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PRUDENT FOOD STORAGE:
Questions & Answers

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The Prudent Pantry:
Your Guide to Building a Food Insurance Program

"In this work, when it shall be found that much is omitted,
let it not be forgotten that much likewise is performed."

Samuel Johnson, 1775, upon
completion of his dictionary.
Courtesy of James T. Stevens

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The home of the Prudent Food Storage FAQ can be found at:
http://athagan.members.atlantic.net/Index.html
Check there to be sure of the most current FAQ version.

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FOREWORD

This Frequently Asked Question (FAQ) file is concerned with those methods and techniques that have been found generally useful to extending the shelf lives of foods suitable for use in home food storage programs. It is not intended for, nor should it be used in, any commercial food applications.

While you are developing your food storage program, please don't overlook your water supply. Without safe drinking water a food storage program is useless for within a few days you must find water or perish. A water storage and treatment FAQ may be found at **http://athagan.members.atlantic.net/Index.html**

This file is updated as sufficient material becomes available. Lend a hand -- point out mistakes, contribute data or information, or provide new sources of material. Contributors will be acknowledged by name in the FAQ, unless they indicate otherwise.

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SHELF LIVES: TIME, TEMPERATURE, MOISTURE, OXYGEN AND LIGHT

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Is your food insurance up to date?

We create food storage programs with the idea that the food which has been put by will be available later should there come a time of need. The quality of the food at that time necessarily depends on its quality when it was stocked and the conditions in which it was stored. It cannot be any better than what it was when it went in, but it can certainly be worse when it comes out. In the fullness of time, all stored foods will degrade in nutrients and palatability until they reach the inevitable end where they cannot be eaten at all. It's because of this eventuality that every article, book, and teacher concerned with putting food by gives the same advice:

Date all food containers and rotate, Rotate, ROTATE.

The first food in should be the first food out. This concept is often shortened to FIFO.

The reason for this emphasis on stock rotation is because nearly all foods have a limited shelf life or, more correctly, it should be said that nearly all foods have shelf *lives.* There are really two we are concerned with here – the length of time a food retains substantial important nutrients and the length of time a food remains palatable.

Nutritional content actually begins to fade at the moment of harvest. Three major factors influence how much nutrition a food will have left by the time you eat it:

- The food's initial nutrient content;
- the preservation process the food underwent and;
- the storage conditions in which it's kept.

Given sufficient time, all but the most durable nutrients will dwindle away to nothing. Unfortunately, there is no good way outside of laboratory testing to know how much nutrition is left in a given food, but we can make our own determinations about other criteria which leads us to the palatability life mentioned above.

A food's palatability life is the point at which undesirable changes occur to taste, texture, color or cooking qualities. This is the reason for the "use by" and "sell by" dates on many foods and for shelf lives in general. *It will almost always be in excess of good nutritive life* which means that by the time the flavor or color begins to fade or the texture goes mushy the more perishable nutrients like sensitive vitamins will have long since plummeted.

Within reason, the key to prolonging the shelf life of your chow lies in lowering the temperature of the area in which it's stored. The storage lives of most foods are cut in half by every increase of 18º F (10º C). For example, if you've stored your food in a garage that has a temperature of 90º F (32º C) you should expect a shelf life of about half what could be obtained at a lower temperature, perhaps in your pantry at 70º F (21º C), which in turn is half the storage life that you could get if you kept it in your basement or refrigerator at 50º F (10º C). Your storage area should be located where the temperature can be kept above freezing and, if possible, below 72º F (22º C). Avoid major temperature fluctuations in this area if you can.

Ideally, your storage area should have a humidity level of 15% or less, but unless you live in the desert it's not likely you'll be able to achieve this. Regardless, moisture is not good for your dry stored edibles so you want to minimize it where possible. This can be done by a couple of methods. The first is to keep the area air-conditioned and/or dehumidified during the humid times of the year. The second is to use packaging impervious to moisture and then deal with any moisture trapped inside. If you are able, use both.

All containers should be kept off the floor and out of direct contact with exterior walls to reduce the chances of condensation brought on by temperature differences between the container and the surface on which it is resting.

Another major threat to your food is oxygen (O_2). Chances are that if your foods are sealed in moisture-proof containers they are probably air-tight as well. If air cannot get in, your only concern is the oxygen that was trapped inside the container when it was sealed. Lowering the percentage of O_2 to 2% or less of the atmosphere trapped inside the packaging (called *head gas*) can greatly contribute to extending its contents shelf life. The three main tactics for achieving this are vacuum sealing, flushing with inert gas, or chemically absorbing the oxygen. Depending on the nature of a particular foodstuff any one or a combination of the three can be used to good effect.

Once you have temperature, humidity and oxygen under control, we next look at light. Light is a form of energy and when it shines on your stored foods long enough it transfers some of that energy to the food which can damage its nutritional content and appearance. Fat soluble vitamins, such as A, D, E, and K are particularly sensitive to light degradation. It's a pretty sight to look at rows of jars of food, but if you want to keep them at their best, you'll admire them only when you turn the light on in the pantry to retrieve one. If you don't have a room that can be dedicated to this purpose then store the jars in the cardboard box they came in. This will protect them not only from light, but also help to cushion them from shocks which might cause breakage. For those of you in earthquake country, this is a particularly good idea. Should "terra" suddenly stop being "firma" your jars might just dance right off onto the floor.

Providing they were properly processed, canned, dried, frozen, or freeze dried foods do not become unsafe to eat when stored longer than their recommended times, but their nutrient quality fades and their flavor, color and texture go downhill. Following these rules of good storage will keep your food wholesome and nutritious for as long as possible:

#1 - First In, First Out (FIFO) means rotating your storage;
#2 - Cooler is better;
#3 - Drier is better;
#4 - Less oxygen exposure means more shelf life;
#5 - Don't shed light on your food.

Think of rotating your food storage as paying your food insurance premiums -- slacking off on rotation cuts back on your coverage.

Is your food insurance up to date?

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-- II --

COMMON STORAGE FOODS

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Herein are covered a range of foods suited for incorporation into home storage programs.

As you review them there are several considerations you should keep in mind when deciding on what foods you want to include.

The first is *variety in the diet*. This is of great importance but many do not give it adequate thought Some simply buy however much wheat, corn, rice, or beans they think is necessary to meet their needs and leave it at that. Others rely on pre-packaged decisions made for them by their storage food retailer who put together a "year's supply of food" to buy all at once. Either decision could possibly be a mistake.

There are many food storage plans one may use as a guide. Some are based on the so-called "Mormon or Basic Four" of wheat, milk, honey and salt, with as many additional foods as the planner found desirable. This plan was developed in the 1930's and we've learned a great deal about workable food storage in the decades hence. Among which are the food allergies or intolerances that an unfortunate number of people in our society develop.

One of the more common food allergens is wheat. Even more unfortunate is the fact that many who have such an allergy are unaware of it. They won't become aware until they try to live with whole grain wheat as a large part of their diet and their latent allergy reveals itself. Another thing we have learned is that many adults suffer from an intolerance to the milk sugar lactose, especially those of certain ethnic backgrounds. For these reasons and more you should always make it a practice to *store what you eat and eat what you store*, so that ugly surprises such as these do not arise after it's too late to easily avoid them.

A second reason to think about storing a wide variety of foods is *appetite fatigue*. There are those who think providing variety in the diet is relatively unimportant and that if and when the time comes they'll eat what they've got and that will be that. For healthy, well-adjusted adults under ordinary circumstances or for those who have the vital *survival mindset* this might be possible without too much difficulty. However, the reason for having a home food storage program in the first place is for when circumstances aren't ordinary.

Times of crisis produce stress - possibly physical, but always mental. If you are suddenly forced to eat a diet both alien and monotonous, it is going to add that much more stress on top of what you are already dealing with. If your planning includes the elderly, young children, and/or infants there is a significant risk they will quit eating or refuse to eat sufficient amounts of the right foods leaving them unable to survive. *This is not a trivial problem and should be given serious consideration.* When it's wheat, day in and day out, wheat is going to start becoming unpopular fast. Far better to have a variety of foods on hand to forestall appetite fatigue and, more importantly, to *use those storable foods in your everyday diet so that you'll be accustomed to eating them.* In his book, Making the Best of Basics, James Stevens mentions a post-WWII study by Dr. Norman Wright, of the British Food Ministry, which found the people of England and Europe were more likely to reject unfamiliar or distasteful foods during times of stress than under normal conditions. Consider the positive aspects of adding variety and comfort foods to your storage program.

A last thought that I want to give for ALL foods you might put into your program. Unless you are already familiar with and eating a particular type ***and*** brand of food do not put large quantities of it into your pantry until you – preferably everyone who will be depending on that food – have ***eaten*** some of it first. It's not always as easy to pick up a new food as it may first appear. Differences between brands of foods alone can sometimes be enough to disappoint you when consumed. You'd hate to discover that you cannot abide a particular food item after you've brought home a case of Brand X. Seriously relying on any food that you are not already familiar with is making a fools bet.

A. GRAINS AND LEGUMES

A.1 GRAINS & GRAIN PRODUCTS

ABOUT GLUTEN: As you read through the grain descriptions below you will come across frequent mention of "gluten". Gluten is a combination of proteins found in some grains which enables the dough made from them to rise by trapping the gasses produced by yeast fermentation or chemical reaction of baking powder or soda. The amount of these proteins varies depending on the species of grain and varieties within a species. Some grains such as rice have virtually no gluten at all and will not produce a raised loaf by itself while others like hard winter wheat have a great deal and makes excellent raised bread. As a general rule yeast raised breads need a fair amount of gluten to attain good dough volumes while non-yeast raised breads may need little or none at all. Whether gluten content is of importance to you will depend upon the end uses you intend for your grain.

Some of the common and relatively uncommon types of grains are listed below.

AMARANTH: Amaranth is not a true cereal grain at all, but is a relative of the pigweeds and the ornamental flowers we call "cockscomb". It's grown not only for its seed, but for its leaves that can be cooked and eaten as greens. The seed is high in protein, particularly the amino acid lysine which is limited in the true cereal grains. It can be milled as-is, or toasted to provide more flavor. The flour lacks gluten, so is not suited for raised breads by itself, but can be made into any of a number of flat breads. Some varieties can be popped like popcorn, boiled and eaten as a cereal, used in soups, granolas, and the like. Toasted or untoasted, it blends well with other grain flours.

NOTE: Like some other edible seeds, *raw* amaranth contains biological factors that can inhibit proper absorption of some nutrients. For this reason amaranth seeds or flour should always be cooked before consumption, whether for human food or animal feed.

BARLEY: Barley is thought by some to be the first grain intentionally cultivated by man. It has short, stubby kernels with a hull that is difficult to remove. Excluding barley intended for malting or animal feed, this grain is generally consumed directly by humans in two forms. Most common is the white, highly processed *pearl barley* with much of its bran and germ milled off along with its hull. It is the least nutritious form of barley. The second offering is called *pot* or *hulled barley* and it has been subjected to the same milling process as pearled, but with fewer trips through the polisher. Because of this, it retains more of the nutritious germ and bran, but does not keep as well as the more refined product without special packaging. Unless you are prepared to try to get the hulls off I don't recommend buying unhulled barley. Although it can be milled into flour, barley's low gluten content will not make a good loaf of raised bread. It can be combined with other flours that do have sufficient gluten to make leavened bread or used in flat breads. Barley flour and flakes have a light nutty flavor that is enhanced by toasting. Whole barley is commonly used to add thickness to soups and stews.

Recently, a hull-less form has become available on the market through a few suppliers. This is whole grain barley with all of its bran and germ intact and should have the most nutrients of any form of this grain available. I don't know yet how suitable it is for long term storage.

BUCKWHEAT: Buckwheat is another of those seeds commonly considered to be a grain, but which is not a true cereal. It is, in fact, a close relative to the docks and sorrels. The "grain" itself is a dark, three cornered seed resembling a tiny beechnut. It has a hard, fibrous hull requiring a special buckwheat huller to remove. Here in the U.S., buckwheat is most often used in pancakes, biscuits and muffins. In Eastern Europe and Russia it is known in its toasted form as *kasha*. In the Far East, it's often made into *soba* or noodles. It's also a good bee plant, producing a dark, strongly flavored honey. The flour is light or dark depending on how much of the hull has been removed before grinding. Dark flour is much more strongly flavored than lighter flour, but because of the high fiber and tannin content of its hull, which can interfere with nutrient absorption, it is not necessarily more nutritious. Buckwheat is one of those foods with no middle ground in peoples opinions -- they either love it or they hate it. Like amaranth, it's high in lysine, an amino acid commonly lacking in the true cereal grains.

CORN (maize): Corn is the largest grain crop in the U.S., but is mostly consumed indirectly as animal feed or even industrial feedstock rather than directly as food. As one of the *Three Sisters* (maize, squash and beans) corn was the staple grain of nearly all of the indigenous peoples of the American continents before the advent of European colonization. This American grain has an amazing variety of forms. Major classes are the flint, dent, flour, and popcorns. To a certain extent, they're all interchangeable for milling into meal (sometimes known as polenta meal) or flour (finely ground corn, not cornstarch). The varieties intended to be eaten as sweet corn (fresh green corn) are high in sugar content so do not dry or store well relative to the other corns but instead are usually preserved as a vegetable. There are a number of lesser corn varieties with specialized uses that do not lend themselves to direct food use, but these are seldom found in the open market.

