Strengthening Standards and Technical Regulations for Safer Drinking Water: Developing an International Roadmap

APEC Sub-Committee on Standards and Conformance

June 2026

Asia-Pacific
Economic Cooperation

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The findings, analyses, and recommendations in this report are based on the presentations delivered during the workshop, expert contributions, and publicly available data and guidelines. They do not necessarily reflect the views of all APEC economies.

Executive Summary

Ensuring safe drinking water for the nearly three billion people living in APEC economies requires strong, coherent, and science-based standards and technical regulations. The 2025 APEC Workshop on Strengthening Standards and Technical Regulations for Safer Drinking Water—held during SOM3 in Incheon, Republic of Korea—brought together regulators, policymakers, standards bodies, industry leaders, researchers, utilities, and civil society to examine the regulatory, technical, and practical pathways needed to reduce risks from drinking water contamination, particularly from lead and other hazardous materials. The event included 18 speakers from four APEC economies, two speakers from non-APEC economies, academic institutions and international organizations, and 129 in-person participants. The workshop featured a series of presentations grouped around five general areas (described in detail below). Participants included trade and development officials, domestic regulators, industry representatives, and businesspersons and scholars.

Across two days of technical sessions, economy case studies, and draft roadmap co-creation exercises, participants reviewed lessons from international standards development; the health, trade, and infrastructure drivers shaping regulatory reform; and opportunities for deeper regional cooperation. Presentations from the World Health Organization (WHO), ASTM International, IAPMO, U.S. Department of Commerce, Indonesia's Ministry of Industry, Chinese Taipei regulators and laboratories, University of North Carolina, and major regional manufacturers (LIXIL, Kohler, TOTO, Rucika) underscored the urgency of action and the potential for coordinated improvement.

Water is essential not only to health, but also to poverty reduction and food security. To strengthen water security, the workshop examined strategies that include increasing sector-wide investment and capacity-building, promoting innovation, enhancing cross-sectoral coordination and cooperation among all stakeholders, and adopting a more integrated and holistic approach to water management.

The objective of the project was to promote the adoption of plumbing product regulations and conformity assessment procedures that address water efficiency, safety, and quality, with a particular focus on markets that may benefit most from stronger regulation and enforcement. By utilizing international standards and conformity assessment processes, plumbing product regulations will become harmonized and public health will be enhanced. The workshop included information on new products that can be used to improve water quality.

The workshop highlighted the need for harmonizing product standards across APEC economies, strengthened conformity assessment systems, clearer regulatory pathways, improved laboratory and workforce capacity, and industry accountability across the supply chain. Participants worked together to frame priorities and parameters for a Regional Roadmap for Lead-free Drinking Water—a multi-stage approach that economies can adapt based on domestic capacity, legal frameworks, and market conditions. While the proposed Roadmap was framed specifically around preventing lead in drinking water, it reflects best practices that could be applied for safer drinking water infrastructure generally.

This report synthesizes the evidence presented, distills lessons learned, documents the Roadmap process, and provides a set of APEC-aligned recommendations for advancing safer, more resilient drinking water systems.

Key Findings

1. **Unsafe water and sanitation remain significant health and development challenges across APEC.**

WHO reported that over 2.2 billion people globally lack safely managed drinking water, and unsafe WASH contributes to 1.4 million deaths each year. Several APEC economies face high exposure to chemical contaminants, microbial risks, and infrastructure failure under climate pressures. (Trouba, WHO) This crisis threatens economic growth, security, and public health. Although the APEC region is experiencing strong population growth, it has less freshwater per person than any other region. These trends diminish the ability to advance domestic priorities, including those related to sustainability and resiliency.

Public and private stakeholders have an important role to play in addressing these challenges by providing technologies and policy solutions that will contribute to a healthier, more water-secure world. The project will identify issues, barriers, and opportunities for policymakers to help shape their water and sanitation systems. The project will help economies apply relevant international water and plumbing standards into their technical regulations. This will help shape the construction of quality infrastructure and the availability of safe and efficient products.

Access to safe water, sanitation and hygiene is the most basic human need for health and well-being. Billions of people will lack access to these basic services in 2030 unless progress quadruples. Demand for water is rising owing to rapid population growth, urbanization and increasing water needs from agriculture, industry, and energy sectors.

2. **Plumbing products, materials, and water-contact components vary significantly in safety and compliance across the region.**

ASTM, IAPMO, MIRDC, and BSN presentations showed variation in national standards for pipes, faucets, tanks, meters, fittings, and treatment devices, as well as differences in how lead content, leaching, durability, and performance are regulated.

3. **Conformity assessment and market surveillance systems require strengthening.**

Economies identified challenges with limited accredited laboratories, inconsistent auditing practices, insufficient recognition of foreign CABs, and weak enforcement at borders and in domestic markets. (BSN, IAPMO, Commerce, MIRDC)

4. **Industry stressed the importance of supply chain integrity and material traceability.**

Manufacturers (LIXIL, Kohler, TOTO, Rucika) emphasized challenges related to inconsistent domestic requirements, high testing burdens, limited mutual recognition, counterfeit or non-conforming products, and reliance on global supply chains for critical components.

5. **Regional coordination offers substantial benefits for public health, trade, and cost-efficiency.**

The U.S. Department of Commerce, ASTM, IAPMO, and WHO highlighted that harmonized standards, mutual recognition, and international alignment reduce burdens on regulators and manufacturers while improving safety.

6. **Workforce development and public communication remain essential.**

Economies identified the need for trained plumbers, installers, inspectors, and utility staff; WHO stressed the importance of communication strategies for consumers and building owners.

7. **Drinking water safety addressing contaminants such as lead in drinking water is a major, preventable hazard requiring regulatory attention.**

Lead contributes to 1.5 million deaths and 33 million DALYs annually (WHO 2022). Presentations from WHO, UNC, and industry emphasized that lead leaches from fittings, solder, faucets, pipes, meters, tanks, and other supply-chain elements—especially where water is corrosive or standards are weak.

Key Recommendations

1. **Increase awareness of drinking water risks, with a focus on improving the material safety and performance of water and sanitation system components.**

Promote evidence-based awareness campaigns, build technical understanding among regulators, and improve communication with property owners, water suppliers, installers, and communities.

2. **Promote harmonization and coherence of drinking water product standards and technical regulations to ensure safer water systems.**

Encourage alignment with international standards (ASTM, NSF/ANSI, IAPMO, ISO, WHO GDWQ) and reduce fragmentation by supporting comparable requirements across APEC economies to prevent the use of leaded materials and parts in new water systems.

3. **Strengthen regulatory frameworks, enforcement mechanisms, and institutional capacity.**

Adopt risk-based and health-based frameworks, expand regulatory scope to underserved areas, strengthen inspection regimes, and increase monitoring frequency where appropriate.

4. **Expand laboratory capacity, accreditation systems, and analytical readiness.**

Support investments in accredited laboratories, reference materials, proficiency testing, and training to ensure economies can detect contaminants, including lead and emerging pollutants such as PFAS.

5. **Enhance conformity assessment and mutual recognition.**

Encourage the recognition of accredited international conformity assessment bodies, strengthen domestic CABs, and develop pathways to improve cross-economy equivalency and regulatory cooperation.

6. **Support industry engagement and good manufacturing practices.**

Facilitate participation of manufacturers in standards development processes, advance supply chain traceability, and promote high-quality materials, design, and testing.

7. **Improve supply chain integrity and market surveillance.**

Strengthen border controls, retail inspections, and surveillance for non-conforming or counterfeit products; leverage digital tools where feasible.

8. **Advance APEC-wide collaboration on safer drinking water infrastructure.**

Support multi-economy roadmaps, regional peer learning networks (building on WHO RegNet), development of training resources, and sharing of technical documentation and best practices.

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Abbreviations and Acronyms

ABS	Acrylonitrile Butadiene Styrene
AMR	Antimicrobial Resistance
APEC	Asia-Pacific Economic Cooperation
ASTM International	American Society for Testing and Materials
BSMI	Bureau of Standards, Metrology and Inspection (Chinese Taipei)
BSN	Badan Standardisasi Nasional (Indonesia National Standardization Agency)
CAB	Conformity Assessment Body
CNS	Chinese National Standards (Chinese Taipei)
EPA (US EPA)	United States Environmental Protection Agency
GDWQ	WHO Guidelines for Drinking-water Quality
IEC	International Electrotechnical Commission
ILAC	International Laboratory Accreditation Cooperation
ISO	International Organization for Standardization
IAPMO	International Association of Plumbing and Mechanical Officials
ITA	International Trade Administration (U.S. Department of Commerce)
LPK / LSPro	Indonesia Product Certification Bodies
MIRDC	Metal Industries Research & Development Centre (Chinese Taipei)
MRA	Mutual Recognition Arrangement
NSF/ANSI	North American performance and safety standards for drinking water products
NTD	Neglected Tropical Disease
PE, PVC, PP, PEX	Common piping materials
PFAS	Per- and Polyfluoroalkyl Substances
SCSC	APEC Sub-Committee on Standards and Conformance

SDGs	Sustainable Development Goals
SNI	Indonesian National Standards
SSP	Sanitation Safety Planning (WHO)
TBT	WTO Agreement on Technical Barriers to Trade Agreement
TPL	Chinese Taipei Plumbing Research & Testing Laboratories
UNC	University of North Carolina at Chapel Hill
WASH	Water, Sanitation, and Hygiene
WHO	World Health Organization
WSP	Water Safety Plan (WHO)

APEC Nomenclature

AUS	Australia
BD	Brunei Darussalam
CDA	Canada
CHL	Chile
PRC	People's Republic of China (China also acceptable)
HKC	Hong Kong, China
INA	Indonesia
JPN	Japan
ROK	Republic of Korea (Korea also acceptable)
MAS	Malaysia
MEX	Mexico
NZ	New Zealand
PNG	Papua New Guinea
PE	Peru
PH/PHL	The Republic of the Philippines (the Philippines also acceptable)
RUS	The Russian Federation
SGP	Singapore
CT	Chinese Taipei
THA	Thailand
US/USA	United States
VN	Viet Nam

1. Introduction

Background and Context

Safe drinking water is foundational to public health, social well-being, and economic development across the Asia-Pacific region. As highlighted by the World Health Organization (WHO), more than 2.2 billion people globally lack access to safely managed drinking water, and unsafe water, sanitation, and hygiene (WASH) contribute to 1.4 million deaths each year. Within APEC economies, rapid urbanization, climate shocks, aging infrastructure, and the proliferation of diverse water-contact materials and products amplify risks related to microbial contamination, chemical hazards, and system failures.

Lead and toxic metals are major contaminants of global public health concern, accounting for 1.5 million deaths and the loss of 33 million disability-adjusted life years (DALYS) in 2021. Lead in drinking water is a major preventable source of lead exposure, and the primary cause of this exposure is the use of lead-containing parts and materials in drinking water systems. Therefore, eliminating the use of lead and lead-containing parts, materials, and products in new water systems is an important step towards preventing lead exposure. However, APEC economies do not currently have a harmonized and collaborative process for working together to eliminate these hazards.

The 2025 APEC SOM3 Workshop on Strengthening Standards and Technical Regulations for Safer Drinking Water was convened to address these challenges by examining how standards and technical regulations—supported by robust conformity assessment and market surveillance—can reduce risks and create more coherent, resilient, and health-protective drinking water systems. The workshop focused particularly on addressing material safety and performance while preventing lead contamination and other hazards arising from pipes, fittings, faucets, meters, storage tanks, and treatment products.

Given the APEC region's crucial role in global manufacturing of plumbing and water-related infrastructure products, improving the coherence and quality of standards across the region has both public health and trade facilitation benefits. Harmonized standards and aligned conformity assessment practices help economies reduce regulatory burdens, improve product quality, and strengthen consumer protection.

Workshop Objectives

The workshop was designed to:

1. Demonstrate the role of safer infrastructure in delivering safe, sustainable, and resilient drinking water services.
2. Identify technical and policy solutions for improving the quality, safety, and performance of drinking water products and systems.
3. Strengthen regulatory pathways for safer water through standards adoption, implementation, conformity assessment, and enforcement.

4. Support APEC economies in developing or enhancing domestic drinking water standards and technical regulations.
5. Develop a practical, multi-stage Roadmap for improving drinking water infrastructure safety, grounded in evidence and adaptable across diverse economic contexts.
6. Facilitate regional collaboration, including participation in international standards bodies and mutual recognition initiatives.

Alignment with APEC Priorities and the SCSC Mandate

This project supports APEC's broader commitments to:

- Trade facilitation by reducing unnecessary technical barriers to trade (TBT).
- Regulatory cooperation, consistent with the WTO TBT Agreement's principles of transparency, nondiscrimination, and reliance on international standards.
- Public health and resilience, especially given climate-related disruptions to water systems.
- Inclusive and sustainable development, aligned with SDG 6 (Clean Water and Sanitation).
- Good Regulatory Practices (GRPs) through evidence-based policy design, stakeholder consultation, and capacity building.

Within the SCSC work program, this initiative contributes to improved regulatory coherence, supports robust conformity assessment systems, and fosters cooperation between regulators and industry.

Methodology and Evidence Base

This report synthesizes:

- Presentations delivered by regulators, standards organizations, industry, academia, and NGOs during the 2025 APEC workshop summarizing adequate evidence that lead is harmful to human health, occurs in drinking water at levels of concern, and can be prevented through appropriate actions to protect supply chains.
- WHO normative guidance, including the Guidelines for Drinking-water Quality, Water Safety Plans (WSPs), Sanitation Safety Planning (SSP), and RegNet insights.
- Economy case studies (Indonesia; Chinese Taipei; United States; others where relevant).
- Industry evidence on supply chain integrity, materials, testing burdens, and product design.
- International standards documentation (ASTM, IAPMO, NSF/ANSI, ISO).
- Conformity assessment and accreditation frameworks (ILAC, IAF, CAB systems).
- Breakout session worksheets and economy-submitted Roadmap inputs.

Consistent with APEC guidance and your instruction, all findings follow the rule: "the data are the data." Assertions requiring evidence rely on verified sources; where external sources are required but none can be identified, "[Reference Needed]" will be used.

2. Case for prioritizing global and regional action for safer drinking water

Safe drinking water is essential for human health and development and has been recognized as a universal human right. As economies and regions work to advance progress on safe drinking water, there is a critical need to address multiple hazards and exposure routes that threaten water safety. These include taking action on securing supply chains to ensure the use of safe and high-quality plumbing products and materials in drinking water systems and ensuring that efforts are responsive to emerging and re-emerging challenges including PFAS, climate change, urbanization, and others. Finally, there is an opportunity to accelerate progress by coordinating efforts to reduce sector fragmentation and enhance synergy and mutual support at a regional and global scale.

Global Health and Development Imperatives

Unsafe drinking water continues to impose heavy health and economic burdens. Drinking water quality is impacted by numerous hazards with multiple exposure routes and methods of management. One particular set of hazards and exposures that often receives insufficient attention is the presence of toxic chemical and other hazards in plumbing products and materials used in water system construction. These are often key opportunities for primary prevention to protect public health, and are frequently amenable to regulatory control and enforcement by economies. However, lack of coordinated and effective action on these hazards can delay progress on public health or fragment efforts, impeding progress. In this session, presenters reviewed the strong technical and public health case for effective, coordinated, and evidence-based action to ensure drinking water systems are free from preventable hazards of public health concern:

- WHO estimates 1.4 million deaths annually from WASH-related diseases (Trouba, WHO).
- More than 2.2 billion individuals lack safely managed drinking water.
- Diarrheal diseases, cholera, and other waterborne illnesses remain major contributors to childhood morbidity.
- Chemical hazards—including lead, arsenic, PFAS, and manganese—pose additional risks.

