



# **JFPR 9005: IMPROVING NUTRITION OF POOR MOTHERS AND CHILDREN IN ASIAN COUNTRIES IN TRANSITION**

## **Issues Paper on Flour Fortification**



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## I. INTRODUCTION

1. Fortifying wheat flour with deficient vitamins and minerals was one of the key components of the project to *Improve Nutrition for Poor Mothers and Children in Asian Countries in Transition*. There is clear evidence of micronutrient deficiencies within the region, particularly for iron and, more recently, folic acid. Wheat flour and products made from it, like bread, is an ideal vehicle for delivering these micronutrients to people within the region, since it is relatively simple to fortify and consumed by nearly everyone in fairly high amounts.
2. The objective was to fortify one-third of the suitable flour consumed in the region. This proved to be a highly ambitious goal that was not met for reasons which will be discussed later.
3. There are three stages in the success of any mass fortification project.
  - a. Initiation
  - b. Expansion
  - c. Sustaining
4. Clearly, this project was to initiate flour fortification in the region, to get the practice started. In some ways this is one of the more difficult steps. It requires government regulators to enable food fortification. It requires millers to start doing something they are not familiar with and may even disagree with. It requires consumers to first accept and then deliberately chose to buy fortified versions of familiar food staples.
5. To this extent the project has been very successful. Flour fortification has started. The train has left the station. The next task is to keep it moving down the track and to pick up steam.

## II. PROJECT REVIEW

### A. KAP Komplex #1

6. One of the first steps in this activity was the development of a suitable fortification premix to add to wheat flour in the region. The premix was formulated by the Kazakhstan Academy of Nutrition under the direction of Professor Mussa Aidjanov.
7. There were a lot of considerations that went into the formulation of the premix, called KAP Komplex #1, which Professor Aidjanov would be happy to share with you if you desire more information. The primary ones were estimates of micronutrient deficiencies and the mean consumption of flour. Table 1 shows the composition of the premix and the amount of micronutrients it adds to flour.

**Table 1. KAP Komplex #1 Composition**

<b>Micronutrient</b>	<b>Source</b>	<b>% nutrient in premix</b>	<b>ppm added at 150 g/MT</b>
Thiamin	Mononitrate	1.33	2.0
Riboflavin	Riboflavin	2.00	3.0
Folic Acid	Folic Acid	1.00	1.5
Niacin	Niacinamide	6.66	10.0
Iron	Electrolytic iron	33.30	50.0
Zinc	Zinc Oxide	14.70	22.0

8. The reason this is called Komplex “#1” is that it was believed and even expected that additional formulations would be developed depending on specific needs, and they would be given different numbers.

9. The source of iron was specified to be electrolytic elemental iron. This is the form of iron that is currently understood to have the best stability in flour with the highest bioavailability; that is, the ability to be absorbed and utilized by the body. It is the form of elemental iron recommended by the WHO, PAHO and a panel of nutrition experts convened by SUSTAIN, providing that the level added be twice that if ferrous sulfate is used.

10. Ferrous sulfate has even better bioavailability, twice that of electrolytic iron, but it can cause flour to go rancid faster if the flour is kept for extended periods. There are applications, such as bakery flour and flour for pasta, where ferrous sulfate can be used, and can even be preferable, but we did not want to take the chance of having sensory or product acceptance problems at the start of the program, so we went with the most stable form of iron. Some of you may remember that an earlier flour fortification program in the Kyrgyz Republic using ferrous sulfate ran into serious acceptance problems when the fortified flour was kept for longer than expected periods. We did not want to have that nasty situation repeated, so we went with a form of iron where that would not occur. But now that the program has been established, we would suggest that a KAP Komplex #2 with ferrous sulfate be made available for applications where it can be utilized.

## B. Flour Standards

11. All of these six micronutrients are naturally present in wheat and flour. Their levels in flour are much reduced from that in wheat due to milling refinement. A flour fortification program requires that we have 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. A small variance is provided to allow for natural variation and analytical error. Using these considerations and based on the natural micronutrient levels in premium grade flour, the minimum standards for flour were developed, shown in Table 2. These became the standards promulgated in regulations in the six participating countries.