As a general rule of thumb, the flint varieties make better meal as they have a grittier texture than most other corns. If meal, hominy and hominy grits (commonly called just "grits") are what you are interested in then use the flint type if you can find a source. If you intend to make corn masa for tortillas and tamales, then the flour corns are what you want, but these are fairly uncommon on the commercial market so the dent corns are next best. Yellow dent seems to be the most commonly available and will work for almost any purpose except popping.

Popcorn is for snacks or used as a cold cereal after popping or can be ground into quite acceptable meal. In my experience I have found it difficult to hull popcorn with alkali treatment for making hominy (posolé, nixtamal) though your mileage may vary. Popcorn is one form of a whole grain available to nearly everyone in the U.S. It is so common a snack food, particularly at movie theaters, fairs, and ball games, that the smallest of towns will often have at least one business selling it cleaned, dried, and ready to pop in twenty-five or fifty pound bags. Popcorn is harder than other varieties of corn so if your mill is not of the heavy duty sort you may want to consider cracking the kernels into coarse pieces first then grinding into finer textured meal. The Family Grain Mill states that it should not be used to mill popcorn at all and the Back To Basics mill should not be used for any great quantity. All other manual and electric mills that I am aware of will mill popcorn without problem.

Once you've decided on your preferred corn type you may also be able to choose your preferred color. There are yellow, white, blue, red, and multicolored varieties. The yellow and whites are the most common by far with the blues, reds, and parti-colored varieties mostly being relegated to curiosities, though the blue and red corns have been gaining in popularity these last few years. These would be worth investigating if you can find a good source. It should be kept in mind that white corn does not have the carotene content (converts into vitamin A) of yellow corn. As vitamin A is one of the major limiting nutrients in long term food storage, any possible source of it should be utilized. For this reason I suggest storing yellow rather than white corn. Additionally, much of the niacin content of corn is chemically bound up in a form not available for human nutrition unless it has been treated with an alkali. This is really of importance only if most of your sustained daily calorie intake will come from corn, but grits, hominy (posolé) or corn masa (for tortillas and tamales) are traditional uses of this grain and can go a long way toward increasing the number of recipes you can make with corn. Give them a try, they're quite good.

Any grain as widely grown as corn is naturally going to be processed into many products. Here are a few suited for use in home storage programs.

Corn Meal (polenta meal): This is simply dry corn ground into a meal. Corn meal intended for polenta may be found in either a coarse or a fine grind. In the U.S. corn meal for making corn bread and most other uses is typically ground to a fairly fine meal. Finely milled corn is often used for breading foods to be fried and is known as *corn flour* to distinguish it from coarser meals. This sometimes causes confusion because *corn starch* (see below) is also known as corn flour in Great Britain - a different product and not really interchangeable.

The germ of the corn kernel contains about twice the oil content of wheat and is highly susceptible to rancidity once the kernel is broken in the milling process. Because of this most commercially available corn meal will have had the germ and hull removed to extend shelf-life then nutritionally enriched to make up for some of the vitamins and minerals lost with the grain germ. This is desirable for the miller and the grocer, but for the diner it comes at a cost of flavor and some of the nutrition of the whole grain. Some grocers may offer a whole grain corn meal that keeps the grain germ and bran which gives a superior flavored product and retains the full nutrition of the grain but makes for a more perishable commodity. If you go this route be sure of your product's freshness then store it in your refrigerator or freezer.

The grocer's corn meal is mostly milled from yellow or white corn, but some suppliers are now offering blue or even red corn meals. The flavor of the degerminated yellow and white meals are largely indistinguishable from each other, but blue and red corns are interestingly different. Might be worth investigating if you can find them.

Storage life of degerminated corn meal is about one year in average conditions in store packaging and a good deal longer if you repackage it for long term storage. Whole grain meal is good for about four weeks on the shelf, months in the refrigerator, and several years in the freezer or if carefully put up in oxygen free packaging. If you have a grain mill I recommend storing your corn meal in the form of whole corn and milling it as needed. This is what we do, milling a few weeks worth of meal at a time then keeping it in the freezer until needed. The fresh whole grain meal has a much fuller corn flavor than the degerminated meal from the grocery store.

Hominy (posole'): This is corn with the hull, and possibly the germ, removed. Hominy cooks faster than unhulled whole corn, is easier to digest, and in some circumstances the alkali peeled varieties can present a superior nutritional profile to whole corn. There are two methods of producing hominy: Mechanical dehulling in a wet milling process or by treating with one of a number of various alkalis such as industrial lye (sodium hydroxide), wood ash lye (mostly potassium hydroxides) or by using some form of lime (calcium hydroxide).

Dry lye peeled hominy is now seldom found for sale, but canned white or yellow hominy is still common across the Southern U.S. and many other areas as well as in Latin American groceries. Generally speaking hominy produced using lime is known by its Spanish name – *posole'* – but this will not always be clear on labels. I have seen can labels of lime peeled hominy simply called hominy. Whether this is important to you depends on the particular flavor you are trying to achieve in the dish you are preparing. Freshly hulled corn using the lime process that is to be ground to make masa (dough) for corn tortillas is called *nixtamal*. Dry posole' can be found in Latin American groceries or ordered from the Internet in nearly any color that corn offers. There's a world of things that can be done with hominy other than simply heating it up and serving with butter and salt. A few minutes spent searching the Internet will produce dozens of recipes using hominy as a major ingredient. It's an excellent ingredient in hearty soups and stews.

Hominy Grits: Usually just called "grits" this coarsely ground meal can be either simple whole corn ground coarse or corn that has been hulled in a process using a form of lye to make hominy then dried and coarsely ground. Grits produced from lye peeled corn typically cook faster, have a longer shelf life, and presents a different, possibly superior, nutritional profile than the whole grain product. Grits produced from whole corn take much longer to cook, have a short shelf life if not refrigerated or put up in special packaging, a superior flavor to the lye peeled product, and retains the nutrition of the whole grain. Very coarsely ground grits is also known as *samp*.

Hominy grits in the U.S. must be enriched like many other refined grain products and are now typically industrially produced. They are usually what you will find at your local grocers. Whole grain grits are primarily the product of grist mills making stone ground products and are often found in living history demonstrations, heritage fairs, pioneer day celebrations, and so on. Both yellow and white corns are commonly milled for grits and which one you should buy probably depends on what you ate growing up. If you're indifferent as to the color of your grits then I suggest buying yellow corn grits as the beta carotene content of yellow corn can be converted by our bodies into Vitamin A whereas white corn has none.

Masa Harina: In Spanish "masa" means "dough" and "harina" means "flour" which is a straight forward description of what masa harina is: A lime peeled corn that has been dried and milled into meal to be made into tortilla dough. It's flavor is distinctively different from either corn meal or hominy grits and is used in making tortillas, tamales, and many other Southwestern, Mexican, Central and South American dishes. Can often be found in mainstream grocery stores and grocers catering to a Latin American trade. Will store on the shelf for about a year and even longer if refrigerated or put up in good storage packaging. If you have a mind to try making your own tortillas you will save yourself much time and effort by using a tortilla press. These can be found in some groceries catering to a Latin American clientele or ordered over the Internet.

Corn Starch: A common starch used as a thickener. Made by a roller milling process removing the hull and germ leaving behind a nearly pure starch. Storage life is indefinite if kept dry. In the United Kingdom and some other areas it is known as *corn flour* which occasionally causes confusion with finely milled corn also known as corn flour here in the States. The two products are largely not interchangeable.

MILLET: Millet is an important staple grain in North China and India, but is little known in the U.S, where we mostly use it as bird feed. The grain kernels are small, round, and usually ivory colored or yellow, though some varieties are darker. A lack of gluten and a rather bland flavor may account for the anonymity of this cereal. Millet has a more alkaline pH (and a higher iron content) than other grains which makes it easy to digest. A major advantage of millet is that it swells a great deal when cooked and supplies more servings per pound than any other grain. When cooked like rice millet makes an excellent breakfast cereal. It has little gluten of its own, but mixes well with other flours. Adding whole millet kernels to the dough can add a pleasant crunch to your home made breads.

OATS: Though the Scots and the Irish have made a cuisine of oats, it is mostly thought of in the U.S. as a bland breakfast food. Seldom found as a whole grain, it's usually sold processed in one form or another. Much like barley, the oat is a difficult grain to separate from its hull. Besides its longtime role as a breakfast food, oats make an excellent thickener of soups and stews and a filler in meat loafs and casseroles. Probably the second most common use for oats in America is in cookies and granolas. A little creative thought can really increase their culinary range.

Listed below are the forms of oats found in the U.S. Rolled and cut oats retain both their bran and their germ.

Oat groats: These are whole oats with the hulls removed. They are not often found in this form, but can sometimes be had from natural food stores and some storage food dealers. Oats are not the easiest thing to obtain a consistent grind from so producing your own oat flour takes a bit of experience. If you have a roller mill or attachment you can produce your own oatmeal using whole oat groats.

Steel cut oats: Also known as Irish, pinhead or porridge oats. They are oat groats cut into chunks with steel blades. They're not rolled and look like coarse bits of grain. Steel cut oats can be found in many supermarkets and natural food stores. They take longer to cook than rolled oats, but retain more texture. They need oxygen free packaging to be kept at their best for long term storage.

Rolled oats: These are also commonly called old fashioned, thick cut or porridge oats. To produce them, oat groats are steamed and then rolled to flatten. They can generally be found wherever oats are sold. They take slightly longer to cook than do the quick cooking oats, but they retain more flavor, texture and nutrition. This is what most people will call to mind when they think of oatmeal.

Quick cooking rolled oats: These are steamed oat groats rolled thinner than the old fashioned kind above so that they will cook faster. They can usually be found right next to the thicker rolled oats.

Instant rolled oats: These are the "just add hot water" or microwave type of oat cereals and are not particularly suited for a storage program. They do, however, have uses in "bug out" and 72 hour food kits for short term crises.

Whole oats: This is with the hulls still on. They are sold in feed & seed stores and sometimes straight from the farmer who grew them. Unless you have some means of getting the hulls off, I don't recommend buying oats in this form. If you do buy from a seed supplier, make certain that they have not been treated with any chemicals that are toxic to humans.

QUINOA: Pronounced "keen-wah" this is yet another of the grains that is not a true cereal. It's botanical name is *Chenopodium quinoa*, which makes it a relative of the common weed Lambsquarter. The individual kernels are about 1.5-2 mm in size and are shaped rather like small flattened spheres. When quinoa is cooked, the germ of the grain coils into a small "tail" that lends a pleasant crunch when eaten. Some forms of this grain have a bitter tasting water soluble component that should be removed by a thorough washing unless this was already done by the processor as most of the quinoa sold in the U.S. apparently has. There are several varieties of quinoa that have color ranging from near white to a dark brown. The larger white varieties are considered superior and are the most common.

RICE: Rice is the most widely consumed food grain in the world with the U.S. being the leading exporter of this important staple, though we actually only produce about 1% of the global supply. The majority of the world's rice is eaten within five miles of where it was grown.

Much like wheat and corn, rice comes in a number of varieties, each with different characteristics. They are typically divided into classes by the length of their kernel grains; short, medium and long.

Short grain rice: The short grain variety is a little softer and bit moister when it cooks and tends to stick together more than the longer rices. It has a sweeter, somewhat stronger flavor than long grain rice.

Medium grain rice: The medium grain variety is not very common in the States. It has flavor like the short variety, but with a texture more like long.

Long grain rice: The long grain variety cooks up into a drier, flakier dish than the shorter types and the flavor tends to be blander. It is the most commonly found size of rice on American grocery shelves.

Each of the above may be processed into brown, white, parboiled or converted, and instant rice. Below is a short discussion of the differences between the various types.

Brown rice: This is whole grain rice with only the hull removed. It retains all of the nutrition and has a pleasant nutty flavor. From a nutritional standpoint it is by far the best, but it has one flaw: The essential oil in the germ is very susceptible to oxidation and soon goes rancid. As a result, brown rice has a shelf life of only about six months unless given special packaging or storage. Freezing or refrigeration will greatly extend this. It's possible to purchase brown rice from long term food suppliers already specially packaged in air tight containers with an inert nitrogen atmosphere or you can do it yourself. In this kind of packaging, (if properly done), the storage life can be extended for several years.

***Converted rice*:** Converted rice starts as whole rice still in the hull which undergoes a process of soaking and steaming until it is partially cooked. It is then dried, hulled and polished to remove the bran and germ. The steaming process drives some of the vitamins and minerals from the outer layers into the white inner layers. This makes it more nutritious than polished white rice, but also makes it more expensive. Its storage life is the same as regular white rice.

White rice: This is raw rice that has had its outer layers milled off, taking with it about 10% of its protein, 85% of its fat and 70% of its mineral content. Because so much of the nutrition is lost, white rice sold in the U.S. has to be "enriched" with vitamins to partially replace what was removed. It stores well and is generally the cheapest form of rice to be found in the market place making it a common storage food.

Instant rice: The type of rice is fully cooked and then dehydrated needing nothing more than the addition of water to reconstitute it. In a pinch, it's not even necessary to use hot water. It's not particularly suitable for inclusion in storage programs, but may have a place in "seventy-two hour" and other short-term emergency kits. The white variety is by far the most common, but in the last few years instant brown rice has made an appearance on the market.

RYE: Rye is well known as a bread grain in the U.S. It has dark brown kernels longer and thinner than wheat, but less gluten. Rye flours can be found in varying stages of refinement from dark whole grain flour to semi-refined medium to pale fully refined offerings. Bread made from this grain tends to be dense unless gluten is added (often in the form of a lot of wheat flour). German pumpernickels and Russian black breads, made with unrefined rye flour and molasses, are two of the darkest, densest forms of rye bread. Many sourdoughs are built upon a rye base with a resulting interesting, intense flavor.

