



Report

Design and Implementation of a Revolving Fund System
for the Supply and Delivery of Potassium Iodate in Ethiopia

Prepared by the Global Alliance for Improved Nutrition

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1. Executive Summary

GAIN conducted a mission to Ethiopia from 11-20 June 2012 in order to investigate the best options for establishing a revolving fund system for the sustainable supply of potassium iodate (KIO₃). This was a continuation of the work GAIN has been undertaking since September 2009 to address KIO₃ supply in the country. A sustainable supply of KIO₃ is critical to the national universal salt iodization (USI) program and to combating Iodine Deficiency Disorders (IDD) which remains a serious threat to the population of Ethiopia. In order to assess the background, current situation and next steps, GAIN conducted interviews with salt producers of various sizes, as well as key stakeholders including the Federal Ministry of Health (FMoH), UNICEF, the Micronutrient Initiative (MI), the Ethiopian Food, Medicine and HealthCare Administration and Control Authority (FMHACA) and the Pharmaceutical Fund and Supply Agency (PFSA).

KIO₃ supply needs to be rapidly professionalized, made independent from donations and designed in a sustainable manner. Since September 2009, 22.4 MT of KIO₃ have been donated to the FMoH by GAIN, MI and UNICEF for distribution to salt producers. Producers put aside 1.83 Birr per one quintal of their iodized salt production. To date this money has only been partially collected. The government estimates only about 2 million Birr, a fraction of the total amount, can be collected and used for KIO₃ purchase.

GAIN in partnership with UNICEF and MI, propose establishing a revolving fund by January 2013 to be hosted by the Pharmaceutical Fund and Supply Agency (PFSA). This fund will ensure an efficient, cost effective and quality supply of KIO₃.

The estimated annual demand for iodized salt for household consumption of 318,000 MT can be fully satisfied by production from the Afar, Dhobi and Somali regions. Capacity to iodize almost 150% of the yearly demand exists. However, only 60% (maximum) capacity exists to professionally iodize salt that complies with the salt regulations.

12.59 MT of expired KIO₃ from previous donations is in the country (verified by the mission). Realistic assumptions on KIO₃ demand along with strict supervision of the supply need to be implemented to effectively manage the fortificant which in recent years saw a price increase of more than 100% but seems to have stabilized at 55 US\$ per kg.

By taking into account the annual demand for salt and installed and operational maximum iodization capacity of 60%, KIO₃ demand amounts to 0.794 MT per month or 9.5 MT per year¹. GAIN and UNICEF recommend working with this estimated demand and increase demand only after iodization capacity is restored. All KIO₃ supply should be handled through the revolving fund which can be effectively launched in January 2013. Until then, progress should continue on design decisions and equipping the fund with a seed stock of 30% annual demand. This is an appropriate balance between prevention of stock-outs and stock expiry. The proceeds from KIO₃ sales by the fund operator PFSA should be used to replenish the fund. If monthly demand increases over time, the fund simply needs to replenish faster and increase the base stock levels. Until the fund is operational in January 2013, sufficient stock of KIO₃ from previous donations is in the country to iodize salt.

During interviews the proposal to establish a fund was received well by all parties involved. Producers also did not see a problem to pay for 100% of the KIO₃ cost as long as a grace period – as proposed until the end of 2012 – is granted. GAIN's calculations also indicate that the salt production sector, especially among the more mature producers, is profitable enough to cover the 0.055 Birr cost of KIO₃ per 1 kg of salt themselves.

¹ There is ambiguity regarding the interpretation of the iodization standard. Please see chapter 7 and annex 1 for details on potential KIO₃ demand.

2. Objective

This report assesses the potassium iodate (KIO_3) supply situation in Ethiopia. It will analyze how much of this important fortificant is needed in Ethiopia to satisfy market demand for adequately iodized salt to overcome Iodine Deficiency Disorders (IDD) which are prevalent in the country.

This assessment will give recommendations on the design of a revolving fund for potassium iodate in order to create a sustainable supply system and decrease dependency on donations by international agencies.

The report bases its recommendations on the detailed assessment of what has been found on the ground and provides a comprehensible analysis to inform a sound design for a KIO_3 fund. The proposed recommendations will be discussed with the Federal Ministry of Health and USI partners to effectively institutionalize the system for its successful implementation.

3. Methodology and organization of this report

Information for the report was gathered during a GAIN mission to Ethiopia from 11th to 21st of June 2012 where the team consisting of Roman Przewlofsky GAIN USI managing consultant, Lorenzo Locatelli-Rossi, Senior Technical Specialist and Tena Yigezu, GAIN USI Ethiopia associate conducted interviews with various stakeholders from the Ministry of Health, UNICEF, the Micronutrient Initiative, the Ethiopian Food, Medicine and Health Care Administration and Control Authority (FMHACA), the Pharmaceutical Fund and Supply Agency (PFSA) and various salt producers of different sizes in the regions of Afdera, Dhobi and processing sites in Tigray (Mekelle) and Oromia (Bishoftu).

The report first assesses the status of Universal Salt Iodization (USI) efforts in Ethiopia to give a better context of how the potassium iodate supply fits into the overall situation in the country. The report extensively analyzes the iodized salt production sector and how the KIO_3 supply is organized, giving some indication of the demand for KIO_3 to satisfy market demand for adequately iodized salt. The chapters that follow estimate current and future demand for potassium iodate, while taking into consideration installed machine capacity.

This study also explores different viable supply sources for KIO_3 on the international markets and an in-depth analysis explores which components make up the total sales price for potassium iodate to salt producers. What follows are recommendations on characteristics that should be implemented in a revolving fund regarding a hosting institution, pricing, distribution, seed stock and modalities of implementing the recommended system.

The report closes with a risk analysis, recommendations on monitoring and evaluation and a conclusion.

4. Background

4.1 Iodine Deficiency Disorders in Ethiopia

Iodine Deficiency Disorders (IDDs) are the leading cause of preventable mental retardation and impaired psychomotor function in young children. In the extreme form, IDD causes cretinism and increases risks of IUGR (Intrauterine Growth Retardation), still birth and miscarriage in pregnant women.

The earliest published report about IDD in Ethiopia (1976) indicated area-specific goiter rates as high as 71%. According to a situational analysis carried out by Ministry of Health (MoH) and UNICEF in 1993, 42 million people (78%) of the total population of Ethiopia were at risk to iodine deficiency, 35 million (62%) were iodine deficient, 14 million (26%) had goiter and at least one in 1000 people was cretin; with about 50,000 prenatal deaths. This report claims that many health problems in the country are attributable to iodine deficiency. A 2005 survey on iodine deficiency conducted by the Ethiopian Health and Nutrition Research Institute (EHNRI) shows that goiter prevalence among children was 40% (28% for palpable and 12% for visible goiter) and was 36% among mothers aged 15-49. Only 4.2% of Ethiopian households consumed iodized salt, a marked deterioration from a decade ago.

The household coverage rate was measured using *non-quantitative* Rapid Test Kits (RTKs). These tests can only detect the presence of iodine in salt but not the iodine level. As such, compliance with the mandated standards cannot be assessed. According to the EDHS 2011 survey, a 15.4% compliance rate was observed. Quantitative tests, including the more accurate titration method, were not performed.

