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Effect of Geopolitical Situation on Potassium Iodide Sale



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Abstract

This whitepaper explores the intricate relationship between geopolitical dynamics and the demand for potassium iodide (KI), a critical component of public health and emergency preparedness measures. KI serves as a safeguard against the adverse effects of radioactive iodine (RAI) exposure in the event of nuclear incidents. Geopolitical factors significantly influence the availability, accessibility, and trade regulations of KI, as demonstrated through case studies like the Russia-Ukraine conflict and historical nuclear accidents. International agreements, regulatory frameworks, and trade policies are key in shaping the KI market, with growing demand stemming from the nutraceutical and laboratory reagent sectors. While solid KI is the predominant market segment, there remains a challenge in the presence of iodine alternatives. Amidst the Russia-Ukraine war, KI demand has surged, depleting supplies and resulting in price gouging. Understanding these trends and the broader geopolitical impact on KI is essential to appreciate its critical role in safeguarding public health.

Keywords: *Potassium Iodide, Geopolitics, Nuclear Incidents, Emergency Preparedness, Radiation Exposure, Geopolitical Dynamics.*

I. INTRODUCTION

When it comes to public health and emergency preparedness, potassium iodide (KI) stands as a global safeguard against the adverse effects of radioactive iodine (RAI) exposure. In the event of a nuclear incident, such as a reactor accident or nuclear warfare, KI has been instrumental in protecting the thyroid gland from radiation-induced harm due to the fission products released when a nuclear warhead detonates or a reactor leaks.

However, the availability, accessibility, and sale of KI are not isolated components of the pharmaceutical and healthcare industry but are intertwined with the fluctuations of global geopolitics. As wars loom and political instability becomes prevalent - both within countries and between neighbors, the risk of nuclear detonations or attacks on nuclear power plants gets increases even more. The recent Russia-Ukraine war was a major issue that led to the uptick in demand of Potassium Iodide, especially now as Russia withdraws from the New Start Treaty.

Geopolitical dynamics are inextricably linked to the global risk of nuclear incidents, giving rise to a profound interdependence. As countries engage in diplomatic dialogues or tensions escalate, the shadow of nuclear warfare and nuclear accidents looms larger. This interplay between global politics and nuclear risk underscores the criticality of potassium iodide in safeguarding public health.

International Agreements & Nuclear Proliferation Concerns

The arms control landscape, characterized by international agreements and treaties, is a central arena where geopolitics affects the potential for nuclear incidents. The more nations become party to arms control agreements, the less likely the risk of nuclear warfare. Conversely, fraying relations or withdrawals from these agreements can intensify the risk.

One such example is the New Strategic Arms Reduction Treaty (New START) between the United States and Russia. This treaty, intended to limit the number of deployed strategic nuclear warheads and delivery systems, fostered cooperation and transparency between the two superpowers. However, geopolitical tensions have put this treaty in jeopardy, and as Russia withdraws from it, it raises concerns about the broader arms control framework. Such developments have implications for the potential for nuclear conflict and, in turn, KI sales.

As of today, KI is readily available to the public in many countries and can be purchased over-the-counter or distributed in the event of a nuclear incident. However, the demand for KI is not static. It is sensitive to geopolitical events and nuclear risk perceptions. Recent geopolitical tensions and nuclear proliferation concerns, notably the standoff between North Korea and the United States, have triggered a surge in public interest in nuclear preparedness and, consequently, KI sales. Understanding these trends is essential for a comprehensive analysis of the impact of geopolitics on KI sales.

Global Regulatory Framework & Trade Policies

Geopolitical situations influence not only the demand for KI but also the regulatory environment governing its trade. The international regulation of nuclear safety and preparedness is governed by agreements such as the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency. These conventions facilitate international cooperation in response to nuclear incidents, emphasizing the role of KI as a preventive measure.

However, the effectiveness of these agreements and the trade policies surrounding KI depend on the diplomatic relationships between nations. The ability to access KI quickly and efficiently is reliant on geopolitical factors that influence border controls, customs regulations, and international cooperation during emergencies.

Historical Precedents & Case Studies

To gain a deeper understanding of the correlation between geopolitical situations and potassium iodide sales, we must delve into historical instances. The Chernobyl disaster of 1986 serves as a stark reminder of the consequences of a nuclear catastrophe. In the aftermath of the Chernobyl explosion, the Soviet government initiated a vast distribution of KI to protect the population from the release of radioactive iodine. This event demonstrates how geopolitical factors, such as the management of nuclear incidents, can dictate the sudden surge in KI demand.