Safe drinking water is explicitly recognized as a human right and underpins multiple Sustainable Development Goals (SDGs 3, 6, 11, 13).

Lead as a Priority Drinking Water Hazard

Lead exposure was a central theme of the workshop. According to WHO, lead is a global chemical hazard of major public health concern. Lead exposure from all sources causes approximately 1.5 million deaths annually and more than 33 million DALYs (WHO, 2022). Children bear the heaviest burden due to neurological impacts and long-term developmental harm. Sources of lead exposure include lead in soil, dust, paint, food, cosmetics, drinking water, toys, and a variety of other products and media.

Drinking water is one important source of child lead exposure, and one that is entirely preventable. The major source of lead in drinking water is unsafe water infrastructure that contains lead or lead-bearing parts and materials. Lead in drinking water systems arises from leaching associated with:

- Faucets and fittings
- Service lines
- Solder and brass components
- Water meters
- Valves
- Storage tanks
- Poor-quality plumbing materials

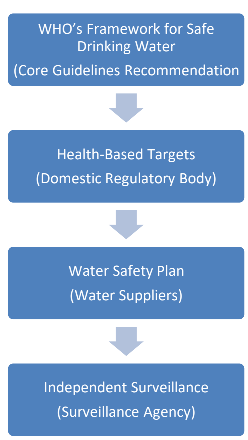
Corrosive or high-temperature water increases leaching risk, and areas with such water are particularly vulnerable to elevated lead levels in the absence of effective corrosion control treatment. Prevention—including elimination of lead in plumbing products—is the most effective management strategy. Where lead is already present, corrective actions such as filtration can also be effective, but primary prevention remains the most impactful and efficient approach to preventing lead in drinking water wherever it is possible to prevent the introduction of lead into the supply chain.

WHO emphasized that actions are required at multiple levels: regulators, utilities, installers, manufacturers, and consumers. WHO noted that lead should be considered within a broader framework of efforts to ensure water safety. This framework includes health-based targets, Water safety plans (WSPs), and independent water quality monitoring and surveillance efforts (Figure 1, below). WHO also leads RegNet, a network of water regulators, which can serve as a resource to economies and regulators seeking ways to align on preventing lead in water infrastructure.

Figure 1. WHO regulatory tiers across APEC economies

WHO recommends that lead be considered within a broader framework of efforts to ensure water safety.

Lead Should be Considered as Part of Broader Efforts to Improve Drinking Water Safety



Source: Trouba, WHO Presentation, APEC 2025 Workshop: SCSC 105 2024A.

Climate Change, Urbanization, and Infrastructure Stress

APEC economies face increasing pressure on water systems from:

- Extreme weather events (floods, typhoons, droughts) increasing contamination risks.
- Population growth and urban density outpacing infrastructure capacity.
- Resource constraints in rural and remote regions.
- Aging distribution networks contributing to chemical and microbial contamination.
- Shifts in source water quality, requiring more robust treatment and monitoring.

These factors underscore the need for resilient standards and adaptive regulations.

Regional Opportunities for Harmonization

APEC economies produce a large share of the world's faucets, pipes, fittings, and water-treated products. Because supply chains span multiple economies:

- Divergent standards raise costs and increase risks of non-conforming products.
- Mutual recognition agreements (MRAs), regulatory coherence, and reliance on international standards can reduce duplication.
- Economies expressed strong interest in strengthening regional cooperation, including peer learning, shared laboratory resources, and joint development of guidance documents.

3. Proceedings of the Workshop

Workshop Overview

Over 2.2 billion people lack access to safely managed drinking water services, and more than half of the world population lacks access to safe sanitation. This crisis threatens economic growth, regional and domestic security, and public health. Despite significant progress, many APEC economies are water insecure and several have rates of access to these basic services below 50%. In addition, APEC economies vary widely in their adoption of enforceable standards and regulations governing materials, construction, and/or operation of water and sanitation systems and infrastructure. These trends impact the ability of economies to advance domestic priorities, including those related to health, sustainability, and resilience.

Building off previous APEC-funded projects, the 2025 APEC Workshop on *Strengthening Standards and Technical Regulations for Safer Drinking Water* convened regulators, standards organizations, manufacturers, researchers, and international agencies for two days of panel discussions and collaborative breakout sessions.

Participants from across APEC economies shared experiences on regulatory strengthening, product standards, conformity assessment, market surveillance, and supply chain integrity. Discussions centered on the health impacts of drinking water contamination—particularly from lead—and the need for coherent approaches to regulating pipes, faucets, fittings, meters, storage tanks, and treatment devices.

The session further enabled participants to lay out the need for and begin to develop framing around a road map for policymakers identifying key issues, barriers, and opportunities that will help to formalize and regulate the product markets for this sector. This will help develop and strengthen global markets and supply chains. It will also aid in the development of regional and domestic quality infrastructure and operations to strengthen safe and sustainable service delivery.

Panel Summaries

Panel 1: Role of Safer Infrastructure Solutions in Meeting Health, Sustainability, and Development Goals

Panelists	
Name	**Title**
Dain Hansen (Moderator)	Executive Vice President, IAPMO
David Trouba	Water, Sanitation and Health (WaSH) Unit, WHO
Indika Gunawardana	WASH Advisor, World Vision
Michael Fisher	Senior Researcher, Water Institute at the University of North Carolina

Key Themes:

This session brought together global experts to explore how safer infrastructure solutions—including materials selection, supply chain oversight, regulation, and systems design—contribute to delivering safe, sustainable, and resilient drinking water systems. Panelists offered insights into how improved infrastructure supports public health outcomes, advances the Sustainable Development Goals (SDGs), and strengthens regional and domestic quality frameworks. Speakers highlighted WHO's global guidance on drinking water quality and its call to action for stronger water and sanitation regulation. The panel offered research perspectives on the life-cycle costs of water infrastructure and the importance of service delivery monitoring. The panel also addressed practical challenges and innovations in community WASH programs, including efforts to prevent toxic metal contamination and ensure safe water in vulnerable regions. It also drew connections to international initiatives such as the Global Partnership for Lead-Free Water, Partnership for a Lead-Free Future, and efforts to reduce non-tariff barriers to trade across the APEC region. Insights from this session can directly inform the development of an international roadmap, helping to identify key priorities, best practices, and collaborative actions that APEC economies can take to strengthen regulatory frameworks and ensure safer water infrastructure across the region.

World Health Organization (WHO): Global Drivers and Regulatory Imperatives

Mr. David Trouba of the World Health Organization's (WHO) Water, Sanitation, Hygiene and Health Unit spoke on his organization's efforts to improve water quality. Trouba emphasized that access to safe drinking water remains a major challenge globally, with over 2.2 billion persons lacking access to safely managed drinking water and more than 3.5 billion lacking safely managed sanitation. This gap in safely managed WASH services contributes to **1.4 million deaths per year** from diarrhea, cholera, neglected tropical diseases (NTDs) and antimicrobial resistance (AMR), among other causes. Within the APEC region, growing populations, climate pressures, and aging or under-regulated systems exacerbate risks.

Trouba went on to group APEC economies into four categories: strong, comprehensive systems; moderate systems with some gaps; developing or fragmented regulation; and weak or nascent regulation. The WHO facilitates water quality through issuing guidance, supporting standards development, sharing information among partners and beneficiaries, and building capacity. Clean water and sanitation is one of the Sustainable Development Goals. Improved water quality boosts public health. WHO has issued guidance on drinking water quality, sanitation, and recreational water quality. WHO has organized a network of water and sanitation regulators (RegNet) who customize WHO guidance into economy-level regulations. Mr. Trouba highlighted the dangers posed by lead in drinking water. Reducing lead is part of the overall effort to improve water quality, but different bodies play different roles. For example, regulators adopt standards related to lead, whereas water suppliers monitor the amount of lead in water.

Key messages included:

- Lead's disproportionate health burden (1.5 million deaths, 33 million DALYs, WHO 2022).
- The role of corrosion, legacy plumbing, and poor-quality products in leaching.
- The need to strengthen regulatory frameworks using WHO's guidance:
- Good practices for drinking-water regulation
    - Water Safety Plans (WSPs)
    - Sanitation Safety Planning (SSP)
    - RegNet systems-strengthening tools

Trouba underscored the benefits of clear product standards and risk-based regulatory models.

World Vision: Safe Infrastructure and Community-Level Impacts

Ms. Indika Gunawardana of World Vision (WV) described her organization's Water, Sanitation and Health (WASH) program. WV operates WASH programs in over 100 economies worldwide, but has identified 42 priority economies. She used the acronym "SAFER" to describe the program's key elements:

- Safe: Meeting applicable materials and water quality standards
- Accessible: Accessed by all including most vulnerable
- Functional: Designed according to demand and environmental conditions
- Equitable: Available equally to all and do not create unavoidable social conflicts

- Resilient: Available when needed and resistant to climatic and other shocks

She noted that using high quality infrastructure reduces costs over the long term. Her organization seeks to embed quality into its programs by training staff and formalizing procedures. She noted challenges, such as convincing governments to align their internal standards to international standards.

Ms. Gunawardana also presented evidence of critical infrastructure gaps in rural and peri-urban communities, showing how unsafe materials, poor installation practices, and lack of maintenance contribute to contamination.

Key insights:

- Use of uncertified pipes and fittings leads to leaching and breakage.
- Training for plumbers and community water managers is essential.
- Standardization of basic materials can reduce failures in low-resource settings.
- Emphasized the importance of affordability and supply chain transparency.

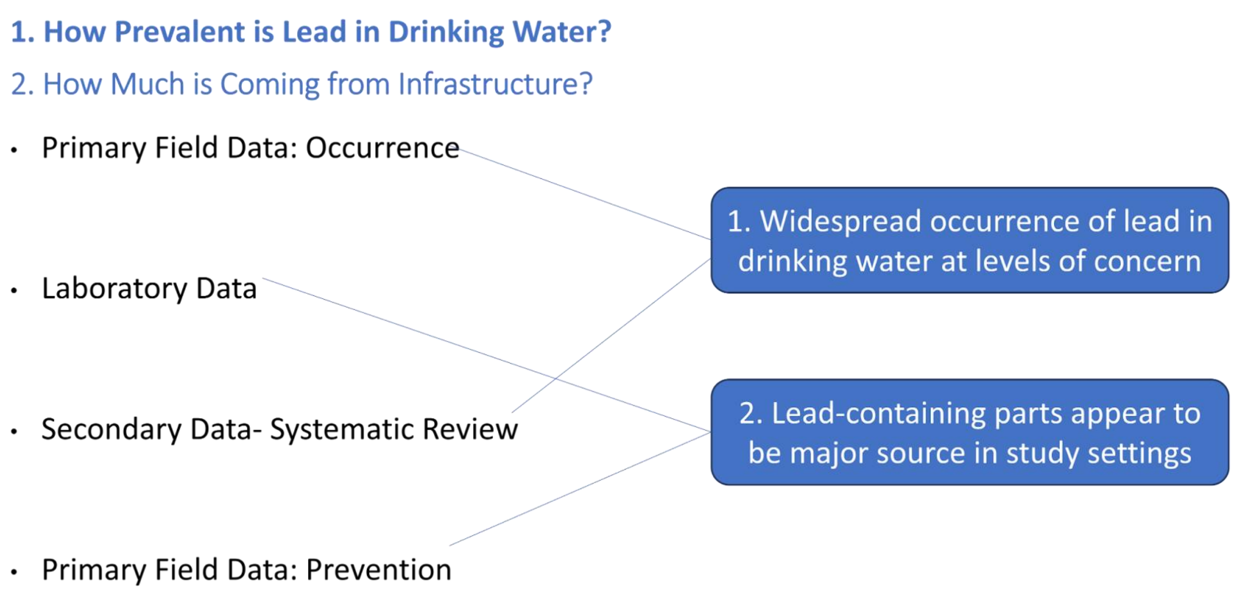
UNC Water Institute: Lead in Drinking Water and Risk Pathways

UNC's presentation (Mike Fisher) highlighted widespread occurrence of lead in drinking water across global settings. Evidence from field trials, laboratory studies, and literature reviews confirms that lead in water system parts and materials is contributing to elevated lead concentrations in drinking water worldwide. These levels represent serious hazards to human health, and can be prevented by the use of lead-free parts and materials in new water systems.

Key insights:

- Lead enters water through corrosion of lead-containing service lines, brass fittings, solder, valves, meters, and galvanized pipes.
- Long stagnation times, high water temperature, acidic or soft water increase leaching.
- Low-cost lead test strips and smartphone apps can support household-level detection and awareness.
- APEC economies benefit from capacity building in monitoring and surveillance.

Figure 2. Multiple lines of evidence indicate that lead in water system parts and materials is contaminating drinking water worldwide.



Source: Fisher, UNC Presentation. APEC 2025 Workshop: SCSC 105 2024A.

Panel 2: Defining the Water and Sanitation Product Markets & International Standards

Panelists	
Name	**Title**
Shirley Dewi (Moderator)	Senior Vice President of Quality Assurance, IAPMO
Craig Updyke	Senior Director, Global Policy and International Trade, ASTM International
Tom Palkon	Executive Vice President & Chief Technical Services Officers, IAPMO

Key Themes:

This session defined essential product categories that should be prioritized in the development of an international roadmap for water and sanitation product standardization. Speakers examined the current landscape of international codes, standards, and conformity assessment frameworks relevant to plumbing products and water infrastructure—including plumbing fittings and fixtures, piping, and water filtration technologies. The session highlighted the critical role of standards in ensuring material safety and performance, improving water efficiency, and preventing contamination from lead and other harmful substances.

Drawing on recent research conducted in Southeast Asia and the ASEAN region, panelists also discussed key findings related to gaps in standards adoption, challenges to regulatory harmonization and standard monitoring and compliance, and opportunities to reduce technical barriers to trade. The panel offered insights into the role of voluntary consensus standards and global trade policy in supporting cross-border product compliance. It also presented technical perspectives on standardization priorities and the development of product certification systems that protect public health. Outcomes from this session can directly inform the structure and scope of the international roadmap, helping APEC economies align on high-priority product categories and shared approaches to regulatory coherence and supply chain integrity.

ASTM International: Standards for Water Infrastructure Products

Mr. Craig Updyke of ASTM International described his organization's role as a standards developer. He highlighted ASTM's standards that relate to water quality, particularly in the area of pipes. He described the difference between voluntary and mandatory standards and identified some points for users to consider, such as the process through which they were developed. ASTM's standards are developed using the WTO's "Code of Good Practice," which provide for openness and transparency. Updyke further emphasized ASTM's global reach (83 economies using ASTM standards; 125+ MOUs) and outlined relevant standards for:

- PVC, CPVC, PP, PE, and PEX pipes
- Fittings and joints
- Testing methods for leaching, durability, burst strength, and hydrostatic performance

Key presentation points:

- Economies face challenges identifying which ASTM standards apply to which product categories.
- Where harmonized adoption is lacking, manufacturers face duplicative testing and compliance burdens.
- ASTM provides numerous technical committees relevant to water supply infrastructure.