Production of salt by solar evaporation of inland brines is relatively recent in Ethiopia. Until 1998, Ethiopia imported all domestic salt requirements from Eritrea. After this time, salt was imported from Djibouti. The total salt requirement for Ethiopia is around 350,000 MT per year of which about 30,000 MT are used for the tanning, food and general industry.

Ethiopia has the capacity to produce raw quality salt in several sites including Afdera and Dhobi in the Afar Region, and Afder in the Somali Region. The potential annual capacity in Afar alone is three times the annual requirement for raw salt in the entire country. Raw salt producers in Afdera have agreed on a quota system for production to prevent flooding the market and leading to artificially low prices.

4.2 The national USI program

Ethiopia is one of the sub-Saharan African countries most affected by IDDs. Through the late 1990s the problem was solved through government importation of iodized salt from neighboring countries including Eritrea and Djibouti. Universal Salt Iodization attained coverage of 80%. The problem re-emerged after the 1998 war with Eritrea, resulting in household coverage with iodized salt plummeting to less than 5%.

After the war there was strong government interest to develop a national salt industry to satisfy demand. Accordingly, Lake Afdera in the Afar regional state was identified for having huge potential for salt production. Subsequently, Dhobi area in the same region and Godusbo area in the Somali region, were also identified as salt producing areas. Raw salt production in these three sites was found to be exceedingly sufficient to satisfy the demand of the population. After successfully achieving in-country production of salt, small-scale iodization efforts were started around the year

2004/05 to contribute to Universal Salt Iodization. Thereafter, different partners were generously supporting the government in its effort to iodize salt to meet Universal Salt Iodization target to be achieved in 2010.

However, due to many reasons, the coverage did not exceed 16% in 2010. This urged government to enact a law mandating the compulsory iodization of salt. The law was passed in 2011 by the Council of Ministers, and responsibility of enforcement was allocated to FMHACA.²

The enforcement of the law that makes iodization of salt compulsory with regular checks, started almost a year later in January 2012. By ensuring that only non-iodized salt is allowed to enter the market, the situation will hopefully change, further increasing household coverage with adequately iodized salt over the coming years, encouraging developments and continued international support.

The government and partners have undertaken various interventions to date among which public awareness and demand creation activities are being carried out by FMOH, and UNICEF in all parts of the country. Advocacy workshops sponsored by UNICEF were conducted in most of the regional states in an effort to raise the awareness of regional officials. Health extension workers are the frontline agents to pass the message to the community. They are given Rapid Test Kits to demonstrate test results and create awareness.

Apart from the above progress in reaching USI, GAIN recommends to continue working on other constraints that pose threats to the program such as:

1. The quota system on salt production

A quota system in some regions prevents companies with enough production capacity, in terms of good quality raw salt and latest existing iodization technology, to market their quality assured, adequately iodized salt. GAIN believes that the quota system needs to be modified to allow for competition.

2. Lack of a holistic management system

Salt iodization equipment has been generously donated in the past to an extent that ownership and responsibility towards keeping those machines operational and in good shape (“as if they were their own”) suffered. The mission found an excessive number of machines unused, in bad conditions or inconveniently placed. This was especially the case at Lake Afdera.

Proper and holistic site management with elements of a zonal approach and centralized facilities for iodization can overcome this problem.³ Furthermore GAIN and UNICEF realize that in order to use funds wisely, existing machines need to be made operational instead of purchasing new equipment that may go unused. For this, spare parts and generators have been donated in addition to new iodizing machines. The calculations indicate that with these donations the demand can be met.

² Salt law published 25th March 2011. Regulation Number 204/2011.

³ The authors recommend considering the “GAIN Lake Afdera Management Proposal” sent to FMOH in October 2011 as a starting point.

3. Continued strengthening of the regulatory body

In order to prevent inadequately iodized salt that does not comply with the new standards, the body for enforcement of the salt law needs continued support to fulfill their tasks. During interviews salt producers indicated they are aware of possible checks by FMHACA to their production sites and in the market. As part of strengthening the work of the regulatory body, the GAIN-UNICEF partnership donated testing equipment and will roll out its Quality Assurance (QA)/Quality Control (QC) program in the country within 2012. This program aims to build the capacity of FMHACA through trainings on QA/QC best practices as well as training the salt industry. Salt factory internal procedures on QA/QC primarily need to ensure that only properly iodized salt leaves their production facilities.

Today these listed issues are still dominant in the program and they must be addressed before success can be achieved.

4.3 The KIO₃ Problem

Since the introduction of the Universal Salt Iodization program, the supply of potassium iodate has taken a front seat due to its importance as the ingredient needed to eliminate IDD. For many years in most if not all countries, KIO₃ was distributed free of cost with the intention to assist iodized salt producers in producing iodized salt at an affordable price. In recent years in a number of countries, it was realized that donations of KIO₃ hindered the sustainability of the program as donors' ability, focus and willingness to provide KIO₃ for free are decreasing.

Now the USI program is at a very crucial stage. On the one hand the financial donations for the program are being reduced rather dramatically as the world is confronted with many different humanitarian challenges coupled with a nearly global financial crisis. Furthermore, the Tsunami that caused the Fukushima (Japan) nuclear disaster immediately caused the price of KIO₃ to increase substantially from US\$28/kg to US\$60/kg. This dramatic hike placed severe strains on the USI program.

GAIN immediately took the lead with its partners UNICEF and MI in providing a world review of the KIO₃ supply situation. The most important finding was that producers of KIO₃ reported their main problem in securing constant supplies was the inability to forecast KIO₃ requirements by iodized salt producers.

Potassium iodate has been supplied without charge to salt producers in Ethiopia over the past few years. Donations were made to the Federal Ministry of Health (FMOH) by donors and implementing partners such as UNICEF, MI and GAIN. A major breakthrough in the Ethiopia USI program was realized in March 2011, with the passing of mandatory legislation by the Council of Ministers, requiring all edible salt in the country to be iodized. Furthermore, both government and donors have determined it is time the iodized salt business becomes self-sustaining in its requirements of KIO₃. This has led to the critical need to develop a cost recovery system in Ethiopia.

5. Overview of the salt production sector

5.1 Number of producers and location

In Ethiopia there are three sites where salt is produced. The first site, in the Danakil desert in Afar region, salt is produced in Lake Afdera and in the extreme north, Berhale, where rock salt is mined. Berhale is the oldest source of salt mining in the country and dates back to the famous camel caravans of salt. Second, in the Afar region is Dhobi, an area on the trading route from Djibouti to Addis Ababa. Third, in the Somali region there is the Afder zone in the town of Godusbo where small salt farmers are producing salt from underground brine similar to Dhobi.

Ethiopia is self-sufficient with salt and has potential capacity to export. Nevertheless due to being a land locked country and reliant on Djibouti as a port of export, it is difficult for this to be profitably realized.

While the number of salt producing regions is easy to identify, only rough estimates are available on the number of salt producers. Farmers are not necessary fixed in their endeavor but rather it is an opportunistic way to generate income. More than one thousand small farmers are salt producers, the majority being in Lake Afdera followed by Godusbo, Berhale and Dhobi.

