ADB

Consultant's Report

Project Number: JFPR 9005 and 9052
September 2009

Promoting Wheat Flour Fortification in Central Asia and Mongolia, 2001–2007

Experiences of Japan Fund for Poverty Reduction (JFPR) JFPR9005 and JFPR9052

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Asian Development Bank

ABBREVIATIONS

AA	–	Atomic ascorbic spectrophotometer
ADB	–	Asian Development Bank
AIC	–	American Ingredients Company
APC	–	Anemia Prevention and Control
CIS	–	Commonwealth of Independent States
CIP	–	Country Investment Plan
CPO	–	Country Project Office
EAR	–	Estimated Average Requirement
FF	–	Fortified (wheat) Flour
FFI	–	Flour Fortification Initiative
FSU	–	Former Soviet Union
GAIN	–	Global Alliance to Improve Nutrition
GOST	–	State Standardization
HPLC	–	High Performance Liquid Chromatograph
IAOM	–	International Association of Operative Millers
IEC	–	Informative-educational-communicative programs
IDA	–	Iron deficiency anemia
IDD	–	Iodine deficiency disorders
JFPR	–	Japan Fund for Poverty Reduction
KAN	–	Kazakh Academy of Nutrition
KIBS	–	Kyrgyz Independent Bread Inspection
LGBK	–	League of Grain Processors and Bakers of Kazakhstan
MES	–	Ministry of Education and Science
MI	–	Micronutrient Initiative
MoH	–	Ministry of Health
MT	–	Metric Tons (1000 kg)
NE	–	niacin equivalent
NFA	–	National Fortification Alliance
NTD	–	neural tube defect
NTBD	–	Neural Tube Birth Defects
NGO	–	Nongovernmental Organizations
ppm	–	Parts per million or g/MT or mg/kg
RCAO	–	Regional Office on Coordination and Administration
QA	–	quality assurance
RDA	–	recommended daily allowance
RDI	–	recommended dietary intake
SES	–	Sanitary and Epidemiological Service
UNDP	–	United Nations Development Programme
UNICEF	–	United Nations International Children Fund
USI	–	Universal Salt Iodization
UDM	–	Uzdonmakhsulot Milling group in Uzbekistan
UL	–	upper level
SES	–	Sanitary-epidemiologic service of MoH
SUSTAIN	–	Sharing US Technology to Aid in the Improvement of Nutrition
WFP	–	United Nations World Food Program

CONTENT

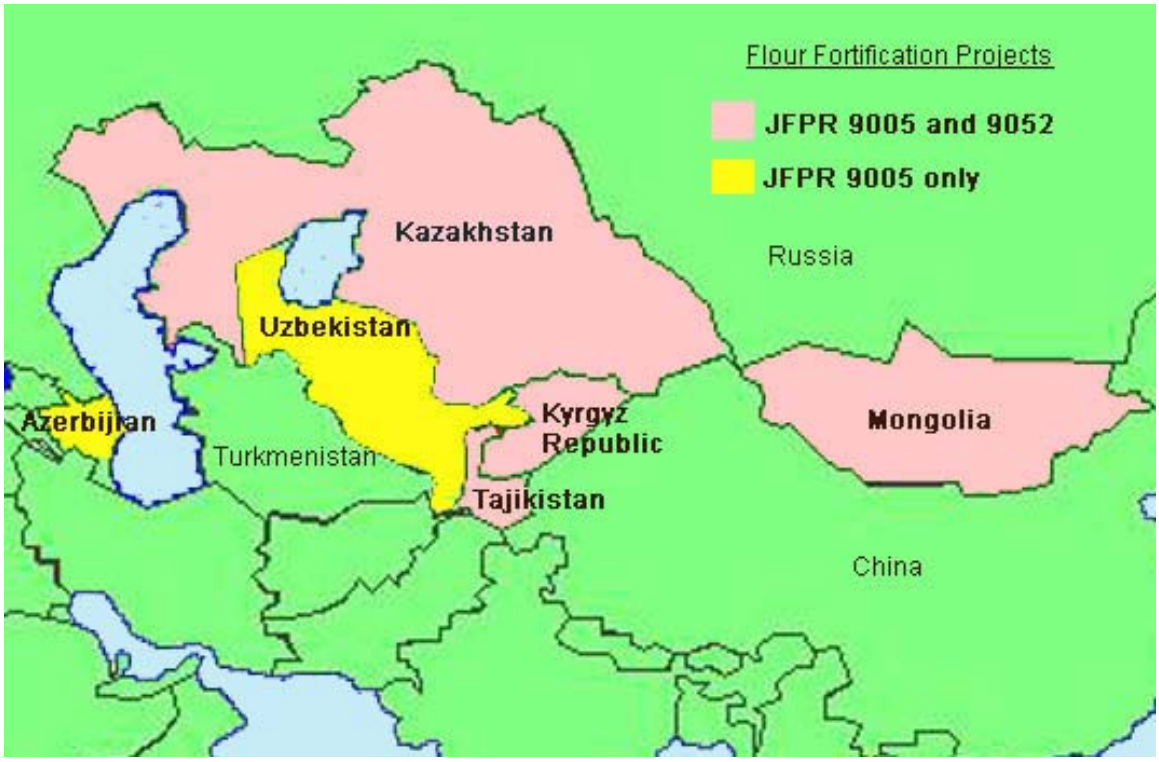
I. INTRODUCTION

1. This monograph describes in some detail a regional Project to fortify wheat flour in six countries in Central Asia. The Project also involved iodization of salt, which is described separately.

2. The primary aim of the Project was to reduce iodine deficiency disorders (IDD) and iron deficiency anemia (IDA) by initiating food fortification in the six participating countries: Azerbaijan, Kazakhstan, Kyrgyz Republic, Mongolia, Tajikistan and Uzbekistan. To attain these objectives the countries developed standardized methods of fortification; regulation, tax and tariff exemptions for fortificants and fortification equipment, monitoring, surveillance, quality control systems, and strengthened awareness of and demand for the fortified foods.

3. There were two regional projects funded by the Japan Fund for Poverty Reduction (JFPR) of the Asian Development Bank (ADB). The first, JFPR 9005 (2001 to 2004), was to initiate fortification and the second, JFPR 9052 (2004 to 2007), was to extend and sustain it. Azerbaijan and Uzbekistan were not included in the second JFPR 9052 project on flour fortification.

Figure 1: JFPR Flour Fortification Project Countries



4. There were four major objectives of the two Projects:

(i) To build capacity of the food industry to deliver iodine and iron/folate through the commonly consumed foods of salt and wheat flour respectively and to create informed demand by poor consumers for these fortified foods.

(ii) To institute legislative frameworks and structural reform with related institutional development in food inspection, nutrition surveillance, product licensing, labeling, and food quality and safety regulations.

(iii) To build partnerships (public-private-civil, country-donor, donor-donor, intra-industry) to sustain affordable food fortification with salt and flour.

(iv) To ensure that the preconditions for regional exchange of knowledge-based policy instruments and fortified foods will be possible, including alignment with internationally accepted trade protocols.

5. It is hoped that the many issues, strategies and lessons learned in this Project will be of help to mass food fortification projects in other countries that are either under way or in the planning stages. All such projects can expect to encounter a similar set of challenges and problems. Where this Project worked well and where it did not, where it was successful and where it fell short should prove instructive to the design and management of other food fortification projects.

A. Vitamin and Mineral Deficiencies in Central Asia

6. Micronutrient deficiencies are a serious public health problem in Central Asia affecting a large proportion of the population.

Table 1: WHO[1] Anemia Prevalence in Central Asian Countries

Country	Preshool (<5) Children (%)	Pregnant Women (%)	Non-pregnant Women of Reproductive Age (%)
Hg level	< 110 g/L	< 110 g/L	< 120 g/L
Azerbaijan	32	38	40
Kazakhstan	36	26	36
Kyrgyzstan	50	34	38
Mongolia	21	37	14
Tajikistan	38	45	41
Turkmenistan	33	30	48
Uzbekistan	38	54	65

WHO category of public health significance for anemia prevalence: (i) Mild: 5.0 to 19.9%, (ii) Moderate: 20.0 to 39.9%, (iii) Severe: ≥ 40%

7. Iron deficiency is the most prevalent nutrient deficiency in the world affecting more than 2 billion persons. Anemia caused by iron deficiency is widespread in Central Asian countries as shown by the above table reaching a severe public health status in five of the countries. Iron deficiency has its greatest impact on the physical and intellectual well being of preschool children and women of childbearing age, though it can affect other population groups including

[1] de Benoist, B.; E. McLean, I. Egli and M. Cogswell. 2008. *Worldwide Prevalence of Anemia 1993-2005*. WHO global database on anemia.

elderly males. Although often more severe in poor and rural communities, iron deficiency can also occur in more affluent and urban populations. The main cause of iron deficiency in Central Asia is the lack of absorbable iron in the diet along with ingestion of iron absorption inhibitors, such as tea, coffee and phytic acid found in cereals and legumes.

8. Iron deficiency anemia (IDA) reduces work capacity and adversely affects productivity for those that are affected. It is especially dangerous in pregnant women and children. In pregnancy it increases the risk of premature and low birth weight babies, and greatly heightens a woman's risk of death during childbirth. Children with IDA face poor growth and physical development, impaired cognitive abilities and reduced resistance to disease. Widespread iron deficiency affects a country's economic status by lowering worker productivity and increasing health costs associated with childhood illness and maternal deaths.

9. Evidence for other micronutrient deficiencies in the region is primarily dietary based. Zinc deficiency[2] usually accompanies iron deficiency, particularly in wheat eating populations and is responsible for approximately 4% of deaths among under-five children in lower income countries. Inadequate zinc intake in young children increases the rates of diarrhea and acute lower respiratory infections. It adversely affects growth and physical development. Adequate zinc nutrition in women of childbearing age is necessary for normal pregnancy outcomes.

10. Inadequate folic acid intake before, and in the first weeks of, pregnancy increases the risk of neural tube defects (NTD). There is now general agreement that women need 400 micrograms of folic acid per day and that high an amount cannot be provided by normal diets indicating the need for fortification or supplementation.[3] There is some geographic distribution of NTD prevalence based on dietary patterns. For example, in China, among the predominately wheat eating northeast population of the country, folate deficiency is more severe and the prevalence of NTDs is more than 10 fold higher than among the more rice eating populations of the south-east.[4] That situation likely extends to the wheat eating populations of Central Asia. Overall, however, all women around the world can substantially reduce NTDs by eating folic acid fortified foods, whether they are highly industrialized or not, urban or rural.

11. Micronutrient deficiencies now appear in a list of priority health concerns for national governments of Central Asia. They recognized that the lack of dietary micronutrients, including key vitamins, and minerals such as iodine, iron, and folic acid, has a major impact on the health of large segments of the countries' populations, straining education and health systems, lowering productivity, and raising levels of poverty. Preventive action was needed and fortification of food staples is the most cost effective method for doing that.

B. Types of food fortification projects

12. There are two types of projects in support of food fortification. One is to initiate mass food fortification in countries that have no existing programs and little experience or knowledge of fortification in general. This was the situation with the JFPR 9005 project, Unicef projects in Indonesia, Fiji and Turkmenistan, ADB projects in Vietnam and Pakistan and Global Alliance to Improve Nutrition (GAIN) projects in Morocco, Zambia and Uganda to name a few examples. This is probably the most difficult type of project to accomplish in that most things have to be started from scratch.

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[2] http://www.izincg.org/

[3] Wald, N., Law, M., Morris, J., & Wald, D. (2001). Quantifying the effect of folic acid. Lancet, 358, p2069.

[4] 2008 Second Technical Workshop on Wheat Flour Fortification: Practical Recommendations for National Application, March 30 to April 3, 2008, Stone Mountain, Georgia, USA

13. A second type of project is to support and expand on an existing mass fortified (wheat) flour (FF) program. This was the nature of the JFPR 9052 project. Other examples were the GAIN projects in South Africa and Nigeria. These types of projects often focus on social marketing, regulations, monitoring compliance and assessing health impacts – areas important to continuation and sustainability that are often given limited resources with the initiation phase that concentrates on establishing industrial ability to fortify and monitoring the compliance and extent of fortification.

14. Some believe, or hope, that additional outside support will not be needed once a country has been given the means to fortify and the practice has gained a foothold. This may be the case with a few countries but there are others that will need added support, albeit at a diminished scale, in order to insure continuation. Achieving sustainability without need for outside funding is the ultimate objective in these projects. This requires support by the food industry, government and the consuming public. Achieving this end can be the most difficult aspect of these types of projects.

C. The Public Health Basis for Mass Fortification of Food Staples

1. Types of Food Fortification

15. Fortification is the addition of nutrients, primarily vitamins and minerals, to foods. There are different reasons to fortify food. A common one is to make a branded food product more appealing to the public so that they buy more of it or are willing to spend more for it.

16. This type of voluntary fortification, called *open market* or *free market* fortification by the World Health Organization (WHO),[5] is normally desirable and something to be encouraged, or at least allowed, but it produces only a limited improvement in public nutritional health. One reason is that its continuation by food companies is determined largely by how well it increases profits or market share or how much it enhances the company's image. Food companies can stop doing it at any time if management feels that the practice is not providing a reasonable return or generating positive public relations. Companies continually change management, so what one group may decide is the right thing to do may be discontinued by their eventual replacements.

17. Many of the branded products typically voluntarily fortified are relatively expensive, or at least unaffordable by the poorer segment of the population. A good example is fortified ready-to-eat breakfast cereal. This is a *huge* market around the world. It has great public appeal and many health benefits. But most poor people in developing countries simply cannot afford to buy such products. They have to spend their limited resources on basic, inexpensive food staples. They are normally not persuaded to buy branded foods because they are fortified or more nutritious. The main exception might be special foods for children and infants, such as complementary or weaning foods. Parents place a high value on their child's well being and may be more willing to spend a little extra money on foods that they believe will promote grown and health of their children.

2. Mass Fortification

18. The mass fortification of a food staple with micronutrients known to be deficit in the diet is a true public health program. Ideally, it should benefit everyone, or at least a major proportion

[5] www.who.int/nutrition/publications/guide_food_fortification_micronutrients.pdf

of the population. It should not cause a noticeable increase in the product's cost and should not cause perceptible changes in any of the properties (taste, odor, color, shelf-life) of the food. In short, the fortification should be invisible. The consumer only becomes aware of it through labeling, advertising or education. The consumer need not make a conscious choice to buy a more nutritious version of the product, as would be the case with open market fortification. Rather, the familiar product becomes more nutritious. There is no need to change diets, food habits or cooking methods.

19. Once established mass fortification is mostly paid for by the food industry, which passes it on to the consumer, just as they pass on any ingredient cost. The fortification cost is fairly stable and very small in relation to the price of the food (0.5% in the case of flour fortification). It becomes a fixed cost of doing business. This works best when all competing companies, including those importing products, must comply creating the level competitive playing field desired by industry. The cost to the government is to monitor and enforce fortification to insure compliance and adherence to standards so that the level playing field is maintained.

3. Limitations of food fortification

20. All of these things make mass fortification of food staples a very attractive nutritional intervention public health program. But it is not a panacea. It has some serious limitations. It often takes years and great effort to get it started, accepted and established to the point of being self-sustaining. It does not directly benefit, nor is it aimed at, infant children less than 2 years of age. It may indirectly benefit them by helping to maintain the health of nursing mothers. Infants do not consume sufficient quantities of flour or bread to make much of a difference in their nutritional status.

21. Mass fortification cannot be designed to meet the needs of segments of the populations with special nutritional needs, such as pregnant women, the sick and infirm or the elderly. In Central Asia, there are remote regions that do not have ready access to commercially milled flour, particularly in the wintertime when road travel is no longer possible. In all of these cases alternative interventions are indicated. This includes supplements, complementary weaning foods for infants and home fortification (e.g. Sprinkles™). Mass fortification of food staples can play an important role in improving nutritional intake and status, but it cannot solve all the problems and should not replace other programs where they are needed.

II. WHEAT FLOUR FORTIFICATION

A. The Importance of Wheat to the Region

22. Wheat as a cultivated crop originated some 6 to 8 thousand years ago in the region of Asia that now runs from Iraq to Turkmenistan. It started as a chance genetic cross between two wild grasses resulting in a plant that produced a heavier, nutritious and versatile seed. This seed did not do well in propagating itself. It needed humans to harvest, store, plant and cultivate it.

23. The land in the region in those times was well suited for growing wheat. The cultivation of wheat and its use as food played an important role in the advancement of civilization. Wheat could be stored over several years allowing people to survive famines and droughts. The bread made from wheat could be kept over a couple days providing a ready food to eat while traveling and working. It helped relieve mankind from the daily drudgery of hunting and gathering food.

The cultivation of wheat and the popularity of bread spread throughout the Middle East region, into Egypt, Europe, Central Asia and Northern China.

Table 2: Wheat Production and Flour Consumption in Project Countries

Country	2006 Population (millions)	Wheat Production Thousand MT/year	Percentage of Wheat Consumed Supplied by Local Wheat Production	Flour Consumption	
				g/person/day	1000 Metric Tons/year
Azerbaijan	8.5	1,537	89	428	1,299
Kazakhstan	14.8	10,703	494	294	1,623
Kyrgyzstan	5.3	987	94[6]	417	785
Mongolia	2.7	123	47	212	198
Tajikistan	6.6	640	72	302	626
Uzbekistan	27.0	4,186	144	304	2,912
Total	**64.9**	**18,175**			**7,442**

Wheat productions are average FAO values for 2003-2005.
Flour consumption includes imports and is estimated from FAO wheat consumption values for 2003-2005 using a flour extraction rate of 75%.

24. Wheat is still a vital food staple in these regions of the world. Per capita wheat flour consumptions in Central Asian countries (Table 2) are some of the highest in the world. It supplies more calories and more protein to the population than any other crop.

25. The wheat grown in Central Asian, except for that grown in Northern Kazakhstan, is winter wheat having a low test weight, low protein and gluten content (below 20-22% wet gluten in grain), and weak gluten. This wheat is suitable for the hand production of flat breads but is inferior in quality attributes (protein quantity and quality) needed for other types of baking to that of the spring wheat grown in northern Kazakhstan.

26. Besides having stronger, high quality wheat, Kazakhstan grows much more wheat than they need domestically, as shown in Table 2. As a result Kazakhstan has become one of the major wheat and wheat flour exporters in the world. Large quantities of wheat from northern Kazakhstan are exported to other Central Asian countries. Tajikistan and Kyrgyzstan need wheat to make up for a shortfall in their own production. Mongolia also requires a lot of imported wheat, which they have received in the past mainly from Russia. Uzbekistan and Turkmenistan have limits on how much wheat they can import since, theoretically at least, they grow sufficient amounts for their own needs.

27. All of the countries also import large quantities of wheat flour from Kazakhstan and a small amount from Russia to supplement the weaker flour made from local wheat. This extra strength is needed in the preparation of some types of baked products. The use of imported flour can dilute the impact of domestic fortification when the imported flour is not fortified.

[6] This figure for Kyrgyzstan has been reported to be 64% in 2008.

B. Wheat processing

1. Milling Industry in Central Asia

28. Before wheat is consumed it must be ground into flour. The flour is then used as the major ingredient to make baked products, bread being the most common. This requires it to go through two different processes: milling and baking. Both of these can be done on a small scale, either at home or by a neighborhood business. Or they can be done on a much larger industrial scale. Both large and small operations are found in Central Asia.

29. Flour mills in the region are of the following types:
- (i) Old "Soviet" mills. 150 to 400 MT/day
- (ii) New modern mills. 50 to 300 MT/day
- (iii) Medium size mills. 20 to 100 MT/day
- (iv) Small roller mills. 2 to 20 MT/day
- (v) "Chinese" roller mills. 0.2 to 2 MT/day
- (vi) Water or electric stone mills. 0.5 to 2 MT/day
- (vii) Electric or diesel stone, pin or hammer mills. 0.1 to 0.5 MT/day

30. Flour mills can be categorized by milling capacity (amount of wheat that can be milled in one day, or 24 hours.), which relates to their ability to fortify. This distinction became important to the Project in efforts to expand the number of fortifying mills in order to increase the amount of fortified flour available.