**Table 2. Flour Fortification Standards and Dietary Contribution**

<b>Micronutrient</b>	<b>Minimum Flour Standard (ppm)</b>	<b>% of RDA provided by 260 grams of fortified flour</b>	<b>% of RDA provided by 67 grams of fortified flour and 173 grams first grade unfortified flour</b>
Thiamin	3.3	70	60
Riboflavin	2.8	55	35
Folic Acid	1.5	100	50
Niacin	18.0	30	25
Iron	55.0	70 <sup>a</sup>	40 <sup>a</sup>
Zinc	25.0	65	45

<sup>a</sup> corrected for absorption of iron being half that of ferrous sulfate.

12. Table 2 also shows the dietary contribution that would be provided by 260 grams of fortified flour per day, the average flour consumption estimated for the region. These are clearly large numbers that would have a major impact in reducing micronutrient deficiencies in the region, providing of course that this much flour would be fortified, which is unlikely to ever be the case. The last column estimates the impact were only one-third of the flour to be fortified, which was the objective of the past project.

13. Of the six added micronutrients, niacin appears to have the lowest contribution. This was done deliberately. Niacin deficiency was not considered a major concern in the region and it can add substantially to the cost of the premix. Also, these values do not include the contribution of the amino acid tryptophane, a niacin precursor naturally present in flour. Once all niacin equivalents are included the value is closer to 50% of the RDA.

### C. Types of Flours that are Fortified

14. The types of flours produced in the region are shown in Table 3. These flour types are common to all the CIS countries having had quality standards established during Soviet times. The higher the ash content, the high the level of retained nutrients.

**Table 3. Flour Types in CIS Countries**

<b>Flour types</b>	<b>Ash Content (%)</b>	<b>Fortified</b>
Premium or Supreme grade	0.50 – 0.55	Some
First grade	0.75 – 0.80	Yes
Second grade	1.25	No
Whole wheat flour		No
Rye flour		No

15. As mentioned, the KAP Komplex #1 premix and flour fortification standards were formulated on basis of the lowest ash, *Supreme grade* flour, which is the normal type of flour being fortified around the world. However, we very quickly learned that *First Grade* flour is by far the most commonly used product in this region of the world.

16. Because of the higher micronutrient levels in first grade flour versus premium grade flour, it is possible to add a lower amount of the KAP Komplex premix to achieve the established fortification standards. Using estimates of natural levels in first grade flour, we suggested that first grade flour be fortified with 130 grams/MT as opposed to the 150 grams/MT used on Premium grade.

17. This lower addition rate had a number of consequences. For one, it increased the amount of flour that could be fortified with the supplied premix by 15%. It also reduced the cost of fortification by 15%. We could have left the addition rate at 150 gram for first grade flour, and perhaps we should have. The fortification standards are minimums, so being 15% higher would not have caused regulatory problems. However, because of concerns by some people expressed at the workshop in Tashkent, and at other times, that the iron levels may be getting excessively high, the lower addition rate was recommended.

18. Confounding this situation as well as the estimates of micronutrient contributions previously discussed, is the fact that we really do not have good data on the micronutrient levels in first grade flour. There were 12 samples of non fortified first grade flour tested for all six micronutrients by KAN, but they showed such a wide variation in levels as to make the data suspect. It may well be that this high variation in nutrient content is real, or a large part of it may be analytical error. At this point we do not know. If a large variation in natural levels continues to show up, for whatever reason, we are going to have to accept a similar large variation in assays on fortified flour.

19. In the mills I visited there was very little supreme grade flour being produced. Each mill had only one feeder and they were all set up to fortify first grade flour. When they did produce supreme grade they had to move the feeder to that line in order to fortify it, so it was often not fortified since moving the feeder was difficult. In the future mills that produce a lot of premium flour may require two feeders in order to fortify both grades.

20. Second grade and whole wheat flour are not being fortified under this program, nor are their any immediate plans to do so. Both have higher levels of micronutrients, but they lack folic acid and have high levels of phytic acid, which will decrease the absorption of iron. If they were to be fortified in some future program, the premix should include folic acid and iron, but of a special type that would be better absorbed, such as iron-EDTA (??).