5.2 Annual production capacity and capacity utilization

The annual requirement is calculated on the classical basis of 10 grams of salt per person per day. With a population of 87 million in 2013 this amounts to an iodized salt requirement of approximately 318,000 MT per year⁴. With regards to installed capacity of machines that have been either provided through donor funds or bought through investments, the iodization capacity in Ethiopia is sufficient to cover the full requirement. The following calculation shows the theoretical maximum capacities at the different production sites:

Company name or site/machine type	Number of machines	MT per Hour	Total installed capacity (MT/h)	MT per Year Capacity in 1000
Afdera/Glotra*	10	7	70	115.5
Afdera/Indian	10	6	60	99.0
	3	10	30	49.5
Dhobi/Indian	3	10	30	49.5
	2	6	12	19.8
Somali/Davey*	1	10	10	16.5
Somali/Glotra**	3	7	21	34.7
Amole	1	3	3	5.0
Share Company/Afdera	1	30	30	49.5
Shewit/Glotra	2	7	14	23.1
Total	36	96	280	462.1

Table 1: Potential capacity to iodize salt in Ethiopia in existing production sites, June 2012

*GAIN 2011 delivery of one Davey and 5 Glotra parts for machine restoration with respective generators not yet installed by USI program management

** Two Glotra machines procured by UNICEF are not installed

To calculate the tonnage per year, the following formula was used and based on a **one shift per day** production: machine hour capacity x 7.5 hours per day x 5 days x 4 weeks x 11 months / year.

⁴ Population data from Central Statistical Agency (CSA) extrapolated for the year 2013 with expected growth rate of 3.192% from the 2012 figure. Salt requirement is 317,596 MT annually at 87,012,513 people.

The above capacity estimates show that theoretically the total yearly salt demand can be satisfied. However, from the above theoretical maximum capacity only a fraction has been found operational today. This needs to be taken into account to calculate a realistic demand for KIO₃. From the GAIN mission assessment, the following table shows a list of the machines that are currently functioning.

Company name or site/machine type	Number of machines installed	Number of machines operational ⁵	MT per Hour	Total installed capacity (MT/h)	Total operational capacity (MT/h)	MT per Year Capacity in 1000	MT per Year operational in 1000
Afdera/Glotra	10	4	7	70	28	115.5	46.2
Afdera/Indian	10	0	6	60	0	99.0	0
	3	1	10	30	10	49.5	16.5
Dhobi/Indian	3	0	10	30	0	49.5	0
	2	0	6	12	0	19.8	0
Somali/Davey	1	0	10	10	0	16.5	0
Somali/Glotra	3	1	7	21	7	34.7	11.6
Amole	1	1	3	3	3	5.0	5.0
Share	1	1	30	30	30	49.5	49.5
Company/Afdera							
Shewit/Glotra	2	1	7	14	7	23.1	11.6
Total	36	9	96	280	85	462.1	140.4

Table 2: Comparison of potential and current operational capacity to iodize in existing production sites in Ethiopia, June 2012

The above figures show that only 30% of the installed capacity is operational. It should also be noted that the above assumes maximum values that can be lower in case of breakdowns, not working full weeks or less than 11 month of the year.

Comparing the operational capacity of 140,400 MT of iodized salt per year with the annual demand of 318,000 MT, at best 45% adequately iodized salt coverage can be achieved. These figures increase as re-installed iodization capacity increases. The GAIN-UNICEF partnership therefore donated spare parts and generators to gradually increase capacity.

It needs to be mentioned that knapsack technology to iodize salt has not been considered in the calculation due to the following reasons:

- It is unclear how many of the 160⁶ knapsacks still exist and can be utilized,
- The production capacity of one knapsack is very low and will not dramatically increase coverage above 45% and
- Knapsacks are not able to iodize salt accurately with the mandated PPM levels,
- Knapsacks have always been considered as an interim measure to ramp-up iodization in a short time frame.

The authors recommend shifting from quantity iodization (as much as possible) to quality iodization (as accurate as possible). It is worth mentioning that only adequately iodized salt will pass the “to-be introduced” checks by FMHACA.

Due to the inaccuracy of iodization, we recommend against the use of knapsacks and instead continue to make the existing advanced technology operational, including the Glotra, Davey and Indian iodization machines. The inaccuracy of the result cannot outweigh the relative affordability of

⁵ As of June 2012.

⁶ Different figures exist on how many knapsacks are in the country.

this technology, which makes iodization more expensive in the long-term. In addition, the above calculation shows knapsacks are not needed to produce the required demand for salt.

5.3 Type of technology used and product quality

It is of fundamental importance the type of technology used to iodize salt is appropriate so that it can deliver an iodized salt that is adequately iodized in accordance with the required national standards. The machines should be built in a way to be able to cope with the highly corrosive environment of salt and of heavy duty construction in order to withstand use during production led by an unskilled labor force under harsh climatic and environmental conditions. Furthermore, it has been observed that if the machines are stationary, they have less probability of breakdowns compared to the mobile units. The basic requirements for an appropriate iodizing machine have the following elements:

- Parts in contact with salt are constructed in stainless steel,
- Feed hopper is fitted with a metering salt feeding unit,
- The iodine is added by using a metering pump rather than compressed air and
- Speed and length of screw feed is sufficient for proper mixing and gives sufficient time for the hopper to be manually fed.

The types of machines listed are appropriate for the production of adequately iodized, provided the standard allows some variation.

5.4 Marketing and distribution practice

The salt produced in the three production areas is distributed to all parts of the country. The price at the production site is set by the government at 80 Birr per quintal for raw salt and 99.43 Birr per quintal for iodized salt. In the market, the price for non-iodized salt goes up to 300 Birr per quintal and it ranges from 450 to 700 Birr per quintal for iodized salt.

Afdera Salt Producers Mutual Support Association (ASPMSA) was supplying its production to one national distributor that distributes to wholesalers in different regions. Recently, ASPMSA announced a new bid and selected three distributors replacing the previous one. Most of the iodizing companies found in towns like M. Amole in Debrezeit source their salt from Dhobi and Afdera. Somali region producers do not have a permanent distributor. They sell their product to any interested buyers, including wholesalers in the nearby South Nations Nationalities and People's Region (SNNPR) and Oromia.

6. Current systems used for KIO₃ supply

6.1 Review

Currently there is a system in place in Ethiopia where salt producers contribute to the recovery costs of potassium iodate. Although KIO₃ has been donated by various agencies before, this system was seen as a start to involve salt producers in contributing to the real cost of KIO₃. In this system, operational since the end of 2010, salt producers were requested to put into a separate account 1.83 Birr per quintal (100 kg) of iodized salt produced. In one year a maximum of 5.6 million Birr (322,000 US\$) could have been put aside by salt producers or their associations.⁷ While compliance with this regulation by the salt producers could not be verified, the FMOH estimates that approximately 2 million Birr (113,000 US\$) can be collected, namely from the Afar Salt Producers Share Company (ASPSC) and the Afdera Salt Producers Mutual Support Association (ASPMSA). Only after an account has been opened, it will be determined how much of this contribution that can be collected and utilized for the purchase of potassium iodate. Furthermore, the cost recovery formula uses all salt produced and the production situation is mostly clear for big producers. For others, their production quota can be utilized to calculate their contribution, at least for bigger producers or their associations, the funds are likely to be collectible.