SORGHUM: Sorghum is probably more widely known here in the States for the syrup made from the sweet juice squeezed from the stalks of some varieties of this grain. Also known as "milo", it is one of the principle cereal grains of Africa. Its seeds are somewhat round, a little smaller than peppercorns, of an overall brown color with a bit of red and yellow mixed in. The varieties called "yellow endosperm sorghum" are considered to have a better taste. It is a major feed grain in the Southwestern U.S. and is where the vast majority of the national production goes.

Like most of the other grains, sorghum is low in gluten, but the seeds can be milled into flour and mixed with higher gluten flours or made into flat breads, pancakes or cookies. In the Far East, it is cooked and eaten like rice, while in Africa it is ground into meal for porridge. It's also fermented for alcoholic beverages.

TEFF: Easily the smallest of the grains, teff kernels are only about 1/32nd inch in diameter. The name itself means "lost" because if dropped on the ground, it's too small to recover. It's been little known in the U.S. until recently, but has been a staple grain in Ethiopia for nearly five millennia. Small amounts are now being grown in South Africa and the United States. This grain ranges in color from reddish brown to near white. It has a protein content in the 10-12% range, good calcium and a useful source of iron. It is traditionally used in making the Ethiopian flat bread "injera", but has no gluten content of its own. It'll combine well with wheat flour though and has something of a sweetish flavor.

TRITICALE: Triticale is not a creation sprung from the smooth brows of *Star Trek* script writers. It is, in fact, a cross between durum wheat and rye. This youngest of grains combines the productivity of wheat with the ruggedness of rye and has a high nutrition value. The kernels are gray-brown, oval shaped larger-than-wheat and plumper than rye. It can be used in much the same way as either of its two parents. It will make a raised bread like wheat does, but its gluten is a bit weak so wheat flour is frequently added to strengthen it. Because of the delicate nature of its gluten, excessive kneading must be avoided.

WHEAT: The most widely consumed grain in the United States and along with rice and corn one of the three most widely grown in the world. Wheat is also one of the most intensively processed to turn into food of all the grains. It comes in a number of different varieties each more suitable for some purposes than others based on its particular characteristics. The most common classifications of these varieties are based on their respective growing season, hardness of kernel, and color of their bran layers - spring or winter, hard or soft, red or white.

The hard wheats have kernels that tend to be small, hard in texture, and with high protein (primarily gluten) contents. As a general rule, hard varieties have more protein than soft varieties. Yeast raised breads that need a lot of gluten are where it's at for the hard wheats.

The soft wheats have kernels tending to be larger, plumper and softer in texture than hard wheats. As their gluten content is lower they are primarily used in biscuits, pastries, quick breads, some pastas, and breakfast cereals where a higher gluten content would contribute an undesirable tougher texture. Soft wheats do not produce as fine a loaf of yeast raised bread as high gluten hard wheat, though it can still be used for yeast breads by combining with higher gluten flours or using methods suitable for its protein level. Many traditional European yeast raised breads are made with lower protein flours.

Durum wheat also has a hard kernel and a high protein content, but of a somewhat different nature than the other hard wheats. Durum is not primarily used for breads but is instead consumed mostly in the manufacture of pasta where it lends its characteristic yellowish color to the finished product. There are some specialty breads that call for durum/semolina flour so it can be used for bread making even if it’s not best suited to the task.

Winter wheats are planted in the Fall, over winter in the field, grow through the Spring and are harvested early the next Summer. Spring wheats are planted in the early Spring and are harvested the following Fall. Red wheats comprise most of the hard varieties while white wheats comprise most of the soft. Recently, hard white wheats have been developed that are suitable for yeast raised bread making. Some feel the hard white varieties make a better tasting whole wheat bread than the hard reds and I am inclined to agree. When milled, whole grain hard white wheat flour looks somewhat like unbleached refined white flour in appearance.

The hard red varieties, either spring or winter, are commonly chosen for storage programs because of their high protein content which should be no less than 12% with 14% or more being excellent. The hard white spring wheats are still relatively new and not yet as widespread but are steadily growing in popularity. They have the same excellent storage characteristics as the hard red wheats and should be selected with the same protein contents as well.

With so many different varieties of wheat it should come as no surprise that there are a number of different types of wheat flour offered to the home baker. Distinguishing between the array of products available through both retail

grocery stores and commercial supply houses catering to bakers nearly requires the knowledge of a professional baker or a cereal chemist and would take up page after page to explain it all. Instead I will briefly cover only those flours or flour products that one can usually find in supermarkets in the U.S. and elsewhere. If you need more advanced knowledge in order to purchase through commercial or institutional food channels I recommend taking your questions to the Usenet newsgroups rec.food.baking, sci.bio.food-science, or alt.bread.recipes where you may be able to get answers from professionals in the field.

All Purpose Flour: Of all the flours in the retail market all-purpose flour is the one most subject to major differences between brands, regions of the U.S., and/or other nations. This refined flour is typically made from a blend of hard and soft wheats with a protein content that can range from as low as 8% to as high as 12%. The regional brands of the Southern U.S. have traditionally been on the lower end of the protein scale. This is due to the fact that historically only soft wheats were grown in the South and the resulting flour was best used is in making biscuits and other types of non-yeast raised breads that did not require high gluten levels. The regional brands of the Northern U.S., and Canada are typically at the high end of the protein scale at or approaching 12%. This is because hard wheats are primarily northern grown and are well suited to making yeast raised breads which need higher gluten levels as were customarily made there. The national brands either differ by region or are in the 10-11% range in an effort to try to satisfy all markets.

In the U.S. all-purpose flour is enriched and can be had either bleached or unbleached and may possibly have small quantities of malt added as well (see below about enrichment, bleaching and malting).

As the name implies all-purpose is meant to serve as a general all-around flour from which you can make anything from cakes and pie crusts to sandwich bread. So far as it goes you can, but it's a lot like one-size-fits-all clothing in that chances are it won't work as well for a given project as a flour milled with that particular use in mind. The lower protein all-purpose flours sold in the Southern U.S. will produce a more tender biscuit, cake, or pie crust than the higher protein all-purpose flours of the Northern U.S. and Canada, but unless you use some special techniques (like how true French bread is made) it won't produce a satisfying loaf of yeast bread. The flours in 10-11% range try to strike a happy medium between the two, but still won't serve as well as flour produced specifically with a given end use in mind. If you want to limit the number of types of flour you put into your storage program I'd recommend going with the 10-11% flours and either plan on adding gluten as needed to make the best yeast raised breads or cornstarch to produce more tender cakes and pie crusts.

In the United Kingdom and Canada all-purpose flour is oft times labeled as "plain flour", "top patent", "general purpose", or "family flour."

Bread Flour: A refined white flour with a higher protein (gluten) content than most all-purpose flours to achieve better performance in making yeast raised breads. Protein levels should be at least 12% with 13-14% better still.

As this is a refined flour in the U.S. it will be enriched with added vitamins and iron, and can be found either bleached or unbleached. Because it is intended primarily for use in yeast raised breads this flour will usually have other additives such as small amounts of malt to improve yeast performance and vitamin C (ascorbic acid) to improve dough volume and texture. Some bread flours may also be treated with potassium bromate to improve gluten qualities, but concerns over possible toxicity of this additive is leading to its diminished use.

A high gluten refined bread flour is commonly added to whole wheat doughs to strengthen them which can improve loaf rises and volume. Bread flour is most commonly used in the production of yeast raised breads, pizza crusts, and some specialty baked goods. In Great Britain bread flour is often labeled as "Strong Flour" meaning it has a high protein content.

Whole Wheat Flour: Real whole wheat flour should include 100% of the bran and germ so read your ingredient labels carefully to be sure this is so. This flour is mostly milled from hard red wheats, but whole grain hard white flour is available from some mills and will produce a bread that looks closer to refined white bread if that is what you are accustomed to eating. Protein contents can vary, but as most whole wheat flour is used in yeast bread making it should be at least 12% with 13-14% being better still. This is good because the bran and the germ can interfere with good gluten development as the dough is mixed and kneaded. Some do not mind this

while others strengthen their flour by adding vital wheat gluten or high protein refined bread flours to achieve the rise and volume they are accustomed to in yeast breads. Approximately 90% of the total protein of a kernel of wheat is gluten with the remaining 10% other proteins being mostly found in the grain germ. Refined flours have had the germ removed so a statement of protein content can be taken as an indication of that flour's suitability for making raised yeast breads. With whole wheat flours one must remember that ten percent of non-gluten germ proteins and judge that flour's protein content accordingly. Whole wheat flour milled from lower protein soft wheats may be offered as "whole wheat pastry flour" so be sure of what you are buying. Some whole-wheat flours are also enriched.

Whole wheat flour may also be called "Graham Flour", sometimes simply "Stone Ground Wheat Flour" and in Great Britain, Canada, and Australia may be known as "Whole Meal Flour." In Britain there is also a "Brown Flour" which is midway between whole meal and white flour in that it retains about 85% of the wheat kernel rather than only the 72-75% that is typical of refined white flours.

The real disadvantage to storing whole wheat flour is that like other processed grain products that includes the oil rich germ it wants to go rancid. How fast this can happen depends upon temperature, moisture, etc, but four to six weeks is generally enough time for rancidity to become noticeable. One can, of course, package the flour in good containers with oxygen absorbers and the like, but better still would be to buy the flour in the form of whole wheat berries and mill them yourself. This is exactly what I and many other folks with food storage programs do. Baking with fresh, whole wheat flour is something of an art so the time to get good with it is right NOW while you can toss your failures to the chickens rather than having to eat them regardless because you can't afford to waste the food.

Vital Wheat Gluten: Sometimes labeled as simply "wheat gluten." This is the purified gluten of hard wheat extracted from flour. It is generally 75-80% protein and is used to strengthen weak or whole grain flours for making yeast raised breads or made into "seitan" a wheat protein meat substitute. Somewhat confusing the issue is "High Gluten Flour" which is available in some markets. Careful investigation is needed here because this flour can range from a mere high gluten bread flour (approx 14%) to a gluten enriched flour (typically 40%+) all the way up to purified wheat gluten (75%+). Be clear as to what it is you're buying and if you're not certain contact the manufacturer. If your whole wheat bread is not rising for you as much as you'd like then an addition of a few spoonsfuls of gluten or some high gluten flour may perk it up a bit.

Cake Flour: Typically the lowest protein content (6-8%) flour available to the home baker. This highly processed flour will make the tenderest cakes, cookies, and biscuits but performs poorly for yeasted breads. The flour is nearly always bleached (chlorinated) both to give it a bright whiteness and to improve its moisture holding capacity for cakes calling for a high ratio of sugars or fats. Unless you make a lot of cakes this is a rather specialized item to store.

Pastry Flour: Similar to cake flour, but generally slightly higher in protein, not chlorinated, and may be found bleached or unbleached. Used to produce tender pie crusts, biscuits, etc. Similar to the regional all-purpose flours of the Southern U.S. Can also sometimes be found in a whole-wheat version as well. In Great Britain, Canada, and Australia may be known as "soft flour."

Semolina/Durum: Produced from durum wheat this flour is typically high in protein, 12% or more, enriched, unbleached with a distinctive pale yellow color. Texture depends largely on brand and can range from fairly coarse to bread flour fine. Most commonly used in the production of pastas, noodles, and couscous, but some specialty bread types call for semolina flour. May also be known as "alimentary flour", "macaroni flour", or "pasta flour." Farina, a coarse meal used as a breakfast cereal, is made from durum wheat.

Self-Rising Flour: This is ordinary refined and enriched all-purpose flour to which approximately 1.5 teaspoons of baking powder and 0.5 teaspoons of salt have been added to each cup of flour. This flour has its fans, but it's not well suited to long storage as the baking powder wants to go flat over time even with special packaging. Nor is it suited to making yeast raised breads. Most self-rising flours are in the mid to low end of the protein scale (8-10%) because this is where chemically leavened quick breads perform best to achieve good rises and textures. You can make your own self-rising flour by adding in the requisite amount of double acting baking powder and salt mentioned above which is what I recommend doing rather than trying to store the ready-made product. Self-

rising flour is sometimes known as phosphated flour (for the baking powder used in it) and in Great Britain, Canada, and Australia may be known as "self-raising flour" or "raising flour."

Instant Flour: This specialized flour product is also sometimes known as "shaker flour" for the shaker can in which it's usually found This is a low-protein flour in a granular form processed for easy and rapid dissolution into hot or cold liquids for making sauces, gravies, and batters. A fairly specialized item which any worthy cook can use ordinary flour to replace.

FLOUR TREATMENTS AND ADDITIVES

Flour milling companies (and home bakers) use a variety of additives and treatments in their flours to improve or suppress a particular quality in their product. If you read the package labels carefully you can discern quite a lot about what has and has not been done. Here are a few of the more common:

Enrichment: U.S. law (and some other nations) requires that refined flours which have had their bran and germ portions removed to be "enriched" by adding back a portion of the niacin, thiamin, riboflavin, folic acid, and iron that were lost in the refining process. Some milling companies go even further by adding vitamins A & D as well. There are various opinions about the value of this enrichment, but it's there. It has no affect on the taste, color, texture, caloric value, or baking qualities of the flour. Outside of the U.S. refined white flours may or may not be enriched so study your package labels carefully if this concerns you.