## D. Selection of Mills

21. The 2001 Almaty meetings started planning for which mills to select for participation in the program. We wanted to start out with the largest mills, preferably those with milling capacities greater than 200 MT/day. This was to optimize the amount of flour that would be fortified with are limited resources for equipment, as well as to increase the chances that the participating mills could produce a quality product, thinking that the larger mills would be more technically advanced.

22. Unfortunately for the program, some of the largest mills were the old Soviet ones that were barely operating and in very poor condition. These are gradually being replaced by smaller, more efficient mills with newer equipment. Many of these mills are well suited for fortification, but because of their smaller size many were omitted from the first phase of the project. The next phase should try to get all of these mills into the program. I believe we can go down to mills with capacities as low as 20 MT/day.

23. Table 4 summarizes the different types of mills in the region. It would be difficult but not impossible to fortify 1<sup>st</sup> grade flour produced by the small roller mills. Tajikistan has developed on their own a prototype feeder to use in the small “Chinese” mills, which should be explored further.

**Table 4. Mill types in Region**

Mill Type	Capacity MT/day	Flour Products
Old “Soviet” mills	150 - 400	All types
New large mills.	100 - 300	All types
Medium size mills	20 - 100	All types
Small roller mills	2 - 25	1 <sup>st</sup> to 2 <sup>nd</sup> grade
Small “Chinese” roller mills	0.2 - 2	1 <sup>st</sup> to 2 <sup>nd</sup> grades
Water or electric stone mills.	0.5 - 2	Whole wheat (atta)
Electric or diesel stone, pin, disc or hammer mills	0.1 – 0.5	Whole wheat (atta)

## E. Feeders and Mill Support Provided

24. Table 5 shows the feeders and premix supplied to each country in this project.

**Table 5. Feeders and Premix provided to each Country**

Country	Beneficiary flour mills	JFPR Support		
		Feeders	Premix (MT)	Sum (USD)
Azerbaijan	8	8	20.0	201,472
Kazakhstan	17	30	95.0	820,574
Kyrgyz Republic	10	7	15.0	168,194
Mongolia	6	6	8.0	133,150
Tajikistan	6	2	22.0	145,865
Uzbekistan	14	38	89.0	857,056
<b>Total</b>	<b>61</b>	<b>91</b>	<b>249.0</b>	<b>2,326,310</b>

25. The larger feeder provided under this program had the following technical specifications:
- a. A screw type feeder mechanism with ability to change screw sizes.
  - b. An active or live bottom hopper.
  - c. A variable speed control calibrated from 0 to 100% of feeder capacity.
  - d. 220 volt  $\pm$  10% 50/60 Hz single phase power.
  - e. Empty hopper indicator.
  - f. Automatic shut off capability.
  - g. Feed screw and all metal surfaces in contact with the premix of stainless steel construction.
  - h. Active bottom made from white vinyl nitrile.
  - i. 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.
  - j. Capable of delivering from 0.4 liters/hr to 4.0 liters/hr with  $\pm$  2% accuracy over full range.
  - k. Hopper capacity of 20 liters minimum.
  - l. New, unused equipment.

26. This type of feeder is the standard design now being used throughout the world to fortify flour. There are a number of companies that make this type of feeder and there are a number of reputable companies that could manufacture the KAP Komplex #1 premix.

27. Both the feeder and premix to be provided in each country were put out for open bidding using standard ADB procedures. The vendor was required to provide on site technical assistance for all feeder installations. The American Ingredients Company was awarded the contract for both feeders and premix.

[Photographs of feeder installations]

28. There was some criticism after the fact that the feeder should have been of an older, two stage mixing design, or could have been a less expensive version of what was eventually supplied. There were other questions expressed at the Astana meeting about provision of associated equipment such as a voltage regulator. It is my understanding that for the most part these issues were successfully resolved and the supplied feeders performed quite satisfactorily.