The authors recommend exploring the possibility of increasing collections of more iodized salt producer contributions. As a side effect, this would also lean towards more fairness as money will not only be collected from ASPSC and ASPMSA but from all producers.

Note that iodized salt producers had to collect the KIO₃ from the Ministry of Health storage in Addis Ababa and transport was at their own cost.

Over the past three years, this system was maintained by donations from GAIN, UNICEF and MI. Table 3 shows when and how much KIO₃ was donated as well as how it was distributed to the salt producers.

This shows that nearly 9 MT of KIO₃ were in stock at the time of the assessment and ready for distribution.

Apart from the 9 MT, 12.59 MT of expired stock exist in the country from previous donations.

⁷ 1.83 Birr per 100kg = 18.3 Birr per MT x demand for 2012 of 308,000 MT annually = 5,636,400 Birr. This theoretic calculation assumes that 100% of the 308,000 MT of salt produced in 2012 were iodized.

Date	Donated from agency	Received in MT	Distributed in MT	Receiving salt producer	Stock balance in MT
Sep 09	GAIN	4			4
Nov 09	GAIN	6			10
Oct 10			0.4	MSA	9.6
Jan 11			1	ASPSC	8.6
Jun 11			0.1	Dhobi	8.5
Sep 11			0.1	Somali	8.4
Oct 11			0.5	ASPSC	7.9
Nov 11	GAIN, MI	4.5			12.4
Nov 11 ⁸			1	MSA	11.4
Nov 11			0.1	Shewit	11.3
Dec 11 ⁹			1.5	MSA	9.8
Dec 11			2	Temesgen	7.8
Jan 12	UNICEF	7.9			15.7
Jan 12			0.1	Somali	15.6
Jan 12			0.8	Dhobi	14.8
Jan 12			0.2	Tofik	14.6
Feb 12			1.3	MSA	13.3
Feb 12			0.2	Somali	13.1
Mar 12			0.6	ASPSC	12.5
Apr 12			2	Temesgen	10.5
Apr 12			0.6	Dhobi	9.9
Apr 10			0.6	ASPSC	9.3
Apr 10			0.4	MSA	8.9

Table 3: Amount and distribution of potassium iodate by partners in Ethiopia, June 2012

6.2 Limitations

One of the biggest limitations of this cost recovery system was that no collection and deposit modalities have been set up. Therefore the system was not able to collect the 1.83 Birr per quintal of iodized salt. Due to its design, the system seems to favor collecting money from larger producers where production can be easily reconciled because proper sales data systems are available or production quotas are in place. This helps to explain the assumption that the deposited funds can most likely only be collected from the ASPSC and the ASPMSA, but not from smaller producers. Regardless, small, medium and large-scale producers and distributors should pay for the KIO₃ used directly or indirectly.

Furthermore a donor-based system is not sustainable. Past donations have been made under the condition that a self-sustained system will be introduced as soon as possible and donations served to bridge this period.

6.3 Strengths

The implementation of the 1.83 Birr/quintal system is practical as it has started to request some financial contribution from salt producers towards the cost of potassium iodate. Furthermore, the system was very easy to implement, since the contribution of Birr as a fraction of their production is easy to reconcile. The problem, however, was that no reliable production figures exist and were unlikely to be reported correctly since they also formed the basis for income taxation.

⁸ Date not verified.

⁹ Date not verified.

7. Present and projected demand for KIO₃

Ethiopia with a population of 84,320,987 inhabitants and an annual growth rate of 3.192% has a demand for adequately iodized salt of around 308,000 MT annually in 2012, and will rise to 360,000 MT by 2015.¹⁰ According to the salt law, iodization needs to be 34 to 66 PPM of potassium iodate at the point of production.¹¹ For the calculations below, an average of 50 grams of potassium iodate (equals 30 PPM of iodine) will be assumed.

In order to prevent the expiration of precious potassium iodate, realistic assumptions need to be made regarding the demand for KIO₃. The latest available data from 2011 shows that household coverage with adequately iodized salt was 15.4%¹² using the RTK method. This means coverage of adequately iodized salt, as per local standards and verified by quantitative methods such as titration, was most likely much lower.

Bringing iodization capacity from less than 15% to 100% needs a number of years. In the calculation below, it is assumed that iodization capacity can be brought up to a maximum of 70% in the first year of the fund and then increases gradually. This figure can only be supported by realistically assessing a) the installed technical capacity – the iodization machines – which has been found to not be ready to support production figures higher than 60%, and b) a proper general management of the USI program at production sites of both raw salt and bagged iodized salt.

	Unit	2012	2013	2014	2015	2016	2017
Population	number	84,320,987	87,012,513	89,789,952	92,656,048	95,613,629	98,665,616
Annual salt requirement	MT	307,772	317,596	327,733	338,195	348,990	360,129
Monthly salt requirement	MT	25,648	26,466	27,311	28,183	29,082	30,011
HHIS coverage target/ utilization	percent	60%	70%	80%	90%	100%	100%
KIO ₃ required annually	MT	9.23	11.12	13.11	15.22	17.45	18.01
KIO ₃ required monthly	MT	0.77	0.93	1.09	1.27	1.45	1.50
Cost of KIO ₃ annually	US\$	558,605	672,509	793,115	920,735	1,055,694	1,089,392
Cost of KIO ₃ monthly	US\$	46,550	56,042	66,093	76,728	87,974	90,783

Population growth rate	3.192%
Mean PPM level potassium iodate	50 (corresponds to 30 mean PPM iodine)
KIO ₃ cost per kg	60.5 in US\$, including overhead cost
Average daily salt consumption	10 gr/Person/day

Table 4: Projection of KIO₃ requirements for the years 2012 to 2017 in Ethiopia

¹⁰ Central Statistical Agency (CSA).

¹¹ Ethiopian Standards Agency, ES 298:2007, Third Edition 2007-01-01, page 2, Table 1: Essential compositions and quality factors of edible salt.

¹² EDHS 2011 survey.

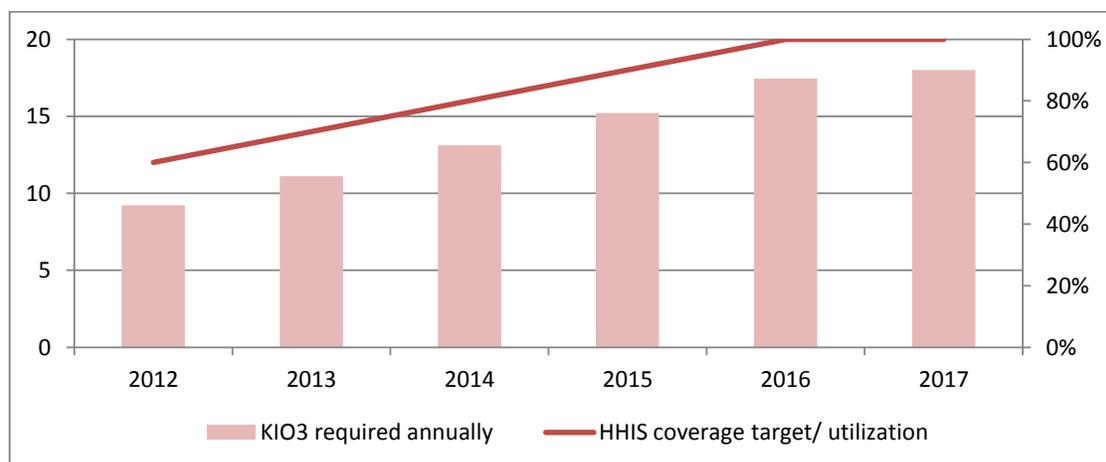


Figure 1: Trends of KIO₃ requirement in the years 2012 - 2017

Due to a potential stock-out in 2013, we recommend starting a revolving fund in January 2013. The annual demand for KIO₃ for the ambitious plan of reaching 70% iodization is around 11 MT. Demand is expected to rise until 2015, reaching 18 MT for a forecasted population of nearly 99 million and iodization is projected to be 100% by this year.