Bleaching: White bread and white cakes come by their snowy beauty thanks to bleaching. This is a process by which the yellowish carotenoid pigments that naturally occur in wheat are bleached white in order to improve the appearance of the flour and perhaps to change some of its physical characteristics as well. This would occur naturally by itself were the refined flour allowed to sit around for several months, but it's an uneven process and time is money to the milling comp anies who cannot afford to have large stocks of product sitting around in their warehouses for long periods of time.

Beyond making naturally off-white flour snowy in appearance bleaching can perform several other functions which the individual baker must decide if they are important to his needs. Until fairly recently much refined flour was also "bromated" using potassium bromate both to lighten the color, and to improve the qualities of the gluten. Concerns over the toxicity of this chemical has led to its gradual decline or outright ban on its use. Other bleaching agents are now used such as chlorine gas, chlorine dioxide, benzoyl peroxide and possibly others as well. Flours treated in this fashion will often exhibit improved loaf volume, finer grain, and look better in the finished product.

Cake flour is generally chlorinated not only whiten but also to improve its moisture holding ability when used in cakes with a high ratio of sugar and fat to flour. This bleaching also further tempers the already low gluten of the flour to produce the tenderest possible texture.

For the folks who do not care to buy bleached flours, small amounts of ascorbic acid (vitamin C) are often added as a dough conditioner and yeast nutrient. Home bakers often add their own vitamin C to their breads when they make them for the same reasons. A mere 1/8 tsp of ascorbic acid per cup of flour is all that is necessary.

All bleached flours must be so labeled in the U.S.

Malting: Many bread flours and some all-purpose flours will have small amounts of malt, malted barley flour, malt flour, or diastatic malt added to them. This additive improves the performance of the yeast by providing enzymes which speed the conversion of some of the flour starches into the digestible sugars the yeast use as fuel which can improve both the rise of the dough and the flavor of the finished product. The malt can also serve to improve the appearance of the bread when baked and lengthen its shelf life. You can add your own diastatic malt in the ratio of about 0.5-1.0 teaspoons for every three cups of flour.

Organic: This is flour produced and processed under the guidelines of the U.S. Department of Agriculture's Organic foods program. Most of the basic flour types (all-purpose, bread, pastry, etc.) can be found in organic forms though you may have to search a bit to find them.

Pre-Sifted: This is flour sifted at the mill before it was packaged. Supposedly this means you do not need to sift it again at home, but many feel that due to settling during transport and storage if the recipe calls for sifted flour it should be done again.

Other Additives: There are many other potential additives that you may potentially come across in flour which would require more space than is possible here to cover them. Most are for use within the commercial/industrial baking fields and you would need to contact the supplier to determine precisely what it is they can do for you.

STORING FLOUR PRODUCTS:

As already mentioned above whole wheat flour wants to go rancid rather quickly after it has been milled. Once ground it will stay fresh for about four to six weeks sitting on your room temperature kitchen shelf. In a sealed container in the refrigerator the flour will stay good for a year or so. In the freezer it will keep for years. Personally, I think it best to store your whole wheat flour in the form of wheat berries and only mill as much flour as you will use in a week or two and keep that in the refrigerator or freezer until you do. If for some reason you cannot do this then buy the freshest product you can and package it well in Mylar bags, glass jars, or metal cans with oxygen absorbers. Due to the fine texture of flour it will not gas flush well at all.

Even the refined white flours have limited shelf-lives. In spite of what some would have you believe they are not "dead foods." The bran and germ may have been removed, but a minute portion of the germ oils will remain as well as the naturally occurring enzymes found in the grain. Refined white flour won't noticeably go off on you the way whole wheat flour will, but given sufficient time and exposure to heat and atmospheric humidity the protein content of the flour will slowly breakdown. Your first indications of trouble may be a slowly developing musty smell or degraded dough performance – poor rises and bad loaf volumes. In a sealed, air tight container you should easily achieve six months to a year at room temperatures. Sealed containers in the refrigerator or freezer will last for at least several years. If you want your white flour to stay at its best for the longest possible time then package it in Mylar bags, glass jars, or metal cans air tight with oxygen absorbers. At a decent storage temperature sealed in a low oxygen environment you should easily achieve five years of shelf life or more.

A.2 LEGUME VARIETIES

If you're willing to spend what it takes on preserved meats and dairy products it's not necessary to store legumes at all. But most people do choose to keep a selection of beans, peas, and lentils in their larders either for reasons of economy, because they like them, or both. There are few non-animal foods that contain the amount of protein to be found in legumes with the varieties commonly available in the U.S. ranging from 20%-35%. As with most non-animal proteins, they are not complete in themselves for purposes of human nutrition, but become so when they are combined with the incomplete proteins found in grains. This is why grains and legumes are so often served together the world around.

The legume family, of which all beans, peas, lentils, and peanuts are a part, is one of the largest in the plant kingdom. Because of this and the many thousands of years of cultivation and development that man has given them on several continents the variety of edible legumes available to us is huge. Both their appearance and their names are colorful and varied. They range from "adzuki beans", a type of soybean from the Orient, to "zipper peas", a common field-pea here in the Southern U.S. Their color can range from a clean white, to deep red, dull green to flat black with thousands of mixtures and patterns in between.

In spite of this incredible variety, many legumes are largely interchangeable in cooking, although some dishes wouldn't be the same if a different type were used. Below is a partial list of common legumes.

ADZUKI BEANS: These small, deep red beans are popular in Japan, China and other Asian nations, but are not as well known in the U.S. They are actually a cousin of the soybean and are commonly used in producing sweet bean paste for Chinese buns and other dishes. Pressure cooking will sometimes impart a bitter flavor so they are best pre-soaked then boiled in the conventional fashion. Their flavor is somewhat milder than kidney or small red beans, but they can serve as an adequate substitute for either in chili and other dishes in which those beans are commonly used.

BLACK BEANS: Also known as "turtle beans", they are small, dark brownish-black and oval-shaped. Well known in Cuban black bean soup and commonly used in Central and South America and in China. They tend to bleed darkly when cooked so they are not well suited to being combined with other beans, lest they give the entire pot a muddy appearance. The skins of black beans also slip off easily so for this reason they are generally not recommended for pressure cooking for fear of clogging the vent. This can be lessened by not pre-soaking before cooking.

BLACK-EYED PEAS: Also known as “cowpeas” or “field peas” there are many varieties these peas eaten across the Southern United States, Mexico, and Africa with black-eyed peas being the most commonly known in the U.S. The coloring of field-peas is as varied as the rest of the legume family, with black-eyed peas being small, oval shaped with an overall creamy color and, of course, their distinctive black-eye. Dried field-peas cook quickly and combine tastily with either rice or cornbread and are often eaten as Hoppin’ John every New Years for luck. They’re also reputed to produce less flatulence than many other beans.

CHICKPEAS: Also known as the "garbanzo bean" or "cecci pea" (or bean), they tend to be a creamy or tan color, rather lumpily roundish and larger than dried garden peas. Many have eaten the nutty flavored chickpea, even if they've never seen a whole one. They are the prime ingredient in hummus and falafel and are one of the oldest cultivated legume species known, going back as far as 5400 B.C. in the Near East. Chickpeas tend to remain firmer when cooked than other legumes and can add a pleasant texture to many foods. I like them in red spaghetti sauces in particular and they are often used in Spanish cuisine in a tomato based sauce. Roasted brown then ground they have also served as a coffee substitute.

FAVA BEANS: Not as well known in the U.S. as in Europe and the Mediterranean favas are also known as "broad beans" or "horse beans" being broad in shape, flat and reddish brown in color. This is one of the oldest legume species in European cultivation, but it does require more effort to consume. The hull of the bean is tough and not conducive to being tenderized by cooking so is often peeled away. The skinless bean falls apart so is made into a puree. A small number of people with Mediterranean ancestry have a genetic sensitivity to the blossom pollens and undercooked beans, a condition known as "favism" so should avoid consuming them.

GREAT NORTHERN BEANS: A large white bean about twice the size of navy beans they are typically bean flavored and are frequently favored for soups, salads, casseroles, and baked beans. One of the more commonly eaten in the U.S. Milled into meal these mild flavored beans can be included in many baked goods as a protein booster or used to thicken soups and stews.

KIDNEY BEANS: Like the rest of the family, kidney beans can be found in wide variety. They may be white, mottled or a light or dark red color with their distinctive kidney shape. Probably best known here in the U.S. for their use in chili and bean salads, they figure prominently in Mexican, Brazilian and Chinese cuisine.

LENTILS: Lentils are an odd lot. They don't fit in with either the beans or the peas and occupy a place by themselves. Their shape is different from other legumes being roundish little discs with colors ranging from muddy brown, to green to a rather bright orangish-red. They cook quickly and have a distinctive mildly peppery flavor. They are much used in Far Eastern cuisine from India to China. Next to mung beans they make excellent sprouts though their peppery flavor tends to strengthen somewhat so are best mixed with milder sprouts.

LIMA BEANS: In the Southern U.S., they are also commonly called "butter beans". Limas are one of the most common legumes, found in this country in all manner of preservation from the young small beans to the large fully mature type. Their flavor is pleasant, but a little bland. Their shape is rather flat and broad with colors ranging from pale green to speckled cream and purple. They combine well with rice.

MUNG BEANS: Best known here in the States in their sprouted form, they are quite common in Indian and other Asian cuisines and are a close relative of the field peas (cowpeas). Their shape is generally round, fairly small with color ranging from a medium green to so dark as to be nearly black. They cook quickly and pre-soaking is not generally needed.

NAVY BEANS: Smaller than Great Northerns these petite sized beans are also sometimes knows as pea beans. They are the stars of Navy and Senate Bean Soups, favored for many baked bean dishes, and are most often chosen for use in commercial pork and beans. They retain their shape well when cooked. Ground into meal they can be added to many soups and stews without overpowering them.

PEANUTS (Groundnuts): The peanut is not actually a nut at all, but a legume. They are another odd species not much like the more familiar beans and peas. Peanuts have a high protein percentage and even more fat. Whatever their classification peanuts are certainly not unfamiliar to U.S. eaters. They are one of the two legume species commonly grown for oilseed in this country, and are also used for peanut butter, and boiled or roasted peanuts. Peanut butter (without excessive added sweeteners) can add body and flavor to sauces, gravies, soups, and stews. Many Central and South American, African, Chinese, and Thai dishes incorporate peanuts so they are useful for much more than just a snack food or cooking oil.

PEAS, GREEN OR YELLOW: More often found as split peas though whole peas can sometimes be had. The yellow variety has become somewhat uncommon but has a milder flavor than the green types which well lends them to blending inconspicuously into other foods. Probably best known in split pea soup, particularly with a smoky chunk of ham added. They are also used in Indian cuisine, especially dals. Whole peas need soaking, but split peas can be cooked as is. Split peas and pea meal makes an excellent thickener for soups and stews. Because splitting damages the pea, this more processed form does not keep for as long as whole peas unless given special packaging.

PINK AND RED BEANS: Related to the kidney bean these are smaller in size but similar in flavor. The pink bean has a more delicate flavor than the red. The are both often favored for use in chili and widely used across the American Southwest, Mexico, and Latin America. They can add nicely to the color variety in multi-bean soups.

PINTO BEANS: Anyone who has eaten Tex-Mex food has likely had the pinto bean. It is probably the most widely consumed legume in the U.S., particularly in the Southwestern portion of the country. Stereotypically bean shaped, it has a dappled pattern of tans and browns on its shell. Pintos have a flavor that blends well with many foods. When ground together with great northern or navy beans they make my favorite home-made version of falafel. When milled into a meal pintos will cook in mere minutes, making a near instant form of refried beans.

SOYBEANS: The soybean is by far the legume with the highest protein content in large scale commercial production and it's amino acid profile is the most nearly complete for human nutrition. Alongside the peanut it is the other common legume oilseed. The beans themselves are small, round, and with a multitude of different shades though tan seems to be the most common that I've seen. Because of their high oil content, they are more sensitive to oxygen exposure than other legumes and precautions should be taken accordingly if they are to be kept for more than a year in storage, especially if they are to be processed for soymilk or tofu. Although the U.S. grows a large percentage of the global supply, we consume virtually none of them directly. Most go into cattle feed, are used by industry, or exported. What does get eaten directly has usually been intensively processed. Soybean products range from soymilk to tofu, to tempeh, to textured vegetable protein (TVP) and hundreds of other forms. They don't lend themselves well to merely being boiled until done then eaten the way other beans and peas do. For this reason, if you plan on keeping some as a part of your storage program you would be well served to begin to learn how to process and prepare them now while you're not under pressure to produce. This way you can throw out your failures and order pizza, rather than having to choke them down, regardless.

A.3 AVAILABILITY OF GRAINS AND LEGUMES

Grains and legumes of all types may be purchased in a number of different ways depending largely on where you live and the time of year. The following will cover the various steps of the processing chain starting with the forms most immediately suitable for storage and progressing all the way back to the farmer.

Each type of availability has its good and bad points. As you might expect, the more processing a product receives, the higher its price is likely to be. The further back along the processing chain you go the cheaper a product should become in terms of purchase price. It will, however, cost you more in time and effort to get it ready for storage.

The easiest and simplest way to incorporate grains and legumes into your storage program is to purchase your items *pre-cleaned* and *pre-packaged*. These are products that have been harvested, passed through fans and screens to remove chaff, smut balls, insect parts, mouse droppings and other debris, then put up in retail sized bags or other containers - possibly even going so far as to already be packaged for long-term storage. This would be either from your local grocer or a storage food dealer. If you don't live in the area where what you want is grown it may be your only option.