29. As can be seen in the table, roughly one-third the total cost of the program was spent on feeders and premix. The high feeder cost occurred partly because of the feeders being of high quality capable of lasting many years, partly because of high shipping cost, and partly because of the requirement that the vendor makes sure each feeder is properly installed and operational in every mill. Subsequent feeders should be less expensive, partly because they can be smaller capacity since the mills they will be used in will be smaller, and partly because the milling industry in each country is now well aware of how to install and maintain feeders.

### **III. WORKSHOPS AND TRAINING**

30. There were three workshops conducted that related directly to flour fortification.
- a. Almaty in September 2001 (do you mean October?)
  - b. Astana in October 2002
  - c. Tashkent on regulations, standards and quality control (QC) in June 2002.
31. Each country conducted training workshops for millers and some for bakers.

#### IV. CURRENT STATUS AND ACCOMPLISHMENTS

32. The following tables give the latest but provisional data from JFPR showing the extent to which enabling regulations were enacted in the different countries, how much flour has actually been fortified, and the extent to which quality control testing has been performed.

##### A. Regulations and Legislation

33. Each country was able to obtain the necessary regulations that allowed feeders and premix to be brought into the country and for fortified flour to be produced and sold, which is no simple accomplishment considering the complexity of this type of activity in the CIS countries. Some countries were able to eliminate or reduce tariffs and taxes on imported premix and feeders, and some obtained technical or GOST (??) standards on the KAP Komplex #1 premix. Kazakhstan was the only country to get close to having mandatory flour fortification legislation.

**Table 6. Wheat Flour Regulations and Tariffs**

	<b>Regulatory Actions related to Flour Fortification</b>
<b>Azerbaijan</b>	<ol style="list-style-type: none"> <li>1. [TS AZ 00900003-18-2003] Fortified Wheat Flour allowed (December 2003)</li> <li>2. Hygienic Certificate on KAP-1 Komplex (MOH, October 2003)</li> </ol>
<b>Kazakhstan</b>	<ol style="list-style-type: none"> <li>1. [TU 70 00 RK 39309831 - ZAO-025-2002] Vitamin-Mineral Additive 'KAP Komplex no. 1' (March 2002)</li> <li>2. [TU 70 00 RK 39309831- ZAO-026-2002] Wheat Flour Fortified with the Vitamine-Mineral Additive 'KAP Komplex no.1' (March 2002)</li> <li>3. [TU 70 00 RK 39309831- ZAO-028-2002] Bread and Bakery fortified with the Vitamin-Mineral Additive 'KAP Komplex no.1' (September 2002)</li> <li>4. Article on mandatory wheat flour fortification amended to the Law on "Food Quality and Safety" (April 2004)</li> </ol>
<b>Kyrgyz Republic</b>	<ol style="list-style-type: none"> <li>1. [TR 9293-002-05712834-2002] Fortification of Wheat Flour with Vitamin-Mineral or Mineral Additives (May 2002)</li> <li>2. [KMS 918:2004] Wheat Flour Fortified with the Vitamine-Mineral and Mineral fortificants (February 2004)</li> <li>3. [KMS 918:2004] Bread and Bakery Fortified with the Vitamine-Mineral and Mineral fortificants (February 2004)</li> <li>4. Elimination of VAT on imported fortification equipment (February 2002)</li> <li>5. Elimination of VAT on drugs and pharmaceuticals, including KAP Premix components (January 2003)</li> <li>6. Adoption of zero rate on taxes on fortification equipment (March 2003)</li> </ol>

	<b>Regulatory Actions related to Flour Fortification</b>
	<ol style="list-style-type: none"> <li>1. [MNS5155:2002] Testing of Vitamin-Mineral Additive 'KAP Komplex no.1' (May 2002)</li> <li>2. [MNS5157:2002] Testing of Wheat Flour Fortified with the Vitamine-Mineral Additive 'KAP Komplex no.1' (May 2002)</li> <li>3. [MNS5154:2002] Food Vitamine-Mineral Additive 'KAP Komplex no.1' (May 2002)</li> <li>4. [MNS5156:2002] Wheat Flour Fortified with the Vitamine-Mineral Additive 'KAP Komplex no.1' (May 2002)</li> </ol>
<b>Tajikistan</b>	<ol style="list-style-type: none"> <li>1. [TS 9352 RT 020007157 001-2002] Technical Requirements on Vitamin and Mineral Additive KAP Komplex-1 (January 2003)</li> <li>2. [GOST 1057-2004] Wheat flour fortified with KAP Premix (January 2004)</li> <li>3. [GOST 1058-2004] Bread and bakery fortified with KAP Premix (January 2004)</li> </ol>
<b>Uzbekistan</b>	<ol style="list-style-type: none"> <li>1. [Tsh 8-178-2002] Wheat Baking Flour Fortified with the Vitamin-Mineral Additive KAP Komplex 1 (August 2002)</li> <li>2. [TIUz 8-215-2003] Production of Wheat Baking Flour Fortified with the Vitamin-Mineral Additive ""KAP Komplex 1"" (March 2003)</li> </ol>