Table 3: Fortification Ability at Different Size Mills

Mill Capacity (MT wheat/day)	Ability to Fortify
> 50	Large mills of this size are usually well suited to fortify flour. The equipment and procedures used are well established.
20 to 50	Medium size mills can fortify flour but may require different equipment, premix or operational methods.
5 to 20	At small mills fortification is difficult but possible with proper equipment. The amount of flour produced is small but they often serve remote and poor areas.
< 5	In micro-mills the equipment, operational methods and logistics required to successfully fortify is quite different and has yet to fully worked out.

31. The flour milling industry in Central Asia has been going through major changes, reflecting what has been happening in the industry throughout the former Soviet Union. In Soviet times under a planned economy the trend was to build very large mills serving a wide area. These mills used Soviet designed and manufactured equipment and operated under standardized procedures. In more recent times some equipment was made under license to the Buhler Company, the premiere manufacturer of milling equipment in the world.

32. As the Soviet Union neared its end it became increasingly difficult to obtain spare parts or replace worn equipment. With the breakup of the USSR into separate republics many of these large mills had to run on much reduced capacities or stopped production entirely. The extent to which this happened varied with each country depending on their political and economic stability. Some of these large mills were successfully privatized but many were not.

They were too big with too small a market to operate profitably. They also came under increasing market pressure from smaller, private mills using newer, more efficient equipment.

33. The early commercial mills that sprang up around the region in the 1990s used inexpensive Ukraine and Chinese equipment. These were gradually replaced by higher quality Turkish equipment, which is the most common type of new milling equipment being installed in the region today. Some of the better-financed milling companies went directly to using top quality Swiss (Buhler) and German equipment. This progression toward better equipment is most evident in Kazakhstan, whose mills enjoy a sizeable export market to the other Central Asian countries besides serving their own local market.

34. It is expected that mills will continue to get larger using more modern equipment. These will gradually replace the smaller, older mills. The large, antiquated Soviet mills will be put out of business. Milling companies will consolidate and larger companies with multiple manufacturing sites and national marketing will result. The really small mills with capacities less than 2 MT/day will gradually disappear except for those in remote locations that cannot be readily served by the larger companies. These trends are good for fortification because it means that a higher proportion of the flour can be fortified and a greater proportion of the population will have access to and benefit from fortified flour.

2. Types of flour

35. The following table shows the basic types of wheat flour produced in Central Asia. Similar mill products are found throughout the Former Soviet Union (FSU) and Eastern European countries.

Table 4: Types of Wheat Flour Available in Central Asia

Flour types	**Ash Content** (%)
Premium or Supreme grade	0.5 – 0.7
First grade	0.7 – 0.8
Second grade	1.25
Whole wheat flour	

36. Flour mills in the region run at an average 75% extraction rate, meaning they produce 75 kg of flour from every 100 kg of wheat. The remaining 25% goes into making bran, which is used primarily as animal feed. The extraction rate can vary depending on the design and efficiency of the mill and the properties of the wheat, including the amount of impurities it contains. Since flour commands a higher price than bran, mills want to get as high a flour yield as possible without having bran particles in the flour (the theoretical upper limit for this is about 83% but mills have to run at a lower extraction due to inefficiencies in the process). Some mills deliberately run at a higher extraction rate by including more bran in their flour. Such flour is of poorer quality and will be cheaper in price but it allows the mill to produce more flour from the same amount of wheat. This is more likely to be done in locations where wheat is in short supply or expensive.

37. Roller mills separate flour into various streams with different proportions of endosperm content. The steams are characterized by their ash content: the more endosperm or the less bran, the lower the ash content. Different types of flours are achieved by combining these different streams. Wheat flour of the first grade is the most common flour product produced in

Central Asia. It typically accounts for 60 to 70% of a mill's flour production. First grade flour is primarily used to make bread.

38. Flour of premium or supreme grade is made from the lower ash streams. It is used to make confectionaries, pastries, cakes and high quality bread products. This type of flour can account for 10 to 30% of a mill's flour output depending on the local market for such products. Flour of the second grade, the lowest quality and cheapest flour product is used to make heavy, dark breads. Its production, which ranges from 5 to 20%, depends somewhat on the amount of premium grade flour produced, since it is made from the higher ash flour streams not included in the premium flour. This is actually the most nutritious flour product since it contains the highest natural levels of vitamins, minerals and fiber. It is the least desirable to the average consumer since it has poor baking properties and gives a dark, heavy bread. A mill running at a higher extraction rate can make more second grade flour.

3. Bread, Flour Products and the Baking Industry

39. During the times of the Soviet Union, Central Asians consumed much of the dense, dark pan type (Russian) bread produced from second grade flour in large, centralized baking plants. After independence, the traditional flat breads rapidly regained popularity throughout the region, to become nowadays the main bread type consumed in small cities, and the only type of bread consumed in small villages of the rural areas. This is typically made from lean dough with a small amount of yeast given a short fermentation. The dough is baked in small hearth ovens or in clay tandyr ovens where they bake while stuck on the concave wall of the oven.

40. In the larger cities one can find a variety of other baked products as well as noodles and pasta made commercially. These normally employ large ovens and use pans for bread baking. There is also a considerable amount of home baking, particularly in rural areas. Home baked flour products include gravy, dumplings and pancakes. It should be kept in mind that people do not eat flour; they eat products made from flour. The type of baking and food preparation has a huge influence on the stability and availability of added micronutrients. An important distinction regarding mineral availability is the effect of the type of leavening applied (yeast, chemical or steam) on residual phytic acid levels. This is discussed in a later section.

41. Support, or at least not strong opposition, by the baking industry is necessary to establish a flour fortification program. Bakers first of all need to be convinced that their products will not suffer in quality or consumer acceptance. This is easy to demonstrate, as was done early on in the Project when KAN prepared samples of fortified bread and showed them to millers and bakers. A more serious hurdle is getting them to accept any increase in cost. Unlike individual consumers who would hardly notice a one percent price increase because they purchase such small quantities of bread or flour, commercial bakers do notice the increase since they purchase much larger quantities. They need to be informed why this is being done and, if given a choice between fortified and unfortified flour, encouraged to use the fortified product. Once fortification becomes established as a mandatory practice the issue of cost to the baker disappears. Some bakers may also need to change their product labels to reflect it being fortified. This is a small, one-time cost.

42. An added problem with bakeries in Central Asia was that new GOST standards had to be enacted for bread made with fortified flour. The United States has a similar situation with standards for both enriched bread and enriched flour, but many countries just have standards for flour. Once flour fortification becomes mandatory or common practice there is no need to have separate standards for fortified and unfortified bread.

C. History and Background of the JFPR Flour Fortification Project

43. Joseph Hunt of ADB originated the JFPR Central Asian food fortification Project with support from Nevin Scrimshaw and Gary Gleason of the International Nutrition Foundation. ADB's early interest in food fortification was demonstrated by their February 2000 meeting in Manila on Strategies to Fortify Essential Foods in Asia and the Pacific. This conference, attended by a delegation from the Kyrgyz Republic, concluded among other things that *"flour fortification with essential vitamins and minerals should be an integral part of all strategies to control and prevent micronutrient deficiencies"* and that "*All salt intended for human consumption should be iodized*." It was also advocated at this meeting, by Alex Malaspina and others, that "Centers of Excellence" needed to be established around the world to help support food fortification.

44. Much of the early planning for the Project was done by Gary Gleason and Nevin Scrimshaw with active participation of Academician Sharmanov of KAN The first objective of the JFPR Project was to expand salt iodization in the region, which had been initiated in Central Asia by Unicef and other groups but had not yet become widely practiced enough to reach all the population and fully eliminate iodine deficiency disorders. Flour fortification was included mainly to address the widespread problem of iron deficiency anemia, recognized as a major public health problem in the region.

1. Prior Anemia Prevention Programs

45. Inclusion of wheat flour fortification in the JFPR Project was a way of expanding the anemia prevention and control (APC) program being run by Unicef in the region. Anemia was long known to be a major public health problem among women and children in Central Asia as evidenced by their low hemoglobin levels and other indices of iron status. Anemia has a number of possible causes but the main one is considered to be a lack of iron in the diet (called iron deficiency anemia or IDA), or more precisely, a lack of *absorbable* iron. This problem is aggravated by the widespread use of tea with meals, whose tannins inhibit the absorption of iron, and the limited consumption of meat by women and children.

46. The following types of supplements were used in Unicef's APC program:

- All women of reproductive age (60 mg FeSO4 + .4 mg folic acid once per week)
- All pregnant women (120 mg FeSO4 + .8 mg folic acid once per week)
- All children 6-12 months (30 mg FeSO4 syrup) once per week
- All children 12-24 months (60 mg FeSO4 + .4 mg folic acid once per week)

47. The APC program relied mainly on education and supplements. The educational efforts included promotion and instructions on the regular use of iron or iron/folate tablets, recommending foods that are good sources of iron and encouraging tea drinking no closer than 30 minutes before or after eating food. The APC program found that, while the supply and distribution of iron supplements was generally adequate, getting non-pregnant women to take them on a regular basis was difficult and dependent on how well the local health workers encouraged it. This is especially a problem with folic acid, since the vitamin is needed prior to pregnancy if birth defects are to be avoided.

48. Many of these supplementation and educational activities are still being done in the region and they should always be part of any nutritional intervention program. But it is well recognized that human habits change slowly so education alone has limited effectiveness while

the distribution of free supplements requires continuous funding by donor agencies or the government.

49. Mass fortification of food staples does not require people to change their eating habits and the cost of the program is largely paid for by the food industry, who pass it on to the consuming public with a barely noticeable price increase. It was thought that iron fortification of wheat flour would help augment the existing APC programs to better combat iron deficiency anemia. Interviews conducted within Oblasts during this project indicated that there was openness toward accepting wheat flour fortification by both consumers and local millers.

50. There had been two previous flour fortification projects in Central Asia—one in Kyrgyz Republic in 1995 and one in Turkmenistan in 2000—both initiated by Unicef. Gary Gleason was with Unicef at the time and helped originate and manage the Kyrgyz project. Both projects involved fortifying flour with iron from ferrous sulfate. The Kyrgyz project also included adding a small amount of iodine to flour as potassium iodate, which was used as a bread improver in the United States but also functions as a nutritional source of iodine. Unicef supplied the ferrous sulfate and the micro-feeders for adding it at the flour mills.

51. This project ran into trouble in the Kyrgyz Republic when some of the fortified flour was found to turn rancid and change color. This is a well-known problem with the use of ferrous sulfate occurring when an excessively high level is added or the flour is stored for too long a period. Ferrous sulfate is considered a very good source on iron from a nutritional viewpoint in that it is well absorbed by the body. It is also relatively inexpensive. Ferrous sulfate has been used to fortify bakery flour in the United States for decades, but that flour is normally used up within weeks of it being milled.

52. Wheat flour contains a small amount of fat that can oxidize and turn rancid over time giving it a limited shelf life. This problem is more pronounced with high storage temperatures and in higher extraction (high ash) flours since they have a higher fat content. Ferrous sulfate is a pro-oxidant that accelerates the rate at which oxidative rancidity develops in flour. The more ferrous sulfate that is added, the higher the flour's fat content and the longer the flour is stored all work to reduce a flour's shelf life by producing unacceptable odor and color. It is probable that in the Kyrgyz Republic some of the first grade flour (which has a higher fat content than the lower ash, premium grade flour) was fortified with a much higher than desired levels of ferrous sulfate and this led to the reported quality problems. This experience gave ferrous sulfate, and to some extent flour fortification in general, a bad reputation in the country, so the project was terminated.

53. A similar problem did not appear to occur in Turkmenistan. One reason for this was that the level of ferrous sulfate being added there was very low—only 25 grams of ferrous sulfate per metric ton of flour or 8 ppm of added iron—and so would be less likely to cause problems. The normal addition would be 94 grams of ferrous sulfate per ton or 30 ppm of added iron. If there had been problems due to accidental over-treatment, they had not been serious or extensive enough to cause changes in the program. Another difference could be that the government controlled milling industry in Turkmenistan is not as dependent on customer satisfaction as the private milling industry in Kyrgyzstan. Turkmenistan has continued to fortify flour with ferrous sulfate to this day and increased the level to 25 ppm iron in 2006.

2. Flour Fortification under the Soviet Union

54. The Soviet Union ran a limited wheat flour fortification program roughly from the 1970s to the 1980s. This involved addition of thiamin, riboflavin and niacin at very large flour mills in the Union with milling capacities over 500 MT. This included a couple in the Central Asian Republics. This program did not involve addition of iron. The vitamins were centrally supplied out of Moscow to the mills.

55. Fortification was accomplished by adding the vitamins to flour with a specially designed two-stage mixer. The first stage would mix the vitamins with flour to form a type of preblend. The second stage would then continuously add that to the flour. This equipment was reported to be quite complex and often in need of repair. In the later years of the Soviet Union it became harder to obtain the vitamins or spare parts for the mixer. Mills stopped fortifying and the equipment fell into disrepair and became unusable. By 1990 flour fortification in the Soviet Union had ceased.

3. Kazakhstan Academy of Nutrition

56. Early in the Project the involvement and support of the Kazakhstan Academy of Nutrition (KAN) was solicited, recognizing that this highly respected and well-connected organization would be invaluable in gaining support for the Project within government and medical circles as well as providing monitoring and analytical services that the Project would need. It was anticipated it would become one of the regional “Centers for Excellence” on fortification advocated at the 2000 Manila meeting.

57. Professor Toregeldy Sharmanov, the Director of KAN, was invited to attend a meeting on iron nutrition in Atlanta, GA, in the United States, in May 2001 to talk about nutritional problems and their control in Central Asia, on which he is a foremost authority. This presentation was published in the Journal of Nutrition.[7] Other distinguished nutritional scientists from KAN that became deeply involved with flour fortification were Drs. Mussa Aidjanov, Shamil Tazhibayev, Yuri Sinyavskyi and Firuza Ospanova.

4. Project Formation

58. At the October 2001 Almaty Forum the governments of Central Asia forged a landmark regional agreement to boost production, distribution, and consumption of iodized salt and fortified wheat flour. Participating countries were Azerbaijan, Kazakhstan, Kyrgyz Republic, Mongolia, Tajikistan, and Uzbekistan. The effort was backed by a partnership of international advisors consisting of ADB, the United Nations Children's Fund (UNICEF) and the Kazakh Academy of Nutrition (KAN). It was financed by a US$8.8 million grant from ADB's Japan Fund for Poverty Reduction (JFPR). A timetable of important events in the Projects is given in the Appendix.

[7] Gary R. Gleason and Torgeldy Sharmanov *Anemia Prevention and Control in Four Central Asian Republics and Kazakhstan*. J. Nutr. 2002 132: 867S-870S.

Table 5: Responsible Government Position in Each Project Country

Country	Responsible Government Minister	Position
Azerbaijan		Minister of Health
Kazakhstan	Anatoly Belonog	Chief State Sanitary Physician, MoH
Kyrgyzstan	Tuigunaaly Abdraimov	Minister of Health
Mongolia	J. Tsolmon	Vice Minister of Health
Tajikistan	Ranokhon Abdurakhmanova	Minister of Health
Uzbekistan	Bakhtiyor Niyazmatov	Vice Minister of Health

59. The primary goal of the flour fortification component of the JFPR project was to reduce the incidence of iron deficiency anemia by supplying more iron to the population. A secondary goal was to supply additional micronutrients that were known to be deficit in the diet. The vehicle for accomplishing this was wheat flour since it is an inexpensive food staple consumed by all segments of the population in high volumes and very amenable to fortification with micronutrients, particularly iron and folic acid.

60. The original resolution was to fortify flour to the maximum extent possible in the region. The specific, early objective of the project was to enable a sufficient number of mills in each country to fortify flour so that one-third of wheat flour would be fortified. This later came to be refined so that one-third of the premium and first grade flour would be fortified since other types of flour were not intended to be fortified. The “one-third” objective was an arbitrary figure made to establish the number of mills that would be set up to fortify flour, the quantities of premix to order and to qualify the degree of success of the project. In retrospect it turned out to be an overly ambitious goal that was not realistic for some countries in the project for reasons that will be discussed.

5. JFPR Project Management and Coordination

61. ADB Project management was under Dr Joseph Hunt for the startup and then turned over to Dr. Rie Hiraoka, Senior Social Sectors Specialist. The JFPR Regional Coordination and Administration Office (RCAO) was set up July 2001 in Almaty managed by Dr. Rustam Mustafarov. Country Steering Committees and Country Project Offices (CPO) were organized in September 2001. The Country Steering Committees were made up of representatives of interested government ministries and departments, manufacturers, social/scientific organizations and international nongovernmental organizations (NGO), presided over by the Minister of Health. The Committee executed overall control and monitoring of the Project.

62. The CPO, consisting of the Country Coordinator and a financial/administrative assistant, performed the direct project coordination. Each country had local advisors on flour milling.

Table 6: CPO and Milling Consultant In Project Countries

Country	Country Coordinator (CPO)	Milling Consultants and Milling Association Directors
Azerbaijan	Tahmina Tahgi-zada, Vusala Allahverdiyeva	Karat and Azerbesine Milling Company representatives
Kazakhstan	Nailya Karsybekova	Evgeny Gahn, Vitaly Lagoda (LGBK)
Kyrgyzstan	Artur Byuklianov	Alexander Shefner (KIBS)
Mongolia	Khainazan Jambalmaa, Baasaikhuu Byambatogtokh	Ya Altantsetseg, Rentsen Batmend
Tajikistan	Abdusalom Vokhidov	Urunboy Isakov
Uzbekistan	Amankul Baikulov	Dilyarom Gafurova

63. International consultants were assembled in early 2001. These included:
(i) Dr. Nevin Scrimshaw – senior nutrition advisor,
(ii) Dr. Gary Gleason – social marketing and communications specialist,
(iii) Peter Ranum – flour fortification specialist, and
(iv) Dr. Frits Van der Haar – salt iodization specialist

64. Unicef was an important partner in the Project. In addition to the country Unicef offices there was a regional Unicef office in Kazakhstan with a Food Fortification Specialist that assisted the Project.

D. Development of the Premix Formulation and Flour Fortification Standards

65. The following general considerations were taken into account in determining the levels and sources of micronutrients to add.

- ***Impact***: Amounts and sources added must be capable of producing a significant positive impact.
- ***Safety***: They should not cause potential harm.
- ***Sensory***: There should be no adverse effect on the color, shelf-life, baking properties or consumer acceptance.
- ***Cost***: Costs to the producer or consumer should be reasonable and acceptable.

66. Mussa Aidjanov of KAN and Peter Ranum collaborated with ADB funding to make recommendations on the types and levels of micronutrients to add to flour and to establish specifications for the fortification premix and fortified flour. The recommendations were based on the following reasoning and criteria:

(i) While the main motive for flour fortification was to address the problem of iron deficiency anemia (IDA) there were good reasons to include other micronutrients, particularly folic acid, which had recently proved highly effective in reducing neural tube birth defects. This would require use of a multi-nutrient "premix" instead of the single iron source that had been previously employed.

(ii) It was decided by the project management that a single premix and uniform set of fortified flour standards should be used, rather than allowing each country to set up their own standards and premix. This would simplify premix procurement and help reduce cost. It would also enhance free trade of fortified flour within the region. A uniform set of fortification standards for this large a region had not been attempted before. It required all the participating countries to agree on one set of standards and to write their regulations and laws accordingly.

(iii) Prof. Aidjanov, who was very experienced in the nutritional requirements and deficiencies in the region, after taking advice on cost, suitability for use in wheat flour and practices in other countries, determined that flour should be fortified with iron, zinc, thiamin (vitamin B_1), riboflavin (vitamin B_2), niacin and folic acid. Vitamin A was not included because of its impact on cost and the belief that other foods, such as vegetable oil and margarine, were more appropriate and cost-effective carriers for this vitamin. Vitamin B_{12} and B_6 were not considered at the time because not as much was known about them in regard to flour fortification as is known now. Had the fortification been devised today vitamin B_{12} may very well have been included.