Similarly, the Fukushima Daiichi nuclear disaster in 2011, triggered by a massive earthquake and tsunami in Japan, highlighted the global implications of nuclear incidents. This event sent ripples through the international community, spurring discussions on nuclear energy safety and emergency preparedness. It also increased the focus on the production, availability, and distribution of KI.

II. POTASSIUM IODIDE: AN ESSENTIAL OVERVIEW

Potassium iodide, or KI, acts as a powerful shield against the potentially devastating health consequences of exposure to radioactive iodine (RAI). Radioactive iodine isotopes, such as iodine-131, are frequently released into the atmosphere during nuclear incidents, be they accidental meltdowns or intentional detonations. The thyroid gland, which is responsible for regulating the body's metabolism, has a particular affinity for iodine, making it highly vulnerable to radioactive iodine uptake.

Mechanism of Action

The fundamental function of potassium iodide in a nuclear emergency is to provide stable, non-radioactive iodine in a form that the body can rapidly absorb. When individuals at risk of radiation exposure take KI tablets or liquid, the thyroid gland becomes saturated with this stable iodine.

As a result, it essentially becomes "full," leaving no room for the absorption of radioactive iodine. This straightforward yet remarkably effective mechanism plays a critical role in reducing the incidence of thyroid cancer and other radiation-related health problems.

Broader Applications

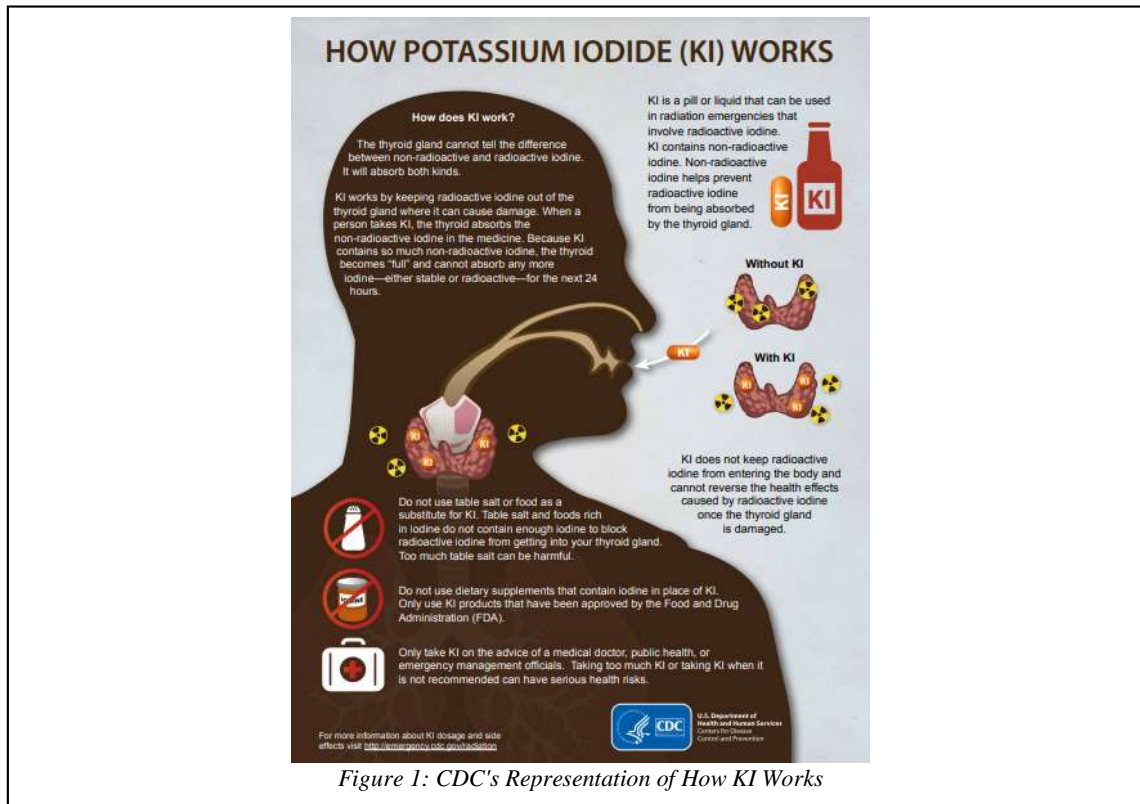


Figure 1: CDC's Representation of How KI Works

KI's importance isn't confined to nuclear safety alone. It is a versatile chemical compound with applications across various industries and scientific domains. In chemistry, KI serves as a critical reagent in numerous reactions, particularly those involving the synthesis of organic compounds. The pharmaceutical and healthcare industries also utilize KI in the manufacturing of certain medications.