If you want to purchase in bulk then you may be able to find *pre-cleaned but not yet packaged* products. These sources would be commercial or institutional food suppliers, food co-ops, warehouse grocers like Sam's Club or Costco, local food companies that package their own product lines, and the like. If what you want is not already in 50-100 lb bags you may have to provide your own container and there may be minimum purchase amounts as well. If the moisture content is in the right range then nothing will need to be done other than to put it up in your own storage packaging. If you don't buy it from some sort of foods dealer then be certain read the cautionary text below.

Should you happen to live in the area where the type of grain or legume that you are interested in purchasing is grown you may be able to purchase direct from the producer or distributor.

If you are interested in doing this, it may be possible to find your product *field-run* which simply means that it's been harvested and sold shortly thereafter. It will not have been given any cleaning or processing and is likely to be rather dirty depending upon the conditions under which it was grown and harvested.

A second form called *field-run from storage* is product that has been harvested then put into storage for a time. It will have the dirt and debris of field run grain and whatever it may have picked up from the grain elevator as well.

IMPORTANT NOTE: If you have purchased your grains and legumes from a foods dealer then you needn't worry about hidden mold infections, fungicides or insecticides that are unsafe for human consumption. In the U.S., the products will have been checked several times by Federal and State agriculture departments and probably by the major foods dealers as well, to ensure its quality.

This is not necessarily the case when you purchase your grains or legumes directly from the farmer or elevator operator as field-run or field-run from storage grain. Nor is it necessarily the case if you've made the decision to utilize grains marketed as animal feed. Inspection procedures vary from nation to nation, so if you buy outside of the U.S. inquire of your supplier.

If you are buying your grains and legumes from some place other than a foods dealer, you need to know the history of what you are buying. There is the remote possibility that field-run from storage or any grade of grain not specifically sold for human consumption may have had fumigants, fungicides or insecticides not certified as safe for human foods added while it was in the bin. It is important to know what it has been treated with before you buy it.

Straight field-run grain, other than being dirty, is not likely to have had anything added that would make it undesirable for human consumption. There is, however, the also remote possibility it may have been infected with fungi that would make it unsafe for eating.

One of these fungal infections of grain is called "ergot". This fungal disease affects the flowering parts of some members of the grass family, mostly confined to rye. Consuming the fungus causes a nervous disorder known as St. Anthony's Fire. When eaten in large quantities the ergot alkaloids may cause constriction of the blood vessels, particularly in the extremities. The effects of ergot poisoning are cumulative and lead to numbness of the limbs and other, frequently serious, symptoms.

The fungus bodies are hard, spur like, purple-black structures that replace the kernel in the grain head. The ergot bodies can vary in size from the length of the kernel to as much as several times as long. They don't crush as easily as smut bodies of other funguses. When they are cracked open, the inner broken faces can be off-white, yellow, or tan. The infected grain looks different from ordinary, healthy rye grains and can be spotted easily. Ergot only rarely affects other grains and will generally afflict rye only when the growing conditions were damp. If you purchase field run rye, you should closely examine it first for the presence of ergot bodies. If you find more than a very, very few pass up that grain and look elsewhere.

Ergot is typically not a common problem in the U.S and is easily spotted when it does occur. Other grain fungi, however, are much harder to spot and also have serious consequences should they be consumed. The various species of *Aspergillus* and *Fusarium* molds can be a problem almost anywhere. ***Please see Section IV.B.3 Molds In Grains and Legumes for more information.***

Animal feed grains or seed grain/legumes are widely available and there are those who want to consider using these sources. Keep in mind that animal feeds are typically dirtier than food grains and may have a higher contaminant level than what is permissible for human consumption. The USDA allows the sale of grain or legumes for animal feed that could not be sold for direct human food use. It may even be mixed varieties of one grain and not all one type. In the case of feed wheat it may have an acceptable protein content but still make miserable raised bread so try milling and baking with a small amount before you put a lot of it away. Seed grains, in particular, must be investigated carefully to find out what they may have been treated with. It is quite common for seed to be coated with fungicides, and possibly other chemicals as well. Once treated, they are no longer safe for human or animal consumption. Be sure to inquire of your supplier.

If you do purchase field-run grain of any sort, examine it closely for contamination and moldy grain. Ask the farmer or distributor whether it has been tested for mold or *mycotoxin* (fungal toxin) content. *This is especially the case if you are buying field-run CORN, RYE, SOYBEANS or RICE.* When you purchase direct from the field, you may be getting it before it has been checked. Be certain of what it is that you are buying and ask questions if you choose to go this route. Know who you are dealing with. Unless you can't find any other source, I don't recommend using animal feed or seed grains for human food use. ***Please see section IV.B.3 " Molds In Grains and Legumes" for further information.***

A.3.1 MOISTURE CONTENT

The moisture content of the grain or legume you want to put by has a major impact on how long you will be able to profitably keep it in storage. Some of the available literature states that grain with a moisture content as high as 13% can be safely put up, but there is a risk to keeping it at that level that should be understood.

The outside of every kernel of grain and bean you buy or grow hosts thousands of *fungi* spores and bacteria. This is all perfectly natural and is not a cause for alarm. The problem is that at moisture levels between 13.5% to 15% some fungal species are able to grow and reproduce. Aerobic *bacteria* (needing free oxygen to survive) require moisture in the 20% range. If you have grain with a moisture content as high as 13% you are perilously close to having enough moisture to enable mold growth which could lead to the spoilage and loss of your product. For this reason, I suggest you keep all grains and legumes to a moisture content of no more than 10%. An exception to this is raw peanuts which are particularly susceptible to an *Aspergillus* mold growth that produces *aflatoxin* (a type of mycotoxin) so should be stored with an 8% moisture content or less.

If you do not have a clue as to what the moisture level of your grain is here are several methods to determine it. The first method is quick, simple and will usually give you a close enough idea to work with of how much moisture there is in your grain or legume. The last two require a great deal more time and effort, but give more precise results.

METHOD ONE

This is the method I use myself. It’s quick and dirty requiring nothing more than crushing a kernel of grain or a bean between two solid objects like a hammer and a brick. You don't have to hit it like you're driving spikes, just give it a sharp rap. If the grain shatters nicely into powdery debris or many small bits then the moisture level ought to be in the right range and you can package as-is. If the kernel just mashes flat or only reluctantly breaks into pieces it probably has too much moisture. If you're not sure of what you're seeing try drying a small amount overnight at only a warm temperature (100º Fahrenheit) such as you'd get from the pilot light in a gas oven. The next day take another sample from the same container and rinse in warm water for a few seconds, rub dry on a towel and let sit for about ten minutes. Now try the crush test on both samples. One should give you a good result and the other should be much different. Any seed with a high fat content such as soybeans and peanuts will not work well with this method.

COMMON TO METHODS TWO AND THREE

The more precise moisture content measurements require more time and effort. Nevertheless, you can make useful determinations with home equipment and I include them here for those who find Method One to be unsatisfactory.

You'll need some way to measure weight with a fair degree of accuracy. The better the scale you use, the more reliability you'll have in your determinations. Provided that it will weigh accurately to the half-ounce or less, any scale that can be calibrated with a known check weight will do. Postal scales can be made to serve if they are carefully calibrated against a known weight. Many individuals interested in starting storage programs may have grain weight scales used in ammunition reloading that might serve well.

Also necessary is a thermometer capable of withstanding and accurately measuring oven temperatures. As many bakers can tell you, home oven thermostats are often notoriously inaccurate so it is better to rely on a decent thermometer. Most kitchen supply stores can supply one that is oven safe and will accurately measure to the degree Fahrenheit or Celsius.

Proper technique calls for preheating the oven for a half-hour or more before starting the dehydrating process so that it will be of a uniform heat throughout. The sample pan should be placed on the middle rack as close to the vertical and horizontal center of the oven as possible. The bulb or dial of the thermometer should be placed next to the pan.

METHOD TWO

This method is for measuring moisture content in whole grains and legumes. Grain flours or meals, milk powders and any other finely textured foods should use Method Three detailed below.

To be done prior to measuring -- choose a shallow heat resistant container that has a close fitting lid. Clean it thoroughly and dry completely in your oven for 10-15 minutes. Allow it to cool and then weigh it carefully. This will give you the *tare weight* or what your container weighs empty.

Depending on how your scale is calibrated you can use a smaller sample size than what is indicated below. Using the twenty-ounce sample mentioned in the following text will allow for fairly accurate readings with the average postal scale. A scale that will measure to the gram could use as small a sample as 20 grams. A powder scale could use even less, but the smaller your sample size becomes the more finicky care you must exercise not to allow error to creep in. Keep your sample size large enough to easily work with.

Allowing for the weight of the sample pan, measure out a weighed twenty-ounce representative sample of the grain or legumes in question. Ideally, you should thoroughly mix the entire lot immediately before removing the sample, but if this is not possible then take it from the middle center of the container. It is important that you use care in this measurement since it will affect all following determinations.

Put the sample in the container making sure it is not more than an inch deep. Place it in the oven with the lid off and allow to heat. Below is a table giving the oven temperatures and times per grain or legume type:

Time and Temperature Settings for Determining Moisture Contents of Whole Seeds.

Seed	Oven Temperature in Degrees*		Oven Time Hours
	°F	°C	
Barley	266	130	20
Beans	217	103	72
Corn	217	103	72
Oats	266	130	22
Rye	266	130	16
Sorghum, millet	266	130	18
Soybeans, peanuts	217	103	72
Wheat, rice	266	130	19

***** No home oven that I am aware of will allow for such precise temperature control. Try to keep the temperature within ten degrees either way of what is listed and you will still achieve useful results.

When the dehydration period is over place the close fitting lid on the sample pan and allow to cool in the oven with the door closed. Remove and carefully weigh the pan.

A one ounce loss in weight indicates your grain has a roughly five percent moisture content, 2 ounces indicates that it has a 10% moisture content, etc., etc. You might even be able to cut it as fine as a half-ounce loss, but I wouldn't try to take it further than that.

Obviously, this is only a rough measure, but it works and can be done with postal or dietetic scales that are available virtually everywhere. As I mentioned above, if you have a scale with a finer calibration it is possible to use a smaller sample size and achieve the same result.

METHOD THREE

This method is much faster to use than the first, but greater care must be taken to prevent error. It can be used to determine moisture contents of whole grains and legumes, flours, meals and various food powders.

The same equipment as was used in Method Two will be required here as well as a low-RPM grain mill or some other device that can reduce a quantity of the grain to a meal consistency with only minimal heating of the sample. If the food to be tested is already at a meal consistency or finer then it can be used as-is.

Grind a quantity of product from which you want to measure the moisture content. Take care to grind the sample slowly enough to keep friction heat build up to a minimum (should not be more than mildly warm) or else moisture will be lost due to heat evaporation before it can be weighed.

Immediately upon finishing the grinding, weigh out your sample so as to minimize unmeasured moisture loss.

Place the sample in the oven and dehydrate in the manner used in Method Two for a period of two hours at a temperature setting of 275º F (135º C). When the heating period is finished cover with the tight-fitting lid and allow to cool in the oven. Remove and weigh carefully. Moisture determination is the same as above.

If anyone has a better way of measuring moisture levels which can be done without a lab or special equipment I'd surely like to hear from you.

A.3.2 CLEANING IT YOURSELF

If you've chosen to purchase field-run grain or if the pre-cleaned product you've bought isn't clean enough to suit you it can be given further cleaning.

The fastest and easiest method is "fanning", a form of winnowing. This is done by pouring the grain slowly through the air stream of a fan or blower into a clean, deep container such as a cardboard box or trash can. The wind blowing through the falling grain will blow out most of the broken kernels, chaff, smut balls, mouse droppings, etc. If you're losing too much good grain, try turning the fan down or moving it further back from the container. The deep container will cut down on the amount of kernels that bounce out. Repeat fanning as necessary until the grain is clean enough to suit or you've blown all of the lighter contaminants out.

If the fanning didn't get the grain clean enough it can be further cleaned by running it through a screen or sieve. This should be made with holes just big enough to pass an average sized grain of what it is you're cleaning. Obviously, the size of the holes will necessarily vary depending upon the kernel size of the grain.

Should the kernels still not be clean enough to suit then you'll have to resort to hand picking out the offending particles. I'd strongly suggest doing this prior to grinding where it can be done in small batches rather than trying to do your entire storage all at once. It's much easier to do a few pounds at a time than fifty or a hundred.

If you have it in mind to wash the grain, this should not be done prior to storage, but rather just before use. After rinsing, dry the grain immediately in an oven heated to 150º F (117 º C) for an hour in a layer no deeper than 1/2 inch deep stirring often.

A.3.3 STORING GRAINS AND LEGUMES

Now that you have properly prepared your grains and legumes they are ready to be packaged.

For methods and procedures of packaging please see Section III.

III. Specific Equipment Questions
- *A. Storage Containers*
- *B. CO_2 and Nitrogen*
- *C. Vacuum Sealing*
- *D. Freeze Treating*
- *E. Oxygen Absorbers*
- *F. Desiccants*
- *G. Diatomaceous Earth*

B. DAIRY PRODUCTS

Got milk? Butter? Cheese? In the refrigerator, right? Dairy products are a great source of essential amino acids, vitamin D, and calcium, but in their usual forms found in the refrigerator cases of your local supermarkets they are perishable commodities. Fortunately, there are a number of dairy products that lend themselves to food storage.

B.1 DRY MILKS

Dry, powdered milk is available in nearly as many varieties as the fresh fluid product. Most can be found on the shelves of your local supermarket while a few may have to come from rather more specialized suppliers. Skillfully and knowledgeably used they can vastly improve the quality of your food storage program.