34. I should point out that this was done without much outside help of a good legal expert in the area of fortification legislation and regulations. I believe the ADB really tried to find such a consultant, but was unable to come up with someone who could really help. This important task was then left to the CPOs with help from the Kazakhstan Academy of Nutrition.

### **B. Flour Fortified**

35. Table 7 shows the amount of flour that has been fortified in each country in tonnage and as a percentage of the 33% goal.

**Table 7. Amount of Flour Being Fortified**

<b>Countries</b>	<b>MT</b>	<b>Percentage of Goal</b>
<b>Azerbaijan</b>	24,087	9
<b>Kazakhstan</b>	131,273	27
<b>Kyrgyz Republic</b>	36,140	22
<b>Mongolia</b>	8,252	10
<b>Tajikistan</b>	45,593	22
<b>Uzbekistan</b>	335,413	41
<b>Total</b>	580,758	29

MT = metric tones.

### **C. Quality Control Testing**

36. Table 8 shows the quality control tests that were run on flour samples in each country except for Azerbaijan, which submitted no data on this.

**Table 8. Quality Assurance (QA) Tests Run**

Country	Internal spot tests	HPLC Tests by KAN		HPLC Tests by AIC	
		Contract arrangements	Samples made	Contract arrangements	Samples made
Kazakhstan	8,273	10	53	30	23
Kyrgyz Republic	427	10	10	10	7
Mongolia	30	10	6	10	8
Tajikistan	271	10	14	10	14
Uzbekistan	3,253	10	9	30	9
<b>Total</b>	<b>12,254</b>	<b>50</b>	<b>92</b>	<b>90</b>	<b>61</b>

37. After being supplied the laboratory testing equipment and training in the U.S. on the analytical methods, the Kazakhstan Academy of Nutrition is now capable of running all six added micronutrients and is testing flour routinely.

38. While the amount of flour actually fortified fell well short of the goal, I believe the major success in the project was that fortification has indeed started. The necessary regulations have been enacted, feeders and premix have been distributed, mills have been set up to fortify, people have been trained in how to carry out and control flour fortification, QC testing has started, mills, flour distributors and consumers have been educated on the benefits of flour fortification, and the public is actually buying and consuming fortified flour.

39. It might be instructive to compare this progress to that of other countries during this same time period. About the same time this project started, a couple Eastern European countries showed an interest in flour fortification but as of yet have been unable to get anything started, largely due to a lack of outside support. Brazil has been working on a program for the same amount of time, and just now have started to fortify flour in a few mills, but not to the extent accomplished in Central Asia. Argentina adopted flour fortification standards but no one is fortifying. Morocco has yet to fortify any flour and Egypt has been arguing over it for 20 years. South Africa started working on this some years back and is now fortifying most flour, but they are a single country with large, modern flour mills. They have yet to accomplish fortification in the smaller maize mills. Getting flour fortification started is not easy, as many countries are finding out. You who have worked on this should all be proud of what you have accomplished in this relatively short time period.

## V. DISCUSSION OF INDIVIDUAL COUNTRIES

40. Kazakhstan is the largest country in the project. It produces the most wheat and exports wheat to other countries in the region. It also contains the regional coordination and administration office (RCAO) and the important facility of the Kazakhstan Academy of Nutrition (KAN). One would think with all that going for it should have been the most successful in fortifying flour. That honor seems to go to Uzbekistan. Kazakhstan was able to accomplish much in the way of training, consumer promotion and working toward a mandatory fortification program, but they seem to have had delays in getting the necessary regulations and convincing large bakers to accept fortified flour and produce fortified bread. The baking industry in Kazakhstan appears to be more concentrated in large operations than it is in other countries, which may have contributed to this problem.