Global Availability and Accessibility

KI's global availability has significantly increased in recent years, driven by the growing recognition of its importance in nuclear and radiological emergency preparedness. Many countries have made KI readily accessible to the public, either through over-the-counter sales or distribution during emergencies. The awareness of KI as a vital protective measure has resulted in greater preparedness for nuclear incidents. Nevertheless, the availability and accessibility of KI remain contingent on various factors, including local regulations, healthcare infrastructure, and international cooperation.

Role in Nuclear Safety

While KI has a range of applications, its most critical role is in nuclear safety. The World Health Organization (WHO), the International Atomic Energy Agency (IAEA), Centers for Disease Control (CDC), and other international bodies have emphasized the significance of KI as a key protective measure in the event of a nuclear incident. This recognition has led to the inclusion of KI stockpiling in many countries' nuclear emergency response plans.

A. Children: The Most Vulnerable Group

Children are particularly vulnerable to the harmful effects of radioactive iodine exposure, making potassium iodide (KI) an indispensable safeguard for this age group. The tragic aftermath of the Chernobyl nuclear accident in 1986, which unfolded in Belarus, Ukraine, and Russia, highlighted the significant increase in thyroid cancer incidence among children exposed to radioiodine. The youngest children faced the highest observed risk. Notably, no similar surge in thyroid cancer cases was reported among adults.

Recommended Radiation Doses for KI

To provide clear guidance on when KI should be administered, the U.S. Food and Drug Administration (FDA) issued updated recommendations on December 10, 2001. These guidelines stipulate specific radiation doses that warrant KI usage across different age groups:

- **0 - 18 years:** 5 rem
- **Pregnant and Lactating Women:** 5 rem
- **Over 18 - 40 years:** 10 rem
- **Over 40 years:** 500 rem

The recommendations emphasize a lower radiation dose threshold for younger individuals and pregnant or lactating women, reflecting their heightened vulnerability to radiation's adverse effects.

B. Optimal Timing for KI Administration

For KI to be most effective, it should be taken before or immediately after exposure to radioiodine. Even if administered three to four hours post-exposure, it still significantly reduces the thyroid's uptake of radioactive iodine. However, the effectiveness diminishes with delayed intake, underscoring the importance of timely administration.

Determining the Need for KI Usage in an Emergency

The usage of KI is exclusively indicated in emergencies where there is a likelihood of public exposure to radioiodine. State and county health departments closely monitor radiation emergencies and issue advisories to inform the public whether KI should be taken. In cases where KI is

recommended, health departments also provide guidance on when KI administration is no longer necessary.

C. Limitations of KI in Radiation Emergencies

It is crucial to acknowledge the limitations of potassium iodide in radiation emergencies:

- **Protection Limited to the Thyroid:** KI effectively reduces radiation doses to the thyroid but does not shield other organs or tissues.
- **No Defense Against External Radiation:** KI does not protect against radiation received from sources external to the body, such as exposure to a radioactive plume or contact with radioactive materials on the ground.
- **No Guard Against Non-Iodine Radioactive Materials:** KI specifically guards against radioactive iodine isotopes and offers no protection against other radioactive materials, including non-iodine isotopes, that may be inhaled or ingested.

D. Complementary Protective Measures

KI serves as one component of a broader set of protective measures implemented during nuclear incidents. Existing emergency response plans, especially in regions with nuclear facilities, prioritize



evacuation and sheltering-in-place as primary protective measures. Evacuation is essential for reducing exposure to radioactive materials, while sheltering-in-place applies to individuals who cannot be relocated, such as those in healthcare facilities or schools. Additionally, controlling the food supply is crucial to prevent the ingestion of contaminated products.

E. Understanding KI's Side Effects

A study conducted in Poland following the Chernobyl accident provides valuable insights into the side effects of KI usage. The research revealed that among newborns administered 15 mg of KI, one in 270 displayed transient biochemical hypothyroidism. Generally, side effects observed in both adults and children were of minimal clinical significance. These side effects range from

gastrointestinal issues in approximately 2% of cases to a rash or irritation in ~1% cases. It also led to hospitalization for two adults with iodine sensitivity.