Until the fund is made operational in 2013, potassium iodate to support the USI program will be available in a bridging period as follows:

- As informed by the Ministry of Health a current stock of 9 MT is available, where 1 ton is stored at the Pharmaceutical Fund and Supply Agency (PFSA) and around 8 MT at UNICEF, which is to be moved to the PFSA stores.
- The GAIN-UNICEF partnership project found 12.59 MT of expired stock from previous donations. The FMOH has approved that GAIN can ship this out of the country. GAIN has identified a partner willing to purchase this expired stock at 50% market rate, ship it from the country and import 6 MT of new stock.
- As detailed in chapter 5 and explained by the Ministry of Health around 2 million Birr (113,000 US\$) can be collected from the existing KIO₃ fund mechanism. Currently the Ministry is working to identify an account where money can be wired from salt producers or their associations. At current market prices of around 55 US\$ per kg, another 2 MT of KIO₃ could be purchased.

This means roughly 17 MT of KIO₃ are still available in the country or can be made available until the revolving fund is operational. With the different capacity utilization rates this stock will last for 85 more months (at a utilization of 15%) down to approximately 12 months (at a maximum utilization of 100%). Refer to the table below.¹³ Since the iodization standard is ambiguous regarding iodine and potassium iodate, please see annex 1 for the alternative interpretation of the standard and resulting KIO₃ demand calculations.¹⁴

	Utilization rate	15%	30%	45%	60%	75%	90%	100%
Monthly salt requirement	MT	3,970	7,940	11,910	15,880	19,850	23,820	26,466
KIO₃ required monthly	MT	0.198	0.397	0.595	0.794	0.992	1.191	1.323
Months until stock out	months	85.6	42.8	28.5	21.4	17.1	14.3	12.8

Table 5: Illustration of KIO₃ requirement as function of estimated coverage

¹³ All calculations are based on 50 PPM level iodization with potassium iodate, projected 2013 population figures and consumption of 10 grams per person per year.

¹⁴ The standard as per ES 298:2007 says "Iodine content, as potassium iodate mg/kg salt 34 - 66".

This shows that in the maximum case stock would last until end of June 2013.¹⁵

Since we assume that iodization at the moment takes place with a maximum capacity of 60% and a starting date of the revolving fund of January 2013, stock would be available in January for more than 14 additional months.¹⁶ This stock of 14 times 0.794 MT totals to 11 MT and should be carried over to the revolving fund as seed stock, when available.

¹⁵ At 100% utilization from June 2012 onwards.

¹⁶ At 60% utilization stock lasts for 21.4 months starting June 2012. From June to December 2012 stock for 7 months is consumed so that 21.4 months – 7 months = 14.4 months.

8. Selection of supply sources for KIO₃

Of the several places in which iodine occurs in nature, only two sources are useful commercially: the caliches, found in Chile, and the iodine-containing brines of gas and oil fields, especially in Japan and the United States. The caliches contain sodium nitrate which is the main product of the mining activities, and small amounts of sodium iodate and sodium iodide. The high concentration of iodine in the caliches and the extensive mining made Chile the largest producer of iodine in 2007.

Most other producers use natural occurring brine for the production of iodine. The Japanese Minami Kanto gas field east of Tokyo and the American Anadarko Basin gas field in northwest Oklahoma are the two largest sources for iodine from brine.

There are a number of companies worldwide that produce potassium iodate (KIO₃) also known as iodate. They are located in Azerbaijan, Chile, China, France, Germany, India, Indonesia, Japan, Turkmenistan and the United States.

Although KIO₃ is offered with a three year expiry date according to commercial rules, it actually has a very long shelf life. Iodate is highly sensitive to light and when it does “expire” because of exposure to light and high moisture, it gives off a very strong pungent smell and turns yellow. The product is packaged in 25 kg carton drums containing a black heavy-duty plastic lining that protects the KIO₃ from light. While the standard measure of shipment remains the 25 kg drum, the product can be supplied in 1 or 5 kg pack sizes.

The GAIN premix facility (GPF) was launched in July 2009 to fill a strategic gap in sourcing of affordable and quality certified vitamin and mineral premix. To date, the GPF has directly supplied premix and individual vitamins and minerals in 31 countries around the world, with a total value of US\$ 18 million. Of this amount, procured potassium iodate accounted for US\$ 1.4 million.

The GPF has been supporting the scale-up of salt iodization programs through the establishment of innovative procurement and financing models. At the country level, the GPF has developed tailored supply and distribution models to help small-scale food producers finance the cost of premix. In a number of cases, the GPF has set up local distribution mechanisms whereby premix or straight vitamins and minerals are supplied through a revolving mechanism. The producers and suppliers of KIO₃ have been carefully selected from reputable supply sources worldwide.

To guarantee this supply source of KIO₃, the first step was for GPF to call for an international tender to all possible producers and distributors of KIO₃. In collaboration with Intertek GmbH, a German based international laboratory that offers quality assurance and control of both food and chemical certification, all tendered offers were analyzed. Intertek not only qualified the KIO₃ (See: *Attachment 1- KIO₃ Certificate*) but also the company, its source of iodine and the process of KIO₃ production. Following an intensive survey and testing, the companies that qualified and listed at GPF are:

- Ajay, France
- Calibre Chemicals, India
- Ping Ding Shan Kangyuan Industry & Trading Company, China

For every request, GPF completes the following process: 1) a call for tender is offered to these three companies; 2) the companies bid against one another; and 3) based on price and delivery time, a company is chosen. In agreement with the suppliers, GPF runs a 6 month forecasting program that assists the iodized salt producers and the iodate producers. By bundling together numerous iodized salt producers' requirements, GPF is able to negotiate competitive international prices.

Due to its core strengths of assisting with procuring premix from quality verified sources at competitive prices and with assisted financing, the GAIN Premix Facility stands ready to help supply the recommended KIO₃ revolving fund in Ethiopia.

9. KIO₃ pricing

9.1 Projected KIO₃ prices

The price of KIO₃ has fluctuated heavily over the past months, ranging from 23 US\$ to 60 US\$ per kg, as of 2011. This price increase resulted from a sharp increase in demand for iodine for industrial and health uses combined with a global supply shortage. The Fukushima nuclear incident in Japan exacerbated the supply shortage by causing a global panic to stock potassium iodide tablets. The disaster also impacted iodine production in Japan, the world's second largest producer of iodine. Iodine for salt iodization only constitutes 4% of the total iodine market and demand is forecast to continue rising for other applications, especially LCD screens, X-ray contrast media, pharmaceuticals, and biocides. It is unknown when prices will stabilize, however it is likely that high prices will persist until mid to late 2012. This is a significant challenge to the sustainability of the global initiative of Universal Salt Iodization programs.