41. The Kyrgyz Republic produced some excellent promotional and educational materials, not only for the general public but for flour millers and traders. There may be more public demand at this point than there is fortified flour. A couple of the mills that were set up to fortify,

some with feeders previously supplied by UNICEF, were not operating due to lack of wheat and other reasons. Fortunately, there are some new mills coming on line that are ideally situated to fortify once they receive feeders. This may involve transferring feeders from non-operating mills or providing them new ones. There is a large amount of flour coming in legally or illegally from Kazakhstan and Uzbekistan, none of which is fortified. This situation needs to be dealt with.

42. It was known from the start that Tajikistan would present a difficult situation. The large soviet mills there are not operating or running at a fraction of their original capacity. Much of the flour being consumed is made at small or medium size mills that were not included in this project, and there is a large amount of imported flour due to a big decline in local wheat production. Many of the mills are in very difficult to reach locations making the logistics of supplying them premix more difficult. There are a couple of new mills starting up but it is uncertain whether they will be willing to fortify.

43. Kyrgyz shares many of these constraints but they are more pronounced in Tajikistan. Both countries have applied for GAIN grants in the next round of funding, which may allow them to extend fortification to small mills. Tajikistan has already started a pilot project with fortification at a small "Chinese" roller mill.

44. Azerbaijan has had many problems with flour fortification and is the furthest away from viable program. I will let others discuss the basis for these problems but they seem to include the poor state of the milling industry there along with questionable government policies.

45. I do not have first hand knowledge of the situation in Azerbaijan or Uzbekistan, but the latter has appeared to perform fairly well in starting flour fortification. Uzbekistan is reported to have some large mills that are operating regularly and producing fortified flour. They have been awarded a GAIN grant, , they should be in a good position to expand the flour fortification program. (the follow-on ADB project will not support flour fortification in Uzbekistan as GAIN is providing sufficient funds.

46. The basic problem in Mongolia is a lack of wheat to mill. The mills there are keen to fortify flour, and some of them are quite modern and well able to fortify. But you can not produce fortified flour if you are not making flour. Over half of the flour consumed in country is exported from Russia, China or Korea, and none of this is fortified. The good news is that they are getting some wheat donations from the United States that will be required to be turned into fortified flour, so this should help the situation a little. A large, modern mill in the capital city that has recently started up has even purchased their own feeder so they can do this.

## **VI. CONSTRAINTS AND LESSONS LEARNED**

47. As to why we were unable to meet the 33% goal, let me first say that based on what we now know, that objective was probably not realistic, particularly for those countries with high flour imports and little wheat production. This would include Azerbaijan, Tajikistan, Mongolia and the Kyrgyz Republic.

48. One of the things we certainly have no control over in this or any similar project is the weather. Wheat production took a nose dive during the project resulting in limited supplies and high prices. Hopefully, this coming year should be better for the wheat supply.

49. Unfortunately, in many countries in the CIS (not just Central Asia), most of old "soviet" mills are not running to full capacity or not operating at all. There are a number of reasons for this including shortages of wheat, electricity, equipment in poor repair and lack of spare parts. These mills require a large amount of wheat to start up. When the wheat supply is erratic, which is often the case, it takes a lot of wheat to get these plants going and then when they stop it there is too much flour left in the system. It is wasteful and requires a lot of cleaning for which there are no funds. Also, these mills employed a lot of people, as many as 1000 for the very

large plants. They cannot pay the skilled workers on a regular basis with sporadic production so they go elsewhere making it difficult to start up when they do get wheat.

50. On the bright side I did see some new mills in the 50 to 100 MT/day range capacity. These mills are mainly from Turkish manufacturers. They were well suited for fortification. These mills will replace some of the production that was lost with the demise of the large Soviet mills.

