Fishy Business—Regulating Aquaculture Operations in the United States

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The "art of rearing fish," known as aquaculture or "fish farming," has been practiced consistently around the world since its beginnings more than 3,000 years ago in Asia. However, in the United States, aquaculture has emerged only recently as an economically viable industry, largely due to declining wild fish stocks and increasing consumer demand for fish and other aquaculture products. The threat of overexploiting the nation's native fisheries played a significant role in the passage of the National Aquaculture Act of 1980, 16 U.S.C. §§ 2801–2810, which declared a national policy to encourage the development of aquaculture, established a national aquaculture development plan, and required federal coordination of aquaculture activities. Since that time, many people in this country increasingly have recognized aquaculture as a means of alleviating increased pressure on wild fisheries and meeting the rising consumer demand for fish. According to the 1998 Census of Aquaculture taken by the United States Department of Agriculture (USDA), more than 4,000 aquaculture facilities operated in the U.S. These operations produced a wide range of consumer products, including food fish, bait fish, shellfish, ornamental fish, seaweed, and even alligators.

Reflecting the promise of aquaculture as a source of food and employment, the aquaculture industry has been among the fastest growing agricultural sectors in the country. While relatively a small player on the worldwide aquaculture stage, the United States aquaculture industry has considerable market potential both at home and abroad. The economic value of U.S. aquaculture production has experienced 5 percent to 10 percent increases every year over the past decade. The latest figures from the USDA show that aquaculture production totaled 768 million pounds in 1997, consisting largely of freshwater species such as catfish, trout, crawfish, tilapia, and striped bass. The major marine species—salmon, oysters, clams, mussels, and shrimp—accounted for less than 10 percent of the total. Between 1992 and 1997, production increased 11 percent, largely due to increased investment in catfish and salmon farms. Growth in the U.S. aquaculture industry has slowed somewhat recently, due in large part to increasing importation of fish and other aquatic food items.

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The vast majority of imported species are raised in countries that lack the environmental requirements and expectations found in the United States. Consequently, lower production costs in these foreign countries put U.S. producers at a competitive disadvantage. Despite the recent declines in domestic production, however, the industry is poised to make a splash in the coming years. For example, the Department of Commerce has issued an "Aquaculture Policy," calling for a five-fold increase in the value of domestic aquaculture production and a threefold increase in employment in the aquaculture industry by the year 2025.

The growing role of aquaculture in U.S. food production and supply has drawn increased scrutiny from government regulatory agencies as well as the public. Although traditionally regarded as a relatively "clean" industry, a number of potential environmental and health concerns associated with fish farms have been documented recently. Fish farms produce solid waste consisting of excess feed and fecal matter, which may deplete the oxygen in, and add nutrients and solids to, the surrounding waters, degrade benthic ecosystems, and exacerbate toxic algal blooms. In addition, fish farms use a variety of chemicals that may be released into the environment. For example, salmon fish farmers use antibiotics to control disease, pesticides to control parasites, hormones to induce spawning, and vitamins and minerals to enhance the growth of fish. Finally, there are concerns about the potential of "biological pollution"—that is, nonnative species of fish may escape from fish farms and potentially alter native species composition and have other deleterious impacts on the environment.

Types of Aquaculture Operations

Aquaculture is broadly defined by various regulatory agencies as "the cultivation, farming or husbandry of fish, shellfish, and other aquatic animals and plants, usually in a controlled or selected environment for commercial, recreational, or public purposes." The primary types of facilities utilized by the U.S. aquaculture industry are ponds, flow-through systems, recirculating systems, and open water systems.

Pond systems are distinguished from the other types of systems by the frequency of discharge. Rather

than discharging water continuously, ponds generally discharge either as a result of a storm event or when the pond is drained for harvest or to make repairs. Aquatic animals typically produced in ponds include catfish, shrimp, hybrid striped bass, tilapia, crawfish, baitfish, and many ornamental and sport fish species.

The predominant type of flow-through systems, referred to as raceways, are constructed to mimic a stream, with fresh water continuously entering at the upstream end of the system and discharging from the downstream end. A series of production units are constructed between the top and bottom of the raceway system. Smaller, younger fish are typically placed in the upper units of the system near the water source (which is the highest quality water). As the fish grow and are able to tolerate lesser quality water, they are progressively moved to downstream units. Flow-through systems are used to produce species like trout and salmon that require very high quality water.