For all calculations to assess KIO₃ demand, a conservative estimate using the higher end of the range of 55 US\$ per kg is used.

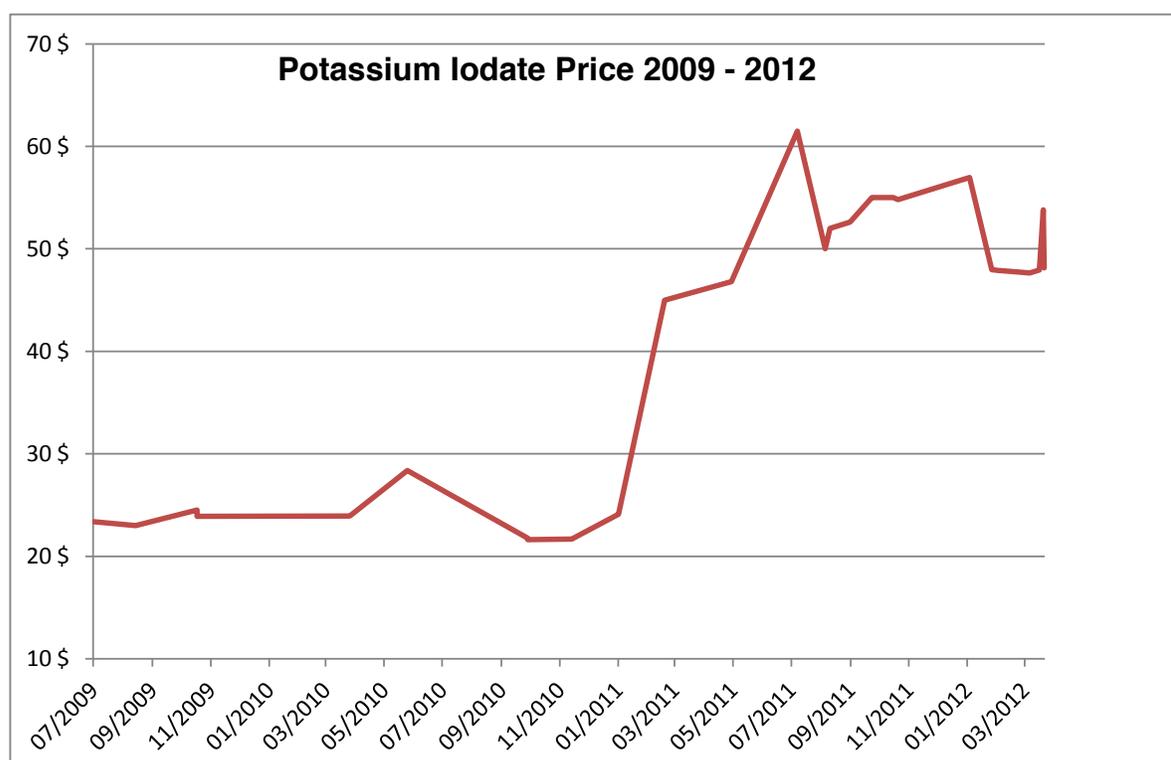


Figure 2: Trends in prices of potassium iodate from 2009 to 2012

Source: GAIN Global Premix Facility, based on 27 bids since 2009

9.2 Price build-up of KIO₃

In addition to the price of KIO₃ at its production, there are other costs involved before it reaches its destination. The major costs are charges for export packing and delivery, cost of freight by air or sea, insurance, and import tax. These all will add up to the price of KIO₃.

Table 6 depicts the approximate cost per kg taking the experience in 2011 and an order size of 1.5 MT. The cost is in US\$.

Item	Subject	Cost in US\$ per kg of KIO ₃	Percentage markup on 55 US\$ KIO ₃ raw price
1	Export packing and delivery	0.54	1%
2	Freight by air	3.64	6.6%
3	Insurance	0.07	1.3%
4	Import tax (Duty, Excise, Surtax, Vat, Withhold)	7.61	13.8%
	Total	11.86	21.6%

Table 6: Breakdown of major components of the price of KIO₃

As it can be seen, a major contributor to cost is the import taxes applied by the government of Ethiopia. This needs to be addressed and advocacy measures need to be taken to exempt KIO₃ from import tax related expenses which unnecessarily increase the burden on the salt industry.

In our calculations going forward, the assumption used is a 10% markup.

9.3 Other overhead costs

Other overhead costs will also be added to the price of KIO₃ after arrival in the port of Djibouti. This includes port handling fees, transportation to production centers, loading/unloading, storage and administrative costs. Due to economies of scale, the prices will be lower per kg of potassium iodate for higher purchase volumes.

Item	Subject	Cost in US\$ per kg of KIO ₃	Remark
1	Transportation to production sites	0.12	Illustrative Estimate
2	Loading/unloading	0.0001	Illustrative Estimate
3	Storage per month	0.028	Illustrative Estimate
	Sub total	0.15	
4	VAT (15%)	0.02	
5	Admin cost	0.02	Illustrative Estimate
	Total	0.19	

Table 7: Overhead cost of potassium iodate

This shows that other overhead costs do not contribute substantially towards the final price of KIO₃ and can be covered with a management fee as described in chapter 9.7.

10. Recommendation on characteristics of a revolving fund

10.1 Hosting institution and alternatives

During the mission, the GAIN team visited the Pharmaceutical Fund Supply Agency (PFSA), created with the mandate to supply the country with essential drugs, vaccines, health facility supplies and laboratory equipment. PFSA's mandate is to be the "sole provider of forecasting, procurement, storage, inventory management and distribution of pharmaceuticals to the public health sector in Ethiopia"¹⁷ and its mission is "to ensure availability and affordability of quality pharmaceuticals to all public health facilities by using a revolving drug fund (RDF)".¹⁸

PFSA imports mostly drugs through the port of Djibouti, trucks them to Addis Ababa and distributes stock among several hubs. Their supply chain management system is currently being updated to better support management of inventory.

GAIN recommends using PFSA to handle the KIO₃ revolving fund for the following reasons:

- PFSA's demonstrated experience with such funds for drugs,
- PFSA has hubs and sub hubs to store KIO₃ in almost all regions of the country,
- A system to professionally manage stock keeping and distribution is already in place,
- PFSA has proven capabilities to handle payments for drugs and therefore can also handle proceeds from KIO₃ sales,
- PFSA is controlled by the government of Ethiopia,
- PFSA has experience in importing goods on international markets,
- PFSA can receive large quantities of KIO₃ and, if required to and assisted with designing and implementing procedures, has the capability to repackage into smaller, more affordable portions in response to customer demand.

We urge the FMOH to consider the following recommendations to institutionalize the supply of and cost recovery of potassium iodate in Ethiopia by taking various considerations into account:

- In order to efficiently handle precious KIO₃ a capable demand forecasting system would need to be established that forecasts the volume of KIO₃ purchased by salt producers, as well as geographic demand. Forecasting could be combined with figures from FMHACA on salt inspections or from production quotas.
- As mentioned above, assistance would be needed to develop procedures for repacking from usually 25 kg drums of KIO₃ to smaller packs that are affordable to small- and medium-scale producers. GAIN recommends offering at least 5 kg packs of KIO₃ to iodize 58 MT of salt.
- A system would need to be implemented that verifies that salt producers order KIO₃ in amounts that correspond with their salt production. Furthermore at FMHACA inspection at salt producers offices could request to see potassium iodate stock and its handling papers. This check will be recommended during the roll-out of GAIN's QA/QC program.