51. In the three countries I recently visited I saw some use of the iron spot test, but not to the degree I would like. Each country was supplied two spectrophotometers for running quantitative iron tests. However, they had not received the reagents or a PC or software so these had not been utilized as of yet. I would like to see a more detailed quality assurance program in the mills along with better monitoring of premix use and fortified flour production. I believe that is even more important than testing flour samples.

52. The quantitative test results from the AIC and KAN laboratories has shown large variability. This is due partly to analytical error and how the flour samples were collected and stored, but it still shows a lot of room for improvement. One should not get too disturbed about these results at this early point since the program is just starting.

53. One of the criticisms of the project from groups like CARE and UNICEF was that we did not try to fortify at small mills, recognizing that they serve some of the neediest of the population. While we all recognize the validity of that point and hope to address it someday, there is no country in the world that has an active small mill fortification program. Everyone starts out with the larger mills where fortification has a proven technology. Once that is established we can work on the extending it to the small mills.

54. Also, there is some confusion as to what is meant by small mill fortification. I see it as two different types. One is the 1<sup>st</sup> grade flour produced by the small "Chinese" mills I discussed. That probably can be accomplished but the cost per ton of flour fortified will be much greater than what it has been with the large and medium size mills.

55. The other type of small mill fortification relates to whole wheat flour or *atta* flour. This will be very costly and difficult to fortify. Fortunately, this is not as big a problem here as it will be in India, Pakistan and Afghanistan, where that type of flour is much more prevalent.

## VII. RECOMMENDATIONS ON NEXT STEPS

56. It appears that there is still a lot of work to be done on regulations in many of the countries. The goal is to eventually achieve enforceable, mandatory fortification regulations for both locally produced and imported flour. This will be a major challenge since the milling and baking situation in the CIS countries is much more complex than in many other countries. There are many production facilities of all different sizes and there is a long tradition and great complexity to the regulations governing flour and bread.

57. We have already started to purchase additional feeders so we can bring some of the smaller mills into the program in Tajikistan, Mongolia and the Kyrgyz Republic. A similar thing could be done in the other countries.

58. One question that we should try to answer is: what is the amount or proportion of flour that can be reasonably fortified in each country, either under a voluntary or a mandatory program? The one-third goal was a fairly arbitrary objective. It was not based on hard data. We would like to see better data on flour production and consumption, such as would be obtained in the very ambitious survey planned for the Kyrgyz Republic by Unicef. It may be that we will never achieve the one-third goal in Tajikistan and Mongolia, whereas we may be able to fortify well over half the flour consumed in Kazakhstan and Uzbekistan. Ideally, we would like to

eventually fortify 260 grams of flour per person, since that was the basis of the KAP KOMPLEX premix.

59. Representatives from the milling and baking association have been very helpful to this project in many of the countries, particularly Mr. Alexander Shefner in Kyrgyz and Evgenyi Gan in Kazakhstan. I would like to see their involvement continue, and even strengthen, to better assure long term sustainability. There are a number of things that could be done to help this happen, which we can discuss at this meeting. One might be to bring in outside experts in milling and related field for general education and training. Another would be to work with the International Association of Operative Millers (IAOM) and the Flour Fortification Initiative. They can provide educational materials for both fortification and general milling technology. Any thing we can do to increase the knowledge and technical abilities of the milling and baking industry in regard to fortification will help strengthen and sustain the program. One way we can make this more attractive to the industry is to provide other technical training along with it. This could include, for example, training on new technologies in milling, baking and quality control.

60. We need to look at flour fortification from a regional perspective. Right now we have six countries with the same premix and a similar set of flour standards, but it would be good if more countries joined in on this. The KAP Komplex fortification is well thought out, so other countries may wish to adopt it. Russia has proposed their own set of flour standards which are different. I do not know if that will be helpful or may create a problem with trade.

61. Eventually, you will need to have imported flour fortified in order to expand the coverage. This may be simple to enact but difficult to enforce.

62. Also in the future you will need to face the problem of how to fortify at small mills, or mills less than 20 MT/day capacity.

63. In conclusion, while we should not be satisfied with where we are, we should all be proud of what has been accomplished and work to expand and improve the program.