Recirculating systems are used to raise fish in a more controlled environment. The fish are raised in tanks with continuously flowing water that is recirculated through a water treatment system and returned to the production tanks. Recirculating systems are well suited for species that require relatively constant water temperatures such as tilapia, hybrid striped bass, and ornamental fish species.

Net pens and other open water systems differ significantly from the other types of aquaculture facilities. Unlike ponds, raceways, and recirculating systems, net pens take advantage of an existing water body's circulation to wash away wastes and bring fresh water to the system. Presently, the most common species raised in net pens are shellfish (oysters, clams, and mussels) that are grown on floating rafts or prepared bottoms, and salmon that are grown to market size in net pens. Net pens are designed to float at the surface and anchored to the bottom of the water body, but are constructed to allow some movement with tidal and wave action. These structures are generally sited to benefit from tidal and current action to move wastes away from the pens and bring oxygenated, high quality water to the net pens. Because net pen operations generally tend to be larger than other systems these facilities have received the most attention and opposition. A frequently unspoken, yet important, factor feeding the opposition to net pen operations is their location—they are often sited in bays and other coastal areas where they are sometimes viewed as unwelcome pockmarks on coastal vistas.

Potential Environmental Impacts

As the number of aquaculture operations has increased in the U.S. and elsewhere, there has been a surge of research and monitoring programs seeking to document the potential environmental effects of the industry. Much of this work has focused on the effects of net pen facilities on coastal and open ocean ecosystems. Based on research conducted over the last twenty years, it is now well documented that fish farms can produce a variety of waste products that are discharged into receiving waters and pose other potential risks to the surrounding flora and fauna.

In the absence of treatment, pollutant loadings from individual fish farms can contribute up to several thousand pounds of nitrogen and phosphorus per year and up to several million pounds of total suspended solids per year. These nutrients and solids may contribute to eutrophication of receiving waters, leading to algal blooms, increased turbidity, low dissolved oxygen, and associated stresses to aquatic biota. Ammonia, a form of nitrogen released from fish farms, can be directly toxic to aquatic life, and has been shown to affect hatching and growth rates of fish, and to cause changes to vital organs during development. Increased turbidity caused by solids discharged from fish farms can reduce the depth to which sunlight can penetrate the water column, decreasing photosynthetic activity and oxygen production in plants and phytoplankton, and potentially causing plant death and oxygen depletion caused by decomposition of organic matter. As solids settle out of the water column, they can smother fish eggs and bottom-dwelling organisms, interrupt reproduction of aquatic species, and destroy benthic habitat.

In net pen systems, the equipment itself is often treated with "antifoulants" containing metals, primarily copper, which are designed to reduce marine growth that would "foul" the nets and other equipment. Metals also may be used as feed additives and occur in sanitation products used by fish farms. Without proper precautions, these metals could be released into the surrounding waters and sediments.

Another area of concern regarding environmental impacts of fish farms is the potential introduction of nonnative aquatic organisms via intentional releases or accidental escapes from fish farms. In general, nonnative species can alter and degrade habitat, disrupt native gene pool through interbreeding, and introduce diseases that could affect native species. Given a plentiful food supply, populations of nonnative species can increase considerably, out-compete native stocks, and be difficult to eliminate once established.

Fish farms can also serve as reservoirs of infectious agents due to higher rearing densities of and stress on captive fish. Escapees from fish farms may then pass these pathogens on to native wild fish stocks and other aquatic organisms. For example, wastes and escape of infected shrimp from shrimp farms are considered major potential pathways for wild shrimp exposure to viral diseases. Farmed salmon have been known to contract a number of diseases, such as bacterial kidney disease, funrunculosis (a cold water disease also known as fexibacter), and vibrio, each of which can be transmitted

to native populations. Viruses, such as infectious salmon anemia, and parasites, such as trematodes and sea lice, have also been associated with captive fish.