Precautions for KI Use

Some precautions are advised when considering KI usage, particularly for individuals with known iodide sensitivity or those with conditions associated with an increased risk of iodine hypersensitivity. It is essential to:

- Consult a physician to assess iodine sensitivity and potential risk factors before an emergency. KI needs to be administered within a specific time frame from exposure to be effective.
- Monitor newborns for signs of hypothyroidism if they have been administered KI. Neonates (newborns to one month), pregnant and lactating women, and individuals with known iodine sensitivity are given priority concerning protective measures.

KI Dosage Recommendations

In December 2001, the FDA issued revised guidance on the recommended KI dosages for various age groups. These guidelines suggest the following lowest effective dosages:

- **Adults over 18 years:** 130 mg
- **Over 12 - 18 years and over 150 pounds:** 130 mg
- **Over 12 - 18 years, less than 150 pounds:** 65 mg
- **Over 3 - 12 years:** 65 mg
- **Over 1 month to 3 years:** 32 mg
- **Birth to 1 month:** 16 mg

KI is available over-the-counter in 65-mg and 130-mg tablets as well as a liquid form. The ease of dosing is greater with the liquid or 65-mg tablets, as they can be split along scored lines or crushed to create lower doses. This flexibility is particularly useful for measuring doses for younger children or infants who cannot swallow pills.

III. POTASSIUM IODIDE MARKET ANALYSIS

The global potassium iodide market is expected to grow significantly, with an estimated increase of USD 267.11 million anticipated between 2022 and 2027, demonstrating a CAGR of 5.36%. Potassium iodide (KI), comprising potassium (K) and iodine (I) ions, serves multiple sectors, including pharmaceuticals, chemical manufacturing, dietary supplements, food fortification, laboratory reagents, and nuclear emergency preparedness.

The market's expansion relies on key factors, including rising demand from the nutraceutical industry, the need for thyroid-blocking agents, and potassium iodide's growing industrial applications.



Currently, the demand for solid, pill-based KI is higher than that of its liquid variant. This high demand for solid KI is not only for healthcare, but also for photography, chemistry, and salt iodization.

The market showcases a ~15% disparity between demand for liquid and solid variants, with pill-formed KI showcasing a ~65% market share.

A. Key Market Driver: Nutraceutical Industry Demand

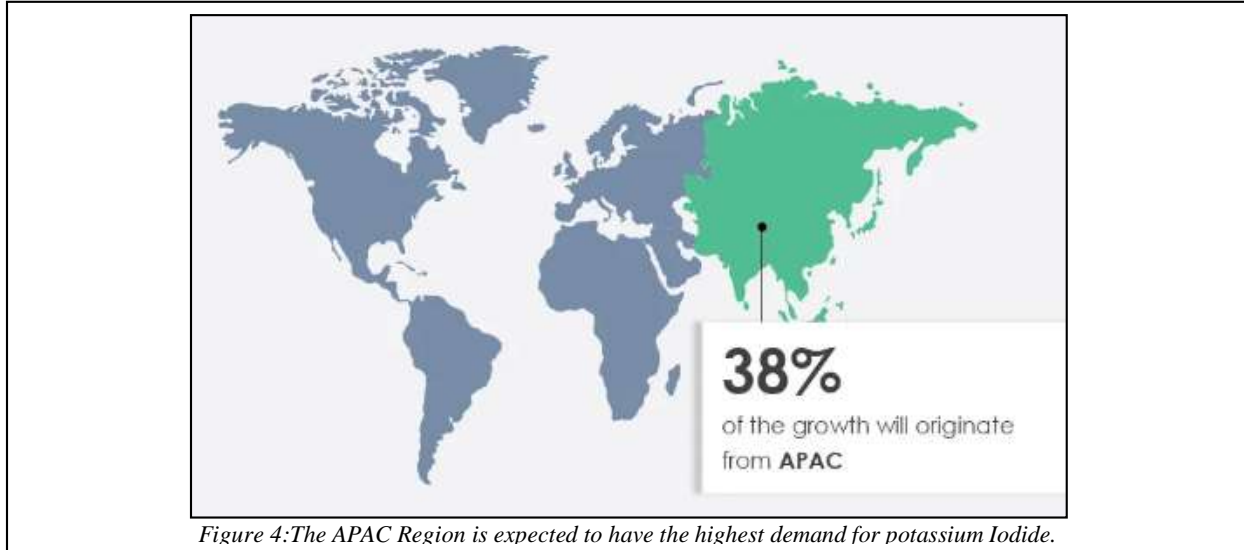
A primary driver of the global potassium iodide market is the escalating demand from the nutraceutical industry. KI acts as a crucial source of iodine, an essential human nutrient, within the food sector. It is integrated into dietary supplements, contributing to multivitamins, thyroid support formulas, and iodine-supplemented functional foods. Vita Pure, NOW Foods and Life Extension are key manufacturers, aiming to provide controlled iodine sources that meet nutritional needs.