One of the main tasks of the GAIN team mission to Ethiopia was to examine the various alternatives for management of the supply and distribution of iodate. Discussions were held with various stakeholders and experts from the public and private sector working in the supply and distribution of KIO₃. It became clear that in the case of a private company, unless such company handles a wide range of other chemicals, to only deal in KIO₃ is not a viable option due to the low frequency of order cycles. Once the stock is brought into storage, it remains there for an unknown period of time prior to a client order and payment. Also, the outlay of cash is high in particular at today's cost of around 55 US\$/kg. Furthermore due to the nature of the business, the overhead costs of handling, storage,

¹⁷ The World Bank: Ethiopia. Improving Health Systems. Public sector healthcare supply chain strategic network analysis and design, May 2009, page 6.

¹⁸ Ibidem.

delivery and other has to be capped to a minimum in order to avoid the price of iodized salt exceeding market affordability. In the case of Ethiopia, PFSA is already in the business of supply and distribution of pharmaceuticals and other products. They have the structure, proven experience and built in costs.

Further, PSFA has shown interest in managing the KIO₃ supply and distribution. Finally all stakeholders interviewed, including salt producers believed PSFA was the best option for the job. Based on the above mentioned criterion, PSFA stands out as the clear choice to effectively manage KIO₃.

10.2 Pricing

The revolving fund will source KIO₃ at market prices that will fluctuate for every order. For the revolving fund, GAIN proposes to fix selling prices at which KIO₃ is sold to salt producers once a month. Adjusting the sales price once a month reduces the risk associated with volatility of KIO₃ world market prices and US\$-Birr exchange rates.

GAIN recommends implementing cash on delivery (COD) procedures rather than buying on credit. This means KIO₃ packages when handed over with accompanying receipts (which need to be filed with the salt producers) will be paid immediately, reducing nonpayment risk.

Pricing should be made transparent regarding its components (KIO₃ purchase price, taxes, handling fees, exchange rates) and favoring purchase conditions due to economies of scale should benefit also the potassium iodate customer.

From interviews and calculations, GAIN found salt producers are ready to use the revolving fund mechanisms without any further subsidies and would be able to begin paying the full KIO₃ price once the fund is launched. At a KIO₃ price of 55 US\$ plus 10% markup per kg, KIO₃ in one kg of salt makes up only 0.003 US\$ or 0.055 Birr.¹⁹ At the fixed market prices of salt at production this appears almost insignificant. GAIN, UNICEF and MI recommend that the revolving fund system starts with 100% producer contributions rather than a phased-in approach to reduce subsidies.

We therefore decided against a phased approach to bring subsidies from currently 100% down to 0% over a longer period which would again increase dependency on donations of the initial stocks. We recommend following the proposal to start with zero subsidies from January 2013 onwards.

10.3 Distribution

As in the current system, we recommend selling KIO₃ “over the counter” and have salt producers pick up their packages at one of the PFSA hubs. In the future, a special delivery system could be implemented, if requested by customers.

10.4 Seed stock

The fund needs to be equipped with seed stock of KIO₃. As it is the nature of a fund, proceeds from KIO₃ sales to salt producers should be used to replenish the fund.

¹⁹ It is 0.00005 kg of KIO₃ per 1 kg of salt. KIO₃ estimated market price of 55 US\$ per kg of KIO₃ plus 10% handling and an exchange rate US\$: Birr of 18.3855.

GAIN's experience from other countries has been to initially supply 30% of the annual demand as seed stock in order to achieve a balance between the prevention of stock outs and expired stock.

Since we assume the monthly KIO_3 demand to be around 0.794 MT (at a 60% utilization rate), a seed stock of 2.858 MT is needed.²⁰ As the calculations in chapter 6 indicate, stock of approximately 11 MT would be able to be drawn from stock already in the country, stock purchased from the collected 1.83 Birr/quintal contribution and stock purchased from exporting expired stock.

In addition, if needed, GAIN considers contributing around 160,000 US\$ in kind of KIO_3 to the fund from BMGF and other sources. At current market prices, this could contribute almost 3 MT of potassium iodate.

One important caution revealed during the mission is that while the mission team is confident to offer a proposal to government and partners of the revolving credit system, there are a few fundamental requirements of the scheme for success:

- Iodized salt producers must give valid forecasting assumptions of KIO_3 requirements in a 6 month window,
- Technology used in the production of iodized salt is appropriate and capable of producing adequate iodized salt,
- All iodized salt producers participate and ensure that the quality assurance and quality control program is pursued including the management system of raw material stock, including KIO_3 .

10.5 Fund mechanisms

Starting with an initial seed stock, KIO_3 would need to be purchased by the fund holders from the proceeds from sales. The lead time for the fund to buy KIO_3 is around 3 months. GAIN recommends considering the use of the GAIN Premix Fund as the agent to source potassium iodate at fair market prices and at verified quality.

To avoid stock-out, GAIN recommends a FIFO (first in, first out) system and replenishing stock when stock levels go lower as the estimated demand of no less than three months (3 MT).²¹ As the capacity utilization rises above the estimated 60%, safety stock levels need to be increased with the rising annual demand for KIO_3 .

10.6 Timing

GAIN estimates the setup time for the revolving fund with development of contracts, creation of operating procedures, creation of accounts, purchase of seed stock and distribution to PFSA hubs would take 6 month. Therefore, a fund could start as early as January 2013. In talks with salt producers, this was welcomed as they demanded a grace period of around half a year.

²⁰ 0.794 MT x 12 months x 30%.

²¹ 0.794 MT x 3 months.

10.7 Management Fees

Fees for management of the fund would cover the following elements:

- Djibouti harbor duties and handling fees,
- Transport from port to warehouse
- Internal transportation of KIO_3 between hubs,
- Storage fees,
- Account management fees,
- Other transaction fees,
- Management cost.

There are basically two ways to account for management fees in the revolving fund system:

- A fixed markup per quantity of KIO_3 sold, or
- A fixed amount for a period (a month or a year).

A markup per quantity is a margin on top of every transaction, for example 5%. This is easy to calculate but difficult to forecast as it is based on actual sales.

A fixed amount per period is easier to forecast as it applies even if no sales transactions occur. For example, a fixed amount of 100,000 Birr annually. It could also be implemented in a stage approach, meaning that up to a certain monthly or annual sales level it is the amount "x", above that and up to the next threshold and amount "y" and so on.

Both systems have particular advantages and no recommendation can be given at this stage until details and directions are issued by FMOH. We are confident that PSFA has the expertise and experience to design such recommendation.

10.8 Alternatives

Donor based financing of the KIO_3 supply is not sustainable. Furthermore there is reluctance to ship large amounts of KIO_3 into the country, when in the past, this precious mineral had to be shipped out because it expired.