Regulation of Fish Farms

Recognizing the potential environmental impacts of aquaculture operations, a number of agencies at both the federal and state levels have taken steps to address these concerns. However, critics who believe additional regulation is needed have questioned the effectiveness of existing measures. Part of the criticism comes from the regulatory uncertainty created by the existing framework of federal laws aimed at protecting the environment from the potential impacts of fish farms. The current regulatory system has been described as muddled and incoherent, at times resulting in an improvised and often unsatisfactory application of laws to proposed and existing fish farms. Several federal agencies have some measure of jurisdiction over aquaculture operations, depending on their location (inland, coastal, or open ocean), including the Department of Agriculture under the National Aquaculture Act; the Army Corps of Engineers (Corps) under the Rivers and Harbors Act of 1899 (RHA) and the Outer Continental Shelf Lands Act; the Environmental Protection Agency (EPA) under the Clean Water Act (CWA), the Ocean Dumping Ban Act of 1988, and the Endangered Species Act; the National Marine Fisheries Service (NMFS) under the Magnuson Fishery Conservation and Management Act and the Marine Mammal Protection Act; and the U.S. Fish & Wildlife Service under the Lacey Act Amendments of 1981. In addition to the federal framework of aquaculture regulation many states have their own unique legal, political, and economic climate for aquaculture. State laws governing aquaculture are frequently inconsistently developed and applied. For example, in Hawaii, aquaculture discharges must meet receiving water quality standards outside the zone of mixing; in Florida, registered aquaculturists may operate under best management practices (BMPs), which supercede state water quality standards. Regardless of whether one views local regulation as a good or bad thing, it adds another layer to the current maze of regulatory requirements and considerations with which aquaculture operations must contend.

Critics of the existing aquaculture regulatory climate also point out that many of the current aquaculture requirements are voluntary, issued by various agencies as "policy" or "guidance." For example, while one of the objectives of the Department of Commerce's Aquaculture Policy is to "develop aquaculture technologies and methods both to improve production and safeguard the environment, emphasizing where possible those technologies that employ pollution prevention rather than pollution control techniques," the Commerce Department lacks the authority to directly regulate most aquaculture operations. Similarly, the National Oceanic and Atmospheric Administration (NOAA), through the Department of Commerce, has a policy to conduct "research on ways to minimize any adverse impacts of aquaculture on the environment and wild stocks." Finally NMFS, also through the Department of Commerce, has drafted a voluntary "Code of Conduct for Responsible Aquaculture Development in the U.S. Exclusive Economic Zone," which NMFS describes as "a 'soft' law to guide policy, development, and research" with respect to offshore aquaculture development.

The growing role of aquaculture in U.S. food production and supply has drawn increased scrutiny from government regulatory agencies and the public.

Currently, most fish farms in the United States operate in inland or coastal waters. The primary federal agencies directly regulating these facilities are the Corps of Engineers and EPA. The Corps requires a permit under Section 10 of the RHA for the building or placement of any structure in waters of the United States that could obstruct navigation, including wharves, piers, booms, and jetties. Section 10 gives the Corps considerable discretion in deciding whether to issue a permit. The Corps has broadly interpreted its authority to allow it to consider impacts on navigation as well as any other factors affecting the public interest, including the effects and cumulative impacts on water quality, recreational activities, fish and other wildlife, pollution, economic factors, safety, and aesthetics. Nevertheless, because of the discretionary nature of the Corps' authority, the practical effects of the Corps permitting process on environmental impacts of fish farms are limited.

On the other hand, EPA can afford significant protection to receiving waters by directly regulating discharges from aquaculture operations pursuant to its jurisdiction under the CWA. One of the core provisions the CWA uses to "restore and maintain the chemical, physical, and biological integrity of the nations waters" is the National Pollutant Discharge Elimination System (NPDES) permit program. Under this program, the discharge of any pollutant from a "point source" into navigable waters of the United States is prohibited unless

the discharge is made according to the terms of an NPDES permit obtained from EPA or an authorized state agency. EPA has designated certain types of aquaculture operations, known as concentrated aquatic animal production facilities (CAAP facilities), as point sources of pollution. As such, they are required to obtain and comply with NPDES permits. 40 C.F.R. § 122.24.