IAPMO: Model Codes, Certification, and Conformity Assessment

Mr. Tom Palkon of the International Association of Plumbing and Mechanical Officials (IAPMO) spoke on advancing water standardization across the APEC region. IAPMO contributes to water quality by creating model codes (e.g., Uniform Plumbing Code) and by conducting conformity assessment. Standards contribute to public health by serving as a tool to prevent contamination and improving water quality. Palkon cited three product categories to prioritize for water quality: plumbing fittings and fixtures, piping systems, and water filtration systems. Palkon presented on IAPMO's initiatives in these areas, including:

- Uniform Plumbing Code (UPC)
- WeStand (Water Efficiency and Sanitation Standard)
- Certification programs for faucets, fittings, and fixtures

Mr. Palkon went on to note that there is currently considerable variation among APEC economies in standards application because of differences in local conditions. Research conducted by IAPMO and U.S. government agencies has highlighted specific gaps in product standardization. Palkon described the importance of conformity assessment as a tool to ensure compliance and facilitate trade. He laid out three goals for international cooperation: 1) develop core set of baseline performance and safety standards for inclusion in a roadmap, 2) strengthen conformity assessment mechanisms, and 3) regulatory enforcement of standards and certification.

Key insights:

- Conformity assessment varies widely across economies.
- Recognition of foreign CABs could reduce testing burdens.
- Many economies lack robust market surveillance systems to detect counterfeit/substandard products.
- IAPMO highlighted opportunities for APEC economies to leverage existing codes and contribute to their development.

WTO TBT Framework

Session introductions emphasized that 93% of global trade is affected by standards and technical regulations. For drinking water products:

- Transparency and nondiscrimination are critical.
- Use of international standards reduces trade barriers while improving safety.
- Coherence with WTO TBT obligations strengthens regulatory effectiveness.

Panel 3: APEC Economy Perspectives on Regulating Plumbing Products

Panelists	
Name	**Title**
Shirley Dewi (Moderator)	Senior Vice President of Quality Assurance, IAPMO
Andi Rizaldi	Head of Standardization and Industrial Service Policy Agency (Indonesia)

Chia-Lieh Chang	Chairman, Plumbing Association of Taiwan
Yu-Chen Wei	Chemical Analysis Engineer, Metal Industries Research & Development Centre
Katelynn Murphy	Business Industry Specialist, US Department of Commerce

Key Themes:

This session featured presentations from APEC member economies on domestic approaches to regulating products used in drinking water systems and the materials used in water infrastructure construction. Government officials shared experiences in developing, implementing, and refining regulatory frameworks to protect public health, ensure product quality, and support sustainable infrastructure development. The discussion examined past and present challenges, cross-agency coordination efforts, and the integration of international standards and conformity assessment systems into domestic regulatory structures.

The session also explored how economies balance regulatory enforcement with efforts to minimize technical barriers to trade, particularly through alignment with international best practices and standards (e.g. ASTM, ASME, IAPMO, ISO, etc.). Presenters highlighted efforts to strengthen collaboration between health, infrastructure, environment, and industry regulators to build comprehensive oversight systems. Case examples showcased how regulatory systems have evolved to address emerging threats such as lead contamination, while supporting market access and innovation. Insights from this session can play a critical role in shaping the international roadmap by identifying common challenges and recommending strategies for regulatory alignment, mutual recognition, and capacity building across the APEC region.

Indonesia (Ministry of Industry): Mandatory SNI System

Mr. Andi Rizaldi of Indonesia's Ministry of Industry spoke on the comprehensive implementation of mandatory Indonesian National Standard (SNI) standards for plumbing and water-related products, noting that SNI is the recognized standard in Indonesia, established by Badan Standardisasi Nasional (BSN). SNI serves as a reference for product quality, safety/environment, and performance. SNI standards are voluntary by default in Indonesia, but can be made mandatory when voluntary standards are applied in a technical regulation.

The Ministry of Industry engages stakeholders and develops standards that are submitted to the Indonesian Standards Bureau (BSN) for formalization. If the standard is considered for inclusion in a technical regulation, the Ministry conducts a regulatory impact assessment, finalizes the measure, and appoints conformity assessment bodies. Mutual recognition agreements can help facilitate trade by reducing compliance costs.

These resulting "Technical Regulations" are legally binding rules issued by the government that mandate compliance with specific standards (typically SNI) for certain products. Binding Technical Regulations are enforced by sectoral ministries, including the Ministry of Industry (MoI) – for specific industrial products. Mandatory SNI for plumbing and water infrastructure materials include:

- Steel pipes (SNI 39:2024)
- Water meters (SNI 2547:2024)
- Toilet and flush devices (SNI 797:2020)
- Water storage tanks (SNI 7276:2020)
- Pipes and fittings (SNI 122:2022)

Rizaldi also described the process for Indonesia to enter into Mutual Recognition Arrangements (MRAs) with suppliers who already conform to internationally recognized certification schemes. Such an arrangement allows the supplier to test and certify a product in conformity with the MRA terms prior to exporting. This enables harmonization as part of international certification and/or standardization schemes. Indonesia is involved in MRAs including:

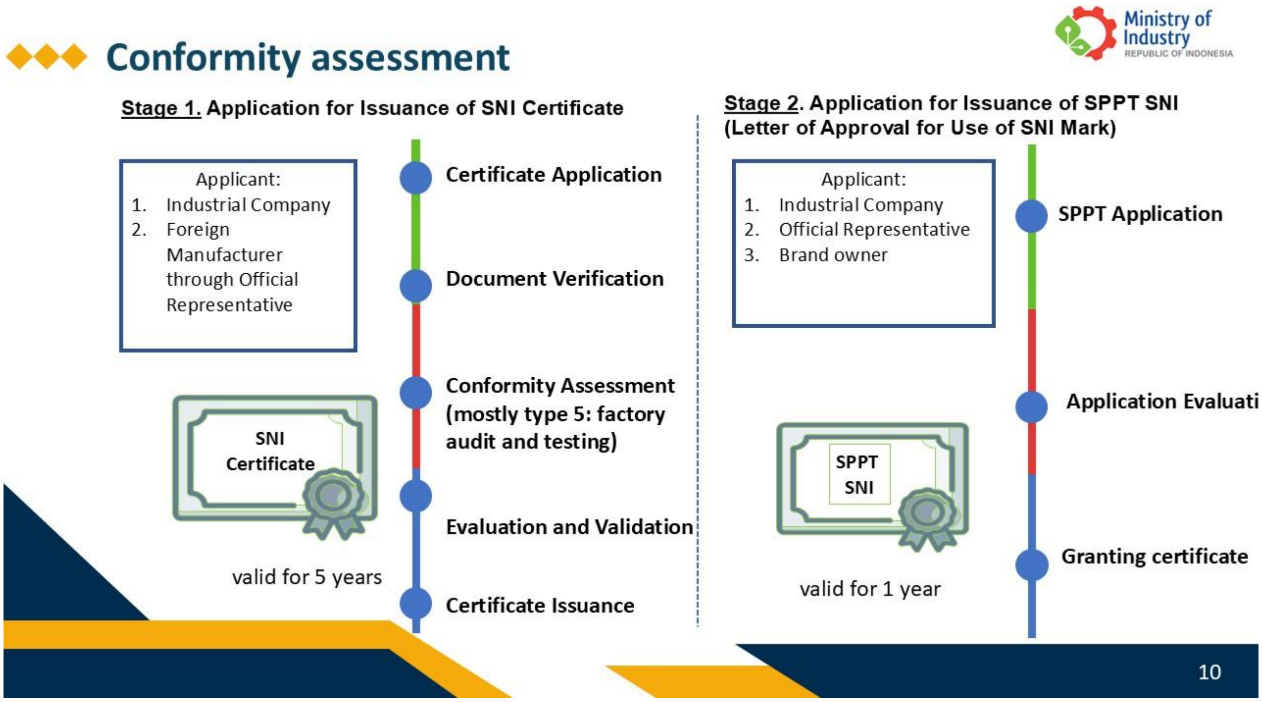
- ASEAN Harmonised Electrical and Electronic Equipment Regulatory Regime (AHEEERR), other products under ASEAN MRA
- ILAC (International Laboratory Accreditation Cooperation)
- IAF (International Accreditation Forum)
- IEC CB Scheme (Certification Body Scheme of the International Electrotechnical Commission)

In comments and discussion following the presentation, Rizaldi highlighted the potential opportunity to enhance the use of Indonesian National Standards (SNI) as a powerful tool to improve water quality. He further noted challenges and barriers exist that can impact mandatory standard development, implementation, enforcement, and conformity assessment. These included:

- Need for increased lab capacity
- Better CAB recognition
- Enforcement gaps at borders
- Need for clearer specifications on lead content and leaching

Figure 3. Indonesia's Mandatory SNI Certification and Regulatory Flowchart

Process for conformity assessment with respect to mandatory Indonesian National Standards.



Source: Rizaldi, Indonesia Ministry of Industry Presentation. APEC 2025 Workshop: SCSC 105 2024A.

Chinese Taipei: Water Efficiency Labels & CNS Standards

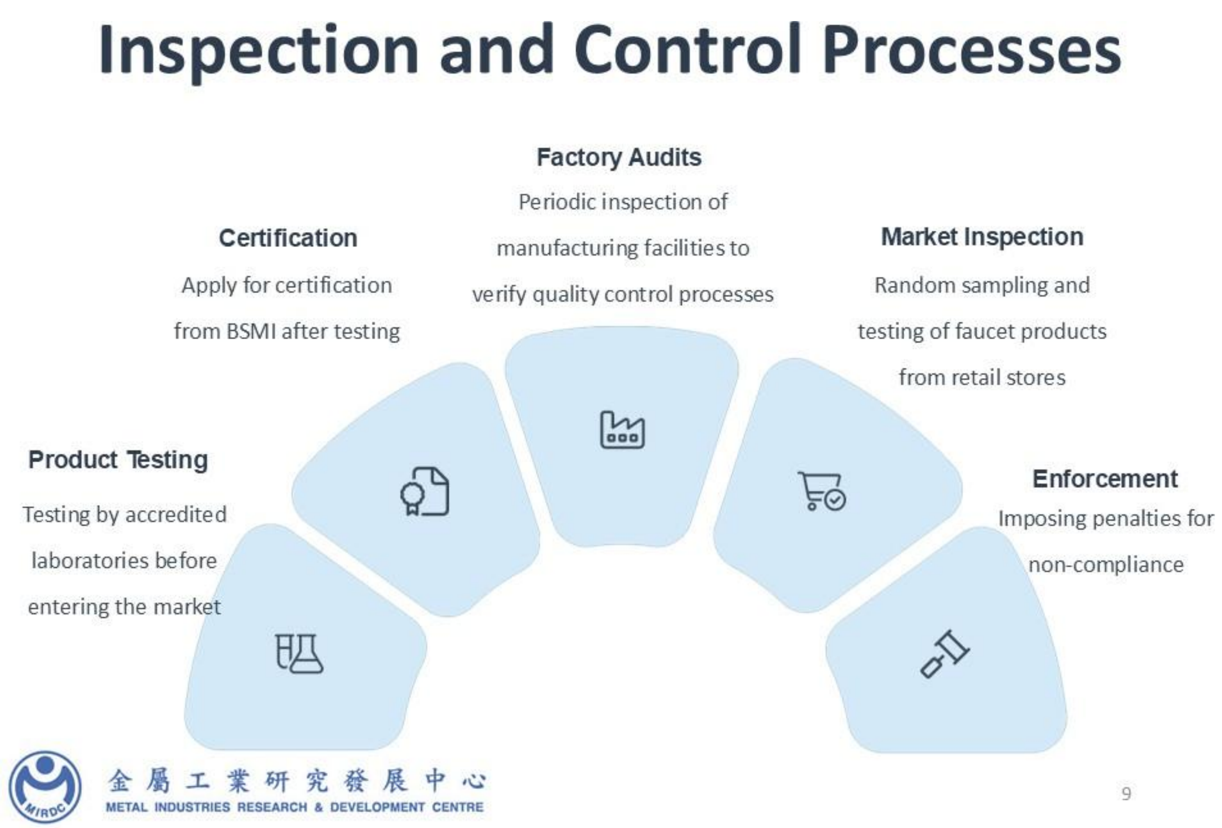
Chia-Lieh Chang of the Plumbing Association of Taiwan spoke on the use of water efficiency labels. These labels are the backbone of a voluntary certification system spearheaded by the Water Resources Agency under the Ministry of Economic Affairs. It is designed to guide consumers toward purchasing products that use water more efficiently. Rainfall patterns and geography have contributed to Chinese Taipei's development of water efficiency programs. Certain products, such as toilets, washing machines, and showerheads can't be sold without water efficiency labels. Chang went on to explain:

- The Water Efficiency Label applies to faucets, showers, toilets, appliances.
- TPL and MIRDC conduct accredited testing.
- Chinese Taipei has moved toward stricter limits on hazardous chemicals (PFAS, lead).

Yu-Chen Wei of Chinese Taipei's Metal Industries Research and Development Center spoke on that economy's regulatory framework for plumbing products. Since 2017, the Bureau of Standards, Metrology, and Inspection (BSMI) has carried out mandatory inspections of faucet components. Wei described the five parts of the inspection and control process: product testing, certification, factory audits, market inspection, and enforcement. The organization's next priority was addressing PFAS in the water system. Wei also described examples of current standards and challenges:

- CNS 8088 includes performance and lead content requirements for faucets and fittings. This standard closely aligns with the NSF/ANSI 61 standard, but has a minimum threshold Q statistic of 5 (as previously specified under NSF/ANSI 61) as compared to the current NSF/ANSI 61 Q statistic of <1 or 0.5. CNS 8088 also incorporates material standards with respect to lead that closely mirror those contained in NSF/ANSI 372. Thus, current standards in use by Chinese Taipei mirror many international standards, but have not been updated in all cases to align with changes and updates to international standards such as NSF/ANSI 61.
- Need for more accredited labs
- Emergence of counterfeit certification marks
- Gaps in traceability documentation

Figure 4. Inspection and Control Processes to Ensure Conformity of Plumbing Products.



Source: Wei, MIRDC Presentation. APEC 2025 Workshop: SCSC 105 2024A.

United States (Department of Commerce, ITA)

Ms. Katelynn Murphy of the U.S. Department of Commerce's International Trade Administration presented on the U.S. approach to standards and technical regulations. The United States system differs from other economies because most standards are developed by private sector organizations, rather than government bodies. This contributes to innovation and the development of high-quality standards. Over 93 percent of world trade is in products covered by standards or regulations, and plumbing products are no exception. The U.S. Commerce presentation emphasized:

- Importance of international alignment for safety and trade
- How standards differences create technical barriers
- The need for transparent regulatory processes
- The role of industry in contributing to standards development
- Examples of supply chain vulnerabilities
- Benefits of CAB recognition and MRA frameworks

Additional Economy Perspectives

Additional comments included:

- Challenges in rural areas (multiple economies)
- Gazetted but unenforced standards
- Limited availability of accredited labs
- Inadequate training for plumbers and installers
- Increasing consumer concerns about chemical contaminants.