NONFAT (skim): This is pasteurized skim milk reduced to a powdered concentrate and is found in two forms - regular and instant. They are both made from the same type of milk, but the instant variety has been given further processing to make it more easily soluble in water than regular dry milk. Both types have essentially the same nutrient composition. The regular variety is more compact, requires less storage space than the instantized variety, usually costs somewhat less, but is a little more difficult to reconstitute. Instant dry milk is commonly available in nearly any grocery store. The regular type generally has to be sought out from baking and restaurant suppliers or storage food dealers. There is a retail brand by the name of "Milkman" that has a bit of fat content that makes it similar to 1% milk. The fat content means it should be stored like whole milk, described below.

It takes 3.2 oz or about 3 tablespoons of instant nonfat dry milk added to 32 oz of water to make 1 quart of milk you can drink or cook with like fresh milk. Combining the dry milk with water at least several hours before you plan to use it gives it time to dissolve fully and to develop a fresher flavor. Shaking the fluid milk vigorously will incorporate air and will also help to improve flavor. Add the powder to baked goods, gravies, smoothies, hot cereals, casseroles and meat loaf as a nutrition booster. It can also be used to make yogurt, cheese and most any cultured dairy product that does not require a high fat content. Several of the ways that we use dry milk powder is in making grits, oatmeal, and our favorite whole wheat bread. A few tablespoons of dry milk greatly improves the amino acid composition of any grain product.

FLAVORED NONFAT: This may be found packaged in a variety of forms from a low calorie diet drink (artificially sweetened) to the other end of the scale, as cocoa mix or malted milk. The key ingredient is the dry milk so buy and store these products accordingly.

WHOLE MILK: This is whole dry milk with all of its fat content (roughly 28% milkfat) and therefore has a shorter shelf life than nonfat. Other than that, it may be reconstituted and used in exactly the same way as nonfat dry milk. Dry whole milk can sometimes be found in the Hispanic foods area of grocery stores (Nido and Klim by Nestlé are the two brands I know), natural or health food stores, and some storage food suppliers carry it as well as institutional and restaurant foods businesses. It can also sometimes be found where camping and outback supplies are sold. Because of the high fat content this form of dry milk really needs to be either vacuum sealed or packaged with oxygen absorbers in gas impermeable containers such as canning jars, Mylar bags, etc. Rotate and use dry whole milk within two years, less if not packaged for long-term storage.

BUTTERMILK: Dry buttermilk is for use in recipes calling for buttermilk. It can be reconstituted into liquid buttermilk, but it's not much like the fresh liquid product and is best used in baked goods. Since it has a slightly higher fat content than nonfat dry milk, it generally does not keep as long. If properly packaged it should keep for several years.

SOUR CREAM: Made from cultured sweet cream like the fresh product then dried and processed into a powder. Like the real thing it has a high milk-fat content (25-28%) and should be stored like whole milk using vacuum sealing and/or oxygen absorbers and kept in a cool place. Mixed with the proper amount of cold water it can be reconstituted into a rich, thick product much like fresh sour cream and can be used in a similar manner or just used as a powder to add a tangy richness to many foods. Properly stored in oxygen free packaging and kept in a cool environment it is possible to achieve about a three year shelf life.

MILK SUBSTITUTES: There are a number of products on the market that purport to take the place of cow or goats milk. They range from soy "milk", rice or other grain "milks", and beverages based on milk components such as whey. If there is not a substantial fat content they may all be stored as you would nonfat dry milk. Those products with a significant fat content (above 1% by weight) should be stored as you would whole dry milk. Do keep in mind that nearly all of these products DO NOT have the same nutritional composition as either nonfat or whole milk. In storage food programs dairy products serve as important sources of high quality complete proteins, calcium, vitamin D and possibly vitamin A. If the milk substitute you're considering does not you'll need to find another adequate source of these important nutrients.

B.1.1 BUYING DRY MILK PRODUCTS

(a)- Be sure the dry milk you are buying has been fortified with vitamins A and D. All of the whole and nonfat dry milks I've seen come fortified with these two vitamins. The dry buttermilk does not come this way, at least the SACO brand does not. The flavored dry milks vary by manufacturer.

(b)- There should be no artificial colors or flavors. I believe it is illegal to add preservatives to any dry milk sold in the U.S. so a claim of "no preservatives" on the label is of no consequence. Other nations may be different, however.

(c)- "Extra Grade" on the label indicates the manufacturer has held to higher processing and quality standards and the milk is somewhat lower in fat, moisture and bacterial content, is more soluble, and has fewer scorched particles.

There are still some manufacturers of dry milk that sell ordinary Grade A product, but they are becoming fewer. Every brand of instant powdered milk in my local grocery store is the Extra Grade, even the generic store brand. This, too, may vary outside of the States.

(d)- If you'll be buying your milk in bulk from businesses such as restaurant and institutional foods suppliers be sure to specify "low-temperature spray process" dry milk. The high-temperature process dry milks will not give you a very desirable product unless you intend to use it solely for baking.

(e)- Try to buy your dried milk in containers of a size that makes sense for the level of consumption in the household. Once it is opened, powdered milk has a short shelf life before undesirable changes in flavor and nutrient content occurs. If you buy large packages and do not use much at one time, consider breaking it down and repackaging into smaller containers at the time of purchase. I vacuum seal mine in glass canning jars.

(f)- As with any storage food you buy, try to deal only with reputable dealers. It is particularly important to do this with dry milk because of its short shelf life and sensitivity to storage conditions. Check expiration dates, then date and rotate packages.

B.1.2 STORING DRY MILKS

Dry milk products are highly sensitive to environmental conditions, particularly temperature and moisture. Their vitamins A and D are also photosensitive and break down rapidly if exposed to light.

The area where your dry milk is stored should be kept as cool as possible. Air-conditioning or even refrigeration can greatly extend the nutrient shelf life.

If the storage container is transparent or translucent then it should be put into a second container opaque to light or stored in a dark room.

Dry milk will absorb moisture and odors from the air so storage containers should be impervious to both air and moisture. The drier it can be kept, the better it will keep which makes the use of desiccants is an excellent idea. Oxygen also speeds decomposition so vacuum sealing or oxygen absorbers will decrease the available oxygen. Because of its fine powdery texture gas flushing with nitrogen or carbon dioxide generally yields poor results.

If the dry milk you purchased was not packaged for long term storage then it should be repackaged right away.

I purchase the instant variety of dry skim, whole milk, and sometimes buttermilk powder at my local grocery and repack it at home. The method I now use is to pour the powder into clean, dry canning jars then vacuum seal them with my Tilia Foodsaver using the jar adapter then storing in the ubiquitous cool, dark place. They must be guarded

against breakage, but they offer the advantage of not holding odors, thus allowing for reuse after cleaning. Since the glass is transparent they must be protected against light.

Clean, sound plastic one and two liter soda bottles can also be used, but probably should be used just once since the plastic is somewhat permeable and will hold odors.

If you have access to a can sealer, #10 cans make wonderful storage containers for dry milk, particularly if used in conjunction with O_2 absorbers.

Please see Section III Specific Equipment Questions for information concerning the proper use of containers, desiccants, compressed gasses, dry ice and oxygen absorbers.

B.1.3 SHELF LIFE OF DRY MILKS

From: SacoFoods@aol.com (Amy Thompson)
To: Dunross@dkeep.com (Alan Hagan)
Subj: SACO Mix'nDrink Instant Pure Skim Milk
Date: May 9, 1996

Dear Mr. Hagan:

Thank you for your e-mail today and for your interest in SACO Mix'nDrink Pure Skim Milk.

Our Mix'n Drink will keep its nutrition value for up to about two years if kept cool and dry, and the only vitamins that actually decrease over time are the vitamins A and D. These are not shelf-stable vitamins and are sensitive to heat and light. A good rule of thumb to follow is that the vitamins A and D will dissipate at a rate of about 20% every year if stored properly. The less heat and moisture the milk is exposed to, the better the vitamins will keep. A freezer could extend the shelf life, as long as the powder does not get moisture in it. If you had to put a time limit on the Mix'nDrink, for rotation purposes, I would date it at two years after the date of purchase.

After opening a package of dry milk, transfer the powder to a tightly covered glass or metal container (dry milk can pick up odors from plastic containers) and keep it in the refrigerator. Unsealed nonfat dry milk keeps for a few months; dry whole milk for a few weeks.

From: SacoFoods@aol.com (Amy Thompson)
To: Dunross@dkeep.com (Alan Hagan)
Subj: SACO Mix'nDrink Instant Pure Skim Milk
Date: May 21, 1996

Dear Mr. Hagan:

Since vitamins A and D are heat and light sensitive, I would say that your 1 1/2 year shelf life is very reasonable. If you are trying to determine when the nutritional value has been affected more than 40%, as you previously indicated, you should be pretty safe with that time element, as long as it is not exposed to extreme heat.

[Eds note: We were discussing the higher average temperatures found in Florida and other hot climates and the effect that it would have on their dry milk's nutrient content]

B.2 CANNED FLUID MILKS AND CREAMS

Preserved liquid milk comes in a number of forms, none of which are very similar to each other. The most common are as follows:

CANNED MILKS: These are commonly called UHT milks (Ultra High Temperature) for the packaging technique used to preserve them. They come in the same varieties as fresh liquid milks: Whole, 2%, 1% and skim. I've even found whipping cream in UHT packaging (Grand Chef - Parmalat), though this may be offered only in the commercial and restaurant trade. In the U.S. they all have vitamin D added. The lesser fat content milks do not keep as long as whole milk and their use by dates are correspondingly shorter term. This milk is packaged in aseptic laminated paper cartons. It has the same composition as fresh milk of the same type, and can be stored at room temperature because of the special pasteurizing process used. The milk has a boiled flavor, but less so than evaporated milk. The dates are usually for approximately six months. The milk is still usable past its date, but the flavor soon begins to go stale and the cream separates.

With a six-month shelf life this type of canned milk naturally requires a much faster rotation cycle than other types. Several companies sell flavored milks (chocolate, etc.) in this packaging, usually in the smaller single-serving sizes. UHT milk makes excellent yogurt, losing the boiled flavor.

EVAPORATED MILK: Made from fresh, unpasteurized milk using a vacuum-heating process that removes 60% of the water, the concentrate is heated, homogenized, and in the States, vitamin D is added. It is then sealed in cans and heated again to sterilize the contents. Some brands may have other nutrients and/or chemical stabilizers added so read can labels closely. A mixture of one part water and one part evaporated milk will have about the same nutritional value as an equal amount of fresh milk. It does not taste like fresh milk but many do not find the flavor to be disagreeable. Both whole and skim milk varieties are available with the higher fat content type having the best storage life. The typical recommended storage time is six months. There is generally no date or use by code on evaporated milk.

Some grocers along with health food stores carry canned, evaporated goat's milk, in a similar concentration.

SWEETENED CONDENSED MILK: A less processed product than evaporated milk. It starts with pasteurized milk combined with a sugar solution. The water is then extracted until the mixture is less than half its original weight. It is not heated because the high sugar content prevents spoilage. It's very rich as well: 8 oz contains 980 calories. Obviously with a greatly reduced water content and a high sugar level it won't taste like fresh milk but it does have many uses in cooking. Some use condensed milk to cream their coffee. This type too is available in whole and skim varieties.

A fairly new entry into the sweetened condensed milk field is Dulce de Leche a popular dessert item in Latin America. It's basically sweetened condensed milk that has been heated to the point that the sugar begins to brown which produces a rich tasting caramel dessert. In the past you had to make it yourself, but now it can be purchased ready made in the can. I have seen it in the canned/dry milk areas or the Hispanic/ethnic foods areas of many grocery stores here in Florida.

Although it is often hard to find, the condensed milk can label should have a stamped date code which indicates the date by which it should be consumed. Condensed milk may thicken and darken as it ages, but it is still edible.

CANNED CREAM: So far as I have found here in the U.S. only the Nestlé company produces canned creams, both being imports. One is "Media Crema" produced in Mexico with a pull-top can and the other is "Table Cream" produced in Australia in a standard (as in use an opener) can. There is a slight difference in preservatives and thickeners, but basically both are a shelf stable light cream which can be used in any way that you would use fresh light cream. I haven't yet determined a shelf-life for these products, but it seems to be in excess of two years in any decent storage environment. Like the Dulce de Leche above I found them either in the dry/canned milk areas or the Hispanic/ethnic areas of my local grocery stores. Would be worth looking or asking for in your local markets.

B.3 BUTTER

Butter can be found in several forms each with their particular strengths and weaknesses.

BUTTER POWDER: Probably the easiest to find of the shelf-stable butters the powder is a moisture free product consisting of butter fat condensed on milk solids generally with added antioxidants. It can be reconstituted by mixing with water to make a spread similar to whipped butter, but it cannot be used for frying or other applications requiring high heat that would burn the milk solids. Most butter powders have something of a milky taste due to the additional milk solids necessary to create the powder, but many do not find this objectionable. Because it is a powder (lots of surface area) with a high fat content it needs good packaging to keep it at its best. Vacuum sealing and/or oxygen absorbers will work well if you are doing your own packaging.

CLARIFIED BUTTER (GHEE): Another form of butter suitable for storage programs is *clarified* butter or *ghee* as it is known in India. This is fresh, unsalted butter gently heated to drive off the moisture with the remaining fat poured off of the butter solids. It can be purchased commercially but most choose to make it themselves. As it's essentially pure butter-fat with no water there is little to spoil so will keep for years in a glass jar protected from oxygen, heat, and light. A good source of fat calories and useful in cooking, but maybe not something you'd want to spread on a biscuit.