CAAP facilities are defined by EPA regulations as "a hatchery, a fish farm, any other facility" that meets specific criteria defined in the regulations, or that EPA determines is a "significant contributor of pollution" and designates as a CAAP facility. 40 C.F.R. § 122.24. Thus, there are two ways an aquaculture operation may be deemed a CAAP facility requiring an NPDES Permit. First, under Section 122.24, Appendix C, a hatchery, fish farm, or other facility is a CAAP facility if it contains, grows, or holds aquatic animals in either of the following categories:

(a) Cold water fish species or other cold water aquatic animals in ponds, raceways, or other similar structures which discharge at least 30 days per year but does not include:
   1. Facilities which produce less than 20,000 pounds of aquatic animals per year; and
   2. Facilities which feed less than 5,000 pounds of food during the calendar month of maximum feeding.

(b) Warm water fish species or other warm water aquatic animals in ponds, raceways, or other similar structures which discharge at least 30 days per year, but does not include:
   1. Closed ponds which discharge only during periods of excess runoff; or
   2. Facilities which produce less than 100,000 pounds of aquatic animals per year.

If a facility falls into any of these categories, an NPDES permit is mandatory.

The second way an aquaculture facility can be deemed a CAAP facility is for EPA to determine that it is a "significant contributor of pollution" under Section 122.24(c). EPA can require an NPDES permit for "significant contributor" facilities at its discretion after considering relevant factors, such as the location and quality of receiving waters; the holding, feeding, and production capabilities of the facility; and the quantity and nature of pollutants discharged from the facility. 40 C.F.R. § 122.24(c)(1)(i-v).

Although EPA has considered CAAP facilities to be point sources since the 1970s, EPA never promulgated effluent limitations for use in setting NPDES permit requirements for CAAP facilities. Effluent limits are permit limits generally based on national technology-based guidelines and uniform treatment standards established by EPA, as well as water quality standards. The effluent guidelines and standards are established by regulation for specific categories of point source dischargers and are based on the degree of control that can be achieved using various levels of pollution-control technology.

In the early 1970s, EPA staff evaluated fish hatcheries and fish farms to develop recommendations on whether EPA should propose effluent guidelines for these facilities. However, EPA did not propose any such regulations because it viewed industrial categories with toxic effluents as a higher priority. On October 30, 1989, the Natural Resources Defense Council, Inc., and Public Citizen, Inc., filed an action against EPA in which they alleged, among other things, that EPA had failed to establish effluent limitation guidelines as required by the CWA. This action resulted in a consent decree that established a schedule by which EPA was to propose and take final action on effluent limitation guidelines for a number of point source categories. Pursuant to the consent decree, EPA was required to propose effluent limitation guidelines for the aquaculture industry by August 13, 2002, and to finalize the proposal by June 30, 2004.

Under the current regulatory regime, EPA's jurisdiction over certain types of fish farms has been challenged in several recent cases.

On September 12, 2002, EPA proposed new technology-based effluent limitations guidelines and standards for wastewater discharges associated with the operation of new and existing concentrated aquatic animal production facilities (CAAPF Rule). EPA recently extended the comment period until January 27, 2003. 67 Fed. Reg. 71,523.

The CAAPF Rule applies to CAAP facilities producing at least 100,000 pounds of fish or other aquatic organisms annually in recirculating systems, flow-through systems, or net pens. For the first two systems, the CAAPF Rule proposes Total Suspended Solids (TSS) limitations based on solids control. For net pens, EPA proposes only feed management and monitoring. For all CAAP facilities, the CAAPF rule proposes BMPs to control the discharge of drugs, chemicals, nonnative species, and pathogens. The proposed regulation specifically does not apply to closed pond systems, lobster pounds, alligator pens, crawfish facilities, molluscan shellfish production in open waters, or aquariums. However, EPA continues to evaluate these systems and has not ruled out future rulemakings targeting

these types of facilities.

Very few of the approximately 4,200 aquaculture facilities identified in the most recent USDA census would be affected by the proposed CAAPF Rule. Based on the type of facility alone (e.g., pond system, lobster pound, etc.), the proposed regulations exclude approximately 65 percent of these facilities. The 100,000 pound threshold excludes another 30 percent. Thus, the proposed regulation only affects roughly 5 percent of the aquatic animal production industry (or approximately 220 facilities).

Under the current regulatory regime, EPA's jurisdiction over certain types of fish farms has been challenged in several recent cases. It is clear that aquaculture operations located inland, which utilize ponds, raceways, or flow-through systems, qualify as CAAP facilities subject to NPDES requirements if they meet minimum thresholds or are deemed "significant contributors of pollution" by EPA. However, there has been some debate over whether discharges from net pen operations constitute point source discharges.