Panel 4: Industry Leadership and Supply Chain Integrity

Panelists	
Name	**Title**
Christopher Lindsay (Moderator)	Senior Vice President of Government Relations, IAPMO
Troy Benavidez	Leader, Government Relations & Policy, LIXIL International
Tina Zhu	Senior Staff Engineer, Kohler China
Fernando Fernandez	Vice President, Codes & Standards, TOTO USA

Muhajir Asrori	APIN Chairman / Technical Training Division Head, PT. Wahana Duta Jaya Rucika
Yanqu Sun (panel participant only)	Manager of Engineering, Kohler China

Key Themes:

This session examined the challenges and opportunities facing manufacturers as they work to ensure safe, high-quality drinking water infrastructure across diverse markets. Panelists shared insights into the safety, certification, innovation, and verification processes required to produce reliable plumbing products—from piped water systems and handpumps to advanced fixtures and filtration components. The conversation also explored how industry can collaborate with government and civil society to promote trusted solutions and raise awareness of quality infrastructure standards, building on initiatives like the Windsor Declaration and the Global Partnership for Lead-Free Water.

Speakers drew on their own organizational experiences to illustrate real-world implementation – identifying challenges and opportunities for market alignment across APEC. They shared strategies for advancing public-private partnerships to help facilitate this work. The panel discussed the integration of performance-based standards into product innovation and the importance of regulatory alignment across borders. It also offered a regional manufacturing perspective, addressing challenges in sourcing compliant materials, navigating domestic regulatory systems, and aligning products with international standards. Finally, the panel highlighted advances in water-efficient technologies and shared insights into how multinational manufacturers address safety, sustainability, and export readiness. The session can contribute directly to the international roadmap by identifying practical industry actions, cross-sector partnerships, and harmonization strategies that APEC economies can use to build safer, more resilient supply chains.

LIXIL: Ensuring Compliance Across Complex Supply Chains

Mr. Troy Benavidez of LIXIL spoke on “Strengthening Industry Leadership and Supply Chain Integrity for Safe Water Infrastructure.” He noted that product safety and certification were key elements of the company’s strategy. In order to meet safety standards, the company must ensure that its supply chain is trustworthy. The company maintains a network of suppliers with rigorous quality controls and traceability protocols. The harmonization of water quality standards provides benefits to both manufacturers and consumers. Manufacturers enjoy reduced barriers to entry and access to global markets. Consumers benefit from higher water quality standards. Harmonized standards help to reduce regulatory differences, which spurs trade and accelerates innovation. However, achieving harmonization requires engagement from both the public and private sectors. Mechanisms that can facilitate this collaboration include multi-stakeholder governance structures (such as joint committees), standards development through an open and transparent process, alignment of incentives to spur uptake (e.g., in procurement), and generating awareness through information campaigns. LIXIL further emphasized:

- The difficulty of navigating divergent requirements across economies
- Need for consistent lead-free requirements
- Importance of third-party certifications in reducing market exposure to non-compliant products
- Challenges caused by long, multi-economy supply chains

Kohler: Innovation and Quality Assurance

Ms. Tina Zhu of Kohler China spoke about "Safe Water for All," the company's effort to develop solutions for communities facing water scarcity. Her company's products meet the standards developed by multiple bodies. She noted that discrepancies in plumbing systems and water efficiency criteria have led to varied and fragmented certification schemes. The requirements on material safety and sanitary compliance differ significantly across regions. The lack of mutual recognition across certifications results in duplicated audits and wasted resources. Finally, complex approval procedures and unclear documentation requirements hinder compliance efficiency. She suggested APEC could facilitate the development of minimum technical benchmarks to standardize core testing methods. APEC could promote a "tested once, recognized by many" mechanism. By developing a unified technical documentation system, it would create a one-stop certification service platform and strengthen capacity building and technical transfer. She suggested that three standards and one testing system could be harmonized across APEC:

- Water supply pipes, faucets and valves,
- Water purifiers and filtration devices, and
- Product durability testing.

She described the CB scheme as a possible model. The CB scheme allows manufacturers to have their products tested once, then recognized in more than 50 participating economies without repeating the testing process. This single IEC standards–based evaluation saves significant time and cost while ensuring consistent quality and compliance worldwide. Kohler's presentation also highlighted:

- Material innovations aimed at reducing leaching
- Importance of robust product testing and certification
- Burdens introduced by inconsistent national standards
- Opportunities for economies to simplify and align regulations

TOTO: Design Engineering and International Standards

Mr. Fernando Fernandez of Toto USA spoke on safer water infrastructure. He noted that his company was dedicated to ensuring compliance with water and plumbing standards. Fernandez noted that lead can come from service lines either pre- or post-property line. It can come from in-line fittings, faucets, or piping or solder. Fernandez highlighted the importance of sourcing decisions to reduce the use of products that may contain lead, and the importance of suitable, harmonized, and practical regulations to incentivize such decisions in contexts critical to human health.

Fernandez described regulatory and standards fragmentation as a critical barrier both to trade in general and to progress on eliminating lead in drinking water. He described the different certification schemes in different regions, which lead to inconsistencies. Different regions apply different standards, which results in varying levels of permissible lead and chemicals. Manufacturers must reengineer their products to comply with the strictest standard. TOTO further discussed technical barriers to trade (TBTs) with respect to navigating regional discrepancies around the diverging certification requirements for drinking water safety. Specifically, various regions and economies have their own distinct and often inconsistent certification schemes that manufacturers must address. This can create challenges. In general, harmonization can be helpful in achieving the requirements of safety while reducing TBTs.

The harmonization of standards helps to reduce regulatory barriers and lower production costs. He cited closer convergence of plumbing standards in Mexico and the United States as an example of efforts that reduce costs. Mexico’s National Water Commission (CONAGUA) has recently undertaken efforts to more closely harmonize Mexican norms with US and Canadian standards around a variety of faucets, valves, and fittings that can be potential sources of lead if not adequately regulated-harmonizing regulation of such products across North American economies can accelerate and streamline efforts to achieve safe and efficient regulation, conformity verification, and enforcement:

- NOM-002-CONAGUA: Toilets, urinals, flushometer valves, fill and flush valves for tanks
- NOM-012-CONAGAU: Faucets and Valves

TOTO also reflected on the lessons learned from other industries regarding the value of harmonization and the importance of having a clear roadmap when undertaking such efforts. Examples and key points included TOTO’s experience interfacing with ISO, ASTM, and domestic requirements, and the benefits of harmonized conformity assessment.

Figure 5. Challenges related to inconsistent certification requirements and standards across economies and regions.

Source: Fernandez, TOTO presentation. APEC 2025 Workshop: SCSC 105 2024A.

Rucika: Domestic Industry Experience (Indonesia)

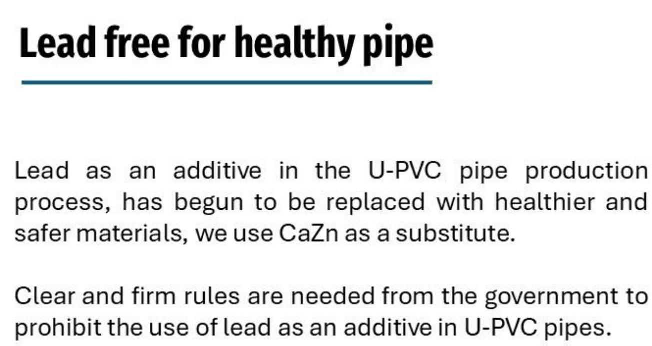
Mr. Muhajir Asrori of Rucika spoke on his company's experience with plastic pipe manufacturing. Indonesia's population growth contributes to its demand for clean drinking water. Rucika is the biggest plastic pipe & fitting manufacturer in Indonesia. Established in 1973, Rucika currently produces various types of plastic pipes for local and export markets. Quality is at the center of Rucika's business, and the firm uses Quality Improvement, Kaizen, and Total Productive Maintenance principles to ensure quality and efficiency in their operations. Asrori outlined four steps to ensuring product quality: improve employee capabilities through training, properly maintain production machinery, control the quality of inputs, and maintain clear instructions for tasks.

PVC is the most widely used material for plastic pipe in Indonesia. Currently, more than 120 manufacturers produce more than 645,000 tons of plastic pipe in Indonesia, of which an estimated 83.5% is PVC/U-PVC pipe, and much of this pipe is used for potable water supply. The quality of pipe manufactured by firms operating in and exporting into Indonesia is variable. This is problematic, since lead (added as a stabilizer) is a common additive to PVC and UPVC pipes in many processes, and can potentially leach into drinking water, exposing users to levels of health concern. Rucika therefore uses zinc compounds as stabilizers in its plastic pipes, and these have been shown not to leach into drinking water at levels of concern in laboratory tests. However, there is still an urgent need for clear, binding, and enforceable standards and regulations from Indonesia's government to prohibit the use of lead as an additive in PVC and U-PVC pipes. Additional points raised in the presentation include:

- Challenges faced by domestic manufacturers under mandatory SNI

- The need for consistent regulatory timelines
- Market exposure to counterfeit or uncertified products
- Importance of verified raw materials suppliers

Figure 6. Lead is added to some PVC and UPVC pipes as a stabilizer. Zinc compounds are nontoxic alternatives that can reduce risk to users.



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LAPORAN UJI

No. Laporan	: 030-24024
No. Proyek	: 980711908-06
Tanggal Laporan	: 9 September 2024
Pelanggan	: PT Wahana Duta Jaya Rucika Jl. Raya Imam Bonjol Karawang Bekasi Km.26,2 Cikarang Barat, Bekasi 17520
Asal Contoh	: Contoh dikirim oleh pelanggan ke PT. IAPMO Group Indonesia diterima dalam kondisi baik pada 14 Agustus 2024
Tanggal Pengujian	: 28 Agustus 2024 – 30 Agustus 2024
Deskripsi Contoh	:
Produk	: Pipa PVC Safe
Merek	: Rucika
Ukuran	: OD 63; S 10
Jumlah	: 2 buah
Lingkup Pengujian	: SNI 06-0084-2002 Pipa PVC untuk saluran air minum

Disiapkan oleh, Niftahul Husna

Disetujui oleh, Bayu Muhammad Aji

Halaman **1** dari **2**

Source: Asrori, Rucika Presentation. APEC 2025 Workshop: SCSC 105 2024A.

Cross-Cutting Industry Themes

Industry identified multiple cross-cutting issues:

- Divergent national standards increase costs
- Lack of mutual recognition increases testing redundancy
- Counterfeit products undermine safety
- Lead-free transitions require consistent regulatory signals
- Industry wants more participation in APEC discussions

Panel 5: Advancing Regional Collaboration

Panelists	
Name	**Title**
Aaron Salzberg (Moderator)	Policy & Advocacy Lead, Water Institute at the University of North Carolina

Donny Purnomo	Executive Secretary, Badan Standardisasi Nasional
Michael Fisher	Assistant Professor, University of North Carolina
Shirley Dewi (panel participant only)	Senior Vice President of Quality Assurance, IAPMO
Troy Benavidez (panel participant only)	Leader, Government Relations & Policy, LIXIL International

Key Themes:

This session explored strategies to strengthen regulatory cooperation and harmonize technical infrastructure across APEC economies in support of safe and efficient drinking water and sanitation systems. Panelists examined the critical role that internationally recognized conformity assessment and accreditation systems play in promoting regulatory confidence, reducing technical barriers to trade, and streamlining cross-border acceptance of water and sanitation products.

Discussions highlighted best practices for accrediting testing laboratories, inspection bodies, and certification programs—ensuring product safety, performance, and reliability across diverse regulatory environments. Speakers also explored how third-party verification mechanisms, such as ISO/IEC 17025, 17065, and 17020, can support effective enforcement and build trust between regulators and manufacturers, particularly in resource-constrained settings.

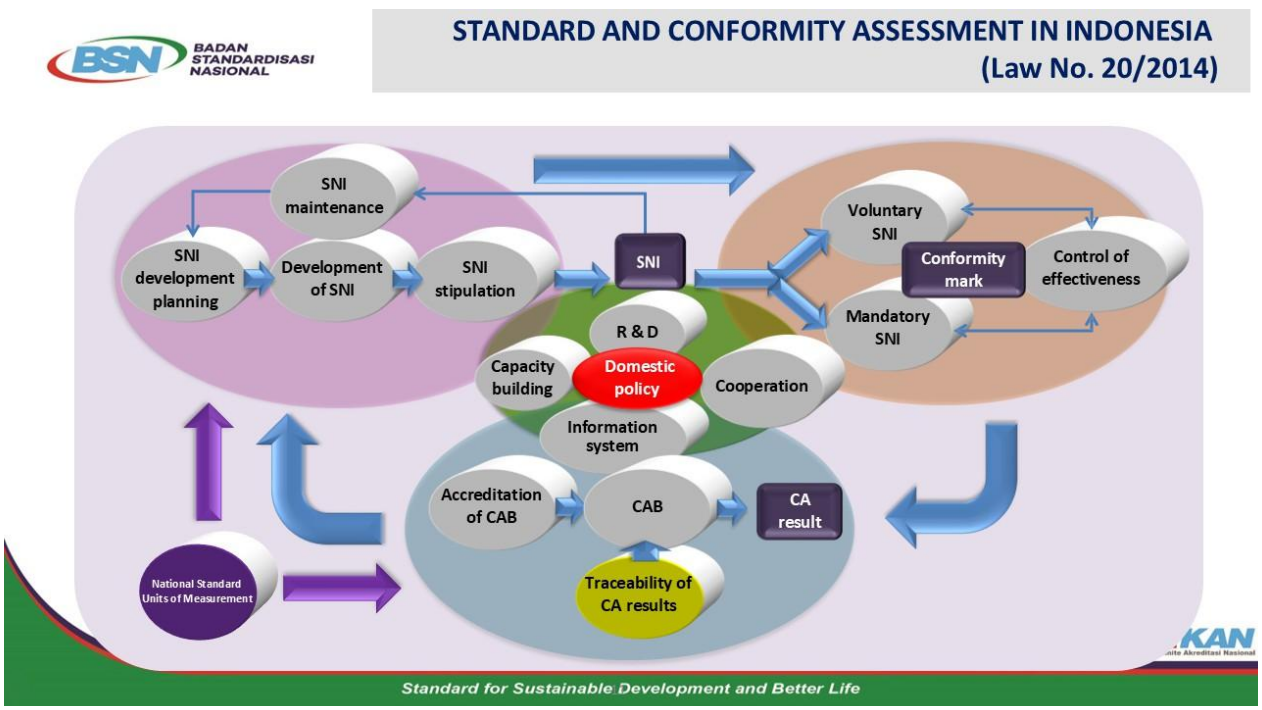
The session included government perspectives on technical regulation development and enforcement—drawing from examples that highlight the role of mandatory certification schemes and efforts to align regional and domestic regulations and standards with international standards while minimizing unnecessary trade barriers. Panelists also discussed workforce development, laboratory capacity, and market surveillance as foundational elements of effective implementation. This session can directly inform the international roadmap by identifying scalable approaches for mutual recognition, harmonized conformity assessment, and collaborative enforcement—paving the way for stronger regional systems that ensure safe drinking water for all.