As market prices are expected to stabilize in the near future and a high level of enforcement by FMHACA can be noted, it is opportunistic time to handle the KIO_3 supply in a professional and sustainable manner.

After exploring alternatives, PSFA was the soundest option for reasons indicated above.

11. Risk analysis and mitigation strategies

During the GAIN mission our proposal of both creating a potassium iodate revolving fund and hosting it with PFSA received broad agreement. The overall acceptance seemed quite high.

Although this endeavor presents some associated risks, they can be addressed through mitigation strategies.

Risk	Mitigation
1. Iodized salt producers do not buy potassium iodate	- FMHACA needs to make checks when visiting production sites and verify that amounts of KIO ₃ purchased match with salt production figures (this will be part of the GAIN QA/QC recommendations)
2. KIO ₃ stock expires again	- realistic assumptions need to be made regarding the production capacity as recommended in this report, - PFSA needs to apply the FIFO stock keeping principle
3. Seed stock too small	- constant monitoring of KIO ₃ sales - early replenishment of stock
4. System seen as non-transparent by salt producers as to the price build-up of KIO ₃	- price build up and “profits” of PFSA need to be monitored and published proactively
5. Iodization capacity has been estimated too small in this report	- replenish KIO ₃ stock faster once sales figures indicate the need to do this
6. KIO ₃ market prices go higher	- the end price of KIO ₃ to salt producers also increases. However, above figures indicate that the price for iodization is marginal compared with the end price for salt.
7. The fund cannot be set up until January 2013	- the fund starts later. However, the 1.83 Birr/quintal system needs to continue and be effectively enforced to ensure collection from all producers.

Table 8: Identified risks and their mitigation strategies

12. Summary of recommended next steps

In order to establish the revolving fund for potassium iodate in Ethiopia, GAIN recommends the steps below and gives a rough timeline for each for follow up. The list is a summary of the recommendations in the chapters above.

1. Consider modification of the quota system in Afdera in order to create a system where salt producers compete in offering the best quality product that is adequately iodized. Timeline: Preferably until end of the year 2012.
2. Develop a holistic salt production site management system for coordinated efforts in production, iodization and distribution. We urge consideration of the GAIN Afdera Management Proposal. Timeline: Preferably until end of the year 2012.
3. Make existing professional iodization capacity operational. Do not use the knapsacks, as the use of this inadequate technology results in higher costs in the long term. Timeline: Ongoing.
4. Continue strengthening the enforcement of the salt law by FMHACA and include KIO_3 checks in factory and iodization sites checks and procedures. Timeline: Preferably until end of the year 2012.
5. Work with realistic assumptions regarding iodization capacity that balance stock outs and stock expiry. GAIN recommends starting with an estimated utilization of 60% as a demand calculation basis, not more. If the utilization rate is higher or increases over time, the revolving fund simply needs to be replenished more rapidly with the proceeds from KIO_3 sales to producers. Timeline: Ongoing.
6. Open a bank account and channel the 1.83 Birr per quintal contribution from all salt producers, not only ASPMSA and ASPSC. Strengthen this collection going forward until the fund is operational. Use the figures of requested KIO_3 by salt producers until the fund is set up for extrapolating realistic demand for the revolving fund. Timeline: Until end of September 2012.
7. Carry over any remaining stock left from the period prior to the launch of the fund as seed stock. We estimate this could be almost 11 MT. Timeline: In January 2013.
8. Consider using the GAIN Premix Fund for the supply of potassium iodate to the PFSA hosted revolving fund. Timeline: In January 2013.
9. Work on reaching import tax and duties exemption for KIO_3 brought into the country as it is an unnecessary burden for salt producers. Timeline: Until end of the year 2012.
10. Implement a demand forecasting system for KIO_3 to better manage potassium iodate stock. Timeline: Until January 2013.
11. Resolve ambiguity of iodization standard as to whether it specifies PPM levels for iodine or potassium iodate. Timeline: Until end of September 2012.

Attachment 1: KIO_3 Certificate

Calibre Chemicals Pvt. Ltd.

Fax: +91-22-22832087

mail@calibrechem.com

Potassium Iodate FCC

CAS No. 7758-05-6

KIO_3

M.W. 214.0

Product Data Sheet

PDS-KIO-R4

Effective 01/01/07

Description	:	White odourless free-flowing crystals. Complies with Food Chemicals Codex V th Edition
Specifications	:	Assay as KIO_3 (on dry basis) : 99.5% (Minimum) Iodide as I : 0.002% (Maximum) Chlorate as ClO_3 : 0.01% (Maximum) Lead as Pb : 4 mg/kg (Maximum) Loss on Drying : 0.5% (Maximum)
Physical Properties	:	Bulk Density (approx.) : 2.1 grams/cc Particle Density : 3.9 grams/cc Solubility : About 1gm in 15 ml water at 25° C
Packing	:	25 Kg nett certified UN performance standard PG II fibre drums with HM-HDPE inner bags. Palletized; stretch-wrapped for exports.
Stability	:	Stable compound with long shelf life when stored properly. Best before three years from manufacturing date. Thereafter re-test before using.
Storage & Handling	:	Store in closed containers away from heat and moisture. Moderate fire hazard. Keep away from combustible materials. Wear goggles and rubber gloves when handling bulk quantities. Harmful if swallowed. Avoid contact with eyes, skin, clothing. In case of spillage, collect into container for disposal. Flush with plenty of water.
Uses	:	Food Industry : Iodination of edible salt. Maturing agent and dough conditioner Agriculture : Animal feed supplement. Pharmaceuticals : Manufacture of iodine compounds. Treatment for exposure to radioactivity. Textiles : Oxidation of sulphur dyes
Shipping Information	:	EINECS Nr. : 231-831-9 H.S. Tariff No. : 282990 UN No. : UN 1479 Packaging Group: II IMDG Code: Proper Shipping Name: Oxidizing Solid N.O.S. (Potassium Iodate) Hazard Class : 5.1 Oxidizing Substance EmS No. : 5.1-11 MFAG Table No: 760 Label : Oxidizer Subsidiary Risk : None Marine Pollutant : No

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Annex 1: Illustration of KIO_3 requirement as function of estimated coverage

The report interprets the iodization standard ES 298:2007 as to specify PPM levels of potassium iodate of 34 – 66.

If interpreted as 34 – 66 PPM of iodine – and not potassium iodate – the illustration in table 5 of the requirement for KIO_3 as a function of the estimated coverage differs significantly. A requirement of 34 – 66 PPM of iodine would result in a PPM requirement of potassium iodate of 57 – 111. The corresponding mean values would be 50 PPM iodine and 85 PPM potassium iodate.

Please see below the same calculation as in table 5 but with a mean PPM level of 85 as potassium iodate. The original table 5 uses 50 PPM of potassium iodate.

Even if interpreted as below, the revolving fund could be established as described above in this report.

	Utilization rate	15%	30%	45%	60%	75%	90%	100%
Monthly salt requirement	MT	3,970	7,940	11,910	15,880	19,850	23,820	26,466
KIO_3 required monthly	MT	0.337	0.675	1.012	1.350	1.687	2.025	2.250
KIO_3 required yearly	MT	4.0	8.1	12.1	16.2	20.2	24.3	27
Months until stock out	months	50.4	25.2	16.8	12.6	10.1	8.4	7.6