Additionally, adherence to regulatory standards and guidelines, governing the composition, labeling, and safety of dietary supplements, influences potassium iodide demand as an ingredient. This, in turn, reinforces the market's growth during the forecast period.

B. Key Market Trend: Laboratory Reagents Demand

A significant trend in the global potassium iodide market is the heightened demand for laboratory reagents. Laboratory reagents are critical for research and development across scientific domains like pharmaceuticals, biotechnology, genetics, and environmental sciences. New technologies necessitate specific reagents for experiments and analyses, while the medical sector relies on these reagents for diagnostic tests.

Stricter standards for laboratory testing and analysis, enforced by regulatory bodies like OSHA and EPA, drive the demand for specific reagents to ensure accurate and reliable results. This heightened demand for potassium iodide, linked to the need for laboratory reagents, is expected to



positively impact market growth.

C. Major Market Challenge: Availability of Alternatives

A key challenge faced by the global potassium iodide market is the presence of alternative iodine sources. Iodine derivatives, as well as other iodine salts like lithium iodide, magnesium iodide, or zinc iodide, offer similar properties and can be more accessible or cost-effective. In some instances, elemental iodine may replace potassium iodide, potentially reducing its demand. Addressing this challenge is critical to sustaining market growth.

D. Market Segment Insights

The market is segmented based on application and geography primarily. These segments include:

- Application:
 - Pharmaceuticals,
 - Nutraceuticals,
 - Polymer,
 - Medicinal
 - Food and
 - Feed additives, and others

- Geography
 - APAC,
 - North America,
 - Europe,
 - South America,
 - Middle East, and
 - Africa.

Based on the current political stance of the world, the highest demand for Iodine pills is expected to rise from the APAC region. However, it is important to note that this high demand is not because of the high population density in the region but because of the ongoing Russia-Ukraine war.

While the Palestine-Israel struggle in the Middle East is also escalating at the time of writing and Israel is a nuclear-armed country as well, the expectation of Israel relying on nuclear weapons is highly unlikely. Furthermore, Palestine does not have any nuclear power plants that may get damaged and lead to radiation leaks.

Therefore, the geographical demand is more prevalent for the Russia and Ukraine region. 38% of the global demand for KI is expected to rise from this region.

At the same time, the segment for application means that the North American and European markets also see significant demand for KI as Nutraceuticals and for research purposes.

Segment Focus: Solid Potassium Iodide

The solid potassium iodide segment is projected to witness significant market share growth. It is a versatile inorganic compound used in various applications, including dietary supplements, analytical chemistry, and iodized salt production.

This segment aligns with the global trend of health consciousness and preventive healthcare. The growing demand for dietary supplements containing potassium iodide to address iodine deficiencies is anticipated to drive its market share.

Additionally, solid potassium iodide's essential role in analytical chemistry is set to contribute to its growth across multiple industries. The key purchase criteria are set to be as follows, in order:

1. Innovation
2. Regulatory Compliance
3. Service
4. Price

5. Reliability

6. Quality

This segment's growth is expected to positively influence the global potassium iodide market. Because of the high availability and low cost of production, the purchase criticality of the product is expected to be uninfluenced by price sensitivity as much. The recent boom in demand for Potassium Iodide can be compared to the rise of the facemask and hand sanitizer market during COVID-19.

IV. POTASSIUM IODIDE DEMAND AMID RUSSIA'S UKRAINE ASSAULT

The intensification of Russia's military actions in Ukraine has brought forth a renewed fear of potential radioactive fallout resulting from either accidental or deliberate attacks on Ukraine's nuclear facilities or the use of nuclear weapons. As a consequence, there has been a notable surge in the demand for potassium iodide pills.

A. *Radioactive Iodine: A Potential Hazard*

Large manufacturers of potassium iodide approved for sale in the United States witnessed a swift depletion of their inventories as Russia invaded Ukraine in February, 2022. The dwindling supplies have sparked price gouging.