(iv) The amount of each of these micronutrients to add, which determines the composition of the premix, was calculated by Prof. Aidjanov to be the amount sufficient to make up for the shortfall between the estimated normal intake of these six micronutrients within the region and their Recommended Dietary Intakes (RDIs) for an average flour consumption of 260 grams/person/day.

(v) Except for iron, the preferred chemical source of each micronutrient to use in flour fortification was well established through conventional practice around the world. The type of iron to use was still to be decided. The possible choices were hydrogen reduced iron, electrolytic iron, ferrous sulfate, ferrous fumarate and NaFeEDTA.

67. Because most of the people involved with this project had no prior knowledge or experience with flour fortification, a two-day training workshop was held in Almaty just prior to the 2001 forum. Mussa Aidjanov and Peter Ranum ran this workshop. Attendees included the country project coordinator and representatives from the milling industry and government from each of the five countries. Some of these people were involved with the project throughout its full duration, while others left and went on to other positions. With extended projects like this, people come and go, so training needs to be occasionally repeated to make sure all involved personnel are up to date.

1. Estimated Consumption of "fortifiable" Wheat Flour

68. The levels of micronutrients to add to flour were based in part on the amount of flour that could realistically be expected to be fortified and consumed. Table 2 gives the estimated flour consumption for the different countries in the project based on FAO wheat consumption data. The average for all five countries is 323 g/person/day. These are very high flour consumptions —some of the highest in the world. But clearly, not all of this flour could or would be fortified for various reasons.

69. The final estimation was to use 260 g/person/day as the regional average consumption of flour that could possibly be fortified under an enforced mandatory program, or 80% of the average amount of flour consumed in the five countries in the Project. This may be high for some parts of Central Asia and low for others, but the same situation would exist in any country where flour consumption will vary from locale to locale. It was thought that the two countries in Central Asia with the lower consumptions and closest to the 260 target, Kazakhstan and Uzbekistan, might be able to fortify a greater percentage of the their flour compared to those countries with higher consumptions since. This now appears to be the case. One reason is the higher percentage of flour produced by larger mills in those two countries.

2. Choice of the Type of Iron to Use

70. Nevin Scrimshaw, Gary Gleason, Mussa Aidjanov and Peter Ranum worked to finalize the flour fortification premix just prior to the flour fortification workshop and opening roundtable. It was decided that based on the unfortunate experience in the Kyrgyz Republic with ferrous sulfate it would not be a good idea to use this as the iron source despite the fact that it appeared to be the best nutritional source of iron at the time. Using the recommendations of the SUSTAIN task force on iron fortification of cereal products[8], which provided a consensus of international experts on iron nutrition, it was decided to use electrolytic iron at twice the iron addition level

[8] SUSTAIN (2001). Guidelines for Iron Fortification of Cereal Food Staples, http://www.micronutrient.org/frame_HTML/resource_text/publications/fe_guide.pdf.

that was intended with ferrous sulfate in order to adjust for it being considered half as bioavailable as ferrous sulfate. The result was that 50 ppm iron would be added instead of the 25 ppm originally calculated.

71. Electrolytic iron is a form of elemental iron powders. These have been widely used to fortify flour around the world because they do not decrease the shelf life of the fortified flour or promote rancidity. They are also relatively inexpensive compared to other sources. However, there have been questions about how well they are absorbed and utilized by the body. There have been numerous studies on this giving highly variable and sometimes conflicting results. There are five basic types of elemental iron powders that could be used in fortification. At the time the Central Asian premix was designed the existing evidence suggested that electrolytic iron was the best of the five so it was specified for use. More recent studies and recommendations have helped clarify the situation but have not substantially changed the recommendation to use electrolytic iron.

3. Premix Composition

72. The addition rate of the premix was chosen to be 150 grams per metric ton of flour. This is a commonly employed addition rate for fortification premix used at roller mills around the world, so most mills should be able to handle it without problems. It leaves sufficient room for a “carrier” or “diluent” and free-flow agents necessary to give the premix good flow and packing characteristics so that it can maintain a constant addition rate through the feeder and mix well with the flour.

73. The final premix composition and specifications are shown in the Appendix and levels added are shown in Table 11. The types, levels and sources of micronutrients to be added to flour were similar to flour fortification performed in other countries, which lent support to the soundness of the premix formulation. Also, the types of micronutrients being added are naturally found in wheat, but reduced by the milling process as illustrated in Table 7.

4. Niacin

74. The amount of niacin added by the premix is lower than the levels used in other countries. There are a couple of reasons for this. Niacin has traditionally been included in cereal fortification programs in order to prevent *pellagra*, a nutritional deficiency disease that is most common in maize (corn) eating populations, such as the Southeastern United States in the early 1900s, where maize was the main food staple and thousands of deaths occurred each year from pellagra. This results from much of the niacin in maize being in a bound form that is unavailable to the body unless the corn is treated in a pH modifying process called nixtamalation that causes it to become unbound and available. Wheat does not have the same problem since little of its niacin is in bound form. This makes wheat a naturally better source of niacin than maize even when the levels appear to be similar.

75. Another source of niacin is the amino acid *tryptophan,* which acts as a niacin precursor (60 mg of tryptophan = 1 mg of niacin = 1 Niacin Equivalent (NE). The recommended daily allowance (RDA) for niacin is now given in NE units. Tryptophan is naturally present in most proteins including the protein in wheat. When tryptophan content is considered the NE level in refined wheat flour triples, as shown in Table 7, making flour a fairly good source of this vitamin.

76. Niacin comes in two chemical forms: niacinamide and nicotinic acid. The latter is normally referred to as niacin so as not to be confused with nicotine, a totally different

compound. Both are white powders, similar in cost with no detrimental effects on taste or flour functionality. Niacinamide has the advantage of not acting as a vasodilator, as is nicotinic acid, which results in a flushing and skin reddening reaction in those handling the fortification premix so it was the source chosen for the premix.

Table 7: Nutrient Composition of Whole and Refined Wheat

Nutrient	Level units	Whole Wheat*	Wheat Flour**	Percent Retention on milling
Calories	kcal/100g	339	364	105%
Protein	%	13.7	10.3	80%
Calcium	ppm	340	150	44%
Iron	ppm	54	12.0	22%
Zinc	ppm	35	7.0	20%
Thiamin	ppm	4.1	1.2	29%
Riboflavin	ppm	1.1	0.4	37%
Niacin	ppm	48	10	21%
	NE	83	32	39%
Pyridoxine	ppm	3.8	1.0	24%
Folates	ppm	0.41	0.25	61%
Phosphorus	mg/100g	346	108	31%
Phytic acid	mg/100g	800	280	35%

***** Whole wheat protein and micronutrient levels can vary widely. Iron, for example, can range from 30 ppm to over 100 ppm. The values shown here are averages taken from USDA Food Composition Tables.
*** *** Normal white, non-fortified, all-purpose flour with 75% extraction.

5. Folic Acid

77. The level of folic acid added by the KAP # 1 premix was set at 1.5 ppm—the same level that was being used in the United States and Canada. This was known at the time to be effective in reducing neural tube birth defects while not adversely affecting flour color or other quality factors.

6. Naming the Premix

78. Nevin Scrimshaw suggested that the premix should be given a special name indicative of the Central Asian region. This was based on his own experience on the successful marketing and acceptance of “INCAPERINA”, a complementary food developed by the organization INCAP in Central America that he had once ran. Since the KAN was highly involved in its formulation, the name chosen was “KAP” using the Cyrillic letters for that organization. This premix was designed for general flour fortification in Central Asia. However, it was recognized that there might be other premix formulations designed for other types of flour, and so this premix was called KAP #1. Two other formulations have since been developed so assigning it a number while keeping the generic term KAP turned out to be a good idea.

7. Testing the premix

79. Some countries, such as South Africa, performed extensive testing of fortified flour by both government and industry laboratories prior to acceptance of a proposed premix formulation in order to make sure it will be acceptable. Because the formulation of KAP #1 was similar to

many flour fortification premixes used around the world there did not seem to be a great need for such pretesting, but samples of the premix were obtained by KAN prior to its procurement to use in their own evaluation and for distribution to mills that wanted to test it in flour and bread made from fortified flour. This product was tested and approved by the laboratory of Standardization and Certification of KAN headed by Professor Luziya Kalamkarova. In some countries a sample of premix needed to be submitted to the government in order to request a state standardization (GOST) standard. A couple of the flour mills with connected bakeries provided breads made with fortified flour to show at some of the early workshops. The positive opinion of the mill personnel along with actual bread samples provided verification to the assertion that fortification would not adversely affect the quality of flour or bread.

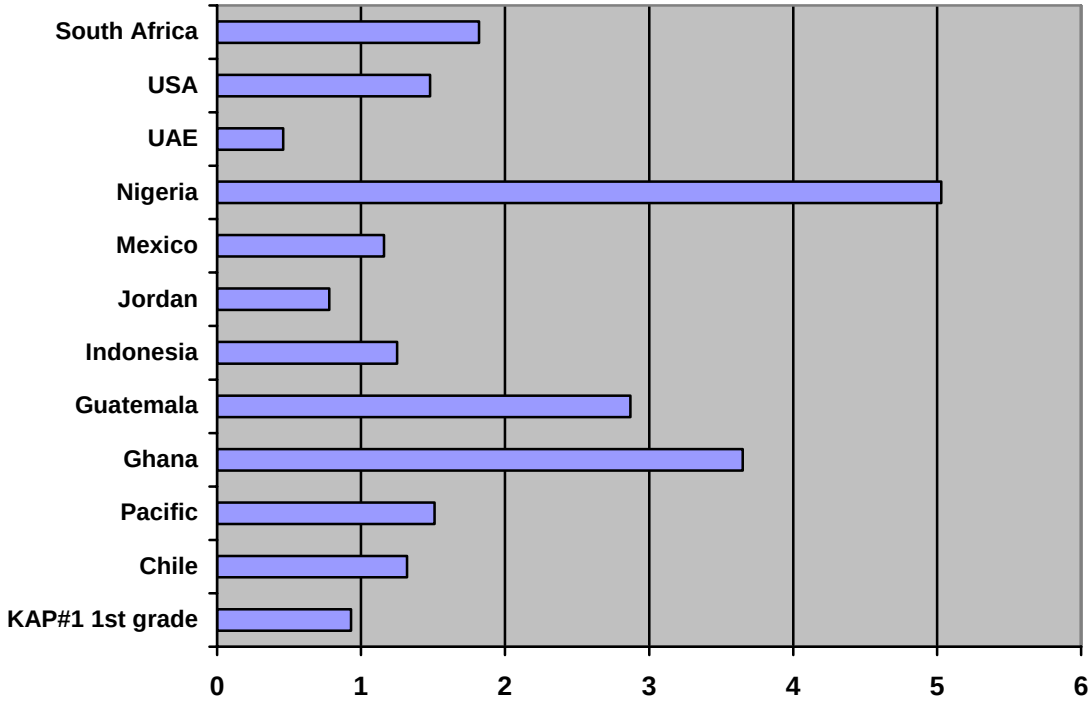
8. Cost

80. The final cost to the flour mills was an important consideration in the premix design. The milling industry would want to know early on what this would be costing them, even if the JFPR project subsidized it at the beginning. The estimated cost had to be stated at the opening round table so there was no subsequent shock. Fortification needed to appear affordable to the milling industry in order for them to accept it.

81. At the time, experience in other countries suggested that resistance to fortification by the milling industry for economic reasons became stiffer if the cost exceeded $1.00 per metric ton of flour. Previous experience had also shown that the premix accounted for about 90% of the cost of fortification, so the goal was to keep the fortification cost around $0.90 per metric ton of flour giving a premix cost of $6.00 per kilogram. It was difficult to get a good estimate of what the actual premix price would be since shipping, duties and other associated costs would all add to the cost. At the 2002 Astana workshop the delivered premix cost was estimated to be $0.76/MT of flour. This included only $0.09/MT for shipping, which turned out to far too low. As it happened, the final premix price with shipping was $6.49/kg. The final cost to the mill was then $0.97/metric ton of flour when used at a 150 g/metric ton addition rate or $0.78/ton when used at the 120 g/MT rate later recommended for first grade flour.

82. Some have argued that the $1.00/ton target is totally arbitrary and that millers will object to any cost but also can be made to accept much higher costs if given the proper incentives (as they were in Nigeria) or required to do it by law (as in South Africa). This may be true, but the higher the cost the more difficult it is to get mills to do it on a voluntary basis and the more resistance there is to making it mandatory. Figure 2 compares the 2007 cost of fortifying first grade flour with KAP#1 to that of fortification in some other countries.

Figure 2: Relative Flour Treatment Costs ($/MT) in Different Counties



83. At the start of this Project the price of wheat flour was about $200 per MT, so at $0.78 per MT for the premix, fortification would increase the cost of first grade flour by around 0.4%. By 2008 the cost of the premix had increased to about $1.10 per MT of flour, but the price of flour had more than doubled causing an actual reduction in the percent of the flour cost due to fortification.

9. Fortified Flour Standards

84. A flour fortification program requires establishing enforceable standards. These are normally the minimum final level expected in the fortified flour, which is the sum of the natural content plus the amount added, less an amount to correct for variation in natural content, processing losses and analytical error. The following calculation method was suggested in the Micronutrient Initiative Fortification Handbook[9].

Minimum standard = **S = 0.92 x (A + N) x (R / 100);**

where: **0.92** factor gives an 8% overage to allow for error in testing and sampling;

R is % of vitamin losses during milling and flour storage.

85. The minimum levels of micronutrients in premium grade flour were calculated by this method as shown in Table 8. These became the flour fortification standards promulgated in regulations in the six participating countries. It was thought at the time that they would apply to all types of wheat flour, since all other flour types have a higher ash content and, therefore,

[9] www.micronutrient.org/

higher natural levels of micronutrients, meaning that the minimum levels could easily be achieved by adding 150 g/MT of KAP #1.

Table 8: Calculation of Fortified Flour Minimum Standards

Micronutrients	Added Level* (ppm)	Natural Level (ppm)#	Processing Retention (%)	Minimum Standards* (ppm)
Thiamin	2.0	2	90	3.3
Riboflavin	3.0	0.4	90	2.8
Niacin	10	11	95	18
Folic Acid	1.5	0.3	90	1.5
Iron	50	10	100	55
Zinc	22	5	100	25

* By KAP #1 premix added at 150 grams/MT.
# In 0.5% ash flour.

10. Natural Micronutrient Content of Flour in Central Asia

86. All of the vitamins and minerals added to flour by KAP#1 premix are naturally present in wheat and flour. As shown in Table 7 their concentrations in wheat are greatly reduced on milling. Fortification with KAP #1 restores the concentrations of iron, zinc, thiamin and niacin in flour roughly back to their levels in the whole wheat. The levels of riboflavin and folic acid are added at higher levels than present in wheat. This is because their levels in wheat are low and higher amounts are needed to make up for their nutritional deficiencies within the Central Asian population.

87. There are also important differences in the form of the added micronutrients and their natural form in wheat and flour. Wheat contains *folates*, which have only 60% on average of the vitamin activity as the added folic acid, and are far less stable. The naturally present forms of iron and zinc in wheat flour may not be as bioavailable as the added forms but that is still open to question and dependent on what forms of minerals are added. Vitamin B_3 is added as niacinamide. This is more nutritionally available than the chemically bound form of niacin that is naturally present in wheat.

88. Natural levels for many of the micronutrients in flour can vary greatly, particularly the minerals. There was not good data at the time the project started on levels of micronutrients in the different types of wheat flour produced in Central Asia so data on North American flour, shown in Table 7, was used. Recent studies have provided better data specific to the region. The following Table 9 shows the iron and zinc levels found in a large number of premium and first grade flour samples.

Table 9: Mineral Levels Found in Central Asian Flours

	Iron		Zinc	
Flour Grade	**Premium**	**First**	**Premium**	**First**
Average (ppm)	14.7	28.0	7.9	13.5
Standard Deviation (ppm)	10.8	14.2	3.2	5.0
Number of samples	27	73	27	76
Low (ppm)	5	9	4	6
High (ppm)	54	64	15	33

89. The lack or good baseline data on natural levels and variation of micronutrients in the flour to be fortified proved to be a failing in preparing proper flour fortification standards. A similar situation occurred in South Africa with some of their standards.

11. Fortification of First Grade Flour

90. As previously discussed, there are three major types of wheat flour produced in the FSU countries. These are defined primarily in terms of their ash content. The natural micronutrient content in flour is also related to ash content—the higher the ash the higher the natural vitamin and mineral levels. First grade flour has higher ash content and higher micronutrient levels than premium or supreme grade flour. Likewise, second grade flour with a higher ash content than first grade flour has higher micronutrient levels.

91. The fortification standards were based on premium grade flour, or flour with an ash content of 0.5%, which is the standard type of white flour used around the world. However, after the standards were proposed during the 2001 workshop and roundtable it became known that first grade flour, with an ash content of 0.7% to 0.9% was the most commonly produced and consumed type of flour in Central Asia. First grade flour accounts for about two-thirds of a flour mill's output. This flour has a higher natural content of iron and zinc as shown in the Table 7.

92. Based on the above results, addition of 150 grams/MT of KAP #1 to first grade flour would give an average iron content of 50 + 28 ppm or 78 ppm with a range of 59 ppm to 92 ppm. Some country health authorities thought this could be dangerously high. As a result, it was proposed at the 2002 meeting on flour fortification in Astana that the addition rate of KAP #1 to first grade flour be set at 120 grams/MT. This would add 40 ppm iron or 80% of the level added to premium grade flour. The addition of the other micronutrients would be reduced accordingly. Based on the above results, the average iron level would then be 68 ppm in fortified first grade flour. Unfortunately, the natural levels of riboflavin and folic acid do not increase to the same extent as does iron when flour ash increases. This makes it more difficult to achieve the minimum standards for riboflavin and folic acid in first grade flour while zinc and niacin should not be a problem.

93. There were other difficulties regarding fortification standards for first grade flour. Analytical testing of flour samples from Central Asia showed that there is not always a sharp cutoff between the different types of flour. Flour sold as first grade can have ash contents ranging from 0.6%, or similar to that of premium grade, up to 1%. Mineral levels would have a wide range of values reflecting that wide range of ash. Vitamin levels vary accordingly as well but not as much as the minerals.

94. While the lower 120 g/MT addition rate was suggested for first grade flour, not all mills followed that. Some mills, such as a major one in Mongolia, made their first grade flour with a lower ash content in order to achieve better quality than their competitors, so they continued to use the 150 g/MT rate on all their flour.

95. Iron and niacin levels in flour would become the primary and secondary indicator of whether a flour sample was properly fortified. There should be little problem in achieving minimum standards with those two indicator micronutrients providing the KAP #1 premix was added at the recommended rate for each type of flour.

12. Micronutrient Contribution of Fortified Flour to the Diet

96. The projected benefits from flour fortification are shown in the following table. The original calculations used to determine the levels of micronutrients to add were based on dietary requirements shown by RDA values. The conventional practice now is to use Estimated Average Requirement (EAR) values.

Table10. Estimated Average Requirement (EAR) Provided by Fortified Flour

Micronutrient	EAR (mg/day)	% of EAR provided by260 g Fortified Flour
Thiamin	1.0	86
Riboflavin	1.2	61
Niacin	12.0	65 as NE
Folic acid	0.32	122
Iron*	10.8	116
Zinc	5.8	112

NE = niacin equivalents

* Corrected for added electrolytic iron having 50% bioavailability that of ferrous sulfate.

97. Table 10 shows the percentage of the EAR that consumption of 260 grams of fortified flour would provide. These values include both the micronutrients naturally present in flour and that added. These are clearly favorable intakes that should satisfy the nutritional requirement for these micronutrients in most people, but not all people will benefit the same due to large differences in flour consumption and availability of fortified flour.

13. Iron Safety Issues

98. There were some vocal critics of adding any amount of iron to flour. One influential Kyrgyz cardiologist addressed an open letter to the Ministry of Health (MoH) expressing his negative view of iron-fortified flour maintaining that it would be harmful to people with hemochromotosis and people living in the highlands. Mussa Aidjanov from KAN refuted that viewpoint at a Bishkek meeting on “Anemia in the Highlands” giving reasons why the few people genetically susceptible to iron overload would have nothing to fear from iron fortification while most women and children would benefit.