CANNED BUTTER: For those whom only the real thing will do it's now possible to find shelf stable real butter. It seems mostly to be sold in those nations where home refrigeration is not as common as it is here in the U.S. As a rule I do not single out suppliers for any given product but at the time of this writing (11/2003) the only U.S. importer of shelf stable canned butter I've been able to find is Bruce Hopkin's Internet Grocer (http://www.internet-grocer.com). His product is Red Feather brand canned butter from New Zealand. It is salted though not as heavily as most salted butter in the U.S. The manufacturer claims an eighteen month shelf-stable storage life though they do advise keeping it in a cool, dry place. Like all butter it will liquefy if allowed to warm too much. Each can contains twelve ounces (equivalent to about three sticks of butter) and once opened should be handled like any other butter.

B.4 CHEESE

There are a number of shelf-stable cheese products that are suited for storage programs. Each of them have particular strengths or weaknesses for given uses. The basic forms storage cheeses can take are:

CANNED CHEESE: Actually, it's "Pasteurized Processed Cheddar Cheese Product" but it's the closest thing to a shelf-stable real cheese that I've yet found. It's another one of those products produced for use in countries where home refrigeration is scarcer than it is here in the U.S. The only brand available in the States that I know of at this time is made by Kraft's Australian division whose product most resembles American cheese or perhaps Velveeta. The only U.S. source for this cheese that I have found thus far is again Bruce Hopkin's Internet Grocer (http://www.internet-grocer.com). It comes in an eight ounce can and the manufacturer claims it will keep "indefinitely" at any reasonable storage temperature.

DRIED GRATED CHEESES: These are the familiar grated dry Parmesan and Romano cheeses, possibly others as well. They're generally a coarse dry powder, low or non-fat, and often with a fair amount of salt. Kept dry, cool, and dark they'll keep as they come from the store for several years though to get the maximum possible shelf life you should vacuum seal them in glass. Usually fairly expensive for the amount you get but as they're also strongly flavored a little will go a long way.

CHEESE SAUCES AND SOUPS: These are products such as Cheez Whiz, Campbell's Cheddar Cheese Soup, chip dips and related. They're not really cheese, but a mixture of cheese, milk, flour, and other ingredients. Depending on what your end uses may be they can provide a cheese flavor, calories, and a degree of protein, fat, and calcium. In any decent storage conditions they'll keep for several years at least. Aerosol cheese is an abomination that will not be discussed here.

POWDERED CHEESE: Used in products such as boxed macaroni and cheese, au gratin potatoes, snacks, and the like, this is basically cheese that has had its moisture removed leaving behind mostly protein, fat, a fair amount of calcium and various flavoring and coloring compounds (naturally occurring or added) along with a fair amount of salt. It can't really be melted, but it can add a nice cheese flavor where a real cheese texture is not needed.

There are also cheese powder blends, typically a mixture of cheese powder, food starch, whey, milk solids and other non-cheese ingredients. It has less fat than true cheese powder, about the same protein, but less calcium. You can make it yourself with dry milk and cornstarch so there's little point in not getting real cheese powder.

Cheese powder will keep for many years in sealed metal cans kept at cool temperatures. You'll probably have to get it from restaurant foods suppliers or order it from storage foods dealers. It's high fat content means that it needs low-oxygen packaging.

C. EGGS

The noble fruit of the hen, eggs play an important role in the kitchen arts. Unfortunately, outside of regular runs to the store to buy fresh eggs or keeping your own hens (which is what I do) they're problematical to store. There are two basic ways to keep eggs for those times when fresh eggs may be hard to come by. One is to preserve them in the shell, a process which must be done at home as there are no commercial sources of preserved shell eggs that I know of. The second is to buy dry, or powdered, eggs. I may address home shell egg preservation in a future FAQ update but for now I will concentrate on dry eggs that anyone can buy.

C.1 DRY EGGS

Dry eggs are generally available in four different forms – whole eggs, egg whites, egg yolks, and as a mix for making scrambled eggs and omelets. Which you should buy depends on how you expect to use them. As a general rule I find dry eggs reconstitute more easily when mixed with warm (not hot) water. Mixing the dry powder with other dry ingredients before adding liquids also increases the ease by which they can be reconstituted. Allowing the eggs to sit a few minutes before using improves water adsorption.

WHOLE EGGS: This is everything but the shell and the water. Usually found in the form of a somewhat clumpy, eggy smelling yellow powder. Typically one tablespoon of whole egg powder mixed with two tablespoons of water will equal one large fresh egg. Can be used to make most anything you'd make with fresh eggs though personally I prefer to use them in baking rather than as scrambled eggs or omelets. Whole egg powder is commonly used in baking mixes of all kinds, but I've never seen plain powdered eggs for sale in any grocery. Fortunately, they're easy to come by from mail order suppliers. A #10 can of powdered eggs is quite a lot so give some thought as to how fast you might use them and either order smaller cans, repackage an opened can into smaller containers, or plan on eating eggs often.

EGG WHITES: Nearly pure protein, egg white powder can add a high-protein boost to anything you put it in. The powder itself is whitish in color and not as clumpy as whole egg powder. When properly reconstituted it will whip into meringue like fresh egg whites and can be used in producing angel food and sponge cakes. Dry egg whites are often found in the baking section of many supermarkets. The brand name I have seen is "Just Whites" by Deb El. Powdered egg whites are also available from many mail order suppliers.

EGG YOLKS: High protein, high fat, and a source of lecithin (a natural emulsifier). Egg yolk powder can add richness and flavor to any number of foods, used to make custards, sauces, noodles, even mayonnaise. Not generally as easy to find as whole eggs and whites, but can be mail ordered. Being pure yolks this powder has a high fat content and must be appropriately packaged to achieve a good shelf life.

EGG MIX OR SCRAMBLING MIX: Typically a mix of whole egg powder, non-fat milk powder, oil, and salt. Used for making scrambled eggs, omelets, or general egg cookery. This mix does offer a degree of convenience but you can easily make it yourself and save the trouble of having to store it as a separate product.

C.1.2 STORING DRY EGGS

All dry egg products are exceedingly sensitive to moisture and will go off quickly if allowed to become the least bit damp. Whole eggs, egg yolks, and egg mix have high fat contents which make them very sensitive to oxygen. I highly recommend vacuum sealing in glass jars or using oxygen absorbers in conjunction with some other form of high barrier property packaging to keep these products at their best. If you bought quality products, packaged them well in oxygen free packaging, and put them away in a good storage environment then whole eggs, egg yolks, and egg mix should be able to achieve at least a three year shelf life, possibly more. Egg whites will easily achieve five years. Naturally, if you're packaging your eggs in any sort of transparent or translucent packaging then they should be stored in a dark place.

D. SUGAR, HONEY AND OTHER SWEETENERS

There are a wide number of sugars to be found for purposes of sweetening foods. Fructose is the primary sugar in fruit and honey; maltose is one of the sugars in malted grains; pimentose are found in olives, and sucrose is what we know as granulated or table sugar. Sucrose is a highly refined product made primarily from sugar cane though sugar beets still contribute a fair amount of the world supply. Modern table sugar is now so highly refined as to be virtually 100% pure and nearly indestructible if protected from moisture. Powdered sugar and brown sugar are simple variations on granulated sugar and share its long life.

Liquid sweeteners do not have quite the longevity of dry sugars. Honey, cane syrup, molasses, corn syrup and maple syrup may crystallize or mold during long storage. These syrups are chemically not as simple as table sugar and therefore lose flavor and otherwise break down over time.

D.1 GRANULATED SUGARS

Buying refined sugar is a simple matter. Select a brand you know you can trust, be certain the package is clean, dry and has no insect infestation. There's little that can go wrong with it.

GRANULATED: Granulated sugar does not spoil, but if it gets damp it will grow lumpy or turn into a sugar rock. If it does, it can be pulverized into smaller pieces and used. Granulated sugar can be found in varying textures, coarser or finer. "Castor/caster sugar" is a finer granulation than what is commonly sold as table sugar in the U.S. and is more closely equivalent to our super fine or berry sugar.

POWDERED, CONFECTIONERS, ICING: All names refer to the same kind of sugar, that is white granulated sugar very finely ground. For commercial use there is a range of textures from coarse to ultra-fine. For home consumption, what is generally found is either Very Fine (6X) or Ultra-Fine (10X), but this can vary from nation to nation. Not all manufacturers will indicate the grind on the package. Sugar refiners usually add a small amount of corn-starch to prevent caking which will make it undesirable for use in sugar syrups or solutions where clarity is needed.

Powdered sugar is as inert as granulated sugar, but it is even more hygroscopic and will adsorb any moisture present. If it soaks up more than a little it will cake and become hard. It's difficult to reclaim hardened powdered sugar, but it can still be used like granulated sugar where clarity in solution (syrups) is not important.

BROWN, LIGHT & DARK: In the United States brown sugar is generally refined white sugar that has had a bit of molasses or sugar syrup and caramel coloring added to it. Dark brown sugar has more molasses which gives it a stronger flavor, a darker color and makes it damp. Light brown sugar has less molasses which gives it a milder flavor, a blonder color and is slightly dryer than the dark variety. Light brown sugar can be made by combining one fourth to one third white sugar to the remainder dark brown sugar and blend thoroughly.

Both varieties need to be protected from drying out, or they will become hard and difficult to deal with. Nor do you want to allow them to become damper than what they already are.

There are dry granulated and liquid brown sugars available, but they don't have the same cooking qualities as ordinary brown sugars. They also don't dry out and harden quite so readily either.

RAW, NATURAL, TURBINADO & OTHERS: In recent years, refiners have realized there is a market for less processed forms of cane sugar in the U.S. so have begun to sell these under various names and packaging. None of them are actually raw sugar as it is illegal to sell in the States due to the high impurities level in the truly raw product. All will have been processed to some degree, perhaps to remove the sticky surface molasses or to lighten the color, but will not have been subjected to the full refining and whitening processes of ordinary white table sugar. This leaves some of the natural hue and a strength of flavor that deepens with the color. All of these less refined sugars may be stored and handled like brown sugar.

Outside of the United States it is possible to buy cane sugars from the truly raw product with all of the detritus remaining from the cane juice extraction process up through various stages of refinement much like we have here in the United States. Many can be found with names such as "muscavado", "jaggery" (usually a raw palm or date sugar), "demerara", “succanat,” and others. Colors will range from quite dark to blonde and may or may not be sticky with molasses. Generally the darker the color the stronger the flavor will be. In spite of any impurities they can be stored like brown sugar since their sugar content is high enough to inhibit most microbial growth. Recently I have found demerara sugar for sale here in the U.S.

D.1.1 STORING GRANULATED SUGARS

All granulated sugars have basically the same storage requirements. They need to be kept in air tight, insect and moisture proof containers. For powdered, and granulated sugar you might want to consider using some desiccant in the storage container if your local climate is damp. Since brown sugars and raw sugars are supposed to be moist, they do not need desiccants. Shelf life is indefinite if kept dry, but anything you intend to eat really should be rotated occasionally. Time has a way of affecting even the most durable of foods.

I've used brown sugar that was six years old at the time it was removed from storage and, other than the molasses settling somewhat toward the bottom, it was fine. A friend to whom I gave a bucket of the brown sugar finished it off three years later which was nine years after it was packaged and it, too, was fine.

D.2 HONEY

Honey may be the oldest sweetener known to man - its use predates recorded history. Remains of honey have been found in the Egyptian pyramids. This product of honeybees is typically sweeter than granulated sugar by a factor of 25%-40% depending upon the specific flowers from which the bees gathered their nectar. This means a smaller amount of honey can give the same amount of sweetening as sugar. The source flowers also dictate the flavor and the color as well. Honey color can range from very dark (nearly black) to almost colorless. As a general rule, the lighter the color and the more delicate the flavor, the greater the price the honey will bring. As you might expect, since honey is sweeter than table sugar, it also has more calories as well -- an average of twenty two per teaspoon compared to granulated sugar's sixteen. There are also trivial amounts of minerals and vitamins in the bee product while white sugar has none. Honey is not a direct substitute for table sugar however, its use in recipes may call for a bit of alteration to make them to turn out right.

Although the chance is remote, raw honey may also contain minute quantities of *Clostridium botulinum* spores so should not be fed to children under one year of age. PLEASE READ THE POST FROM GERI GUIDETTI CONCERNING THIS BELOW. Raw honey is OK for older children and adults.

Honey comes in a number of forms in the retail market and all with somewhat different storage characteristics:

WHOLE-COMB: This is the bee product straight from the hive. It is the most unprocessed form of honey, being large pieces of waxy comb floating in raw honey. The comb itself will contain many unopened honey cells.

RAW: This is unheated honey that has been removed from the comb. It may contain bits of wax and other small particles.

FILTERED: This is raw honey that has been warmed slightly to make it easier to filter out small particles and impurities. Other than being somewhat cleaner than raw honey it is essentially the same. Most of the trace amounts of nutrients remain intact.

LIQUID/PURE: This is honey that has been heated to higher temperatures to allow for easier filtering and to kill any microorganisms. Usually lighter in color, this form is milder in flavor, resists crystallization and generally clearer. It stores the best of the various forms of honey. Much of the trace amounts of vitamins, however, are lost.

SPUN, CRYSTALLIZED or CREAMED: This honey has had some of its moisture content removed to make a creamy spread. It is the most processed form of honey. It keeps quite well. Also available in various flavors.