Despite regulatory uncertainties, the U.S. aquaculture industry has enormous potential as a source of food and of badly needed jobs.

The outcome of two recent federal district court cases suggests that the debate may be just getting started. *Association to Protect Hammersley, Eld, and Totten Inlets (APHETI) v. Taylor Resources, Inc.*, 299 F.3d 1007 (9th Cir. 2002), involved a mussel harvesting operation in Puget Sound. Since the early 1990s, the defendant, Taylor Resources, Inc. (Taylor), operated two mussel-harvesting operations in Puget Sound that produced more than 20,000 pounds of mussels per year. Taylor's operation consisted of attaching mussel brood stock to suspension ropes hanging from floating rafts and anchored to the sea floor. Mesh netting surrounded the rafts to protect the mussels from predators while they matured. Although Taylor did not add food or chemicals to the water, the mussels produced feces and generated other metabolic by-products, such as ammonia and inorganic phosphate, which were released into the surrounding waters. Taylor applied for an NPDES permit, but was told by the Washington State Department of Ecology that none was required. APHETI filed a citizen suit under the CWA alleging that Taylor had violated the Act by "discharging pollutants" such as mussel feces, mussel shells, and ammonia from its mussel-harvesting operation without an NPDES permit. APHETI claimed that the feces, metabolic by-products, and shells were pollutants, that Taylor's harvesting rafts were point sources, and that Taylor's operations therefore required an NPDES permit.

In affirming the lower court's grant of summary judgment in favor of Taylor, the Ninth Circuit acknowledged that the CWA definition of the term "pollutant" as including "biological materials" could literally apply to the mussel by-products and shells. However, considering that all of the other types of "pollutants" listed in the CWA refer to "waste materials from human or industrial processes," the court held that the shells, feces, and other byproducts released by Taylor's operation did not constitute an addition of "pollutants." Given one of the Act's purposes is "protection and propagation of shellfish," the court noted "it would be anomalous to conclude that the living shellfish sought to be *protected* under the Act are, at the same time, 'pollutants,' the discharge of which may be *proscribed* by the Act." *But see Nat'l Wildlife Fed'n v. Consumers Power Co.*, 862 F.2d 580, 583, 586 (6th Cir. 1988) (finding that ". . . live fish, dead fish, and fish remains annually discharged into Lake Michigan by the facility are pollutants within the meaning of the CWA, since they are 'biological materials,'" but holding that because the fish were not "added," a permit was not required) (citing *Ass'n of Pacific Fisheries v. EPA*, 615 F.2d 794 (9th Cir. 1980)).

The court also held that Taylor's facility was not a point source because Taylor did not "add" any feed to its rafts or to the surrounding water. As described above, EPA has specifically determined that certain aquatic animal production facilities can be point sources if they meet the threshold requirements to be considered a CAAP facility or if EPA determines them to be "significant contributors of pollution." However, EPA's regulations exclude from its definition of a CAAP facility "(1) Facilities which produce less than [approximately 20,000] pounds of aquatic animals per year; and (2) Facilities which feed less than [approximately 5,000] pounds of food during the calendar month of maximum feeding." Because Taylor's operations did not add any feed, the court held the facility was not a CAAP facility and was not a point source.

A more difficult, and likely more controversial, case is *United States Public Interest Research Group (USPIRG) v. Atlantic Salmon of Maine, LLC (ASM)*, 215 F. Supp. 2d 239 (D. Me. 2002). USPIRG filed a citizen suit under the Clean Water Act alleging that the net pens in which ASM's salmon were grown required NPDES permits. ASM and USPIRG filed cross-motions for summary judgment with the United

States magistrate judge on whether ASM's net pens were "ponds, raceways, or similar structures" under the NPDES regulations for CAAP facilities, 40 C.F.R. § 122.24(a) and (b) and pt. 122, app. C. The magistrate granted USPIRG's motion for summary judgment, and issued a recommended decision finding that Appendix C "automatically" required NPDES permits for ASM's net pens. The district judge issued an order, without a written opinion, affirming the recommended decision of the magistrate judge.