99. An Azerbaijan association on thallasemia and hemophilia believed it would aggravate those conditions. A meeting was arranged to discuss this with representatives of that association. It was argued by a number of health authorities present, including Shamil Tazhybaev from KAN, that iron fortification of flour and bread would present no problem for *thallasemia minor*, while those with *thallasemia major* would be under medical care and would

have to alter their diet anyway. Non-fortified flour and bread would still be available. Iron intake has no known relation to hemophilia. Despite these arguments the representative from the thallasemia association, whose child has the disease, said he still could not support fortification.

100. Thallasemia and hemochromotosis are fairly rare, inherited iron storage disorders. The Cuernavaca workshop stated that *the increase in the rate of iron accumulation by individuals with such iron overloading disorders from consuming fortified flour would be small over time and pose little additional risk for individuals with these clinical disorders.*

101. The highest continuous consumption of fortified wheat flour that could reasonably be expected for an individual is 650 grams per day. This is based on getting 80% of 3000 kcal/day from flour—a possible but highly unlikely scenario. That level of consumption would provide an average of 18 mg of iron daily if all the flour was non-fortified flour of the first grade. If it were all fortified flour the average iron intake would be 44 mg of iron per day. That works out to 31 mg/day if the lower absorption of elemental iron is taken into account. Even at this abnormally high flour consumption level the iron intake is well under the safe Upper Level (UL) of 45 mg/day recommended by the Food and Nutrition Board of the U.S. Institute of Medicine, 2001.

102. The Cuernavaca workshop concluded that *fortification of wheat flour with appropriate levels of iron is safe. It causes little, if any risk of adverse consequences even in the extremely small proportion of individuals with clinical disorders relating to iron absorption and storage*

Table 11: Levels of Micronutrients Added by KAP Komplex Premixes

Premix:	**KAP #1**		**KAP # 2**		**KAP #3**
Nutrient	ppm @ 150 g/MT	ppm @ 120 g/MT	ppm @ 150 g/MT	ppm @ 120 g/MT	ppm @ 250 g/MT
Grade of flour to be used in	Premium	First	Premium Bakery	First Bakery	Second
Thiamin	2.0	1.6	1.8	1.44	
Riboflavin	3.0	2.4	2.4	1.92	
Niacin	10	8	10	8	
Folic Acid	1.5	1.2	1.5	1.2	1.2
Vitamin B_{12}	--		0.004	0.0032	
Iron	50	40	25	20	20
Iron source	Electrolytic		Ferrous sulfate		NaFeEDTA
Zinc	22	17.6	20	16	

14. Future Considerations

103. The KAP #2 formulation shown in the Appendix and the above table has ferrous sulfate and includes vitamin B_{12}. It could be used in wheat flour used in bakeries and pasta products, or where the flour will be stored for not more than two months. The level of iron to be added by this premix is half that added by KAP #1 since ferrous sulfate has twice the bioavailability of electrolytic iron. The final level of total iron in the fortified flour would lower and likely below the 55 ppm minimum standard. This could create a problem with enforcement. But it is fairly easy to determine whether flour has been fortified with ferrous sulfate or electrolytic iron from the iron spot test, so it would be possible to create separate specifications for ferrous sulfate fortified flour. The cost of fortifying with this premix is about the same as that with KAP #1.

104. The KAP #3 formulation shown is designed for use on second grade flour or any flour with an ash content above 1.0%. Fortification of this type of flour was not included in the Project since it naturally contains higher levels of micronutrients and represents a low percentage (<10%) or the regions flour consumption. This type of flour has a high phytic acid content, which inhibits the absorption of iron. The special form of iron, NaFeEDTA, used in this premix overcomes this inhibition. There may be situations where it would be advisable to fortify second grade flour. However, under a mandatory flour fortification program it is sometimes useful to have at least one type of flour unfortified so that people do not think they are forced to eat a fortified product and have the freedom of choice not to.

105. Much more elaborate procedures for calculating premix formulations and flour standards have since been devised, particularly by Omar Dary[10] working on behalf of the WHO and A2Z. The U.S. Centers for Disease Controls (CDC) in collaboration with the Flour Fortification Initiative (FFI) brought together a number of organizations, companies and scientists to work on devising recommendations for flour fortification. Their first meeting was in Cuernavaca, Mexico in 2004[11] where recommendations on iron and folic acid fortification were made. The types and levels of iron and folic acid provided by the KAP #1 premix are in agreement with those recommendations.

106. A second meeting of this group in Atlanta in 2008 made further recommendations on other micronutrients to add to flour. For the per capita level of flour consumption appropriate to Central Asia (>300 grams/day) these new recommendations were to add 20 ppm iron as ferrous sulfate or 40 ppm as electrolytic iron, 30 ppm zinc, 1.0 ppm folic acid and 0.012 ppm vitamin $B_{12.}$ The KAP premixes are a bit low compared to these recommendations for zinc and vitamin B_{12} but otherwise they are very close. As nutritional science advances there may be changes in the thinking of how best to fortify flour. All countries should be amenable to modifying their fortification standards and the composition of the premix used in accordance with this advancement in knowledge.

III. PROCUREMENT AND IMPLEMENTATION

A. Selection of Flour Mills

107. It was understood early on that flour mills in the region ranged from very large to very small (table 3). The plan was to start fortification at the largest mills (over 200 MT/day) in order to achieve the maximum impact in the shortest period of time with the least expense. Once that has been accomplished, efforts could be directed toward the medium size mills of 50 to 200 MT/day in order to accomplish the one-third objective. Mills with capacities less than 50 MT/day were not to be included in the initial selection since it was not sure what type of equipment they would need and there were doubts about their ability to correctly fortify.

108. The CPOs were asked to identify the larger operating mills in their country and find out their annual flour production. They then selected a sufficient number of those mills so that their combined flour output would total one-third of the country's flour consumption. These mills were then asked if they agreed to participate in the program.

[10] Allen, L., De Benoist, B., Dary, O. & Hurrell, R. (2003). Guidelines on food fortification with micronutrients for the contol of micronutrient malnutrition. Geneva, Department of Nutrition for Health and Development, World Health Organization.

[11] http://www.sph.emory.edu/wheatflour/KEYDOCS/Cuernavaca_Meeting_Summary_Report.pdf

109. There were a number of difficulties in this approach that included:

(i) Not all of the large mills agreed to participate. This required going to additional, smaller mills to achieve the one-third objective.

(ii) The country's flour consumption figure used included a large proportion of imported flour, which could not be fortified under the project. This was particularly true of Uzbekistan, Mongolia and the Kyrgyz Republic.

(iii) Some of the larger mills that claimed to be operating were not functioning, or they were running on a very limited basis. They may not have accepted this situation themselves, or if they did, they did not make it known to the project since they wanted to receive the fortification equipment and premix, perhaps as a means to enhance their fragile operational status.

(iv) The requirement that only mills larger than 200 MT/day capacity be selected made it difficult for some countries, like Tajikistan, Mongolia and the Kyrgyz Republic, to reach the one-third goal since they had an insufficient number of willing, operating large mills.

B. Mill Fortification Equipment

110. The addition of micro-ingredients (chemical improvers, enzymes and fortificants) to flour at the mill had long been a common practice. The technology for adding these is well established. The normal procedure is to continuously meter the ingredients into the flour as it flows through the mill using a single micro-feeder (also called a dosifier). There are three basic designs for this type of equipment; the most commonly used for new installations being a screw type feeder, which has proven to be very reliable and durable.

111. Technical specifications, shown in the Appendix, were drawn up for two types of feeders. The type A feeder was intended for the larger mills while a less expensive, lower capacity type B feeder would go to the smaller mills. The first thought on the service requirement was to set up a demonstration mill in each country where technical personnel from each of the recipient mills would be trained, but this later was changed to requiring the vendor to help install mills at all recipient mills.

C. Testing Equipment

112. Many of the country representatives to the 2001 Almaty forum were highly interested in how quality control and monitoring would be conducted and what analytical instruments would be provided by the Project to accomplish that. Some came with specific requests including clinical instruments such as ultrasound devices. Others expected a testing laboratory to be set up in each country and all participating mills to receive testing equipment.

113. The recommendation made by the project consultants familiar with fortification, however, was that mills need run only the iron spot test, which was the standard QC test used for fortification around the world. For this they needed only the reagents. Each country was to receive two spectrophotometers—one for a government lab and one for a centralized industrial lab—for quantitative testing of iron and niacin in flour. Only KAN was to be provided the full set of analytical instruments for testing flour, premix and serum.

D. Procurement of Premix and Equipment

114. Once the formulation of the premix had been established, the specifications of the mill equipment written and the mills selected that would participate in the project, the next step was to procure premix and milling equipment and transport it to the individual mills. The procurement process needed to follow the procedures of the Asian Development Bank. This required separate bids for equipment and premix for each country, or a total of 12 altogether. The tenders were announced in ADB publications. Only bids from companies in ADB member countries would be accepted. This excluded Russia since it was not an ADB member.

1. Feeders

115. A few of the larger mills in Kazakhstan and Uzbekistan needed two feeders – one each for two separate flour production. The Kyrgyz Republic had some mills already set up to fortify flour with feeders supplied by Unicef, so they needed fewer feeders than the number of mills that would receive premix.

Table 12. Premix and Feeders Supplied in JFPR2005

	Beneficiary Flour Mills (number)	**Feeders** (number)	**Premix supplied** (MT)
Azerbaijan	8	8	20
Kazakhstan	17	30	95
Kyrgyz Republic	10	7	15
Mongolia	6	6	8
Tajikistan	6	2	22
Uzbekistan	14	38	89
Total	**61**	**91**	**249**

116. The ADB wanted to make sure the feeders would be properly installed and working, so the vendor was required to help install them at each mill location. Also, the tender was changed to providing only type A feeders so that recipient mills would not think that they were getting inferior equipment if they received the type B feeder. Delivery was to start no later than two weeks after signing the contract. These requirements along with the cost of shipping equipment to each mill added considerably to the final price and probably limited the number of companies willing to bid.

2. Premix

117. There was considerable interest early on in having a local company manufacture the premix. There were a number of reasons why this was not possible for the initial procurement. There was no company known to operate in Central Asia that had the capacity or experience to produce such a product. There were some in Russia but they were disqualified since Russia was not an ADB member. There was no interest in helping to arrange a startup operation for premix manufacture in the region. It would take too long for that to happen greatly delaying the project and it would be hard to get agreement on what country to locate it in. The idea that local production would provide cost savings was weak since all the ingredients had to be imported and the primary savings, if any, would be in shipping. It was understood, however, that the premix vendor would be willing to provide technical support to KAN on eventually arranging for local production if this was requested.

118. The total amount of premix allocated each country was dependent on their population and their assessment of what was needed to meet the objective of fortifying one-third of the flour production in the participating mills for one and a half years. Premix was distributed to the individual mills dependent on each mill's capacity and actual flour production with some premix held in reserve.

119. There are different points of view on how much premix to supply mills in a project such as this. One view is to provide them just enough premix to prime the pump and help the mill get started in fortifying. This could be enough for one or two months. After that the mill would be responsible for procuring and paying for premix on their own. The advantage of that strategy is that the mill does not become dependent on free or subsidized premix and quickly has to make arrangements to order it themselves. The downside of that is that some mills may simply stop fortifying once the provided premix runs out.

120. Another approach is to provide free premix for an extended period of a year or two to make sure that fortification becomes well established. This was done successfully in Indonesia where the mills were supplied free premix for the first year by USAID and a second year by CIDA.

121. In the JFPR 9005 Project the situation was more complex involving six countries of varying economic status. It was decided to provide premix for up to a year but to have the mills compensate the project for one-third the cost. This would get the mills attuned to the fact that they had to pay for premix while extending the period of subsidized premix use out long enough to make it a standard practice or even to reach mandatory status. This requirement for mills to pay a third of the cost was announced at the end of the 2001 Almaty roundtable. It was waived for Tajikistan because of their difficult economic situation. The representative from Kyrgyzstan objected to having to do it and the mills from that country delayed paying it until the very end of the project. The other countries agreed to the arrangement and made punctual payments. The funds collected from this were used to help extend the project including providing additional feeders and premix.

122. Because the amount of premix provided was estimated to last no more than 1.5 years after the start of fortification, all of the premix was ordered and delivered in a single procurement. This proved to be a mistake because the premix supplied ended up lasting much longer than anticipated, in some countries longer than the three-year shelf life stated for the product. As it turned out, it would have been better to stagger the premix order to prevent this from happening. There were different reasons why it took so long for the mills to use up the initial supply of premix. A major one was the unforeseen low flour production rates at many of the participating mills. Other factors included the change from 150 g/MT to 120 g/MT for first grade flour, which extended the supply of premix, and the stubborn reluctance of a few mills in some of the countries to actually fortify their flour.

a. Selection of Vendor

123. The announcement of the tender and evaluation of bids followed standard ADB procedures. There are four different types of companies interested in submitting bids on this. They are manufacturers of premix, manufacturers of feeders and other mill equipment, suppliers of both premix and feeders (full service companies) and distributors of premix and/or feeders made by other companies. A number of companies around the world make feeders and about ten or so produce premix. But there are only five whose business is to manufacture and supply both to flour mills. Not all of these are in ADB member countries, however.

124. Bids were received from all four types of companies. These were evaluated for ADB by an independent consultant who recommended the contract be awarded to the American Ingredient Company of Kansas City, MO in the United States. This company had a long history of supplying premix, equipment and related technical service to flour mills in North and South America and Africa. Their bid was made more attractive in that they would provide all six countries with both premix and equipment at a discount over supplying separate countries. It was also thought that working with a single vendor would be advantageous to the JFPR project management in simplifying procurement, shipping, training and start-up operations.

125. While an audit of the vendor's premix manufacturing facilities was not required in the tender, as it is in some other fortification projects, it was decided that KAN should make such a visit. This was done by Mussa Aidjanov and Shamil Tazhibayev, with expenses for that paid by the vendor, as is the normal practice. The information on flour fortification practices in the United States and analytical testing methodology obtained during this trip proved to be very useful to KAN and the Project. Another tender was made for the supply of spectrophotometers and reagents for use in quality control. KAN helped develop the specifications on this. The supply contract was awarded to a company in U.K. (Lonestar).

b. Problems, Mistakes and Complaints

126. As might be expected in such a project, there were a number of early criticisms on the types of supplies obtained and how the procurement was conducted. Most of the following complaints were voiced at the 2002 workshop on flour fortification in Astana. Some of these were quite legitimate and were resolved during and following that meeting.

127. Some vendors complained that they never heard about the project or the tender so they never had a chance to bid on it. The ADB does not normally send out tenders to specific companies known to be in the business. They rely instead on vendors keeping track of tenders announced on the ADB web site. But most companies in the business would not make that a standard practice since the ADB had not been known to purchase mill equipment or premix in the past. Once the program had started manufacturers of premix and feeders became aware of it and made it a point of attending some of the meetings. Having multiple vendors interested in flour fortification in Central Asia is good for the program and was encouraged. Competition helps reduce cost and active involvement of vendors calling on mills or milling associations can help expand and improve the program in the region. Premix and equipment companies want to see flour fortification continue and expand, so they benefit by promoting and monitoring it long after groups like ADB are no longer involved.

128. Some of the technically experienced people expected the project to provide mills a complete fortification system different from what was supplied. Representatives from the League of Kazakhstani Grain Processors and Bakers (LGBK) were familiar with the two-stage mixer used to fortify flour under the USSR and asked why that type of equipment was not specified. They questioned whether the single feeder that was being provided was capable of fortifying flour in Central Asian flour mills adequately and uniformly.

129. The milling consultant's response to this was that the type of equipment being provided was a high quality micro-feeder used around the world to successfully fortify flour. It allowed the mill to create a flour fortification system by combining it with associated equipment that is already present in most of the mills chosen for this project. This would require technical assistance for mills to set up, which was included in the contract. The large recipient mills in Central Asia were understood to be no different in their basic milling design from those in the

rest of the world, so this equipment should work satisfactorily when properly installed and maintained.

130. The milling consultant was aware of the two-stage mixing system, having seen it in mills in Russia and Ukraine, but none in Central Asia. These mixers had all fallen into a state of disrepair and were no longer functional. They were quite complex and difficult to maintain according to the mills. The consultant was unaware that any of them were still being used, or that they were being made or that spare parts were available, so no mention of them was made in the bidding document. It came as a surprise that such equipment was available and that the company making it (Buhler) had inquired about using them in the project. If such equipment was to be considered, it should have been mentioned at the 2001 Almaty workshop, but it never was. This equipment was also a couple times more expensive than what was purchased so that would have probably precluded their use.

131. The feeder specification called for a variable speed (delivery) control. This allowed the miller to easily adjust the delivery rate of the premix in accordance with the flow of flour once it had been properly calibrated. Unfortunately, some of the older mills had erratic flour flow rates varying up to ± 20% during the day. Also, the flow rate at any given time was not accurately known, meaning that the feeder could not be properly adjusted. Mills should have a fairly constant flour flow to operate efficiently and modern mills are designed to do that. High variability in the flow rate is an indication of problems with the mill equipment or design. The first step is to address those problems and reduce variability to acceptable levels. Short of that, there are some possible solutions to the problem but all involve installation of additional equipment. These include using an in-line batch mixer, running a conveyor between two flour holding bins and having a device that continuously measures the rate of flour flow so that the premix feeder can automatically adjust to any changes. All of these are costly and were never intended to be covered by the project.

132. While it was not required in the tender, the supplied feeders did have the ability to receive and automatically adjust the addition rate according to a received milliamp signal proportional to the flow of flour. Most recipient mills did not have the equipment to provide the proportional signal. This connection normally has to be done through the main mill control unit and the feeder vendor was not authorized to make any programming changes on such equipment. That is best done by the company supplying the control equipment and programs or by the mill itself. There was no allowance in the project for providing outside technical service to hook it up to the feeder controller. Mills had to arrange for that on their own if they wanted it.

133. The requirement for an automatic shutoff capability in the tender was to enable the feeder to stop working if the flour stopped flowing. This is critical in preventing some of the flour from becoming excessively, and perhaps dangerously, over-fortified due to mill stoppages or chokes. The automatic shutoff can be a simple electrical arrangement whereby the feeder stops if the power to the mill equipment that the feeder is connected to stops. A better arrangement is to have a signal from a simple device that measures whether or not the flour if flowing. This signal may come from a variety of sources related to or indicating flour flow, and is not normally provided with a feeder since it is dependent on the engineering design of each mill. Since the Central Asian mills were not experienced with ingredient feeders, the vender agreed to install and hook-up flour flow indicators to the feeder controller in the five pilot mills for demonstrational purposes, even thought this was not required in the contract. The vendor did not want to be responsible for purchasing or installing similar devices in the other mill, but did provide information on where they could be purchased.

134. Another complaint on the equipment was that it did not include a current stabilizer device. Some of the mills experienced wide fluctuations in line voltage that could affect the performance of the feeder. To deal with that the vendor arranged to have a current stabilizer provided to mills that needed one at no additional charge to the mill or Project.

135. Early comments on the KAP premix were that its delivery to the mills should have been staggered and that packages smaller than 25 kg (e.g. 10 kg) should have been made available for use in the smaller mills. Both were reasonable requests but it was too late to act on them for the initial order. It took a couple years to realize it but the biggest problem with the premix was the use of calcium sulfate as the filler. This would not have been much of a problem if the premix had been used up within a year, but after a couple years it became very packed down in the boxes and clumped up in the feeder. This made it difficult to feed properly. Some of the mills found they had to mix it with flour or semolina in order to get it to feed properly. This problem may have resulted from the calcium sulfate slowly absorbing moisture on storage. A better filler would have been wheat starch or maltodextrin since they do not absorb moisture as readily. Current specifications for the KAP premixes do not allow the use of calcium sulfate, but it would also be wise to avoid the long premix storage that occurred with this procurement.