BSN: National Standardization and Conformity Assessment

Mr. Donny Purnomo of BSN, the standards body of Indonesia, described how his economy strengthened plumbing standards through collaboration. He highlighted the two ways that Indonesia could develop a standard, either through self-development, or by adopting an existing standard. Currently, 17 Indonesian National Standards (SNI) have been adopted from pre-existing international standards. When voluntary standards are adopted in technical regulations, they become mandatory. As of June 2025, 331 SNI were referenced in technical regulations. He described the challenges associated with international standards and conformity assessment systems:

- Limited technical infrastructure and laboratory capacity
- High cost of product and material certification and testing (which can be especially burdensome for small and medium enterprises)
- Human resources gaps, which can limit the adaptation and adoption of complex international standards
- Need for local adaptation of standards, regulations, methods, and other technical resources to fit Indonesia's market, climate, conditions, materials, and available technology and infrastructure landscape.
- Additional challenges cited included challenges in market enforcement of standards and technical regulations once adopted.

Figure 7. Standard and Conformity Assessment in Indonesia.



Source: Purnomo, BSN Presentation. APEC 2025 Workshop: SCSC 105 2024A.

UNC: Lead Monitoring Tools and Risk Communication

Dr. Michael Fisher of the University of North Carolina, Chapel Hill, outlined a framework to develop a possible roadmap for economies to follow in order to reduce lead in drinking water. The framework identified three parts:

1) Reviewing needs and opportunities;
2) Identifying resources, strategies, and tools; and
3) taking the next steps towards development.

In the area of capacity strengthening, he highlighted three questions. First, what is needed for prevention and management? Second, what existing resources are available? Third, what additional solutions are needed? He described the use of brass taps as an example. These taps were found to contain lead, so World Vision developed a recommendation to replace brass taps with ones made of stainless steel. He described how an APEC roadmap might catalyze action within economies by leveraging collective capacity to spur action. He noted some of the challenges facing such work, such as the variation between economies.

UNC also discussed the central importance of monitoring and surveillance for enforcement and assurance of standards and regulations, and the potential challenges that some economies may encounter in developing the capacity to rapidly scale up monitoring and surveillance of lead in water systems and drinking water.

Potential innovations to address these challenges were discussed, including low-cost test strips for rapid lead detection, mobile survey tools and smartphone applications for supporting field-level monitoring, and potential opportunities for manuals, training tools, laboratory networks, and other resources to accelerate monitoring and testing efforts across economies.

The possibility of piloting and validating selected streamlined interim approaches to selected testing and certification protocols was also discussed as a potential option to accelerate action on preventing lead in drinking water. Specifically, the idea of composition-based standards as potential interim options for economies eager to take steps towards preventing lead in drinking water, but not yet in a position to adopt international performance or leaching standards verbatim in the near term. This discussion was broached as an ongoing conversation, rather than a specific recommendation per-se. Additional discussion points included reflections on opportunities for community monitoring programs and on the importance of consumer education and transparent reporting.

4. Roadmap for strengthening standards and technical regulations for safer drinking water

Economies worked in groups to discuss and specify needs and opportunities related to a roadmap for expanding and harmonizing effective standards and regulations to eliminate lead in drinking water in APEC economies. Among participants, there was widespread recognition of the importance of the issue and the value in putting together a notional roadmap to facilitate progress on this important topic. Economies worked together to apply a structured Roadmap tool to specify needs on:

a. Justification
b. Identification of Product Categories
c. Development of National Standards and Technical Regulations
d. Adoption and Implementation

e. Conformity Assessment
f. Enforcement
g. Laboratory Capacity
h. Workforce Development

Economies were asked to list challenges and opportunities under each domain. This chapter synthesizes those outputs and integrates insights from the preceding panels.

1. Justification

Efforts to strengthen standards and technical regulations for safer drinking water require strong justification that connects public health impacts, economic benefits, and regulatory coherence.

Challenges:

- Limited awareness of drinking water-related health risks, particularly chemical contaminants such as lead, PFAS, and other metals.
- Difficulty communicating risks to political leaders and the public.
- Insufficient evidence or monitoring data to justify regulatory change.
- Fragmented roles between ministries, utilities, and regulatory bodies.

Opportunities and Actions:

- Use WHO's burden-of-disease data to frame domestic policy discussions.
- Gather and publish domestic estimates of lead and chemical risks through targeted monitoring.
- Highlight cost–benefit evidence showing that lead elimination yields substantial long-term economic returns.
- Align domestic justifications with APEC and WTO TBT principles to ensure transparency.
- Use documented incidents (e.g., cases from UNC, WHO, and domestic examples) to motivate action.

2. Identification of Product Categories

Participants emphasized the importance of clearly identifying the categories of products that should be subject to standards and technical regulations.

Commonly Identified Categories:

- Pipes and tubing (PVC, CPVC, PP, PE, PEX)
- Fittings and connectors
- Valves and faucets
- Meters and meter housings
- Storage tanks (plastic, metal, composite)
- Plumbing fixtures (toilets, showers, tapware)
- Household treatment devices
- Industrial or commercial water systems components

Challenges:

- Different economies regulate different sets of products.
- Some product categories—particularly meters, fittings, and tanks—lack clear standards.
- No regional consensus on how to categorize high-risk products. Opportunities and Actions:

- Adopt product categories from ASTM, ISO, IAPMO, NSF/ANSI, SNI, and CNS to create regional coherence.
- Map domestic product categories to international standards and identify gaps.
- Develop a shared APEC reference taxonomy for drinking water products.

3. Development of Regional and National Standards and Technical Regulations

Challenges:

- Gaps in existing national standards (e.g., leaching requirements, PFAS control).
- Heavy reliance on voluntary standards where mandatory regulation is needed.
- Lack of comprehensive revision cycles.

Opportunities and Actions:

- Adopt or adapt relevant international standards (ASTM, IAPMO, ISO, NSF/ANSI).
- Strengthen coordination between national standards bodies (BSN, BSMI, etc.).
- Establish mechanisms to review standards regularly.
- Prioritize development of lead-free product standards.
- Build multi-stakeholder standards committees including industry and academia.

4. Adoption and Implementation

Challenges:

- Inconsistent regulation across ministries and agencies.
- Industry uncertainty due to unclear transition timelines.
- Procurement systems that do not require certified products.
- Lack of clarity in notifying WTO TBT Committee of proposed regulations.

Opportunities and Actions:

- Use WTO TBT processes to ensure transparency and reduce trade barriers.
- Develop clear regional and domestic timelines for adopting new standards.
- Provide guidance documents for industry and utilities.
- Align procurement specifications with international and national standards.
- Publish regulatory changes in accessible public formats.

5. Conformity Assessment

Challenges:

- Limited availability of accredited Conformity Assessment Bodies (CABs).
- High cost and complexity of obtaining certification in multiple economies.
- Lack of mutual recognition among economy-level CABs.
- Counterfeit certification marks and fraudulent test reports.

Opportunities and Actions:

- Strengthen regional and domestic CABs and accreditation systems (e.g., ILAC, APLAC).
- Recognize foreign CABs where appropriate.
- Improve transparency and digital authentication of certificates.
- Promote regionally harmonized conformity assessment procedures.
- Encourage third-party certification where government capacity is limited.

6. Enforcement

Challenges:

- Limited market surveillance—especially in rural and informal markets.
- Weak border enforcement for imported plumbing products.
- Unclear responsibility between ministries, customs, regulators, and local authorities.
- Proliferation of counterfeit or substandard products.

Opportunities and Actions:

- Strengthen customs inspection protocols based on product risk.
- Require proof of certification at import.
- Use digital tools to track conformity documents.
- Enhance domestic market inspections and random sampling.
- Engage local governments and utilities in enforcement.

7. Laboratory Capacity

Challenges:

- Insufficient number of accredited laboratories in several APEC economies.
- Lack of equipment for chemical analysis (e.g., ICP-MS for lead).
- Gaps in proficiency testing and quality assurance.
- Delays in test results that hinder certification and surveillance.

Opportunities and Actions:

- Prioritize laboratory investment in high-risk product categories (faucets, pipes).
- Expand accreditation using ILAC/IAF frameworks.

- Use inter-laboratory comparisons to improve accuracy.
- Develop regional laboratory networks to share workload.
- Train analysts in the latest chemical and mechanical testing methods.

8. Workforce Development

Challenges:

- Shortage of trained plumbers, installers, water inspectors, and certification auditors.
- Lack of structured training programs in some economies.
- Minimal continuing education for existing practitioners.

Opportunities and Actions:

- Develop regional and domestic occupational standards for plumbers and installers.
- Expand certification programs for water operators and inspectors.
- Provide targeted training in lead control, sampling, and corrosion management.
- Integrate workforce development into Water Safety Plan (WSP) and domestic regulatory frameworks.

Summary of Roadmap Outputs

Across all pillars, economies emphasized:

- The need for clearer, more coherent standards
- Stronger testing and certification systems
- Greater reliance on international standards
- Broader use of conformity assessment and market surveillance
- Increased investment in labs and workforce training
- Long-term strategies for phasing out lead-containing materials

This Roadmap forms the foundation for APEC's future collaborative work on safer drinking water.

5. Recommendations

Recommendation 1: Increase Awareness of Drinking Water Hazards, with Priority Attention to Preventing Exposure to Lead and Other Priority Chemicals in Drinking Water

APEC economies should improve public, governmental, and industry understanding of chemical and microbial risks associated with drinking water systems. In particular, economies may:

- Communicate the health and economic impacts of lead, PFAS, and other contaminants using WHO and domestic data.
- Communicate the fact that lead in drinking water disproportionately harms the youngest and most vulnerable members of society (children and developing fetuses), and is entirely preventable (through the elimination of leaded parts and materials in drinking water

infrastructure).
- Encourage evidence-based decision-making in procurement and regulatory planning.

Recommendation 2: Promote Harmonization and Coherence of Drinking Water Product Standards and Technical Regulations

The various presentations explained how the international landscape differs between economies and the challenges that each region faces. APEC economies should reduce fragmentation by:

- Referencing relevant international product standards (ISO, ASTM, IAPMO, NSF/ANSI, WHO GDWQ) in developing regional and national standards and shared regional norms, roadmaps, and standards.
- Aligning domestic product categories with internationally recognized taxonomies wherever possible.
- Reducing unnecessary divergences in domestic requirements that increase manufacturer burdens and hinder action on safer drinking water.
- Building common understanding of lead-free composition requirements (as in NSF/ANSI 372) and leaching limits (as in NSF/ANSI 61) and their role in preventing lead in drinking water.
- Establish a basis for progressively harmonizing standards and regulations while meeting all economies where they are currently situated in terms of regulatory requirements, capacity, and priorities.
- Note that regulatory harmonization to eliminate lead and toxic hazards in drinking water supports public health and eliminates technical barriers to trade.

Recommendation 3: Strengthen Regulatory Frameworks, Enforcement Mechanisms, and Institutional Capacity

To ensure effective implementation:

- Adopt risk-based regulatory approaches consistent with international standards and WHO technical guidance on preventing lead in drinking water.
- Clearly define agency roles for drinking water oversight among agencies and actors in each economy and region.
- Develop or revise legislation and implementing regulations to cover plumbing materials, installation, operation, maintenance, monitoring, and enforcement.
- Strengthen enforcement and conformity verification capacity at borders and in domestic markets through consistent inspection regimes.
- Ensure transparency through WTO TBT notifications.

Recommendation 4: Expand Laboratory Capacity, Accreditation, and Analytical Readiness

Economies should invest in laboratory systems to support both regulatory compliance and monitoring:

- Expand the number of accredited laboratories in the APEC region and within APEC economies with suitable instrumentation (e.g., ICP-MS for metals),
- analytical capabilities, trained personnel, and data management and reporting capacity to meet the needs of economies seeking to verify lead-free water system parts and materials, as well as to monitor lead in drinking water.
- Strengthen ILAC/IAF-aligned accreditation processes domestically.
- Participate in proficiency testing and inter-laboratory comparisons.
- Develop shared or regional laboratory networks where appropriate.
- Support training/cross-training and capacity development of laboratories and personnel within and among APEC economies as useful and feasible.

Recommendation 5: Enhance Conformity Assessment and Mutual Recognition

APEC economies may:

- Strengthen regional and domestic CABs and certification schemes.
- Increase transparency in certification processes.
- Promote recognition of competent international CABs to reduce redundant testing.
- Develop guiding principles for mutual recognition of test reports and certifications.
- Address counterfeit certification marks through digital verification tools and other means as appropriate and useful.

Recommendation 6: Strengthen Industry Engagement and Support Supply Chain Integrity

Industry plays a critical role in ensuring the safety of drinking water infrastructure. This project sought to bridge the gap between manufacturers, standards developers, international organizations and government regulators. Each of these groups has a role to play to ensure water quality. Individual economies who may struggle to improve water quality may not be aware of the resources that are available to them. By tapping into established networks, they can conserve financial resources and leverage existing mechanisms.

Economies should:

- Expand industry participation in standards development and regulatory consultations.
- Promote good manufacturing practices (GMP) and supply chain transparency.
- Support traceability of materials and components.
- Encourage innovation in lead-free materials, corrosion control, and environmentally sustainable designs.

Recommendation 7: Improve Market Surveillance and Border Enforcement

To prevent circulation of non-conforming or counterfeit products:

- Strengthen inspection protocols for high-risk product categories.
- Enhance customs capacity to verify certifications before import clearance.
- Conduct random sampling and testing of products in retail markets.
- Establish regional and domestic reporting mechanisms for non-conforming products.

Recommendation 8: Advance APEC-Wide Collaboration on Lead-Leaching and Safe Drinking Water Infrastructure

APEC brings together economies that are in different stages of developing, strengthening, implementing, and enforcing standards and regulations for plumbing products and materials designed to protect drinking water quality. By developing a roadmap that identifies the challenges and the opportunities in this space, economies can apply a more organized and thoughtful plan to improve water quality. APEC should build collaborative mechanisms, including:

- Multi-economy knowledge-sharing on lead elimination and corrosion control.
- Joint development of guidance documents, model regulations, and implementation and enforcement guidance, as appropriate and useful.
- APEC-wide training materials for installers, plumbers, inspectors, water system operators, laboratory personnel, and other key actors and stakeholders (as appropriate and useful).
- Continued refinement of the Draft Roadmap and its use as a planning tool.
- Coordination with WHO RegNet and other international programs.

6. Conclusion

Safe drinking water is a fundamental pillar of health, well-being, and economic prosperity across the APEC region. The 2025 Workshop on *Strengthening Standards and Technical Regulations for Safer Drinking Water* demonstrated the importance of coherent, science-based, and harmonized approaches to regulating drinking water systems and water-contact products.

Workshop discussions highlighted several consistent themes:

- Lead and chemical contamination are significant and preventable risks.
- International standards offer a strong foundation for domestic regulatory frameworks.
- Conformity assessment and market surveillance require strengthening to ensure products meet safety requirements.
- Laboratory and workforce capacity must be expanded to support regulatory implementation.
- Regional collaboration is essential to improving safety, reducing costs, and supporting effective enforcement.

The Roadmap developed during the workshop provides economies with a clear, adaptable tool for planning and implementing improvements in drinking water safety. The recommendations outlined in this report offer a practical framework for future APEC activities and collaborative initiatives.

Continued cooperation through APEC fora, alignment with WHO guidance, and engagement with industry and civil society will help economies achieve safer, more resilient, and more sustainable drinking water services.