A similar trend was seen in 2018, as the US-Korea tensions rose and the risk of a nuclear war increased between the countries. As a result, the increased demand for KI was seen not only in the US, but in Asia as well as countries neighboring North Korea, or those that saw windfall from the region also started stockpiling the essential pill.

As a result of the Russia-Ukraine war, for instance, listings on eBay showed significant price increases. 04 boxes of Thyrosafe, a common potassium iodide tablets, could be seen being sold for an average of \$132.50, and a single 14-pack of IOSAT 130 mg pills was being sold for \$89.95. This marked a roughly 700% increase in the manufacturer's price of \$13.99 for a 14-pack box.

B. *Out of Stock & Heightened Demand*

Another example of the effect of geopolitical tensions leading to a rise in demand was reported by Anbex, Inc., a leading supplier of potassium iodide tablets. It reported to have faced a surge in demand for their IOSAT products.

The company, based in New York, reported in February 2022 of being out of stock of its 130mg and 65mg IOSAT potassium iodide tablets. However, they aimed to replenish their inventory by early April, with efforts to restock by late March.

C. Historical Patterns of Demand

Historically, potassium iodide demand surges in response to real or perceived threats of nuclear fallout. Demand escalated when former President Donald Trump's tweets in 2018 heightened fears of nuclear conflict, and when the Hawaii Emergency Management Agency mistakenly sent out a ballistic missile alert in the same year. More recently, the rhetoric surrounding Russia's increased state of alert and escalating tensions has driven anxiety and the purchase of potassium iodide.

Manufacturers, like Anbex, have increased production to meet the elevated demand. Nonetheless, consumers are advised to adhere to the CDC's guidelines and take potassium iodide pills only under the guidance of health officials.

D. Global Impact on Potassium Iodide Manufacturers

London-based BTG Specialty Pharmaceuticals also experienced heightened demand for potassium iodide products in Europe and the US, which coincided with the conflict in Ukraine.

The company's Thyrosafe, an FDA-approved over-the-counter potassium iodide tablet, had been in high demand since the war started. While they did not run out of stock as quickly, they temporarily halted orders through their website, and some partners and distributors started facing shortages by April, 2022.

In a significant portion of these cases, potassium iodide products were sold to governments, public health agencies, and the military for stockpiling.

V. CONCLUSION

The correlation between geopolitics and the demand for potassium iodide (KI) is undeniable. The geopolitical landscape serves as a powerful driving force influencing the utilization of this vital chemical compound in various sectors. The recent Russia-Ukraine conflict has once again highlighted the paramount importance of KI in safeguarding public health during nuclear incidents and radiological emergencies.

This whitepaper has delved into the intricate relationship between geopolitical factors and KI sales, offering insights into the following key aspects:

1. Geopolitical Dynamics and Nuclear Risk: Geopolitics and global instability intricately intertwine with the risk of nuclear incidents. Wars and diplomatic tensions amplify the potential for nuclear detonations, reactor accidents, and attacks on nuclear facilities, increasing the demand for KI as a protective measure.

2. International Agreements and Nuclear Proliferation Concerns: Arms control agreements, such as the New Strategic Arms Reduction Treaty (New START), play a significant role in shaping the risk of nuclear warfare. The withdrawal or fraying of such agreements can escalate the risk, emphasizing KI's importance in mitigating these risks.

3. Global Regulatory Framework and Trade Policies: The international regulatory framework for nuclear safety and preparedness relies heavily on diplomatic relationships between nations. Border controls, customs regulations, and international cooperation during emergencies all play critical roles in the availability and accessibility of KI.

4. Historical Precedents and Case Studies: Historical nuclear incidents, such as the Chernobyl and Fukushima disasters, underline how geopolitical management of these crises can lead to surges in KI demand. These instances serve as crucial benchmarks for understanding the interconnectedness of geopolitics and KI usage.

The surge in potassium iodide demand during geopolitical crises is a clear indication of its role in nuclear safety. The interplay between geopolitical events, arms control agreements, international regulations, and historical precedents underscore the intricate connection between global politics and the critical need for KI. In a world marked by geopolitical uncertainties, potassium iodide remains an essential guardian of public health in the face of nuclear risks. As international relations and tensions continue to evolve, the demand for KI and its multifaceted applications will remain a dynamic aspect of our global landscape.

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