136. Some equipment suppliers and millers thought the project had paid too much for the feeders arguing that there was less expensive equipment available. That was true - lower cost feeders were subsequently purchased for smaller mills as described in a following section. However, it was necessary for the success of the project to start out with high quality equipment that would not cause a lot of problems or breakdown so that mills would not turn negative about fortifying flour. Also, their delivery and installation accounted for a large part of the feeder cost. Another factor in their cost was that equipment and premix ended up being a package deal. Some premix suppliers actually complained that the cost of the premix was artificially low and could not be supplied at the price paid. Only with subsequent premix orders using competing quotations from different companies can the true cost of the KAP #1 premix be well established.

137. The most difficult criticism of the project to address was that it did not include small or medium size mills. This came particularly from CARE International and Unicef in Tajikistan, but the Kyrgyz Republic and Mongolia were also concerned about this, as did Kazakhstan later on once they faced having a mandatory flour fortification program. The response to this was to arrange for expansion of the program to smaller mills and to help set up a pilot project for really small mills, discussed in a later section.

E. Installation of Feeders

138. The contract called for setting up five demonstration mills. This was to be done before shipment of the other feeders so that the milling industry could become familiar with the fortification system and be convinced that it would work satisfactorily. The millers requested a two-month extension in the pilot stage with three mills in Kazakhstan and two mills in Uzbekistan in order to work out any problems prior to installation of equipment in additional mills. However, due to the tight time schedule imposed by the contract, the vendor had to ship all the feeders at once and start installation in order not to incur a late delivery penalty. Fortunately, the first pilot mills receiving the feeders were generally satisfied with their performance once the above-mentioned problems were rectified so an extended pilot stage was not necessary.

139. The vendor initially sent three technicians to assist in the location, installation and calibration of the feeders. While their help was useful and necessary under the contract, millers

are by nature very good mechanics who quickly understand what needs to be done with many resourceful and creative ways of accomplishing it. The vender found it too difficult to send people from the United States to service all 61 mills so they arranged for local representatives in different countries to help service many of them.

140. An important issue determining how well and uniformly flour gets fortified is where the feeder is installed in the mill. This was discussed at the early workshops in Almaty and Astana, but each mill is different so the optimal feeder location needs to be individually assessed. There are a number of factors to consider in this including having a sufficient amount of mixing after the point of addition, ease of access to filling the feeder and having a physical space to place the feeder. In most of the newer mills this is a fairly easy decision, since they usually have a space on the flour collection conveyor where feeders are generally located. However, location of the feeder became a challenge with the older mills made with Soviet equipment and design, and later on with the smaller mills that were included in the project.

141. There were some novel and ingenious solution for locating feeders. Some mills where the flour collection conveyor ran near the ceiling affording no ready access, so they added the premix to a flour stream coming out of a sieve. Some mills located the feeder on a movable frame that allowed them to fortify at different points in the mill depending on the type of flour they were making. One mill with severe restrictions on where they could locate a feeder ended up adding the premix to the final milling roll. This would not be a recommended method but the mill showed with the iron spot test that they were getting the correct level of iron in the final flour.

142. There were mistakes made in some feeder installations where changes were needed. For example, one mill had the premix flowing by gravity through plastic tubing down to the collection conveyor. Unfortunately, the tube was too small in diameter, not steep enough in its slope and near a walkway so premix could build up in the pipe and fall as a clump into the flour if someone bumped into the tube. All that was required was a simple relocation of the tube.

143. This illustrates the need to have mill fortification systems checked occasionally to make sure they are working correctly and properly maintained. In Western countries full service companies that supply premix and equipment normally do this. It can also be done by technical representatives from a government agency or milling association assigned to monitor fortification. In the JFPR projects this task was handled largely by the milling associate in each country.

144. Most of the millers had no prior experience in adding micro ingredients to their flour. Much was learned about this technology as it relates to milling practices flour products in the FSU. This new knowledge and ability should prove useful to the region's milling industry as it becomes more sophisticated in the types and quality of the products they can offer, as well in other developing countries. Lessons learned during this project have been incorporated into the *Flour Fortification Initiative's Millers Toolkit*. This manual, available as a CD, has been translated into Russian and Turkish. There were no Russian language manuals and few technical materials in Russian available at the start of this project, which was a complaint made by some of the millers. Mongolia, however, wrote a training manual in Mongolian on their own.

F. Logo and Labeling

145. A key aspect of a voluntary mass fortification program is to have a logo and/or name that readily identifies flour as being fortified and can be used in educational and promotional materials. KAN developed the logo, shown here, along with specifications of how it should be

used. The smiling face logo was accompanied by the words “healthy food” in both the local language and English.

Figure 3: Bag of Fortified Flour Bag Showing “Healthy Food” Logo.

G. Expansion to Medium Size Mills

146. It was very evident at the end of the JFPR 9005 project that additional mills would have to be brought on line to fortify if the original 33% objective was to be achieved. By that time Azerbaijan and Uzbekistan were no longer being considered for inclusion in the extended JFPR 9052 project. Kazakhstan also was lagging in the amount of flour being fortified but for different reasons from Kyrgyzstan, Tajikistan and Mongolia, where lack of fortification capacity seemed to be the main problem.

147. The Project looked for smaller, less expensive feeders for use in these medium size mills with capacities from 5 to 50 MT of wheat per day. The hope was to find one with an established record of use in fortifying flour that could be purchased for less than $2000. This was a problem since most feeders on the market cost more than that and manufacturers were reluctant to provide technical support.

148. A feeder from a company in Pakistan (Technomight) was recommended since it had been successfully used to fortify WFP flour going to Afghanistan. The company was also willing to provide training and support in Central Asia. Feeders were ordered from them for use in Kyrgyzstan and Tajikistan mills.

149. Mills had problems with this equipment feeding the KAP premix. The premix was now three years old and started getting sticky and hard to feed. The flow properties of the premix the feeder had been used on in Pakistan were quite different from KAP#1 being somewhat more granular. Also, being small mills they had to use a very low addition rate that was hard to keep uniform. The solution to these problems was to first mix the KAP premix with semolina (a granular type of flour). This greatly improved the flow properties and made it easier to control, but it required another processing step that not all the smaller mills were capable of doing or happy about doing.

150. Installation of the feeders in some of these mills also proved difficult. Some of these mills were quite old. There was often a very limited and inconvenient space in which to locate the feeder.

151. Mongolia also needed additional feeders to expand fortification to medium size mills and one new large mill entering the program. They decided not to go with the Pakistan feeder after hearing about the problems with it. Their milling consultant found a company in China that offered a feeder within the price range so they bought some of those. This feeder had a number of problems as well. It appeared to have been designed for use with animal feeds and not for flour mills. It had too large a capacity for the smaller mills and only one size screw. The feeder could be used but small mills needed to dilute the premix to achieve proper addition control.

152. Uzbekistan also had problems with additional feeders purchased under the GAIN project. They proved to be of substandard quality, though on paper they met the specifications of the tender. The discharge screw did not function well, level sensors were missing for many of them, motors were underpowered, and there were problems with bridging of the premix in the hopper. Getting them properly installed and working required much unanticipated work, and caused delays in the start up of fortification at some mills.

H. Small Mills

153. Even at the start of the Project it was understood that Tajikistan would have a problem with a preponderance of small mills, particularly outside the Capital, Dushanbe. There were few mills in the mountainous eastern half of Tajikistan. The people there relied heavily on small, local mills for flour, particularly in the winter. CARE International and the Aga Kahn foundation argued that to get micronutrients to the people that needed them the most in this country you needed to fortify at small mills.

154. It was believed by the Project management that fortification at small mills (less than 5 MT/day wheat milling capacity) was logistically and economically impractical, so it would not be a part of this Project. Unicef Tajikistan understood the problem and looked for ways of addressing it without lessening the Project's primary goal of fortifying at large and medium size mills.

155. Small mill fortification was also a concern in the Kyrgyz Republic and, to a lesser extent, Mongolia. Even Kazakhstan has some small mills in isolated regions. This is a concern in other parts of the world, such as China and Morocco, so it is not particular to Central Asia.

156. Urunboy Isakov, the local milling consultant in Tajikistan, built a small feeder prototype that he believed could be used to fortify flour in small mills. While this was an admirable effort, it was not something the Project wanted to support. Rather, GAIN was asked if they would support a pilot project on this, since it could be applicable to their food fortification projects in

other countries. This resulted in GAIN funding a two-year project in Tajikistan and Kyrgyzstan to explore the feasibility of small mill fortification in the region. Unicef managed this project but the CPO offices were an important part of the project's team. The project located a Chinese feeder (TraceAdd) costing only $200 that appears to work satisfactorily on these small mills. The results of this project will be reported separately, but they appear to have been fairly successful.

IV. LAWS AND REGULATIONS

A. Enabling regulations

157. Under the Soviet Union most aspects of flour and bread production were under centralized government control. Flour had to meet strict quality and hygienic standards. There were many well-established operating procedures and specifications for equipment, facilities and ingredients. With the break-up of the Soviet Union many of these technical standards and procedures were adopted by the Republics or simply continued as the way things should be done. There may have been major changes in other aspects of life, but people wanted the same flour and bread products they were always familiar with.

158. This made changing regulations to allow fortification of flour and bread, much less making it mandatory, a slow and difficult process. Unfortunately, the Project had no luck in finding a legal expert that could effectively advise on how best to do this. It had to rely on the CPOs and the Regional Coordinator with occasional help from KAN and Unicef to accomplish this critical task. While they performed admirably considering this area was not one in which they had much prior expertise, delays in enacting the enabling regulations slowed the progress of flour fortification.

159. The first task was to obtain the necessary regulations that allowed fortification equipment and premix to be brought into the country, preferably with reduced or eliminated tariffs and taxes. The Appendix provides a reference when and how the different legal requirements were achieved. This includes regulations that allowed fortified flour and bread to be produced and sold, adoption of the technical requirements for KAP-1 premix with exception from VAT if imported, and adoption of the fortified wheat flour and bread standards.

B. Mandatory fortification

160. While there is general agreement that real public health benefits can only be achieved through mandatory fortification, countries differ in how quickly or easily this can be established. Some country projects have started right away with a mandatory program (e.g. Indonesia, Ghana), but this was not possible in Central Asia. An initial voluntary period appeared to be necessary to get the milling industry and consuming public first to be familiar with fortification of a food staple and then to accept it.

161. All of the countries in the JFPR programs started with voluntary flour fortification and worked toward making it mandatory. However, none of the countries were able to achieve mandatory fortification within the time frame of the JFPR projects, although all of them are still working on it and believe they are very close.[12]

[12] The Kyrgyz Republic passed a law with on mandatory flour fortification in July 2008.

162. A lot of preparatory advocacy work is needed to achieve mandatory flour fortification. It requires continuous support from legislative, government and industrial circles. There are many different groups that need to be persuaded. Opposition from just one organization or influential individual could cause setbacks and cripple months or years of work.

163. An example of this was Kazakhstan, which passed mandatory legislation in October of 2004 but had it rescinded in 2007, primarily over trade issues and resistance from some millers. A major flaw of the 2004 Kazakhstan flour fortification law was that it occurred without strong involvement or support of the milling industry. It was the National Fortification Alliance, and in particular the Kazakhstan Academy of Nutrition as a key member of the Alliance, who used their influence to get the law passed. One motivation in pushing for rapid passage of the law was the hope of winning a GAIN grant. When this was subsequently declined for the second time some of the industry and government support for a mandatory law was lost. There was also strong opposition from the Minister of Trade and Industry.

C. Imports, Exports and Free Trade issues

164. Flour trade in Central Asia is characterized by Kazakhstan[13] exporting large amounts of flour to Kyrgyzstan, Tajikistan, Uzbekistan, Mongolia, Turkmenistan and Afghanistan. Uzbekistan then exports lower grade flour to Tajikistan and Afghanistan. Mongolia also receives flour from China and some from Russia. For some countries like Mongolia flour imports account for nearly half of the flour consumed. None of this flour is fortified.

165. It is imperative that flour imports be fortified if the program is to achieve its public health objectives. In order for countries to require fortification of imported flour they first need a mandatory law. Under WTO requirements you cannot require something for importers that is not required within the country itself. Any mandatory law should then have a provision extending fortification to imported flour[14].

166. Enforcement can be difficult since there are a number of flour traders, some operating outside of approved government channels. They tend to want the cheapest price for the flour and are reluctant to specify that it be fortified. Traders get the message very quickly were some of their flour to be rejected, seized, or even held up on the border, as occurred in Indonesia.

167. Free trade issues under the WTO were given as a reason for Kazakhstan rescinding a mandatory law. Actually, there is nothing in WTO requirements that in any way prevents having a mandatory fortification law. There are 37 countries around the world that have such laws where restraint of trade or WTO violations have never been a problem or even suggested.

V. MONITORING

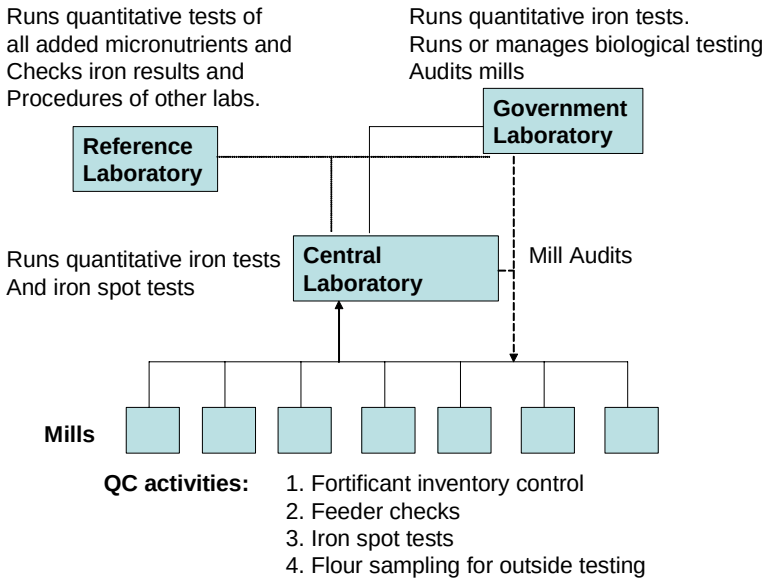
168. Monitoring is an important activity in any mass food fortification program. Two regional workshops were held on monitoring: the first in Tashkent in 2002 that was mainly on mill QC and quality assurance (QA) and one in Almaty in 2004, which covered broader aspects of compliance and effectiveness monitoring. In addition, there were a number of country workshops and training sessions on QC testing methods.

[13] Kazakhstan has since become the largest flour exporter in the world.
[14] This is the case for the new Kyrgyz Republic regulation.

169. There are different types of monitoring ranging from the procedures and testing done at the mill to make sure their flour products are properly fortified, to that done by government inspectors and laboratories to assure compliance to regulations, to that done to access the amount of fortified flour being produced and available to the public, to that done to access the effect the program is having on nutritional health. All of these are different in terms of what, how, when and how often they are performed. But they all involve some form of testing, evaluation of the test results and acting on those results.

170. There are different laboratories used in monitoring fortification, as shown by the following diagram. In this scheme KAN would be the reference lab and could do biological testing used in efficacy and effectiveness studies. The central lab would likely be under the milling association or connected with a major milling group as in Uzbekistan. Labs at the premix suppliers could also provide analytical services as AIC did during the project.

Figure 4: Internal and external Monitoring of Flour Fortification



A. Mill Quality Assurance and Control (Internal Monitoring)

171. The QA activity here refers to procedures set up at a mill to assure proper fortification. This includes checking and adjusting a feeder's addition rate, inventory control of premix, and sampling. QC refers to the actual testing of fortified product, which for flour is by the iron spot test and by occasional outside quantitative tests for iron and niacin.

1. Premix Inventory Control

172. Unlike the system used during Soviet times of supplying the individual vitamins and having them mixed at the mill, a complete premix (KAP#1) was supplied containing all the micronutrients in the correct proportions. Each mill is then expected to verify this by checking the label, lot numbers and Certificate of Analysis (CoA) for the lot numbers of product received to confirm it is the correct product with the correct levels of micronutrients. This information

along with the premix inventory is to be recorded and available to inspection. Some mills did a good job of this but a few kept very poor records.

173. One of the best and easiest ways to determine the extent to which flour is being fortified is from the disappearance of premix matched against the amount of fortified flour produced. In Kazakhstan this record keeping was reportedly done by the LGBK. Having a milling association arrange for supply of premix and check up on its usage is a good arrangement, but it appears from some of the mills visited that the responsibility for this record keeping was largely turned over to the LGBK and not kept in the mill. This could be seen as a residue of the centralized mill control used in Soviet times.

a. Feeder Check Weights

174. Feeders should be checked daily to confirm that they are adding the correct rate of premix. Also, the rate of premix addition should be set to correspond with the rate of flour flow, particularly if that rate is known to have changed. Records should be kept of all checks and calibration changes. Again, some mills did a good job of this while others did not.

2. Iron Spot Test

175. This simple, semi-qualitative procedure is used throughout the world as a way for checking whether a flour sample has roughly the right amount of added iron. That, in turn, denotes whether flour is being properly fortified with all the added micronutrients. There was a lot of training done to show mill personnel how to run and read this test. Mongolia did a particularly good job of training. They even developed a special technique using a paper square to make a receptive surface of flour on which to apply the reagents.

Figure 5. Training Class on Running Iron Spot Test for Mill QC Technicians in Mongolia

176. Many of the mills became very adroit at running the iron spot test. They were happy to demonstrate the test to visitors showing proof that the flour they were making was indeed fortified. There were some misconceptions about the test, however. One was that it could be made quantitative to the extent that results were reported in ppm iron. Another was that the feed rate could be adjusted on the basis of the results. At best this test can show if flour has been fortified and whether the fortification is very low, very high or in the ballpark.

177. There were problems with the iron spot test reagents. Some countries believed they were dangerous requiring a special room or secure storage in order to keep them. If no such facility was available, which was often the case, they did not run the test. Some maintained that special permits were needed in order to have them. This was unexpected since it is not a problem encountered in other parts of the world.

178. Attempts were made to devise modified tests with other reagents that would be more acceptable. The 2 N hydrochloric acid was replaced with a mixture of ethanol and a weak acid. The KSCN reagent could be replaced with a food grade NaSCN. But none of these modifications were accepted as ways to preclude the requirement for permits and a separate testing/storage facility.

3. Quantitative Testing

179. As mentioned, two spectrophotometers were supplied each country for use in quantitative testing of iron and niacin in flour. One was for use at a government lab and the other for use at a centralized milling lab. The analytical methods came from KAN. There was early criticism that while the instrument could be connected to a computer, no PC or software was provided for doing that. One country did not run tests for that reason. Another declined receiving the equipment and another did not bother to set it up. Only Uzbekistan routinely ran quantitative iron and niacin.

180. The American Ingredients Company (AIC) and KAN provided limited quantitative testing of flour samples. Both labs could run all the micronutrients added by KAP#1. AIC provided special flour sample bags along with instructions on sampling. With fortified flour samples it was recommended that only composite samples be submitted. Some unfortified samples were also tested in order to get better baseline data. AIC was well equipped and experience in testing micronutrients in flour samples, running some 5000 samples a year. It was understood in their contract that they would provide this service to all the mills in the Project at no charge. The problem was in the collection, documentation and transport of the samples to their lab in Kansas City in the U. S. Some samples took months to get there.

181. The KAN laboratory was provided high performance liquid chromatograph (HPLC), atomic absorption spectrophotometer (AA) and other high-tech equipment for running quantitative tests of micronutrients in flour, premix, bread and blood serum. The chemist at KAN was sent to Tuffs University in Boston to learn how to test blood serum samples and to Kansas City to learn how to test premix and flour samples at the AIC lab. He became very proficient in this but left KAN for another position. He did train replacements and stayed available to assist in case they had problems. The setting up of KAN to provide analytical services in support of regional fortification should be viewed as a fine technical success. But KAN is a commercial operation, who charge for their services, so some countries, particularly Uzbekistan, would have liked to set up their own laboratory rather than depend on one in another country.

182. Unicef in the Kyrgyz Republic had a project to collect different types of flour samples from different regions in the country. These were sent to KAN for testing, who charged them for the testing service. To save on the expense, the samples were blended together prior to submission, which would not be recommended with these types of samples. Many of the results did not make sense in light of normally accepted micronutrient content for wheat flour, so the study was of questionable use.