Appendices

Appendix A: APEC Workshop Agenda

Strengthening Standards and Technical Regulations for Safer Drinking Water – Developing an International Roadmap
26-27 July

SATURDAY, 26 JULY

TIME	Description
09:00-09:15	**Welcoming Remarks** ● Kent Shigetomi, Director, Multilateral Non-Tariff Barriers, Office of the United States Trade Representative ● Dain Hansen, Executive Vice President of Government Relations, IAPMO
09:15 – 09:35	**Introduction of Workshop Participants**
09:35 – 09:55	**Introduction of Roadmap Framework** ● Aaron Salzberg Policy & Advocacy Lead, Water Institute at the University of North Carolina ● Christopher Lindsay Senior Vice President of Government Relations, IAPMO
09:55 – 11:10	**Panel #1: Role of Safer Infrastructure Solutions in Meeting Health, Sustainability and Development Goals** ● Dain Hansen *(MODERATOR),* Executive Vice President, IAPMO ● David Trouba, Water, Sanitation and Health (WSH) Unit, World Health Organization ● Indika Gunawardana, WASH Advisor, World Vision ● Michael Fisher, Senior Researcher, Water Institute at the University of North Carolina
11:10 – 11:20	**NETWORKING BREAK**
11:20 – 12:10	**Panel #2: Defining the Water and Sanitation Product Markets and Role of International Standards** ● Shirley Dewi *(MODERATOR),* Senior Vice President of Quality Assurance, IAPMO ● Craig Updyke, Senior Director, Global Policy and International Trade, ASTM International ● Tom Palkon, Executive Vice President & Chief Technical Services Officers, IAPMO
12:10 – 12:15	**Workshop Photo**
12:15 – 13:30	**LUNCH BREAK**
13:30 – 14:45	**Panel #3: APEC Economy Perspectives on Regulating Plumbing Products for Safer Drinking Water** ● Shirley Dewi *(MODERATOR),* Senior Vice President of Quality Assurance, IAPMO ● Andi Rizaldi, Head of Standardization and Industrial Service Policy Agency ● Chia-Lieh Chang, Chairman, Plumbing Association of Taiwan ● Yu-Chen Wei, Chemical Analysis Engineer, Metal Industries Research & Development Centre ● Katelynn Murphy, Business Industry Specialist, US Department of Commerce
14:45 – 15:00	**Day 1 Wrap-up and Q&A**

SUNDAY, 27 JULY

TIME	Description
09:00 – 09:05	**Welcome** ● Kent Shigetomi, Director, Multilateral Non-Tariff Barriers, Office of the United States Trade Representative ● Dain Hansen, Executive Vice President of Government Relations, IAPMO
09:10 – 09:15	**Recap of Day 1 and Overview of Day 2** ● Aaron Salzberg, Policy & Advocacy Lead, Water Institute at the University of North Carolina
09:15 – 10:30	**Panel #4: Strengthening Industry Leadership and Supply Chain Integrity for Safer Water Infrastructure** ● Christopher Lindsay *(MODERATOR),* Senior Vice President of Government Relations, IAPMO ● Troy Benavidez, Leader, Government Relations & Policy, LIXIL International ● Tina Zhu, Senior Staff Engineer, Kohler China ● Fernando Fernandez, Vice President, Codes & Standards, TOTO USA ● Muhajir Asrori, APIN Chairman / Technical Training Division Head, PT. Wahana Duta Jaya Rucika ● Yanqu Sun *(Joining panel for moderated discussion),* Manager of Engineering, Kohler China
10:30 – 10:45	**NETWORKING BREAK**
10:45 – 12:00	**Panel #5: Advancing Regional Collaboration on Conformity Assessment and Regulatory Implementation** ● Aaron Salzberg *(MODERATOR),* Policy & Advocacy Lead, Water Institute at the University of North Carolina ● Donny Purnomo, Executive Secretary, Badan Standardisasi Nasional ● Michael Fisher, Assistant Professor, University of North Carolina ● Shirley Dewi *(Joining panel for moderated discussion),* Senior Vice President of Quality Assurance, IAPMO ● Troy Benavidez *(Joining panel for moderated discussion),* Leader, Government Relations & Policy, LIXIL International
12:00 – 13:30	**LUNCH BREAK**
13:30 – 14:30	**Breakout Discussions – Advancing the Roadmap for Safer Drinking Water Systems** ● Aaron Salzberg, Policy & Advocacy Lead, Water Institute at the University of North Carolina
14:30 – 15:00	**Commitments and Next Steps** ● Kent Shigetomi, Director, Multilateral Non-Tariff Barriers, Office of the United States Trade Representative ● Dain Hansen, Executive Vice President of Government Relations, IAPMO

Appendix B: Regulatory Roadmap and Best Practices for Implementation for Plumbing, Water, and Sanitation Related Products

Regulatory Roadmap and Best Practices for Implementation for Plumbing, Water, and Sanitation Related Products

Purpose
This annex provides a consolidated reference for APEC economies seeking to improve the safety, quality, and performance of plumbing products while supporting greater regulatory coherence and reducing unnecessary trade barriers. It identifies common **product categories**, **international standards**, and **recommended implementation steps**, consistent with APEC's Good Regulatory Practices (GRP) and the WTO Agreement on Technical Barriers to Trade (TBT Agreement). The annex is intended to support voluntary alignment, capacity building, and cross-border cooperation.

How to Use This Annex
This annex provides a **practical reference** for regulators, national standards bodies, conformity assessment organizations, and industry. Economies may use it to:

1. **Inform regulatory updates**
   Economies updating technical regulations for plumbing fixtures, fittings, or water-using products may consult the **product categories** and **international standards** listed in the annex to:
   - Identify **internationally recognized performance, safety, and health standards** commonly used across APEC.
   - Compare current domestic requirements with the standards used by other economies.
   - Reduce duplication by referencing or accepting **equivalent standards**, lowering compliance costs for industry while maintaining public health protection.

2. **Improve conformity assessment schemes**
   Regulators and accreditation bodies may use these references to:
   - Determine which international standards form the basis of **test methods**, **certification schemes**, or **approval pathways**.
   - Facilitate **cross-border acceptance** of test data and certifications when based on the same families of standards (e.g., ASME/CSA, IAPMO/ASSE, NSF/ANSI, ISO).
   - Strengthen the use of **risk-based approaches**, particularly for high-risk products such as backflow prevention devices and potable-water-contact components.

3. **Support mutual recognition**
   As APEC economies work toward greater regulatory cooperation, this annex provides a **common vocabulary** and **reference point** for discussions on:
   - Alignment with referenced standards in domestic plumbing construction standards used widely across the region.
   - Identifying where economies already use **the same or similar standards**, enabling opportunities for **mutual recognition** or **regulatory convergence**.

- Referencing international standards that meet the WTO TBT principles of
- **transparency, openness, and international relevance**.

4. **Improve industry clarity and market access**

Manufacturers and suppliers operating across multiple APEC economies may use the annex to:

- Understand which categories of products are typically regulated.
- Identify the corresponding international standards that may apply across different jurisdictions.
- Reduce uncertainty by designing products that comply with standards recognized across the region.

5. **Provide a foundation for future APEC work**

This annex can support ongoing and future APEC initiatives by:

- Serving as a **baseline mapping** for future regulatory reviews, pilot projects, or harmonization studies.
- Helping economies benchmark their national standards against international norms.
- Creating a foundation for developing **regional guidance**, **capacity building**, or **alignment activities** related to plumbing safety, water efficiency, and drinking water quality.

6. **Maintain Regulatory Flexibility**

Consistent with the WTO TBT Agreement and APEC's non-binding principles, this annex is:

- **Non-exhaustive** – economies may use additional or alternative standards.
- **Supportive** – offering a structured reference to guide voluntary alignment and cooperation.

Cross-Cutting Health and Materials Standards

Certain standards apply broadly to many plumbing fixtures and fittings that contact drinking water:

- **NSF/ANSI/CAN 61 – Drinking Water System Components – Health Effects** Establishes minimum health-effects requirements for materials in contact with drinking water.
- **NSF/ANSI/CAN 372 – Drinking Water System Components – Lead Content**
- Sets maximum weighted-average lead content for "lead-free" plumbing products and is referenced in implementation of the Safe Drinking Water Act in several economies.
- **NSF/ANSI 14 – Plastics Piping System Components and Related Materials** Establishes physical, performance and health-effects requirements for plastic piping components (pipes, fittings, valves, traps, etc.), and refers to ASTM, ISO and
- NSF/ANSI/CAN 61 for detailed performance and health criteria.
- **ISO 31600:2022 – Water Efficiency Labelling Programmes**
- Provides requirements and guidance for water efficiency labelling covering products such as showers, taps (faucets), water closets and urinals.

These cross-cutting standards are relevant to many product categories listed below. These standards are widely used across APEC economies and may complement the product-specific standards listed in Table B.4.

Product Categories and International Standards

The following tables classify plumbing fixtures and fittings, water filtration technologies, and piping, commonly regulated across APEC economies and list indicative international standards from ASME, CSA, IAPMO, ASSE, ASTM, NSF, and ISO. Economies may reference these standards directly or recognize equivalent international or regional standards consistent with WTO TBT principles.

Table B.1 – Water Delivery Fittings (Faucets, Taps, Showers, Bath Outlets)

Product Category	Examples	International Standards
Faucets/Taps	Kitchen, lavatory, bar/prep, sensor/metering faucet, laundry	ASME A112.18.1/CSA B125.1; NSF/ANSI/CAN 61 (toxicity); NSF/ANSI/CAN 372 (lead-free); ISO 31600
Shower Devices	Showerheads, hand showers, body sprays, shower panels	ASME A112.18.1/CSA B125.1; ISO 31600
Bath/Tub Outlets	Tub spouts, bath fillers, combination tub/shower outlets	ASME A112.18.1/CSA B125.1; ISO 31600
Pressurized Flush Devices	Urinal flush device, Water closet flush device	ASSE 1037/ASME A112.1037/CSA B125.37
Drinking Water Fountains	Drinking water fountains, water coolers	ASME A112.19.3/CSA B45.4; NSF/ANSI/CAN 61 (toxicity); NSF/ANSI/CAN 372 (lead-free)

Table B.2 – Sanitary Fixtures (Water Closets, Urinals, Basins, Bidets, Baths)

Product Category	Examples	International Standards
Water Closets	Western tank-type, Eastern type (squat), wall-hung	ASME A112.19.2/CSA B45.1; CSA B45.5/IAPMO Z124; ISO 31600; ASME A112.19.3/CSA B45.4
Non-Sewered Toilets	Non-sewered sanitation systems — Prefabricated integrated treatment units	ISO 30500
Urinals	Wall-hung, floor-mounted, waterless	ASME A112.19.2/CSA B45.1; CSA B45.5/IAPMO Z124; ISO 31600; ASME A112.19.3/CSA B45.4
Bidets/Bidet Seats	Stand-alone bidets, electronic seats	ASME A112.19.2/CSA B45.1
Sinks and Basins	Kitchen, lavatory, bar/prep, utility/laundry sinks	ASME A112.19.2/CSA B45.1; CSA B45.5/IAPMO Z12; ASME A112.19.3/CSA B45.4
Bathing Units	Bathtubs, shower receptors, combination tub/showers	CSA B45.5/IAPMO Z12; ASME A112.19.3/CSA B45.4
Plastic Sanitary Latrine Pans	Non-sewered, Plastic Sanitary Latrine Pans	IAPMO IGC 380

Table B.3 – Plumbing Water Supply Fittings

Product Category	Examples	International Standards
Supply Fittings	Angle stops, mixing valves, hose bibbs, shower valves	ASME A112.18.1/CSA B125.1 If there is direct contact with potable water: NSF/ANSI/CAN 61 (toxicity); NSF/ANSI/CAN 372 (lead-free)
Flexible Water Connectors	Braided connectors, water heater connectors	ASME A112.18.6/CSA B125.6; NSF/ANSI/CAN 61(toxicity); NSF/ANSI/CAN 372 (lead-free)
Plastic Piping/Fittings	Plastic valves, DWV adapters, pressure fittings, plastic piping systems	NSF/ANSI 14; see related standards in Table X.3.8 If there is direct contact with potable water: NSF/ANSI/CAN 61 (toxicity); NSF/ANSI/CAN 372 (lead-free)

Table B.4 – Backflow Prevention Devices

Product Category	Examples	International Standards
Assemblies for water supplies	RPZ, double check valve assemblies, PVBs	DCA: ASSE 1015; ASSE 1048; AWWA C510; CSA B64.5 or CSA B64.5.1 RPZ: ASSE 1013;ASSE 1047; AWWA C511; CSA B64.4 or CSA B64.4.1 PVB: ASSE 1020 or CSA B64.1.2
Air Gaps	Space between water source outlet and fixture rim	ASME A112.1.2, ASME A112.1.3
Vacuum Breakers	Atmospheric Vacuum breaker Pressure Vacuum Breaker	AVB: ASSE 1001 or CSA B64.1.1 PVB: ASSE 1020 or CSA B64.1.2 SRPVB: ASSE 1056
Beverage Dispensers	Carbonated beverage dispenser	ASSE 1055
Hydrants and Hose Connections	Hose bibs, lawn faucet, wall hydrants	ASSE 1011, ASSE 1019, ASSE 1052, ASSE 1053, ASSE 1057; CSA B64.2.1.1
Antisiphon fill valve BP	Ballcocks, Water closet fill valves	ASSE 1002/ASME A112.1002/CSA B125.12

Table B.5 – Drain, Waste, and Vent (DWV) Fittings

Product Category	Examples	International Standards
Waste Fittings	Traps, tailpieces, strainers, waste & overflow sets	ASME A112.18.2/CSA B125.2; ASTM F409
DWV Pipe Fittings	Elbows, tees, couplings, gaskets	ASTM DWV piping standards; NSF/ANSI 14; ISO 15749 series

Table B.6 – Point-of-Use (POU) and Point-of-Entry (POE) Drinking Water Treatment Technologies

Product Category	Examples / Treatment Mechanisms	International Standards
Activated Carbon Filtration (POU/POE)	Carbon block or granular activated carbon (GAC) systems; reduction of chlorine, taste/odor, organics, VOCs, lead, cysts, PFAS (depending on configuration)	NSF/ANSI 42 – Aesthetic Effects (chlorine, taste/odor, particulate) NSF/ANSI 53 – Health Effects (lead, cysts, VOCs, PFAS, etc.) NSF/ANSI 401 – Emerging Contaminants (BPA, ibuprofen, DEET, etc.) NSF/ANSI/CAN 372 (lead content) CSA B483.1 POE materials safety protocol refers to NSF/ANSI/CAN 61
Ultrafiltration (UF) Systems (POU/POE)	Hollow-fiber or membrane systems targeting particulates, cysts, bacteria	NSF/ANSI 419 – Public Drinking Water Equipment (UF/MF membranes) NSF/ANSI 53 (for health claims when combined with carbon or other media) NSF/ANSI/CAN 372 (lead content) CSA B483.1 POE materials safety protocol refers to NSF/ANSI/CAN 61
Reverse Osmosis (RO) Systems (POU)	RO membrane technology for TDS reduction, heavy metals, nitrates, arsenic, fluoride, PFAS	NSF/ANSI 58 – Reverse Osmosis Drinking Water Treatment Systems CSA B483.1 NSF/ANSI/CAN 372 (lead content)
Ion Exchange (IX) Treatment Systems (POU/POE)	Water softeners, nitrate-reduction units, arsenic-specific media, PFAS specific media	NSF/ANSI 44 – Cation Exchange Water Softeners NSF/ANSI 53 – Health Effects (when certified for specific contaminant reduction) CSA B483.1