The defendant, ASM, owns and operates several fish farms located in bays off the coast of Maine where it grows nonnative salmon for harvest. All but one of ASM's farms produce at least 20,000 pounds of salmon per year. ASM's operations utilize net pens that contain smolts (young salmon ready to migrate from fresh water to salt water) raised in ASM's fresh water hatcheries. The salmon are grown in the net pens for eighteen to twenty-four months before being harvested for market. USPIRG alleged that ASM's fish farms required an NPDES permit because (1) the net pens discharged pollutants into the surrounding waters and (2) ASM's net pens were point sources.

First, the magistrate judge found that ASM's net pens "added pollutants" to the bays. The court held that the nonnative salmon (some of which escape from the net pens), salmon feed, chemicals used for treating sea lice and other parasites, and copper from the net pens were pollutants that ASM's operations added to the surrounding water. Although USPIRG also argued that the net pens release parasites, pathogens, and disease, the court declined to determine whether these organisms were "pollutants" that were "added" to the water.

Second, the magistrate judge found that ASM's net pens were "point sources," requiring an NPDES permit. Recall that there are two ways that an aquatic animal production facility can be designated a CAAP facility. First, it can fall under Section 122.24, Appendix0 C, in which case NPDES permitting is mandatory. Second, under Section 122.24(c), if a facility does not meet the thresholds of Appendix C, EPA can determine that it is a "significant contributor of pollution" and require an NPDES permit at the agency's discretion. There was no question that EPA had not designated ASM's farms as CAAP facilities under the discretionary provision of subsection (c). However, the magistrate judge found that ASM's farms were CAAP facilities under Appendix C and therefore automatically required an NPDES permit.

ASM argued that its farms did not fall under Appendix C because (1) they were not "ponds, raceways, or other similar structures" and (2) they were not "discrete, confined and direct conveyances" or specifically "discrete discharge pipes." Essentially, ASM submitted that the phrase "ponds, raceways, or other similar structures" by definition contemplates land-based activities with concentrated discharge through a pipe or other channelized point source. In rejecting ASM's first argument, the magistrate judge relied on two letters from the EPA Region 1 office that the judge said "clearly demonstrate that the EPA interprets the Appendix C phrase 'ponds, raceways, or similar structures' as encompassing net pen sea farms." With respect to ASM's second argument, the judge noted that the term "point source" covers a broader means of discharging than just pipes, conduits, and other channeling of water. Rather, the judge held that "a point source exists where there is an *identifiable* source from which the pollutant is released." The judge held that the CWA and case law identifying various point sources support the conclusion that Appendix C is applicable to ASM's net pen operations.

The *Atlantic Salmon* case is the only judicial interpretation of the phrase "ponds, raceways, or other similar structures" under Section 122, Appendix C. Neither the proposed rule nor the final rule for the promulgation of Section 122.24 provides an insight into the scope of that phrase. *Atlantic Salmon*, n.9. However, the regulatory history of Section 122.24 and Part 122, Appendix C suggests that ASM may have been right and that EPA may have intended to treat net-pen systems differently from other types of systems that are typically land-based. For example, in its 1979 rulemaking establishing NPDES requirements for fish farms, EPA stated:

> Commenters also objected to combining warm and cold water aquatic animal production facilities and the 9,090 kilograms (approximately 20,000 pounds) of aquatic animals per year cut-off. In response to those comments, aquatic animal production facilities are now differentiated in the regulations based on whether they produce warm or cold water species and the characteristics of the method of confinement. Warm and cold water production facilities are separated because of basic operational characteristics differences.

44 Fed. Reg. 32,854, 32,870–71 (June 7, 1979). This language arguably supports the position that EPA recognized the differences between different types of fish farms and intended to differentiate among aquaculture operations based on the "characteristics and method of confinement" and "basic operational characteristics differences."

Despite these regulatory uncertainties, the U.S. aquaculture industry has enormous potential both as sources of food and of badly needed jobs. However, if the U.S. aquaculture industry is to expand and prosper, its operations must be profitable and sound environmentally. In order for this to occur, the existing federal and state regulatory frameworks require

improvement and coordination. Prudent future regulations should take into account not only production capabilities, but also operational characteristics and site-specific variables. Moreover, regulatory authorities should carefully evaluate the costs associated with additional environmental regulation of aquaculture facilities to ensure that the impact to domestic production in minimized.