B. Food Control (external monitoring)

183. The Project agreement required some level of external monitoring. This was handled differently in each country with KAN providing some product testing for all the countries. Kazakhstan and Mongolia designed and adopted the procedures for monitoring of production, import and sale of the fortified wheat flour. Kyrgyz Republic, Tajikistan and Uzbekistan worked off existing sanitary regulations and norms. In general these procedures included control on:

(i) Compliance of the fortificants (and/or premix) to the existing standards;
(ii) Adequacy of the flour fortification method;
(iii) Vitamin and minerals' content in final product;
(iv) Compliance of the packaging and labeling to the existing standards.

184. For external monitoring Uzbekistan used the central Uzdonmakhsulot Milling group in Uzbekistan (UDM) and Sanitary and Epidemiological Service (SES) laboratories, Kazakhstan used the LGBK and SES. Kyrgyz Republic relied on the Independent Bread Inspection Laboratory, Mongolia on Special Governmental Inspection and Tajikistan on Urunboy Isakov.

185. In Uzbekistan the SES was supplied an HPLC and AA under the GAIN project. They were to partly use these instruments to generate fee income in order to pay for the acquisition of consumables for vitamin and mineral analysis of flour.

186. Quantitative tests by KAN, AIC and SES in Uzbekistan showed erratic results of mineral levels in fortified flour samples. In some sample sets most of the flours failed to meet the minimum standard for iron and zinc, indicating they were either not fortified or under fortified. But some sample sets meet the minimum standards. These tests were done early in the program. The accuracy of both the mill dosing and quantitative testing should improve with experience.

C. Evaluating Coverage and Impact

187. Does flour fortification work? That is, does it really improve the nutritional health of the people? Following are the different ways to access impact. The first two determine the amount of the different micronutrients added to the average diet and are a measure of the extent of coverage of the program. The next two measure the effect the program has on nutritional well-being.

1. Disappearance of Premix

188. The amount of premix used on an annual basis is the simplest way to determine the amount of micronutrients added to a country’s diet. If a country with a population of 10 million , for example, establishes that in the future they will use 100 MT of KAP#1 per year, that would mean they are adding 0.02 x 100,000kg or 2000 kg of riboflavin to the diet each year. (See Appendix for level of each micronutrient in the premix). That works out to providing 0.20 mg of

riboflavin per person per day or 17% of the EAR. This only works when the supply of premix in the country is known, which should be the case for the countries in the Project for the foreseeable future. The estimate of the amount of micronutrients put into the food supply made by this method has the advantage of being independent of the addition rate used for the premix or the amount of fortified flour produced. However, it does allow the amount of FF produced to be estimated from the addition rate (taken at 120 g/MT), as shown in the table.

189. Uzbekistan and Mongolia ran out of their original supply of premix and had to order more. The other three countries in Central Asia did not run out until the end of 2007. Using these approximate time periods the following micronutrient contributions can be calculated from the amount of premix supplied. These are estimates since it was not known precisely when the premix supply ran out.

Table 13: Fortified Flour Production Estimated from KAP #1 Disappearance

Country	**Years to use up ADB supplied premix**	**Calculated amount of FF produced/year** *(1000 MT)*	**Average amount of FF provided in time period** *(g/person/day)*
Kazakhstan	5.5	144	26
Kyrgyz Republic	5.0	25	13
Mongolia	3.5	19	24
Tajikistan	5.0	37	16
Uzbekistan	2.5	297	31

2. Production of Fortified Flour

190. Another method to determine coverage is based on estimates of annual fortified flour production. The following table shows the Project estimates of the average amount of fortified flour produced over a three-year period from 2002 to 2005. Such estimates could be developed from premix disappearance, in which case it would give data similar to the first method, or they could come from mill production reports. One problem with using mill reports is the tendency to under-report flour production for tax reasons. This would result in lower estimates of coverage and impact. Flour production data from State run mills would be much more reliable, as is the case in Uzbekistan.

191. Both methods indicate that the goal of fortifying 33% of the flour consumption was not achieved and show small average per capita intakes of the added micronutrients, which would not be expected to have much of an overall public health impact. However, some people, particularly in urban areas, would consume significantly more fortified flour than the country average and would be more likely to show a benefit, while some people, particularly in rural areas, would have consumed little or no FF and get no impact. Country averages can be very misleading when a true national program has yet to be achieved.

Table 14: Per capita Amounts of Fortified Flour Produced (Grams/Person/Day)

Country	2003-2005 (Average)	2006	2007 (Estimated)
Kazakhstan	17	37	18
Kyrgyz Republic	11	7	12
Mongolia	19	53	83
Tajikistan	25	35	5
Uzbekistan	33	43	65

Table 15: Per capita Percent of Iron Requirement (EAR) Provided

Country	2003-2005 (Average)	2006	2007 (Estimated)
Kazakhstan	3	7	3
Kyrgyz Republic	2	1	2
Mongolia	3	10	15
Tajikistan	5	7	1
Uzbekistan	6	8	12

Correcting for elemental iron having 50% bioavailability that of ferrous sulfate.

Table 16: Per capita Percent of Folic Acid Requirement (EAR) Provided

Country	2003-2005 (Average)	2006	2007 (Estimated)
Kazakhstan	6	14	7
Kyrgyz Republic	4	3	4
Mongolia	7	20	31
Tajikistan	9	13	2
Uzbekistan	12	16	25

192. The same calculations can be applied to the flour fortification program in Indonesia, which is considered quite successful since virtually all of the flour there is fortified. Their per capita consumption of fortified flour over this period according to FAO data would be 35 g/day. Their fortification premix would add 0.86 mg of iron and 0.07 mg of folic acid. That represents 8% of the EAR for iron and 22% for folic acid. The contribution of micronutrients to the diet from fortified flour in Indonesia will increase slowly with the gradual rise in consumption of flour, but in the countries in this Project it should increase much more dramatically as the proportion of flour being fortified rises. Mongolia and Uzbekistan are already above Indonesia in the average levels of iron and folic acid supplied by fortified flour.

193. There were a number of reasons for the low production of fortified flour during the Project. These include:

(i) *Low flour production* – Some of the mills that were equipped to fortify had lower than anticipated flour production during this period due largely to their inability to procure wheat at a competitive price. 2003 was a poor wheat growing year for the region resulting in higher prices and low stocks of wheat for milling.

(ii) *High flour imports* – All of the countries except for Kazakhstan rely on imports of flour and none of this was fortified.

(iii) *Omission of small and medium size mills* – Mills with capacities less than 50 MT/day were not fortifying much flour during this time period.

(iv) *Delay in acquiring enabling regulations* – Kazakhstan, for example, could not make fortified flour for bakeries since there was a long delay in getting a regulation allowing fortified bread.

(v) *Flour exports* – The many Kazakhstan mills with a large export business chose to fortify none of their flour since they were not sure which would go into exports where fortification was not needed or requested.

(vi) *Low demand* – Mills did not see much demand for or even interest in fortified flour from consumers, flour traders or bakeries during this period.

3. Current and Projected Flour Fortification

194. It is expected that future years will see a greater proportion of the flour being fortified. How much will depend on whether the country establishes and enforces a mandatory fortification law. But one can ask whether it is even worth having fortification if it stays at the current levels? Any addition of deficit micronutrients into the diet should be considered beneficial. It may not solve or prevent health problems caused by their deficiency, but it will increase intakes helping to "raise the sea level" and make other interventions more effective.

Table 17: Mill Situation in 2006, 2007

	Number of Mills Fortifying Flour	**Flour Fortified in 2006** (1000 MT)	**Estimate of Flour Fortified in 2007** (1000 MT)
Kazakhstan	13	206	101
Kyrgyz Republic	17	13	23
Mongolia	28	50	79
Tajikistan	18	84	11
Uzbekistan	56	414	635

195. With the dramatic increase in the cost of wheat since 2007 the price of flour and bread has increased accordingly. This may cause some families, especially the poor, to buy less flour and bread. This situation is not expected to reverse soon and may lead some to question the added expense of fortification. But that cost remains relatively low and far less than the changes caused by the increase and wide swings in the price of wheat. People are not likely to replace the micronutrients lost by eating less bread, making flour fortification even more crucial as a way of maintaining adequate intakes.

D. Sentinel Study

196. One question is whether the type of flour fortification being applied has a beneficial effect on nutritional health. That is, can the iron being added really improve iron status and reduce IDA? Can folic acid addition really increase serum folate levels and reduce the incidence of neural tube birth defects? The *Sentinel Study* of the Project was designed to help answer those questions.

1. Sentinel Study Design

197. Nevin Scrimshaw, President of the International Nutrition Foundation, developed the original study design. Shamil Tazhibayev, Vice President of KAN, completed the design, supervised the project and prepared the final report. Oksana Dolmatova and Feruza Ospanova (Kazakhstan), Galina Ganiyeva (Azerbaijan), Khotambek Khairov (Tajikistan), Dalkhjav Oyunchimeg (Mongolia), and Dilorom Suleimanova (Uzbekistan) were responsible for the field studies in their individual countries.

198. The study was limited to 40 households and 120 individuals (80 children of 2 to 15 years and 40 women) in each country. This small, controlled type of effectiveness study makes sense before investing in more costly and difficult national impact surveys.

199. The study first obtained in each country of the Project baseline data on blood hemoglobin (Hb), iron (serum ferritin), folic acid (serum folate), and iodine status of selected groups of families where the population was expected to have access to fortified wheat flour within 12 months of the initial survey, and in which improvement in flour distribution was expected. The same selected groups of families were retested 12 and 24 months after beginning the fortification programs. The women were interviewed in 2004 and 2007 on their level of awareness and use of fortified flour. The flour they used was tested by the iron spot test to see if it was fortified.

2. Sentinel Study Results

200. The study has been published.[15] Results can be summarized briefly as follows:

(i) Most of the women in the test population were aware of fortified flour and most said they were using it.

(ii) By 2007 the iron spot test showed that the flour used by most households (83 - 100%) in all countries was fortified.

(iii) Baseline data showed high initial rates of anemia in children and women and similar by country to WHO data shown in Table 1.

(iv) Overall anemia rates dropped from 42% to 34% in women and from 35% to 22% children.

(v) Ferritin levels increased in both children and women showing improvement in iron status. The overall incident of low ferritin levels in women dropped from 42% to 24%.

(vi) Serum folate levels increased in both women and children. The overall level of severe folic acid deficiency dropped from 39% to 2% in children and from 13% to 2% in women.

201. This study substantiates that consumption of flour fortified with KAP premix can improve iron and folic acid status in women and children. As with all studies of this limited type, it will be criticized that the sample size is too small, the consumption of fortified flour and micronutrients is uncertain, and there is insufficient data to perform statistical analyses. It is, however, one of the better and more positive studies done to support a newly instituted fortification program.

[15] Tazhibayev, S. et. al. Evaluation of the potential effectiveness of wheat flour and salt fortification programs in five Central Asian countries and Mongolia, 2002-2007, Food Nutrition Bulletin 2008.

VI. CONTINUATION AND SUSTAINABILITY

1. GAIN Grants

202. During the Project all of the countries except for Mongolia applied for grants from GAIN on flour fortification. Kazakhstan[16] applied twice. Applying for a GAIN grant is a very complex process that requires setting up a National Fortification Alliance (NFA) of government, industry and health authorities. It involves training in Geneva and filling out a highly detailed application form. Uzbekistan was the only country that was successful in obtaining a grant. Since flour fortification activities would be covered by their $3 million GAIN grant, only the salt iodization activities were funded by the second JFPR project.

203. It is never reported why countries are chosen to receive GAIN grants. Uzbekistan may have been awarded for their better success in fortifying flour during the first JFPR 9005 project and their positive projections for expanding and funding fortification, which they proposed to do by a revolving fund.

2. Milling Associations and Premix Suppliers

204. In many countries or regions of the world where flour fortification has flourished much of the initial and continuing support comes from milling associations and premix companies. Premix companies have an obvious interest in seeing that fortification is maintained and expanded. They routinely call on mills and often help on technical problems regarding the premix, feeders and QC procedures. They sometimes hold local workshops or seminars on fortifying flour and improving its quality. They check on premix inventory and usage. Having some technically astute, competing premix suppliers in the region is a definite plus for any fortification program.

205. Compared to other regions of the world, the milling associations in Central Asia, where they existed, were relatively weak and fragmented. They represent only a portion of the milling industry and provided few services or programs.

206. A strong milling association can help promote and sustain flour fortification, as happened in South America. Fortification can provide the seed to getting a stronger, more active millers association, which in turn can help provide education, premix, fortification equipment and other services needed to promote and sustain flour fortification.

207. It was recognized that a more active millers association was needed in Central Asia. To this end the Project tried to involve all the existing milling groups and country milling consultants in the Project and encouraged formation of a regional milling association with stronger ties to the international milling community. Representatives from KAN, LGBK and regional mills attended annual International Association of Operative Millers (IAOM) Middle East Section meetings starting in 2004 with travel subsidized by ADB, GAIN, Unicef and AKZO Nobel. This gave them fellowship with other millers in the world who fortified flour along with the opportunity to meet global premix and equipment suppliers. This lead to formation of a Central Asian IAOM Section, who held their first meeting in Almaty in 2007. Support from the IAOM, FFI, LGBK and Unicef were influential in making this happen.

[16] Kazakhstan received a GAIN grant in 2009 in support of activities to increase consumer awareness and demand for fortified flour, develop a rigorous monitoring and evaluation system for fortification and train millers to improve internal quality control of fortification.

208. In order to get more premix and equipment suppliers actively engaged in Central Asia, the Project invited global companies to attend various seminars starting in 2004. They could show their products at "table-top" exhibits and were asked to give presentations. This helped overcome that fact that the market for additional premix and feeders in this part of the world was difficult and limited due to the Project having already supplied a large number of feeders with only Uzbekistan and Mongolia needing to purchase additional premix prior to 2008. Still, there were about 5 global premix companies who attended the meetings.

3. Future Premix Procurement

209. In countries with established flour fortification programs most mills buy directly from premix companies, but procurement of premix and additional equipment is recognized as a problem in developing countries starting new programs. These problems include:

(i) Inability of individual mills to buy in sufficient quantity to enjoy lower premix prices.

(ii) Limits in the amount that can be ordered or stored due to acceptable shelf life restrictions.

(iii) Difficult transportation and high shipment cost.

(iv) Complex country approval and registration requirements.

(v) Difficulties in using local currencies and financing purchases.

(vi) Uncertainty of technical specifications.

(vii) Limited contact with reputable, suitable suppliers.

(viii) Dealing with post delivery problems, such as damaged containers, incorrect product or poor feeding properties.

(ix) Difficulty in maintaining a steady, uninterrupted supply of premix so that mills do not run out and stop fortifying.

(x) Lack of knowledge on how best to write tenders and award contracts.

210. The ADB Project countries expressed a desire to attain more purchasing clout and know-how though some form of centralized procurement, either through a millers association, such as the LGBK, or through a local supplier. This could even be one of the larger mills that would purchase in quantity and then resell the premix to the smaller mills.

211. Uzbekistan set up a revolving fund under the UDM. It collects 0.5% of all flour sales proceeds from UDM mills placing them into a special account for premix purchases. There were problems and delays in the early premix tenders and in getting all the mills, including the private ones, to make prompt payments, but the fund appears to be working. Revolving funds for premix purchase has also been proposed for the other countries in the Project, but it is not settled who would manage and oversee it. It requires a clear set of rules and procedures, which have not yet been worked out.

212. Some progress was made in premix being made locally. The JSC Technopark Company in Kazakhstan presented the layout of a proposed premix production site at the 2005 Almaty forum. They have received approval for pilot scale production samples of KAP #1 from KAN. High transport costs of premix into Central Asia should give local production a cost advantage in

shipping. It may require expansion of flour fortification in the region before actual premix production becomes a viable business.

213. Some of the experiences in the Project and elsewhere led to the writing of *Premix Best Practices* for the FFI. This provides recommendations for both premix suppliers and purchasers on premix procurement. Premix companies have been asked to endorse this document and agree to abide by it. Most have. This should help prevent some of the potential problems in future procurement.

A. Project Evaluation and Lessons Learned

214. The JFPR food fortification Project was exceptional in a number of ways. It was the first truly regional project to establish a mass fortification program. It was only the second attempt (after Turkmenistan) to establish a flour fortification program in the Former Soviet Union or on the Asian continent. Its scale—in terms of number of flour mills and amount of flour to be fortified—was larger than any previous project.

215. The Project had to break new ground in many ways. Flour fortification in the Project countries basically started from scratch, as there was little or no prior experience. There were few examples to follow from other developing countries. South Africa and Indonesia were the closest. Some lessons were taken from their experience, but there were many key differences, such as their regulatory system, types of flour products and makeup of the milling industry. It was comforting to know that flour fortification was well established technically and proven to be an effective public health program in the Americas, but their situation was different as well.

216. Since this Project began, other organizations (primarily GAIN) have started flour fortification projects in a number of other countries. The FFI, a consortium of organizations working in the area, has a very ambitious goal of seeing 70% of all large-scale roller mill flour fortified by 2008. This would require adoption of flour fortification by most of the major countries in the world. Many new country projects will be needed in order to reach this goal. These other projects have run into many of the same difficulties as the JFPR Project. A major obstacle for most of them is getting the government to enact and enforce a mandatory flour fortification law.

1. Regional Projects

217. Regional mass food fortification programs make a lot of sense. There is strong recent interest in nurturing or creating them. This includes countries in the Pacific, Central America, Caribbean, Southern Africa and East Africa. One of the main objectives in a regional program is to produce a common set of flour fortification standards. This greatly simplifies flour trade within the region and enhances import of fortified flour. It also allows for standard premix formulations, which reduces their cost and simplifies procurement.

218. Getting countries to agree on the flour fortification standards and work together on achieving them is not easy. The JFPR 2005 project was very ambitious in trying to include countries ranging from Azerbaijan to Mongolia. Their nutritional needs, types of government, economic situation and milling industries are different, but close enough to make a regional project possible. Mongolia wanted inclusion of vitamin D in the premix, which was not believed to be needed in the other countries, so it was not included. It was suggested instead that Mongolia consider other appropriate food vehicles for vitamin D, such as milk. Turkmenistan would have been logical to include, but they declined because they had an existing program and wanted to continue it on their own.

219. Azerbaijan was not included in the second JFPR 9052 because its track record in project implementation was weak compared with other participating countries; their Government did not demonstrate commitment to the Project objectives; and the grant size for JFPR 9052 was reduced from the requested $3 million to $2 million, which made it essential to prioritize geographical coverage. In other words, someone unfortunately had to be dropped out of the second project and Azerbaijan lost. Actually, some of the larger mills in Azerbaijan were progressing quite nicely with flour fortification. It is hoped they continue to do it on a voluntary basis, but the country did not seem to be moving toward a mandatory program that was a key objective of the JFPR 9052 project.

220. There are limits to how much the different countries in a regional project will cooperate. While the countries in the Project agreed to a single fortification premix and fortified flour standard they did not work towards a single set of mandatory regulations or food control measures. One difficulty was the lack of relevant examples of mandatory fortification regulations or laws in other countries that could serve as a template for one in Central Asia. Each country in the Project devised its own text. There was little attempt to try to harmonize these regulations or to learn from each how best to phrase them.

2. Project Management

221. The presence of a strong, centralized RCAO in Almaty and a good working relationship with ADB greatly contributed to project implementation. Regular communication and follow up by the RCAO with each country CPO helped them deal with ADB's administration procedures and requirements. There were a couple changes in the CPOs during the Project but the overall management remained stable. Other projects have suffered from high turnover in key personnel, which can be disruptive and damaging to the project’s focus.

222. At an early stage of the Project, ADB made a conscious decision to limit international consultants' inputs to technical issues and give maximum responsibility to the country teams. This caused some implementation delays and cost staff time at the beginning, but contributed to build a sense of ownership and capacity within the country teams.

3. Monitoring

223. Much was learned about the different aspects of monitoring during the Project. Lessons learned were used to better organize internal and external QA/QC relationships and help prepare training materials for use in subsequent projects in other countries.

224. One problem with monitoring is to create an adequate but reasonable control system. Some control is obviously needed to insure that flour is being properly fortified, but the control measures need not be excessively complex, costly or burdensome to be effective. The internal mill control methods that were taught are used throughout the world. They require very little additional labor or equipment. They appear to have been adopted fairly readily by most milling companies.