		NSF/ANSI/CAN 372 (lead content) POE materials safety protocol refers to NSF/ANSI/CAN 61
Microbiological Water Purifiers (POU)	Multibarrier systems combining filtration, adsorption, membranes, UV, or chemical disinfection	NSF/ANSI P231 – Microbiological Water Purifiers (performance protocol for removing bacteria, viruses, protozoa) NSF/ANSI 244 Microbiologic Purifier intended for use on potable water CSA B483.1 NSF/ANSI/CAN 372 (lead content)
Distillation Systems (POU)	Counter-top or plumbed-in distillers removing dissolved solids, metals, microbes	NSF/ANSI 62 – Drinking Water Distillation Systems CSA B483.1 NSF/ANSI/CAN 372 (lead content)
Ceramic Filtration (POU)	Candle or cartridge ceramic filters for mechanical reduction	NSF/ANSI 42 – Aesthetic Effects (particulates) NSF/ANSI 53 – Health Effects (cysts, turbidity) NSF/ANSI P231 for microbial performance NSF/ANSI 401 – Emerging Contaminants (microplastics) CSA B483.1 NSF/ANSI/CAN 372 (lead content) When combined with carbon block or other media, chemical reduction for NSF/ANSI 42, 53, 401
Whole-House POE Filtration Systems	Sediment filters, carbon tanks, catalytic media units, iron/manganese reduction systems	NSF/ANSI 42 – Aesthetic Effects (chlorine, taste/odor, particulate) NSF/ANSI 53 – Health Effects (lead, cysts, VOCs, PFAS, etc.) NSF/ANSI 401 – Emerging Contaminants (BPA, ibuprofen, DEET, etc.) CSA B483.1 NSF/ANSI/CAN 372 (lead content) Materials safety protocol refers to NSF/ANSI/CAN 61

Chemical Disinfection Systems (POE/POU)	Chlorine, chloramine, or ozone injection devices for microbiological control	NSF/ANSI 61 – Drinking Water System Components Chemical output evaluated to NSF/ANSI/CAN 60
Combination/Multi-Technology Systems	RO + carbon; UV + filtration; IX + sediment; multi-stage purifiers	Combination of the applicable standards above based on treatment methods used (e.g., NSF/ANSI 42/53/401/58/55/P231/61/37, CSA B483.1)

Table B.7— Piping Materials for Drinking Water and Sanitation Systems

A. Pressure Piping for Cold Water Supply/Water Service

Product Category	Examples	International Standards
CPVC Hot/Cold Water Pipe	Buried Cold potable water Service/Water Supply Piping	ASTM D2846; ASTM F441; ASTM F442; CSA B137.6; NSF/ANSI 14; NSF/ANSI/CAN 61/372; ISO 15877 series
PEX (Crosslinked Polyethylene)	Buried Cold potable water Service/Water Supply Piping	ASTM F876; CSA B137.5; AWWA C904; NSF/ANSI 14; NSF/ANSI/CAN 61/372; ISO 15875 series
PE-RT (Raised Temperature Polyethylene)	Buried Cold potable water service/water supply piping	ASTM F2769; CSA B137.18; NSF/ANSI 14; NSF/ANSI/CAN 61/372; ISO 22391 series
PVC Pressure Pipe	Cold potable water supply lines; buried service lines	ASTM D1785; ASTM D2241;CSA B137.3; AWWA C900; NSF/ANSI 14; NSF/ANSI/CAN 61/372; ISO 1452 series
HDPE Pressure Pipe	Buried water mains; trenchless installations; service lines	ASTM D3035; ASTM D2239; ASTM D2737;AWWA C901; CSA B137.1; NSF/ANSI 14; NSF/ANSI/CAN 61/372; ISO 4427 series
Copper Tube (Type K/L/M)	Cold potable water supply/water service	ASTM B88; NSF/ANSI/CAN 61/372; ISO 16348
Stainless Steel Pipe (304/316)	Potable water in corrosive environments; hygienic systems	ASTM A312; NSF/ANSI/CAN 61; ISO 1127; ISO 2037
Polypropylene	Cold potable water supply/water service	ASTM F2389, CSA B137.11; NSF/ANSI 14; NSF/ANSI/CAN 61/372; ISO 15874

B. Hot and Cold Pressure Piping for Drinking Water Distribution

Product Category	Examples	International Standards

CPVC Hot/Cold Water Pipe	Hot and cold potable water distribution in buildings	ASTM D2846; CSA B137.6; NSF/ANSI 14; NSF/ANSI/CAN 61/372; ISO 15877 series
PEX (Crosslinked Polyethylene)	Potable water distribution;	ASTM F876/F877; CSA B137.5; NSF/ANSI 14; NSF/ANSI/CAN 61/372; ISO 15875 series
PE-RT (Raised Temperature Polyethylene)	Potable water distribution	ASTM F2769; CSA B137.18; NSF/ANSI 14; NSF/ANSI/CAN 61/372; ISO 22391 series
Copper Tube (Type K/L/M)	Hot/cold potable water; building distribution systems	ASTM B88; NSF/ANSI/CAN 61/372; ISO 16348
Stainless Steel Pipe (304/316)	Potable water in corrosive environments; hygienic systems	ASTM A312; NSF/ANSI/CAN 61; ISO 1127; ISO 2037
Polypropylene	Hot/Cold potable water; building distribution systems	ASTM F2389; CSA B137.11; NSF/ANSI 14; NSF/ANSI/CAN 61/372; ISO 15874

C. Fittings for Hot and Cold Pressure Piping for Drinking Water Distribution

Product Category	**Examples**	**International Standards**
CPVC Hot/Cold Water Pipe	Hot and cold potable water distribution in buildings	ASTM D2846; CSA B137.6; ASSE 1061; ASTM F437; ASTM F438; ASTM F439; ASTM F1970; NSF/ANSI 14; NSF/ANSI/CAN 61/372; ISO 15877 series
PEX (Crosslinked Polyethylene)	Potable water distribution; home-run manifold systems	ASTM F877; ASSE 1061; ASTM F1807; ASTM F1960; ASTM F2080; ASTM F2098; ASTM F2159; ASTM F2735; ASTM F3347; ASTM F3348; CSA B137.5; NSF/ANSI 14; NSF/ANSI/CAN 61/372; ISO 15875 series
PE-RT (Raised Temperature Polyethylene)	Potable water distribution and radiant heating systems	ASTM F2769; ASSE 1061; ASTM D3261; ASTM F1055; ASTM F1807; ASTM F2098; ASTM F2159; ASTM F2735; CSA B137.18; NSF/ANSI 14; NSF/ANSI/CAN 61/372; ISO 22391 series
Copper Tube (Type K/L/M)	Hot/cold potable water; building distribution systems	ASME B16.15; ASME B16.18; ASME B16.22; ASME B16.26; ASME B16.50; ASME B16.51; ASSE 1061; ASTM F3226; CSA B242; NSF/ANSI/CAN 61/372; ISO 16348
Stainless Steel Pipe (304/316)	Potable water in corrosive environments; hygienic systems	ASTM F3226; CSA B242; NSF/ANSI/CAN 61; ISO 1127; ISO 2037
Polypropylene	Hot/Cold potable water; building distribution systems	ASTM F2389; CSA B137.11; NSF/ANSI 14; NSF/ANSI/CAN 61/372; ISO 15874

D. Sanitation (Drain, Waste, and Vent – DWV) Piping

Product Category	Examples	International Standards
PVC DWV Pipe	Soil/waste piping, vents, building sewers	ASTM D2665; ASTM D3034; CSA B181.2; NSF/ANSI 14; ISO 3633; ISO 265; ISO 16422
ABS DWV Pipe	Interior drainage, waste, and vent systems	ASTM D2661; CSA B181.1; ASTM F628; NSF/ANSI 14 (no dedicated ISO DWV ABS series
Cast Iron Soil Pipe (Hubless)	Commercial, multi-story drainage; acoustically damped DWV	ASTM A888; CISPI 301; ISO 6594
HDPE DWV / Soil & Waste Pipe	Soil/waste drainage, grease-resistant piping, chemical waste	ASTM F1412; NSF/ANSI 14; ISO 8770; ISO 8771; ISO 4427 (non-pressure)
Polypropylene (PP) DWV Pipe	High-temperature drainage, chemical waste, laboratory systems	ASTM F1412; NSF/ANSI 14;CSA B181.3; ISO 15874 series

Regulatory Implementation Checklist for Economies

Effective regulation of plumbing, water, and sanitation products is essential to protecting public health, ensuring drinking water safety, and supporting efficient water use across the region. In line with APEC's Good Regulatory Practices (GRP) and the principles of the WTO Agreement on Technical Barriers to Trade (TBT Agreement), this checklist provides economies with a voluntary, practical framework for reviewing, updating, and implementing technical regulations and conformity assessment requirements for plumbing fixtures and fittings. It is intended to support greater regulatory coherence, improve transparency, facilitate cross-border trade, and reduce unnecessary burdens on businesses while maintaining appropriate levels of health, safety, and environmental protection. Key steps for voluntary regulatory alignment and modernization include:

1. **Regulatory Scoping and Prioritization**

   - **Identify regulated product categories**
     Use Annex X to determine which plumbing fixtures and fittings fall within current domestic regulations.
   - **Prioritize high-risk product categories**
     Examples:
     - Potable-water-contact components
     - Products linked to waterborne disease or contamination pathways
     - Backflow prevention devices
     - Water closets, faucets, shower devices
   - **Determine whether current regulations align with international practice**
     Compare domestic requirements with the international standards listed in the annex.

2. Standards Adoption and Alignment

- **Review existing national standards for currency and alignment**
  Cross-check current national standards with key ASME/CSA, IAPMO/ASSE, ASTM, NSF, and ISO standards used broadly across APEC.
- **Evaluate options to reference or recognize international standards**
  Consider referencing:
  - ASME/CSA plumbing supply fittings and ceramic/plastic fixture standards
  - NSF/ANSI/CAN 61 and 372 for health and lead content
  - ISO 31600 for water-efficiency labelling
  - ASSE/IAPMO standards for backflow prevention devices
- **Ensure consistency with WTO TBT principles**
  Assess whether referenced standards:
  - Are internationally recognized
  - Are performance- and health-based
  - Reduce unnecessary barriers to trade

3. Conformity Assessment and Certification

- **Identify current testing and certification requirements**
  List accredited laboratories, notified bodies, test methods, and product categories.
- **Evaluate opportunities for cross-border acceptance**
  Check whether:
  - Other APEC economies use the same standards
  - Recognition of test results/certifications would reduce duplication
  - CABs (Conformity Assessment Bodies) participate in ILAC/IAF MLA arrangements
- **Consider risk-based conformity assessment**
  Examples:
  - Full third-party certification for high-risk products (backflow devices, potable-water-contact)
  - Supplier's declaration of conformity (SDoC) for lower-risk products
- **Ensure market surveillance mechanisms are in place**
  Confirm the ability to verify marking, certification status, and post-market compliance.

4. Transparency and Engagement

- **Conduct open public consultations**
  Engage manufacturers, water utilities, installers, consumer groups, and certifiers.
- **Publish proposed regulations and technical changes**
  Align with APEC Good Regulatory Practices (GRP) and WTO TBT transparency obligations.
- **Coordinate with standards bodies and accreditation authorities**
  Ensure consistent application of standards and reduced regulatory friction.

5. Implementation, Capacity Building, and Training

- **Provide training for inspectors, regulators, and enforcement teams**
  Focus areas may include:

    - Recognizing compliant vs. non-compliant products
    - Testing protocols for water efficiency and safety
    - Understanding international standards and technical regulations
- **Assess testing laboratory capacity**
  Identify whether local labs can test to the standards listed in the annex and how to incorporate international partnerships or mutual recognition.
- **Identify needs for technical assistance or capacity building**
  International partners, standards developing organizations, conformity assessment bodies, and industry associations may support training or pilot projects.

6. **Monitoring and Review**

- **Establish Key Performance Indicators (KPIs)**
  Examples:
    - Reduction in non-compliant products
    - Increased market acceptance of certified products
    - Reduced testing/certification burden for SMEs
- **Plan periodic reviews of regulations and standards**
  Suggested frequency: every 3–5 years, or upon publication of major updates to key international standards.
- **Benchmark regulatory outcomes against peer APEC economies**
  Share lessons learned through APEC working groups and policy dialogues.

Closing: Alignment with the APEC Putrajaya Vision 2040 and Structural Reform Priorities

The implementation of this annex supports the ambition of the APEC Putrajaya Vision 2040 to build an open, dynamic, resilient, and peaceful Asia-Pacific community. By promoting alignment with international standards, enhancing regulatory coherence, and facilitating cross-border cooperation, economies advance the Vision's priorities of Trade and Investment, Innovation and Digitalization, and Strong, Balanced, Secure, Sustainable, and Inclusive Growth.

This work aligns with the Aotearoa Plan of Action, which calls for improved regulatory outcomes, enhanced transparency, and deeper regional cooperation. It also supports APEC's structural reform agenda by encouraging modernized regulatory frameworks, fostering innovation, strengthening supply chains, and enhancing the ease of doing business.

Through voluntary alignment with the guidance contained in this annex, economies help improve public health protection, support resilient water and sanitation infrastructure, and promote sustainable economic development. This contributes to a more water-secure, health-protective, and economically integrated Asia-Pacific region by 2040 and beyond.

Appendix C: Regional Roadmap to Lead-Free Drinking Water

A product of the International Working Group on Toxic Metals and the GlobalLeadFreeWater.org partnership.

A Regional Roadmap to Lead-Free Drinking Water

The purpose of this Roadmap is to protect public health by supporting governments in the development and implementation of a domestic strategy to reduce – and ultimately eliminate – lead in drinking water.

Lead is a potent neurotoxin found in many places throughout our lived environment – from the cosmetics and other products we use to the air we breathe, the soil we walk, and the water we drink. No safe level of lead exposure has been established. This doesn't mean that any exposure to lead will cause harm in every instance, but that routine exposure to even low levels of lead can have significant developmental and health impacts. Because lead interferes with neurocognitive development, the impacts of lead exposure on children or those exposed in-utero can be profound and last a lifetime. It is currently estimated that more than 1/3 of the world's children have blood lead levels above 5 micrograms per deciliter – well above the level at which health effects can occur.

Recent studies demonstrate that lead contamination in drinking water systems is widespread and, in many cases, present at levels above the World Health Organization guideline value of 10 ppb. Water is not the only source of lead in the environment, nor is lead the only contaminant present in drinking water. Efforts to reduce lead in drinking water should not be viewed alone as a solution to either of these challenges, but as part of a broader strategy to progressively improve the safety of drinking water supplies and to reduce overall environmental exposures to lead. That said, the significant impacts of lead exposure on health, particularly in children, and the relative ease and low cost of preventing lead contamination of drinking water, make drinking water systems an important and impactful first step in reducing lead-related health diseases.

In addition to its direct impacts on public health, addressing challenges related to lead in drinking water can strengthen businesses and enhance trade in products that are safe to use in water systems, and improve capacity to address other water quality issues through sound policies, regulations, and capacity building from the lab to the field.

