferation in Canada as well. An increasing array of subjects, such as requirements for a minimum percentage of zero-emission vehicles, could become the subject of such subfederal regulatory proliferation.

Such a trend, if allowed to develop, could impose major costs on industry. The additional, state and provincial jurisdictions lack the market size of California. Moreover, the smaller Canadian and Mexican vehicle and parts producers lack the ability to economically produce for these segmented markets. Thus far, the industry response has been to initiate voluntary, preventative action, through its NLEV. In the usual pattern, the U.S. auto industry developed the program, its Canadian counterpart joined, and is urging its government to harmonise on the EPA's U.S.-wide 1998 level. Such continental collaboration, and related work to develop pre-competitive technology for a new generation of vehicles has not as yet fully involved Mexican industry, nor made use of the resources of the NAFTA regime and the CEC.

The threat of subfederal regulatory proliferation is also acute in regard to inspection and maintenance programs, especially as the trend-setting California model is encountering problems and is in a state of flux. It is important for the aftermarket industry to ensure that the North American norm for such programmes emphasizes replacement and upgrade, with appropriate warranty programmes, rather than the early scrapping of vehicles. Scrapping programmes should be combined with a move to the disposable-reusable vehicle, to open up a major new segment of the aftermarket industry, as it has in Europe.

The case of industry would be strengthened, and its economic and environmental strength enhanced, with further moves to expand the well-developed pattern of U.S.-Canadian collaboration to Mexico. The low levels of U.S. and Canadian foreign direct investment in the Mexican automotive industry in the post NAFTA period has meant a restricted flow of new environmental technology and management systems through corporate practices and industry diffusion. There is a particular need in Mexico, especially in the wake of the peso crisis and its temporary regulatory relaxation, to diffuse environmentally state-of-the-art practices and technology downward from the largest assemblers into the smallest tier of Mexican parts and aftermarket firms. Nor has industry itself moved to deal on a trilateral basis, in an anticipatory and preventative fashion, with issues such as pollution prevention, NLEV, fuels standards and next-generation vehicles.

Conclusions

Thus far NAFTA has imposed few environmental burdens on the Canadian and North American automotive industry, even as it has opened important new economic opportunities for it. NAFTA has brought no discernable additional environmental costs to the automotive industry. Yet its economic provisions have led to region-wide integration and rationalisation, and an upward-level harmonisation of environmental practices and standards that have benefited producers and citizens in all three countries. The policy challenge is thus to build on this foundation. More precisely, it is to harness the NAFTA regime to prevent emerging environmental regulatory backsliding (as with MMT), uncertainty (as with 2001 emissions and sulphur fuel standards) and differentiation (with emissions, and inspection and maintenance programs) within and between the United States and Canada. Mexico and the NAFTA institutions need to be involved more directly in the largely informal U.S.-Canada processes that have prevailed to date. This challenge has acquired some urgency with Canada and Mexico already enjoying free trade agreements with promising South America partners, with the FTAA deadline of hemispheric free trade by 2005 and the APEC process of free trade by 2010/2020 promising to begin liberalisation in environmental products and services.

North American wide automotive industry integration and rationalisation, higher level harmonisation of environmental regulation, and public pressure for higher environmental standards and performance are the dominant trends of the NAFTA era. But the process remains uneven. Within the United States and Canada regulatory proliferation is strengthening at the subfederal level, even though there is a place for states and provinces within NAFTA's environmental institutions and regime. As the case of MMT shows, there is the threat of an economically and environmentally costly backsliding with seventeen year-old fuel standards, with NAFTA's dispute settlement mechanism a potential accomplice in the unravelling. Even in the United States and thus Canada, where industry co-operation and regulatory harmonisation comes easily, there is uncertainty over emission and fuel standards, even though the NAFTA text instructed its premier automotive institutions, the ASC and LTSS, to have in place by the start of 1997 a work plan to harmonise automotive emissions standards. And in ongoing industry processes such as the diffusion of technology through foreign direct investment and multistakeholder pollution prevention programs, Mexico often remains outside the Canada-U.S. network.

It is thus clear that the intergovernmental, trilateral institutions and processes created by NAFTA are not performing up to their potential, and thus not adequately assisting the automotive industry with the environmental regulatory challenges it faces. In broad terms, the directions the NAFTA regime should follow to support the needs of the industry are clear. The first is the prevention of a further differentiation of regulations among the NAFTA countries and their subfederal jurisdiction, so that the common upward progression can be maintained, and the costs of a regulatory patchwork avoided. The second is to legitimise an integrated, total systems based approach to environmental regulation, so that the costly conflicts between the automotive and petroleum industries can be minimised. The third is to foster a truly trilateral process that engages Mexico as a full equal. The fourth is to strengthen the role of science, technical co-operation, and policy advice to governments seeking harmonised regulations, in ways that broaden the base of involved stakeholders and thus the legitimacy the NAFTA regime

commands. And the fifth is to equip North American industry to prevail in the competition for the markets of the hemisphere and beyond.

Further research should thus concentrate on how current and prospective high-level harmonised North American environmental regulations compare with those faced by Japanese and European producers in their home markets, with those in the Chilean and other South American markets, and with the distinctive, geographically-based environmental requirements of North America and the western hemisphere. North American standards are in general at a level comparable to those of the German and Japanese global leaders, and the transoceanic alliances and investments of firms from all three regions have furthered this upward convergence. However differences in regulations of specific items, and new forms and speed of regulation can nonetheless confer considerable competitive advantage. It is thus important to consider how North American producers, the U.S. Government, and the Canadian and Mexican governments (through their existing bilateral free trade agreements in the hemisphere) can best extend the existing and developing NAFTA environmental and regulatory regime to the hemisphere as the deadline of hemispheric free trade by 2005 approaches, and globally as a new Millennium Round of multilateral trade liberalisation negotiations is launched in the autumn of 1999.

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