225. External or government control procedures were perhaps poorly devised during the Project and will need improvement if fortification is to become mandatory and widespread, particularly once the CPO is no longer around to keep an eye on the situation. More detailed procedures for mill audits, both on-site and off site, have been better worked out since the Project started, along with recommendations for systems to evaluate mill performance and deal with non-compliance.

226. It is not clear how much influence KAN will have on fortification control outside of Kazakhstan but they should continue to serve as a reference laboratory after the Project concludes. Milling associations can play an important role, as the LGBK already does in Kazakhstan. Millers who do fortify want to see other millers, their competitors, also fortify, so there is motivation to have a self-policing system. But, ultimately the government must play a roll in dealing with cases of deliberate non-compliance or fraud.

4. Achieving Mandatory Status

227. It is generally believed by those working in the field that the factor with the greatest influence on continuation is whether fortification has been made mandatory by law or regulation, and, if so, whether the government adequately enforces it. This was not universally thought to be the case when the project started. Many felt that voluntary fortification would work if the fortified product was adequately promoted, but experience in this was disappointing, not to say very expensive, where it was tried.

228. The JFPR Project concluded before fortification became mandatory in any of the Project countries. The groundwork for it has been laid but it may not happen in every countries. In that case, continuation depends on the milling industry doing it voluntary. Voluntary continuation would be unlikely in Tajikistan and the Kyrgyz Republic once external financial and promotional support is stopped. Mills in those two countries are reluctant to pay for the premix. They do not bother to advertise their products so they would not be expected to promote fortification on their own. Fortunately, mandatory regulations have been passed in both countries. If adequately enforced flour fortification should continue there and expand.

229. The larger mills in Mongolia, on the other hand, have shown a positive attitude toward fortification, and they very well may continue on their own. It is hoped this may also be the case in Azerbaijan. Because of strong state control over the milling industry, Uzbekistan has shown the greatest success in the amount of flour being fortified, and this is projected to expand. It is the only country where a mandatory law may not even be necessary to get good coverage.

230. Turkmenistan, while not part of the project, has been somewhat influenced by it. The late President signed a degree to expand the number of mills fortifying flour and the types of flour to be fortified.

231. Achieving mandatory status needed to become a key component of the Project from the start. It did become a major goal in the second JFPR 9052 Project but more effort, planning and resources could have been devoted to it. The Project may have underestimated the importance and difficulty of achieving this, particularly in the FSU counties.

232. Ministry of Health officials should be the first to support fortification programs, because without their active support and leadership such programs would likely never happen. But other government agencies - such as those governing agriculture, industry and trade - are far less supportive and sometimes outright hostile to such a program. Production of wheat and flour are major industries in Kazakhstan. Officials there are reluctant to change anything that might in anyway jeopardize those industries. This is less so in the other countries in the Project where the supply and price of flour and bread are the main concerns. There is a whole range of officials and interests that must be convinced in order to achieve a mandatory regulation. Officials constantly change so this should be considered a continuing process.

233. The GAIN flour fortification projects for the most part secure the commitment for a mandatory program from the government before funding starts. This has not always worked out as planned, as evidenced in China and Zambia, where the government became reluctance to proceed once the GAIN project was awarded.

5. Lessons Learned

a. Millers do not all agree on mandatory fortification and some may work to block it.

234. When the owners and top managers of flour mills are presented with the public health arguments for flour fortification including the low cost to the mill and high benefits to flour consumers, they generally respond by saying that this is something we can do voluntarily, or they say, yes this is the right thing to do, so let's have a law requiring everyone to do it. But as with any large group there are differing opinions and the more negative ones may not be voiced until a law is actually passed or close to being passed. The negative response to the Kazakhstan law suggests that the public health argument had not been adequately made to enough millers or they simply did not buy it. They do not all see it as their civic responsibility to improve public health. A similar occurrence happened in South Africa where the millers lobbied against a mandatory program before eventually accepting it as inevitable.

b. It really helps to have a government controlled milling industry.

235. The more rapid adoption of flour fortification in Uzbekistan and Turkmenistan is largely due to the government strongly supporting the program and having control over the milling industry in those two countries. The situation is more difficult in a free-market system such as that in Kazakhstan or in countries where the government is unable to exert much control at all.

c. Voluntary fortification does not help much in selling food staples.

236. Few millers see fortified flour as a marketing opportunity. One mill and pasta producer in Almaty spent $240,000 for two months of TV spots featuring his brand of iron-fortified pasta. They saw no response in the market to this campaign and stopped fortifying. In other countries, a Turkish baking company spends a couple million dollars promoting fortified bread that failed in the marketplace. Mills in China have tried a variety of voluntary fortification projects with very little consumer response. One criticism of the Project was that it should have done more to increase national consumer awareness and demand. But the limited budget for the Project did not allow this to be done to the degree required to produce meaningful results.

d. Mills want to see orders specifying fortified flour before they fortify.

237. Central Asian mills have no problems fortifying flour for WFP and the Red Cross because it is specified to be fortified. Bakeries, flour traders and exporters did not require fortification in their purchase orders. One Kazakh mill manager visited county and city officials to get them to specify fortified flour for their tenders for schools, hospitals, prisons, etc. The local officials said they could not specify fortified flour, since they had not received standards from the MoH.

238. Up to a third of the flour used in Uzbekistan is imported from Kazakhstan. This was all unfortified flour during the course of the Project. When mixed with local fortified flour it dilutes the level of fortification in the final product. Uzbekistan could have required that imported flour

be fortified under their GAIN project. This would have not only increased the health impact in Uzbekistan, but would have also encouraged Kazakhstan millers to fortify and make use of the Project supplied premix. Unfortunately, this was not done but may be in the future.

e. Millers need to be actively engaged.

239. This is generally understood, but its implementation is often lacking. The people who run most programs have mainly NGO, health or government backgrounds with little experience and some mistrust of the private commercial sector. They typically rely on an intermediate to deal with industry, but that organization or individual may have conflicting points of view or limited influence.

240. The Project relied heavily on the League of Grain Processors and Bakers of Kazakhstan (LPBK) to get millers support of flour fortification. Unfortunately, they were often lukewarm about it and sometimes even negative. Further, they represented only the largest segment of the industry, with some 15 milling enterprises as members out of 1000+ mills in the country, and apparently made little early effort to talk to the dozens or even hundreds of Kazakhstan mills large enough to eventually fortify. This situation has improved some with the formation of a more active Central Asian Milling Association under the IAOM, which is fully committed to fortification. The milling association in Mongolia appeared to have done a more consistent job in promoting fortification and dealing with the mills, which were far fewer in number.

241. Some thought that the Project staff should have worked closer with the millers, not only the mills that received premix but also the smaller ones who could possibly fortify flour. This was more of a problem in Kazakhstan than the other countries where the Project did reach out to the smaller mills in order to get the targeted amounts of flour fortified. One suggestion was to have more meetings with millers and have them directly engage with Project partners like Unicef, KAN and government officials. Millers were invited to a number of workshops but many failed to attend due to travel costs, work commitments or simple lack of interest. Some who attended did not feel that the program was much benefit to them. Another suggestion was to have a series of seminars around the country so that more millers could more easily attend. In Kazakhstan there was also the problem of the LPBK wanting to act as the main channel to the millers discouraging direct contact by Project staff or KAN. A lot of attention and group visits were made to a couple large mills near Almaty and Astana whose management supported fortification, while mills that were negative about it or far distant were ignored.

242. Workshops and seminars only about fortification are of limited interest to millers. At a couple Almaty workshops the attempt was made to bring in speakers that could talk on other subjects of interest to millers and bakers, such as new milling and lab testing equipment, rather than subject them to only nutrition, health and fortification issues. The best attendance by millers occurred at the final meeting held in conjunction with an IAOM meeting.

f. The amount of “fortifiable” flour needs to be realistically assessed.

243. All projects need to establish the amount of flour to be fortified. This helps determine the levels of micronutrients to add, the amount of premix and equipment to supply, and the potential health benefit. There are big differences in the amount of flour consumed, the amount actually being produced in the country and the amount of that production that could realistically be fortified. You cannot fortify when the mills are not producing flour due to a shortage of wheat or other causes. Getting imported flour fortified is necessary, but very difficult to accomplish and

enforce. This task is complicated in a regional project where consumption, imports and production varies by country, as was the case in Central Asia.

g. Some important data is needed at startup.

244. Information that should ideally be obtained or available at the start of a project includes consumption levels of fortifiable flour, data on the types of flour to be fortified including their relative production levels and nutritional composition, the makeup of the flour milling industry by size and location, flour import and export data, the types of baked products made from flour and the baseline incidence of nutritional deficiencies or nutritionally caused conditions [e.g. neural tube birth defects (NTBDs)). Not obtaining this information or delaying too long to collect it can lead to problems later on. GAIN requires some of this data in the project application. Unfortunately, budgetary constrains can limit how much of the data actually gets collected and the lack of some baseline data should not prevent going ahead with fortification.

B. Determining project success

245. There are different ways to measure success of such a project. As the project is progressing these include such things as the number of mills that have been set up to fortify flour, the amount of premix purchased, the number of workshops conducted, the number of regulations and standards instigated, the number of QC tests run, the number of people trained, the amount of promotional material produced and the number of people that have heard about and have a positive opinion of fortified flour and bread. However, in the end there are three critical indices of success:

(i) The amount of flour actually being fortified and the resultant increase in dietary intakes of the added micronutrients.

(ii) The degree to which fortification will continue on its own after project support concludes.

(iii) The improvement in public health due to fortification.

246. Judging by the first criteria, none of the countries were able to fortify as much flour as hoped. But it can be said that the practice of flour fortification has now been firmly established in the region, and that, while the amount of fortified flour being produced is low in comparison to the total flour consumption, it still can make a valuable nutritional contribution to those people whom do consume it.

247. The second criteria of success is the assessment of whether fortification has been established by law or practice to a strong enough degree that it will continue long after outside funding and support for it has terminated. This is difficult to know precisely since it involves predicting the future. There are events, such as war, change in governments and natural disasters that can alter the situation. Because these are developing countries, some quite poor, they have a tendency to expect the government or international donors to continue to pay for public health programs such as this. Kazakhstan and Uzbekistan, however, have sufficient resources to continue fortification without further assistance.

248. The third criterion is the effect on public health. The controlled sentinel studies indicated a positive effect for both iron and folic acid for people actually consuming fortified flours. The extent of flour fortification would need to be greatly expanded in order to achieve a measurable effect for the general population. This requires valid baseline data and monitoring the rates of

IDD, IDA and birth defects to see if they have significantly decreased. Assessing the effect on IDA would be the hardest task since this condition is influenced by a number of dietary factors besides iron intakes. Also, it takes years for improvements to occur and become statistically significant. A decrease in neural tube birth defects would likely occur the fastest based on experience in other countries.

249. A final criterion of success for such a project may be the influence it has over other similar endeavors. There are a number of countries around the world that have started flour fortification or are considering it. Those in the FSU and Eastern Europe have many of the same situations, problems and constraints that were faced by the JFPR projects. Hopefully, they all can learn from the flour fortification experience in Central Asia.

APPENDICES

A. Chronology of Major Events in Project

2001

Date	Events
March-April	ADB missions to Central Asian countries to discuss project implementation, define country-specific project framework and identify Project stakeholders at national level.
May	ILSI iron fortification in Atlanta, GA, USA where Professor Sharmanov of KAN reported on nutrition situation in Central Asia and discussed Project with consultants.
July	ADB, UNICEF and Kazakh Academy of Nutrition adopt the joint activities plan on CIP preparation by Country Teams.
	JFPR 9005 Regional Coordination and Administration Office (RCAO) established in Almaty.
	Creation of TV film about prevalence of IDD disorders in the high-risk Central Asian areas with assistance of Patricia Light (UNICEF) and Gary Gleason (ADB Consultant).
September	UNICEF CARK, KAN, ADB and RCAO conduct Situational Analysis workshops on salt iodization and wheat flour fortification with participation of Central Asia Country Teams.
	The Governments of Kyrgyz Republic, Mongolia, Tajikistan and Uzbekistan sign Letter of Agreement with ADB on JFPR 9005 Project implementation.
	Steering Committees and Country Project Offices established in Central Asian countries.
October	The Government of Kazakhstan has sign the Letter of Agreement with ADB on JFPR 9005 Project implementation.
	The regional meeting of nutritionists, flour millers and international experts agreed on the formulation of the common premix for Central Asian countries (KAP-1 Premix).
	Forum "Salt Iodization and Flour Fortification: Promoting Nutrition and Human Development for Central Asia and Nearby Countries in Transition" and Roundtable in Almaty.
November	Country Teams design the draft Country Investment Plans and Budgets.
December	Country Teams agree on the Country Investment Plans and Budgets with ADB. Initial disbursements made to Project Imprest Accounts in the countries.
	Governments of Kazakhstan, Kyrgyz Republic, Mongolia, Tajikistan and Uzbekistan have sign Letter of Agreement with ADB on JFPR 2005 Project implementation.

2002

Date	Events
March	Roundtable on Communication Strategy in Bishkek, Kyrgyz Republic.
	Kazakh Academy of Nutrition design Technical Requirements for KAP-1 Premix and fortified wheat flour standards.
	The Government of Kazakhstan adopts the Technical Requirements for KAP-1 Premix and fortified wheat flour standards.
May	The Government of Azerbaijan signs Letter of Agreement with ADB on JFPR 2005 Project implementation.
	The Government of Mongolia adopts the National Standards for KAP-1 Premix and

	fortified wheat flour standards and technical requirements on testing micronutrients contents in KAP-1 Premix and fortified wheat flour.
June	The Government of Kyrgyz Republic adopted the Technical Requirements for KAP-1 Premix and fortified wheat flour standards.
	Third regional workshop on Food Fortification: Regulations/Standards and Quality Assurance/Control held in Tashkent, Uzbekistan.
	Country Teams select beneficiary flour mills and design plans for wheat flour fortification.
July	UNICEF/CDC/ADB workshop on design and implementation of national communication plans held in Astana, Kazakhstan.
	The President of Mongolia adopts the National Program on Iodine Deficiency Disorders Prevention.
	The President of Kyrgyz Republic adopts Decree on strengthening of governmental regulation and control over production, import and trade of salt.
August	The Government of Uzbekistan adopts the Technical Requirements for KAP-1 Premix and fortified wheat flour standards.
	The Government of Mongolia adopts the Technical Requirements for testing iodine content in iodized salt.
September	The Government of Kazakhstan adopts the Technical Requirements for bread and bakery products from fortified wheat flour. The first micro feeders shipped to pilot flour mills in Kazakhstan and Uzbekistan.
October	Regional workshop on Wheat Flour Fortification and Mid-Term Project Review held in Astana, Kazakhstan.
	The Government of Kyrgyz Republic adopts the national standard on iodized salt.
	The Country Teams select the beneficiary salt enterprises and design plans for quality salt iodization and control.
December	The Parliament of Azerbaijan adopts the Law on Iodine Deficiency Prevention.
	The Ministry of Health of Uzbekistan adopts the sanitary regulations and hygienic norms on table salt quality, including the iodine content.

2003

Date	Events
January	The Parliament of Kyrgyz Republic eliminates VAT on drugs and pharmaceuticals, including potassium iodate and KAP Premix components.
	The Government of Tajikistan adopts the Technical Requirements for KAP-1 Premix and fortified wheat flour standards.
March	The Parliament of Kyrgyz Republic adopts zero rate on taxes on fortification equipment.
	Micro feeders installed at beneficiary flour mills in Azerbaijan, Kazakhstan, Kyrgyz Republic, Mongolia and Uzbekistan.
	The Government of Uzbekistan adopts the Technical Requirements for production of baking wheat flour fortified with KAP-1 Premix.
April	Fifth regional Workshop on Policies on Food Fortification, and Monitoring and Evaluation held in Bishkek, Kyrgyz Republic.

	Micro feeders installed at beneficiary flour mills in Tajikistan.
May	Installation of salt iodization and packaging equipment started in Kazakhstan, Kyrgyz Republic, Tajikistan and Uzbekistan.
July	Representatives of Kazakhstan and Uzbekistan Country Project Teams take part in GAIN Program Development Workshop in Geneva, Switzerland. The workshop acquainted Country teams with GAIN concept and format of project proposal.
September	Information seminar on GAIN initiatives in food fortification held by ADB and UNICEF CARK in Almaty, Kazakhstan.
October	The Parliament of Mongolia adopts the law on salt iodization and prevention of iodine deficiency disorders.
	The Parliament of Kazakhstan adopts the law on salt iodization.
	The Ministry of Health of Azerbaijan adopts hygienic certificate on KAP-1 Premix.
	The Government of Kazakhstan adopts national standard on table iodized salt.
December	The Government of Kyrgyz Republic adopts the concept of the national policy in healthy nutrition.
	The Government of Azerbaijan adopts the Technical Requirements on table iodized salt.
	The Parliament of Tajikistan adopts the law on universal salt iodization.

2004

Date	Events
January	The national conference on micronutrient deficiencies in Tajikistan held in Dushanbe.
	The Government of Tajikistan adopts national standards on wheat flour fortified with KAP-1 Premix and production of bread and bakery from fortified wheat flour.
February 2004	Representatives of Kyrgyz and Tajik Country Project Teams take part in GAIN Program Development Workshop in Geneva, Switzerland.
	The Government of Kyrgyz Republic adopts national standards on wheat flour fortified with KAP-1 Premix and production of bread and bakery from fortified wheat flour.
March 2004	The National Committee (Alliance) on Fortification of Food Products established under the President of the Kyrgyz Republic.
	The Government of Tajikistan adopts the national standard on table iodized salt.
April	The Parliament of Kazakhstan amends the article on mandatory wheat flour fortification to the Law on "Food Quality and Safety".
July	Salt Producers of Central Asia conduct First Regional Meeting "Quality salt iodization in Central Asia: challenges and perspectives" in Bishkek, Kyrgyz Republic.
	ADB approves a new $2 million grant for a regional food fortification program to ensure continued progress in the fight against micronutrient deficiencies in Central Asia and Mongolia,
September	The Government of Kazakhstan eliminates taxes on potassium iodate and KAP Premix components and confirms zero rate tax on fortification equipment (adopted in 1996).
	CDC/Emory Univ. workshop on fortification monitoring in Almaty.
	Final conference on the Improving Nutrition for Poor Mothers and Children in Asian countries in transition JFPR 9005 Project held in Almaty, Kazakhstan.

2005

Date	Events
January	National Workshop on Communication Strategy for Mass media and NGOs on Prevention IDD and IDA conducted in Bishkek, Kyrgyz Republic, with the support of ADB.
March	ADB and governments of Kyrgyz Republic, Mongolia, Tajikistan and Uzbekistan sign letters of agreements on participation in the regional project JFPR 9052 'Sustainable Food Fortification' for Central Asia.
	Demonstrations and installation of micro feeders started at small and medium-size flour mills in Kyrgyz Republic.
August	ADB and RCAO conduct information meeting in Bishkek for County Project Coordinators on issues of country communication/social mobilization plans.
November	Second Regional Meeting of Central Asia Salt Producers conducted in Tashkent, Uzbekistan, with the support of ADB, JFPR and UNICEF.
October	The Legislator of Kazakhstan passes a bill making flour fortification mandatory phasing it in over a 3 year period depending on the size of the mill.

2006

Date	Events
February	Regional Meeting of Flour Millers and Bakers of Central Asia and Mongolia conducted in Almaty, Kazakhstan, with the support of ADB, JFPR and UNICEF. Participants discussed the procedures for sustainable procurement of the fortification equipment and premix by flour millers.
September	Regional Mid-Term Review Workshop conducted in Cholpon-Ata, Kyrgyz Republic, with support of ADB, JFPR, KAN and UNICEF. The workshop discussed the achievements and lessons learned during the previous JFPR9052 period, and proposed actions and expected outcomes to achieve the country-specific JFPR objectives.