Finally, it is well-understood that lead is one of many contaminants that threaten the safety of drinking water. While it is essential to take a risk-based approach to progressively improving the safety of drinking water supplies consistent with Sustainable Development Goal 6.1, the relative ease and low-cost of preventing lead exposures, and the profound health impacts, suggest that the relative health benefits per unit cost are significant. The efforts recommended here, should be well integrated into broader water safety planning, domestic health strategies, and other efforts to reduce environmental exposures to lead.

Why a Roadmap?

It can be hard to decide where to begin. Because lead can exist both within a solution but also as particulate in drinking water it can be difficult to measure and results from the same source can be highly variable. While prevention is always the easiest and most cost-effective approach, it is important to know when and how to address a particular exposure. Ensuring the proper regulatory and policy environment is critical to preventing exposures that could be harmful. But what is harmful and how do we properly and equitably balance the risks within the costs of action within the broader context of challenges that communities face? What policies are appropriate, what institutional capacities that need to be built, and who bears responsibility for addressing lead in drinking water and how can those efforts be sustained? This Roadmap isn't intended to answer these questions for each case but rather provide a framework that can help guide an economy's effort towards achieving a lead-free future. Its intent is to support users with the core elements of a strategy that can inform their own discussions on what is most appropriate for them. In other words, the Roadmap isn't a prescription of what everyone should do, but recommendations to be considered within your own
local context.

Goals of the Roadmap

This Roadmap is intended to support the development and implementation of strategies and plans to reduce – and eventually eliminate – lead exposure in drinking water by:

- Identifying and remediating current sources of lead exposure and
- Preventing the introduction of lead-leaching parts and components in the construction of new water supply systems.

The elements of the Roadmap should be adapted based on the user's specific context.

While this Roadmap is not specifically intended to address other exposure routes (e.g., soil, surface water, air, paint, etc.), the elements can be easily adapted to apply for all lead exposure routes.

Overview of the Roadmap

The Roadmap is divided into three phases:

Phase I: Plan
Phase II: Act
Phase III: Inform and Sustain

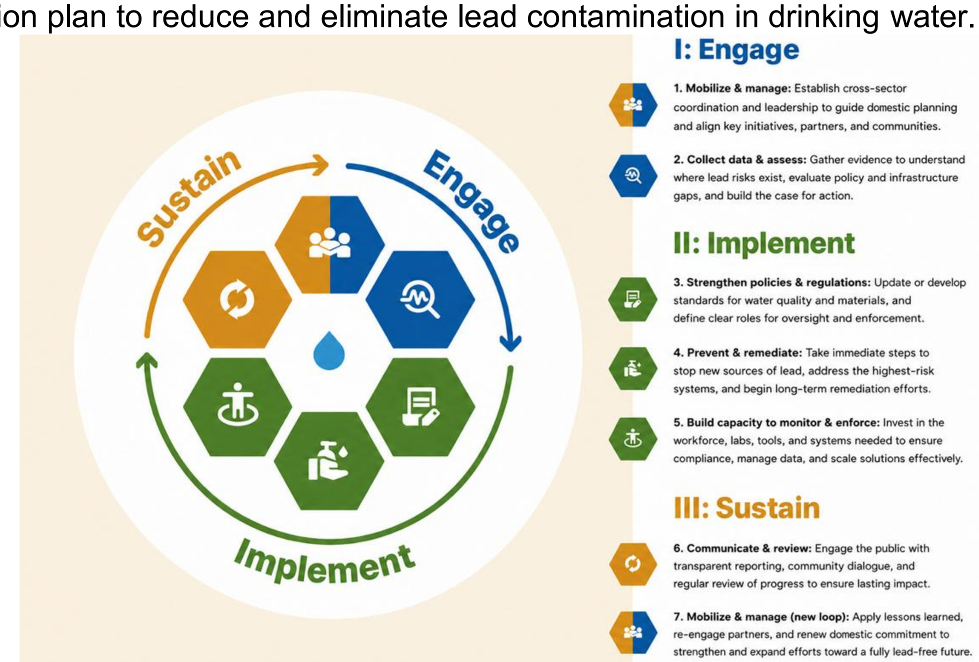
Within these phases there are six described elements or steps. While these can be undertaken sequentially (for example, it is recommended that economies start by engaging the appropriate stakeholders), many of these steps build off each other and can be considered at the same time. This is particularly important when it is known that lead-leaching parts and components are readily available in the marketplace and are being used in the construction of water systems. In these cases, it is strongly recommended that governments and development partners undertake immediate actions to ensure the safety of materials used in the construction of new water systems as an initial preventative step in reducing future exposures to lead.

The Roadmap is guided by the following core principles:

- ***Government sovereignty, ownership, and leadership.*** Domestic efforts must be led by sovereign governments in support of the populations they serve and represent.
- **Collaborative and collective action.** Addressing lead contamination requires a system-wide, whole-of-government approach, within economies and across regions.
- ***Sound science and information must guide decision-making.*** Addressing lead in drinking water requires understanding and managing the health risks within the context of a broader water safety plan that uses an evidence-driven risk-based approach towards addressing water quality challenges appropriate for that specific context.
- ***Progress must be institutionalized.*** To achieve results at scale and ensure sustainability, changes in policies and practices must be adopted within institutional frameworks and organizational plans and strategies and not solely vested within individuals or projects with defined end dates.
- ***Leverage findings**.* What we learn in one economy can inform efforts in others. We will work to make guidelines and recommendations generalizable (with appropriate contextual caveats) and share our findings broadly.

<u>A Roadmap Towards Lead-free Drinking Water</u>

The following actions should be considered in the development of an overall strategy and an implementation plan to reduce and eliminate lead contamination in drinking water.



Phase I: Assess

- **Mobilize and Manage**

The adoption and implementation of a domestic plan to eliminate lead in drinking water will require the buy-in and support of multiple ministries, departments, and agencies, as well as universities, businesses, non-governmental organizations, and other development partners whose own work will be critical to ensuring the program's success and alignment with other efforts related to lead in the environment. Provincial, state, and/or local authorities should also be included as appropriate. At the same time, the specter of lead in drinking water can generate significant concern among consumers and impact property values. It is therefore critically important that this process, and the communication of risks and proposed actions, be well-informed and well-coordinated.

To lead this process, governments should consider establishing at both the regional and domestic levels a government-led interagency working group (IWG), or groups, including, where appropriate, external stakeholders to review data; make recommendations on policies, regulations, and investments; lead the development and implementation of the strategy; establish common data management platforms; and support the development of communication and community engagement products.

- **Collect Data / Assess Situation**

Sound data and information are necessary to establish the scope and magnitude of lead contamination in drinking water and its impact on public health. It's also critical to identify policy, regulatory, and capacity gaps to inform action. Steps to consider include:

- **Establish the evidence base for action.** Review existing water, component material, and health datasets. Where necessary, use pilot studies in selected areas representative of all water supply cases to assess the scope and magnitude of the problem, establish evidence for why action is needed, and identify sites that may require immediate action. Studies should include testing for lead in drinking and source water, material testing of water supply system components, and blood lead-level testing in high-risk regions to inform a risk assessment through biokinetic modelling. Keep in mind that other environmental exposures may contribute to measured blood lead-levels.
- **Stakeholder identification.** Conduct a mapping to identify all parties necessary to inform and support the development and implementation of a domestic plan/strategy.
- **Conduct a policy review.** A bench-top study and survey to assess whether the appropriate standards, regulations, and policies are in place and have the authorities for developing, implementing, and enforcing these standards/regulations/policies been clearly and properly assigned within government ministries/agencies/ authorities. Do building

codes include standards for drinking water systems. Are monitoring plans or credentialing processes in place? How does this fit with other lead-related efforts/regulations? Are the responsible parties for addressing lead contamination in drinking water clearly identified and supported.

- **Assess institutional, laboratory, and workforce capacity.** Do the appropriate institutions at all levels have the required capacity to collect samples for lead testing; test water for lead at the required levels of sensitivity; and analyze, interpret, manage, and effectively communicate test data?

Through the interagency working group, in consultation with stakeholders, the above data should be reviewed to establish the business case for action and develop a list of prioritized actions that will guide future activities. Additional reviews/studies should be performed as needed to fill any knowledge or evidence gaps. The outcomes of this process should include:

1. A clear understanding of current agency/department roles and responsibilities, and recommendations for needed policy reforms
2. Identification of existing standards/regulations for drinking water and associated materials, and identification of any gaps (including any regional requirements)
3. An assessment of current laboratory capabilities and required investments necessary to measure lead at the required levels in water and materials (a minimum of 10 ppb in water and 0.25% lead by weight in materials)
4. A list of immediate actions that can be undertaken to prevent unsafe materials used in the construction of water supply systems from entering the marketplace
5. A costed-evaluation of context-specific risk mitigation options
6. Development of regional and domestic strategies or plans for preventing and progressively eliminating lead in drinking water over the next 5-15 years, as appropriate. This should include the establishment of targets, goals, and indicators as well as a complete costing plan and budget analysis. The latter should include local and regional market costs and benefits.
7. A public commitment to action on lead prevention in water with domestic/regional audiences

Phase II: Act

- **Strengthen Policies and Regulations**

In cases where there are unclear, overlapping, or insufficient legislative or other policy guidance establishing clear roles and responsibilities for ensuring the safety and safe and sustainable delivery of water services, steps should be taken to address gaps to ensure that the ministries, departments, and/or agencies responsible for the following are clearly identified:

- Establishing water quality standards for drinking water. For surface water, for groundwater

- Establishing material standards for pipes, parts, and components used in drinking water systems
- Monitoring and/or enforcing water quality or water system material standards
- Provision of drinking water services and the prevention and/or remediation of lead in drinking water
- Monitoring the provision of drinking water services
- Managing data related to lead in drinking water
- Communicating with the public

In cases where domestic drinking water, material, or product standards need to be developed, the IWG should consider the following steps:

- **Identify relevant product categories.** E.g., Piping, pumps, plumbing fittings & fixtures, Filtration technologies, Corrosion control technologies. (See Annex 1.)
- **Perform a detailed review of existing standards.** Are they appropriate for the local use case, do they restrict local businesses, and how do they align with
- international/regional regulatory standards?
- **Identify potential applicable national standards/technical regulations for each product category based on international standards.** Potential sources include: ASTM, ASME, IAPMO, NSF International, ISO (See Annex 1.)
- **Under the proper regional and domestic authorities, initiate an interagency, multistakeholder process to review and adapt potentially applicable standards/technical regulations to the local context.** For each proposed regulation/standard include: an evaluation of regulatory options (e.g., mandatory vs. voluntary), economic/health justification, regulatory impact assessment (e.g., impacts on markets and product availability at the local, domestic, and regional levels), and the development of specific guidelines and standard operating procedures for conformity assessment (e.g., testing, certification, accreditation of third-party verifiers), enforcement (e.g., who, what, and where), and workforce development.

• Initiate Prevention/Remediation Efforts

Contemporaneously with the other elements described above and below, take immediate steps to prevent the use of leaded parts and materials in new systems. As appropriate and feasible, progressively address high-level exceedances in existing systems and act to prevent future sources of lead contamination. This should include:

- **Adopt policies and draft contracts to require the use of non-leaded (less than 0.25% lead by weight – NSF 61) or non-lead leaching (based on NSF/ANSI 372) parts and components that are in contact with drinking water in the construction of water supply systems.** This should be applied to both government and development partners.
- **Monitor Supply chains to eliminate lead-leaching parts and components from use in the construction of new water supply systems.** Use technologies (e.g., X-ray

Fluorescence) to verify supplier material information and screen materials provided by local distributors. No part in contact with water should contain more than 0.25% lead by weight. Provide marks, traceability, and/or guidance to users on safe component options.

- **Confirm high-level exceedances in existing systems.** I.e., where monitoring and surveillance indicates levels of lead above guideline values in systems and samples, progressively confirm and address the most serious cases and sources of contamination.
- **Apply appropriate and feasible temporary measures.** E.g., corrosion control treatment, filtration, etc. Initiate steps towards a long-term solution. E.g., parts replacement, corrosion control, source water relocation.

Build Capacity to Monitor and Enforce

Successful implementation requires sound planning as well as investments in infrastructure and human capital. This should include:

- **Training on lead science.** The behavior of lead in drinking water systems is complex. It is important that those testing, analyzing, and developing remediation and prevention measures understand how lead enters drinking water systems; the effects of water chemistry, stagnation, temperature, etc.; the challenges of measuring lead in drinking water; and corrosion control strategies.
- **Training on process management, community engagement, and communications.**
- **Adoption of standard protocols and procedures.** To ensure harmonization of data collection and analysis methods and results across all stakeholders, establish standard procedures and protocols for testing for lead, including water sample collection, transportation, and storage; material testing; laboratory testing and QA/QC methods; data analysis, interpretation, and management; reporting; and public communications.
- **Establishment of routine monitoring of drinking water and system components.** To ensure that water systems and supply chains remain lead-free or within established guidelines/standards, a routine monitoring plan should be in place and executed. This plan should include where, how, how often, and by whom, and be integrated into existing water quality management programs.
- **Ensuring that staff and development partners, as appropriate, can properly execute field sample collection, storage, and transport; laboratory testing and QA/QC procedures; data analysis and management; materials screening; and standards/regulatory compliance and conformity.**
- **Infrastructure investment plan.** Identify a list of prioritized investments to ensure that government ministries/departments and laboratories have the necessary infrastructure to ensure compliance with national standards.
- **Data management.** Standard protocols and procedures should be created for the collection, analysis, and storage of water quality data.

Phase III: Inform and Sustain

- **Communicate and Review**

The communication of risks associated with lead exposure in drinking water is especially challenging. For many, it is difficult to reconcile that while no safe level of lead exposure has been established, we accept standards that permit some level of lead in drinking water. For others, the transition to lead-free materials may appear to be not worth the cost. The thoughtful communication of risk within the broader context of safe drinking water supplies is critical and should be conducted before, throughout, and after any testing and remediation/prevention work is done. Strong attention should be given to the communication of the costs and benefits tailored for diverse stakeholders. This should include:

- **Ensure community access to lead testing data.** Ideally, provide access to lead test data as well as regular reporting by water service providers. All products should include explanatory materials that allow for the proper contextualization of risk and recommended actions if necessary.
- **Regular communications with vendors and purchasers.** An outreach campaign should be developed and implemented to ensure vendors are aware of policies and regulatory changes and have access to training resources, and that purchasers have guidance on how to specify and ensure the supply of lead-free products.
- **Regular communications with impacted communities.** Conduct in-person town halls/community meetings at key points throughout the process.

On a periodic basis (e.g., every 5 years), the implementation of the domestic strategy should be reviewed. This should include an assessment of whether established goals and targets are being met, the agency roles and responsibilities are properly distributed and coordinated, any new equipment or infrastructure needs are identified and met, and that standards are consistent with evolving regional and international requirements

Appendix D: Lead in Drinking Water Bibliography

Lead in Drinking Water

Fact Sheet

The following list represents a small subset of the thousands of studies and resources on lead in drinking water, its harmful effects on human health, and effective approaches to prevention and remediation. They are presented as representative examples to support the declarative claims expressed below.

Lead is present in drinking water at harmful levels worldwide.

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