2007

Date	Events
February	Civil Society Forum "Healthy Food – Healthy Nation" conducted by NGOs with the support of the Government of Tajikistan, ADB, JFPR, and UNICEF. The Forum discussed the issue of abandoning the production and sale of non-iodized salt from the open salt deposits in Khatlon Province.
March	National meeting of the importers of wheat flour and bakery products held in Bishkek, Kyrgyz Republic, to facilitate the import of the fortified wheat flour from Kazakhstan
May	The Law on universal salt iodization adopted in Uzbekistan.
October	Final meeting of JFPR project.
	The flour fortification law in Kazakhstan is rescinded by order of the President.

SPECIFICATIONS AND REQUIREMENTS FOR KAP KOMPLEX FLOUR FORTIFICATION PREMIXES

I. KAP KOMPLEX #1

A. Description and Applications

1. KAP Komplex #1 is a general-purpose premix containing elemental iron powder made by an electrolytic process. Based on guidelines from WHO, the level of iron is twice that used with ferrous sulfate to correct for this iron source having 50% the bioavailability of ferrous sulfate. This premix can be used for fortification of premium grade and 1st grade wheat flour. For premium or supreme grade the recommended addition rate is 150 grams per metric ton of flour. For 1st grade flour the recommended addition rate is 120 grams per metric ton of flour.

B. Specifications

Descriptions	Requirements
1 Manufacturer	Manufacturer must be approved for production of KAP Komplex Premixes by the Kazakhstan Academy of Nutrition.
2. Product Composition	Minimum Level in KAP Komplex #1
Ingredient	
Thiamin Mononitrate	1.3 %
Riboflavin	2.0%
Niacinamide	6.7%
Folic Acid	1.0%
Electrolytic iron	33.3% as Fe, approximately 34.7% as electrolytic iron
Zinc Oxide	14.7% as Zn, approximately 18.7% as zinc oxide
Free-flow agent	quantity sufficient to make free flowing
Starch or maltodextrin*	quantity sufficient to make 100%
3. Purity Requirements	All ingredients used in KAP KOMPLEX must meet Food Chemical Codex (Vol. III) purity specifications
4. HALAL Requirements	Product must be HALAL certified
5. Grain Size	It must be free-flowing with no lumps or stickiness. 95% of offered product must pass through a 100 mesh screen.

* Calcium salts are not permitted as fillers.

II. KAP KOMPLEX #2

A. Description and Applications

2. KAP Komplex #2 contains ferrous sulfate as the iron source and includes vitamin B_{12}. It can be used for fortification of premium grade and 1st grade wheat flour used in bakeries and pasta products, or where the flour will be stored for not more than two months. For premium or supreme grade the recommended addition rate is 150 grams per metric ton of flour. For 1st grade flour the recommended addition rate is 120 grams per metric ton of flour.

B. Specifications

Descriptions	Requirements
1 Manufacturer	Manufacturer must be approved for production of KAP Komplex Premixes by the Kazakhstan Academy of Nutrition.
2. Product Composition	Minimum Level in KAP Komplex #2
Ingredient	
Thiamin Mononitrate	1.2 %
Riboflavin	1.6%
Niacinamide	6.67%
Folic Acid	1.0%
Vitamin B_{12}	0.00267% as Cyanocobalamine
Ferrous Sulfate **	16.6% as Fe, approximately 52% as ferrous sulfate
Zinc Oxide	13.3% as Zn, approximately 16.6% as zinc oxide
Free flow agent	quantity sufficient to make free flowing
Starch or maltodextrin *	quantity sufficient to make 100%
3. Purity Requirements	All ingredients used in KAP KOMPLEX must meet Food Chemical Codex (Vol. III) purity specifications
4. HALAL Requirements	Product must be HALAL certified
5. Grain Size	It must be free-flowing with no lumps or stickiness. 95% of offered product must pass through a 100 mesh screen.

* Calcium salts or wheat flour are not permitted as fillers

** Must be dried ferrous sulfate of very fine particle size, white to light tan in color.

III. KAP KOMPLEX #3

A. Description and Applications

3. KAP Komplex #3 is designed for the fortification of high extraction flour, such as 2nd grade flour, whole-wheat flour or any flour with ash content higher than 0.8%. The recommended addition rate of KAP Komplex #3 to flour of this type is 250 grams per metric ton of flour.

B. Specifications

Descriptions	Requirements
1 Manufacturer	Manufacturer must be approved for production of KAP Komplex Premixes by the Kazakhstan Academy of Nutrition.
2. Product Composition	Minimum Level in KAP Komplex #3
Ingredient	
Sodium Iron EDTA	8.0% Fe, approximately 60% as NaFeEDTA
Folic acid	0.48%
Free flow agent	quantity sufficient to make free flowing
Starch or maltodextrin	quantity sufficient to make 100%
4. HALAL Requirements	Product must be HALAL certified

IV. TECHNICAL SPECIFICATIONS FOR MILL EQUIPMENT

Name of Goods or Related Service	Technical Description
Feeder (dosifier)	
Type A Feeders	A total of 70 type A volumetric ingredient feeders are required under this contract. These feeders must have the following characteristics: 1. A screw type feeder mechanism with ability to change screw sizes. 2. An active or live bottom hopper. 3. A variable speed control calibrated from 0 to 100% of feeder capacity. 4. 220 volt ± 10% 50/60 Hz single phase power. 5. Empty hopper indicator. 6. Automatic shut off capability. 7. Feed screw and all metal surfaces in contact with the premix of stainless steel construction. 8. Active bottom made from white vinyl nitrile. 9. A history of satisfactory use for feeding vitamin/mineral premixes at flour mills, confirmed by at least one letter of endorsement for the equipment from a flour milling company. 10. Capable of delivering from 0.4 liters/hr to 4.0 liters/hr with ± 2% accuracy over full range. 11. Hopper capacity of 20 liters minimum. 12. New, unused equipment.
Type B Feeders	A total of 30 type B volumetric ingredient feeders are required under this contract. These feeders have the following characteristics: 1. Can have a screw, drum or rotating disk feed mechanism. 2. A manually operated delivery control calibrated from 0 to 100% of feeder capacity. 3. 220 volt ± 10% 50/60 Hz single phase power. 4. Automatic shut off capability. 5. A mechanism to prevent bridging or tunneling of premix in hopper. 6. All metal surfaces in contact with the premix of sanitary, non-corrosive material. 7. A history of satisfactory use for feeding vitamin/mineral premixes at flour mills, confirmed by at least one letter of endorsement for the equipment from a flour milling company. 8. Capable of delivering from 0.2 liters/hr to 2.0 liters/hr with ± 4% accuracy over full range. 9. Hopper capacity of 10 liters minimum. 10. Can be new or rebuilt equipment.
Technical Service	The vendor is expected to provide the following services under this contract: 1. Assist and train mill personnel on installation, calibration, and maintenance of feeders at five demonstration mills, or 2. Train designated KAN and country personnel on the installation, calibration, and maintenance of feeders.

RESOLUTION OF ALMATY FORUM 2001

IMPROVING NUTRITION OF POOR WOMEN AND CHILDREN IN CENTRAL ASIA AND NEIGHBORING COUNTRIES

1. *After four days of deliberation, participants from six neighboring central Asia nations, attending a regional roundtable on salt and wheat flour fortification from 8-12 October sponsored by the Asian Development Bank, the United Nations Children's Fund and the Kazakh Academy of Nutrition and funded by the Government of Japan through the Japan Fund for Poverty Reduction, agreed on the following set of principles, strategies and actions (to be supported by the Japan Fund through 2002):*

We recognize:

In recent years the nutrition status of women and children in our region has deteriorated badly with negative consequences for children, families and nations - iodine and iron deficiencies are the most serious, but other essential nutrients need to be addressed;

that the damage to the learning capacity of our children from iodine deficiency in pregnancy is irreversible;

that iron deficiency is causing serious damage to social and economic development through poorer pregnancy outcomes, impaired cognition especially in young children, reduced work capacity and increased morbidity from infectious diseases;

that zinc deficiency is associated with lowered immunity, slower growth and increased risk of heavy metal poisoning in contaminated environments;

that folic acid deficiency in women who become pregnant contributes to congenital abnormalities of the central nervous system of the newborn and is an independent risk factor for coronary heart disease; and

that the key B-vitamins thiamin, riboflavin and niacin are removed during milling along with most iron and folic acid contributing to micronutrient malnutrition among populations whose diets are heavily dependent on bread and other flour-based foods.

We affirm:

that the addition of potassium iodate to all salt sold for human nutrition is a well established method for eliminating iodine deficiency as a societal problem;

that the KAP Komplex formula, developed by the Kazakh Academy of Nutrition for Central Asia, is an appropriate and safe, basis for wheat flour fortification in the populations of the region to prevent deficiencies of thiamin, riboflavin, niacin and folic acid and reduce iron and zinc deficiency. This formula is freely available to any enrichment mix producer;

that people of the region should have access to affordable, safe, and efficacious fortified foods as a permanent commitment to the elimination of micronutrient malnutrition;

that there are no capacity constraints for private producers to achieve significant progress in providing affordable fortified salt and flour to consumers in the region;

that the consequences of not implementing fortification programs at national level will be poor child development, low educational achievement of children, and decreased earnings and economic growth; and

that the initiative, supported by the Japan Fund, will contribute to fulfilling commitments made by the participating governments to universal protection of children.

Therefore, we pledge:

that all salt for human consumption will be fortified with potassium iodate and to the maximum extent achievable wheat flour will be fortified with micronutrients using the KAP Komplex formula.

This will require:

that food laws and regulations be reviewed and amended to ensure they support and enable the addition of all essential micronutrients in appropriate food carriers;

that public policies and regulations that constrain or impede investment in food fortification to reduce micronutrient malnutrition be reviewed and amended and that all nations collaborate to produce uniform or consistent standards based on international best practices that will smooth the trading of foods;

that customs protocols and trade regulations will be revised or enacted to ensure the import and export of certified and safe fortified foods at agreed levels of fortificants;

that the cost of food fortification must ultimately be borne by the producer and the consumer, but a transition period of cost -sharing between the public and private sectors may be necessary;

that efforts be continued to inform the public of the benefits of fortified salt and flour to the learning and earning capacities of the region's children and that the interests of NGOs, especially women's federations and consumers' rights unions, be fully included in future activities jointly conducted by the nations; and

that food fortification must be a part of a comprehensive strategy of anemia prevention and control that includes supplementation, dietary diversification, breastfeeding promotion and other public health measures.

A. NATIONAL ACTIONS

National actions to achieve this will require the following coordinated actions at national, oblast and local levels:

Pass and effectively implement mandatory salt iodization laws in all countries and move forward the consideration of flour fortification laws in a timely fashion.

Urge the elimination of tariffs and value-added taxes on inputs to fortification and fortified food products, imported or domestically processed, to promote sustainability.

Avoid excessive price increases for fortified products that may discourage consumer preference.

Initiate cost-sharing by public and private sectors of the costs of producing fortified salt and flour and strengthen the capacity of the private sector to be fully self-reliant shortly after the Japan Fund project completion.

Establish a monitoring framework to assess progress in the percent of salt and wheat flour fortified during production and families with access to fortified food products.

Integrate fortification programs into national strategies and policies to reduce poverty, raise the quality of human resources and support the survival, growth, psychosocial and cognitive development of all children, especially those of early ages.

Promote an expanded public sector-private sector dialogue on fortification of salt and cereal flour and organize advocacy events to increase program and donor support.

Develop and implement a communication strategy and campaign to raise public awareness and improve the child caring skills of parents on the importance of fortified salt, wheat flour and wheat flour products and promote increased consumer demand for these products. These activities will be led by non-governmental organizations in collaboration with the private sector, national experts, the media, local authorities and communities.

Promote mechanisms to exchange information and experiences within and across the countries of the project using the world wide web and other modern communication tools.

Obtain, update and disseminate information on the prevalence of micronutrient deficiencies by including micronutrient-related data collection into Demographic and Health Surveys, Multiple Indicator Cluster Surveys and other nutrition, health and education surveys.

B. REGIONAL ACTIONS

Develop a framework for drafting and proposing harmonized regional and international trade standards and guidelines for fortified foods.

Develop regional activities such as roundtables, joint reports and cross country training focusing on legislation, communication strategies and partnerships among the civil society and private and public sectors.

Demonstrate through regional policy dialogue to economic planning agencies and the general public the large economic damage caused by poor nutrition and the proven low-cost solutions available to the region.

Advocate resource mobilization by governments from domestic budgets, public and private, and strategic investments from development partners, and share country experience in regional forums.

Review and recommend financial and capacity building incentives to sustain food fortification and its expansion to other essential foods widely consumed by the poor.

Set up sentinel sites in at least three project countries to monitor progress of continuing efforts to fortify all salt and wheat flour.

Create communication mechanisms, including a web site, that allow project countries to share advocacy, technical and promotional activities among themselves and with the global community.

Include micronutrient malnutrition issues into the agenda of regional expert group consultations such as associations of pediatricians, nutritionists and reproductive health specialists.

Prepare progress reports toward elimination of micronutrient malnutrition to the Regional Health Ministers Council.

RESOLUTION OF ALMATY CONFERENCE 2006

1. Much progress in flour fortification has been made in the last two years since the Almaty forum 2004. Yet, the public health need for increased iron, folic acid and zinc in the diets of the population of Central Asia remains as strong as ever. We reconfirm the following recommendations made at the 2004 forum that each country should:

(i) Complete the legislation and regulations requiring the appropriate universal fortification and flour in all counties in the region.

(ii) Complete the establishment of an effective and high quality system for quality control and assurance of fortified flour in each country.

(iii) Have their milling associations and government create conducive conditions for procurement of fortificants and equipment for fortification.

(iv) Develop an effective national alliance for flour fortification among government, industry, academia, producers as well as international and bilateral organizational partners. The alliance will encourage and provide oversight for implementation of permanent flour fortification.

(v) Encourage regional cooperation, standards, expert advisory services and mechanisms to facilitate the fortification of wheat flour, share country knowledge and experience and remove impediments to trade in fortified flour and grain.

(vi) Assure that all flour millers have the motivation, commitment and capacity to produce fortified products.

(vii) Assure that the importance of consuming fortified wheat products is understood at all levels of society.

(viii) Ensure that imported wheat products meet national standards.

(ix) Look for ways to improve the trade in fortified foods including customs issues.

(x) Have their associations obtain better information from producers on the production of different types of flour and flour products.

(xi) Should identify midsize flourmills to fortify flour, and investigate feasibility and technology of fortification at small mills.

(xii) Have their association of flour mills, or as a new regional association, work with the Flour Fortification Initiative (FFI) and the International Association of Operative Millers (IAOM) and similar organizations to strengthen and better educate their own milling industry.

(xiii) Have their National Fortification Alliance or milling associations give incentives to flourmills to produce quality fortified flour (e.g. award for excellence).

(xiv) Regulatory agencies regularly conduct testing of fortified flour. This requires sufficient budget allocation by the government.

(xv) Continue to arrange workshops on monitoring conducted by CDC, KAN and other organizations.

2. In addition, the conference recommends the following actions:

(i) Kazakh Academy of Nutrition (KAN) should continue to develop better harmonization guidelines for fortified flour and methods for systems of quality assurance in the region. Finalization and dissemination of guidelines and methods will be done in 2006.

(ii) The results of the completed sentinel studies should be written up in simple form for use in advocacy by March 2006.

(iii) Comparative analyses of (at least) iron in fortified flour samples should be encouraged (by national alliances and associations and KAN) between the reference laboratories, government laboratories and central milling labs.

(iv) Both national and subnational training workshops for millers on fortification technology, QC and reasons for flour fortification should be conducted so as to provide better access to workshops by all mills. Workshops should continue on periodic basis until flour fortification has become well established (at least 70% of flour) and sustainable.

(v) Better information on suitable equipment, methods and reagents should be provided on recommended methods for testing of vitamins and minerals in fortified flour along with better training of technicians on how to run and maintain such testing.

(vi) Provide better incentives to mills to fortify flour. This may include

(a) Lower interest loans (e.g. 10%)
(b) Delayed payment or reduction of certain taxes and custom duties
(c) Provision of access to donated wheat
(d) Requirements that flour procured and paid for by the public budget be fortified
(e) Exemption of tariffs and VAT on fortification and equipment

(vii) Accelerate adoption of a mandatory flour fortification law or legislation in Tajikistan, Mongolia and Kyrgyz Republic. Promote enforcement and further promotion of adopted legal acts in Kazakhstan and Uzbekistan.

(viii) Establish a Central Asian Association of Millers and Grain Processors.

(ix) KAN is working on developing new premix formulas (KAP Komplex #2 and #3) that counties should consider using in appropriate applications.

(x) To recommend associations attempts by the end of 2008 to find out the smallest size of mill at which flour fortification is feasible so that they may be excluded from national mandatory fortification requirements.

(xi) Efforts should be made to simplify the certification process for fortified flour and miller associations should assist mills obtain such certificates.

(xii) Encourage the governments to adopt flour fortification as CIS and Euroasia Economic Association regional policy.

(xiii) Countries identify 3rd party independent laboratories to resolve disputes on micronutrient levels in premixes and flour.

(xiv) National Alliance should advocate flour fortification at the highest possible level and accelerate existing communication plan. Regional Cooperation on this is needed.

(xv) Speed up regional production of fortification premix.

(xvi) Cooperate with other partners such as HarvestPlus and CIMMIT researching improvement of mineral levels in wheat.

Almaty, Kazakhstan, February 9, 2006

QUICK REFERENCE ON LEGISLATION, REGLATION AND STANDARDS ON FORTIFIED FOOD

Descriptive Item	Kazakhstan	Kyrgyz Republic	Mongolia	Tajikistan	Uzbekistan
I. QUALITY SALT IODIZATION					
(I) Principal Legislation & Regulations					
Laws/Regulations	L (2003)	L (2000)	L (2003)	L (2003)	GD (2005)
National Programs	GD (2001)	GD (2002)	GD (2002)		
Other	CIS (2001)	CIS (2001); GD (2003)		CIS (2001)	CIS (2001)
(II) Production Establishment & Sales Promotion					
Laws/Regulations	GD (2005)	GD (2002)			
Standards/Premix	S (1975); S (1977)	S (1975); S (1977)		S (1975); S (1977)	S (1975); S (1977)
Standards/Salt	TR (1996); S (2003)	S (1985, 2001)	S (1986, 1995, 2001)	S (2004a,b)	S (2005)
Other		AD (2006)			
(III) Tax & Customs Duties and Privilleges					
Laws/Regulations	GD (1996,2004)	GD (2004); GD (2006)			
Customs Tax		TC (2004)			
Tax Tariffs		CC (2003,2006)			
Other					
(Iv) Monitoring on Import & Export and Wholesale					
Laws/Regulations		PD (2002); GD (2002)			
Standards/SanPiN	S (1985, 2003)	S (1985); SanPiN (2004)	S (1985, 1996, 2002)		S (1985); SanPiN (2002)
Other					
II. QUALITY WHEAT FLOUR FORTIFICATION					
(I) Principal Legislation & Regulations					
Laws/Regulations	L (2004)			GD (2002)	
National Programs			GD (2003)		
Other					
(II) Production Establishment & Sales Promotion					
Laws/Regulations	GD (2005)	GD (2002)			PD (2005)
Standards/Premix	TR (2002); S (2006)		S (2002, 2003)	TR (2003)	S (2006)
Standards/Flour	TR (2002);S (2005,2006)	TR (2002); S (2004)	S (2002, 2003)	S (2004)	S (2002a,b; 2006)
Standards/Bakery	TR (2002); S (2006)	S (2004)	S (2004a,b)	S (2004)	
Other	GD (2005)	AD (2006)			
(III) Tax & Customs Duties and Privilleges					
Laws/Regulations	GD (1996,2004)				
Customs Tax		TC (2004)			
Tax Tariffs		CC (2003,2006)			
Other					
(Iv) Monitoring on Import & Export and Wholesale					
Laws/Regulations				GD (2002)	
Standards/SanPiN			S (2002a,b; 2003a,b)		S (2006)
Other					

Notes: L - national law; PD - Presidential Decree; GD - government's decree; CIS - agreement of CIS; AD - ministry/agency decree; TC - Tax Code; CC- Customs Code
S - national standard; TR - technical requirements (conditions)