D.2.1 BUYING HONEY

Much of the honey sold in supermarkets has been blended from a variety of different honeys and some may have even had other sweeteners added as well. Like anything involving humans, buying honey can be a tricky business. It pays to deal with individuals and brands you know you can trust. In the United States you should buy products labeled U.S. GRADE A or U.S. FANCY if buying in retail outlets. However, be aware there are no federal labeling laws governing the sale of honey, so only honey labeled *pure* is entirely honey and not blended with other sweeteners. Honey grading is a matter of voluntary compliance which means some producers may be lax in their practices. Some may also use words like "organic", "raw", "uncooked" and "unfiltered" on their labels, possibly to mislead. Fortunately, most honey producers are quite honest in their product labeling so if you're not certain of who to deal with, it is worthwhile to ask around to find out who produces a good product.

Honey may also contain trace amounts of drugs used in treating various bee ailments, including antibiotics. If this is a concern to you, then it would be wise to investigate with your local honey producer what they may have used.

D.2.2 STORING HONEY

Honey is much easier to store than to select and buy. Pure honey won't mold, but may crystallize over time. Exposure to air and moisture may cause color to darken, flavor to intensify and may speed crystallization as well. Comb honey doesn't store as well liquid honey so you should not expect it to last as long.

Storage temperature is not as important for honey, but it should not be allowed to freeze or exposed to high temperatures if possible. Either can cause crystallization and heat may cause flavor to strengthen undesirably.

Filtered liquid honey will last the longest in storage. Storage containers should be opaque, airtight, moisture and odor-proof. Like any other stored food, honey should be rotated through the storage cycle and replaced with fresh product.

If crystallization does occur, honey can be reliquified by placing the container in a larger container of hot water until it has melted. Avoid adding water to honey you intend to keep in storage or it may ferment.

Avoid storing honey near heat sources or petroleum products (including gasoline/diesel engines), chemicals or any other odor-producing products which may infuse through plastic packaging.

D.2.3 RAW HONEY AND BOTULISM

From: Geri Guidetti arkinst@concentric.net

Duane Miles wrote:
> If I recall correctly, honey contains very, very small amounts of the bacteria that cause botulism.
> For adults, this seldom causes problems. Our immune system is capable of dealing with small
> numbers of even nasty bacteria, they do it all the time. The problem is when we get large numbers
> of bacteria, or when our immune system is damaged or not yet developed.

> That is where the problem with honey comes in. Some people used to use honey to sweeten milk
> or other foods for infants. Infants immune systems sometimes cannot handle the bacteria that
> cause botulism, and, of course, those infants became seriously ill. So pediatricians now advise
> strongly against using honey for children under a certain age.

Yes, raw honey can contain the temperature resistant spores of *Clostridium botulinum*, the bacterium that causes botulism. The organism is a strict anaerobe, meaning that it only grows in the absence of molecular oxygen. The problem with infants and honey is that the small, intestinal tract of an infant apparently is sufficiently anaerobic to allow the spores to germinate into actively growing *C. botulinum* organisms. Essentially, the infant serves the same role as a sealed, airtight, contaminated can of beans as far as the organisms are concerned. There in the infant's body the bacteria secrete the dangerous toxin that causes the symptoms of botulism. There have been quite a few documented infant deaths due to honey. As I recall, the studies identifying honey as the source were done in the '80s. Most pediatricians recommend no honey for the first year. It is probably best to check with your own for even later updates...Geri Guidetti, The Ark Institute

EDITOR'S NOTE: The advice not to give raw honey or foods containing raw honey to infants under one year of age still stands. Do please understand, though, that honey is not the ***only*** means by which infants can suffer from botulism, in many of which cases no certain source of contagion could ever be determined. The actual chances of any infant being stricken is very, very small and keeping the child's colon open, active and healthy can reduce it still more. Breastfed children seem to be more resistant as well.

D.2.4 HONEY OUTGASSING

Q: My can of honey is bulging. Is it safe to use?

A: Honey can react with the can lining to release a gas especially when stored over a long period of time. Honey's high sugar content prevents bacteria growth. If there is no sign of mold growth, it is safe to eat. FREQUENTLY ASKED FOOD QUESTIONS, FN250

D.3 CANE SYRUPS

CANE SYRUP: Seldom found in supermarkets, pure cane syrup is a sweet symbol of the U.S. Deep South. Produced by boiling down the extracted juice of the sugarcane in much the same fashion as sorghum and maple syrups are produced. The best syrup is clear with a dark amber color and a smooth intense flavor. Cane syrup usually has to be purchased from roadside stands, living history recreations, farm festivals, or state and county fairs. Some syrup makers will add small quantities of lemon juice or corn syrup to deter crystallization. Flavored cane syrups can sometimes be found, but are usually a sign of inferior syrup.

MOLASSES: A by-product of sugar refining, molasses is generally composed of sugars such as glucose that are resistant to crystallization, browning reaction products resulting from the syrup reduction process, and small amounts of minerals. Flavor can vary between brands, but is usually strong and the color dark and opaque. Sulfured molasses can sometimes be found but its intense flavor is unappealing to most. Brands labeled as 'blackstrap molasses' are intensely flavored.

SORGHUM SYRUP: This is produced in much the same manner as cane syrup, but sweet sorghum cane, rather than sugar cane, is used. Sorghum tends to have a thinner, slightly sourer taste than cane syrup. Good syrup should be a clear dark amber with a smooth flavor. It can sometimes be found in the supermarket, but more often is found in the same types of places as genuine sugar cane syrup.

TREACLE: This sweetener comes in varying colors from a rather dark version, similar to, but not quite the same as blackstrap molasses, to paler versions more similar to golden syrup. If you cannot find it in your store's syrup area check in their imported foods section.

All of the above syrups are generally dark with a rich, heavy flavor.

GOLDEN SYRUP: This syrup is both lighter and paler in color than any of the above four, more similar to what we would call a table syrup here in the U.S. Can usually be found in the same areas as treacle above.

TABLE SYRUP: There are many table syrups sold in supermarkets, some with flavorings of one sort or another such as maple, various fruits, butter, etc. A close examination of the ingredients list will reveal mixtures usually of cane syrup, cane sugar syrup or corn syrup along with preservatives, colorings and other additives. Table syrup usually has a much less pronounced flavor than molasses, cane or sorghum syrup or the darker treacles. Any syrup containing corn syrup should be stored as corn syrup.

D.3.1 STORING CANE SYRUPS

All of the above syrups, except for those having corn syrup in their makeup, have the same storage characteristics. They can be stored on the shelf for about two years and up to a year after opening. Once they are opened, they are best kept in the refrigerator to retard mold growth. If mold growth does occur, the syrup should be discarded. The outside of the bottle should be cleaned of drips after each use. Some pure cane and sorghum syrups may crystallize in storage, but this causes no harm and they can be reliquified using the same method as for honey. Molasses or other sugar refining by-products won't usually crystallize, but will dry into an unmanageable tar unless kept sealed.

D.4 CORN SYRUP

Corn syrup is a liquid sweetener made by breaking down cornstarch into its constituent sugars through an enzyme reaction. Available in both a light and a dark form, the darker variety has a flavor similar to molasses and contains refiners syrup (a byproduct of sugar refining). Both types often contain flavorings and preservatives. It is commonly used in baking and candy making because it does not crystallize when heated. Corn syrup is common in the U.S., but less so elsewhere.

Corn syrup stores poorly compared to other sweeteners and because of this it often has a *best if used by* date on the bottle. It should be stored in its original bottle, tightly capped, in a cool, dry place. New unopened bottles can be expected to keep about six months past the date on the label and sometimes longer.

After opening, keep the corn syrup four to six months. These syrups are prone to mold and to fermentation so be on the lookout for bubbling or a mold haze. If these present themselves, throw the syrup out. You should wipe off any drips from the bottle after every use.

D.5 MAPLE SYRUP

Maple syrup is produced by boiling down the sap of the maple tree (and a lot of it too) collected at certain times in the early Spring until it reaches a syrup consistency. This native American sweetener is slightly sweeter than table sugar and is judged by much the same criteria as honey: Lightness of color, clarity and taste. Making the syrup is energy and labor intensive so pure maple is generally expensive. Maple *flavored* pancake syrups are usually mixtures of corn and cane sugar syrups with either natural or artificial flavorings and should be kept and stored as corn syrups.

New unopened bottles of maple syrup may be kept on a cool, dark, shelf for up to two years. The sweetener may darken and the flavor get stronger, but it is still usable.

After the bottle has been opened, it should be refrigerated. It will last about a year. Be careful to look out for mold growth. If mold occurs, discard the syrup.

E. FATS AND OILS

All oils are fats, but not all fats are oils. They are similar to each other in their chemical makeup, but what makes one an oil and another a fat is the percentage of hydrogen saturation in the fatty acids of which they are composed. The fats which are available to us for culinary purposes are actually mixtures of differing fatty acids so for practical purposes we'll say saturated fats are solid at room temperature (70ºF, 21º C) and the unsaturated fats we call oils are liquid at room temperature. For dietary and nutrition purposes fats are generally classified as saturated, monounsaturated and polyunsaturated, which is a further refinement of the amount of saturation of the particular compositions of fatty acids in the fats.

E.1 BUYING AND STORING OILS AND FATS

There is a problem with storing oils and fats for the long term and that is they want to go rancid. Rancid fats have been implicated in increased rates of heart disease, arteriosclerosis and are carcinogenic (cancer causing) so are best avoided whenever possible.

Oxygen is eight times more soluble in fat than in water and it is the oxidation resulting from this exposure that is the primary cause of rancidity. The less saturated a fat is, the faster it will go off. This may not, at first, be readily apparent because vegetable oils have to become several times more rancid than animal fats before our noses can easily detect it. An extreme example of rancidity is the linseed oil (flaxseed) that we use as a wood finish and a base for oil paints. In a matter of hours the oil oxidizes into a solid polymer. This is very desirable for wood and paint, very undesirable for food.

Because of this difficulty in storing fats and oils for any long period of time many books and articles on the subject of food storage make only passing mention of them, if they say anything at all. This is unfortunate because fat contains *nine* calories to the gram compared to the *four* calories contained by either carbohydrates or protein. This

makes fat a valuable source of concentrated calories that could be of real importance if faced with a diet consisting largely of unrefined grains and legumes. For small children, infants, nursing mothers, and the elderly, they may not be able to consume the volume of food that would be necessary in the course of a day to get all of the calories they would need to avoid weight loss and possible malnutrition. Additionally, fats play an important role in our perception of taste and texture and their absence would make many foods more difficult to prepare and consume. Furthermore, a small amount of dietary fat is necessary for our bodies to properly absorb fat soluble vitamins like A,D,E and K.

Long term storage of fats may be problematical, but it is not impossible. There are some general rules you can follow to get the most life out of your stored cooking oils and fats.

#1 Exposure to oxygen, light and heat are the greatest factors to rancidity. If you can, refrigerate your stored oil, particularly after it's been opened. If possible, buy your oils in opaque, airtight containers. If you purchase it in plastic, particularly clear plastic, then transfer it to a gas impermeable glass or metal container that can be sealed airtight. If you have a means of doing so, vacuum sealing the storage container is an excellent idea as it removes most of the air remaining inside, taking much of the oxygen with it. Transparent glass and plastic containers should be stored in the dark, such as in a box or cabinet. Regardless of the storage container, it should be stored at as cool a temperature as possible and rotated as fast as is practical. All other considerations being equal, oils and fats with preservatives will have a greater shelf life than those without, provided they are fresh when purchased.

#2 Unless they have been specially treated, most unopened cooking oils have a shelf life of about a year to a year and a half, depending upon the above conditions. Some specialty oils such as sesame and flax seed have shorter usable lives. If you don't use a lot, try to not buy your fats in big containers. This way you won't be exposing a large quantity to the air after opening, to grow old and possibly rancid, before you can use it all up. Once opened, it is an excellent idea to refrigerate cooking fats. If it turns cloudy or solid, the fat is still perfectly usable and will return to its normal liquid, clear state after it has warmed to room temperature. Left at room temperatures, opened bottles of cooking oils can begin to rancid in anywhere from a week to a couple of months, though it may take several more months to reach such a point of rancidity that it can be noticeably smelled.

#3 Although darker colored oils have more flavor than paler colored, the agents that contribute to that flavor and color also contribute to faster rancidity. For maximum shelf life buy paler colored oils.

E.2 EXTENDING SHELF LIFE BY ADDING ANTI-OXIDANTS

I take no position on doing this, but if obtaining the maximum possible shelf life in your cooking fats is important to you, it is possible to add anti-oxidant preservatives to the fat you have purchased. Used in conjunction with a gas impermeable container, either opaque in color or stored in a dark place, and cool storage temperatures (70º F 21ºC or less) then shelf life can be extended to about five years, possibly longer.

The anti-oxidant in question is Butylated HydroxyToluene (BHT). It is often used in the food industry to slow the development of off-flavors, odors and color changes caused by oxidation, mostly in foods with significant fat contents. BHT is on the U.S. Food and Drug Administration's Generally Recognized As Safe (GRAS) list as a common preservative. The FDA limits the use of BHT to 0.02% or 200 parts per million (ppm) of the oil or fat content of a food product. The directions that I give below will be for the FDA limit.

BHT is available over the counter in the retail trade, typically found in health or natural foods stores or vitamin and nutritional supplement suppliers. It may also be found from various suppliers on the Internet.

To get the best results you will need the freshest oil you can find. Purchasing from a large, busy supermarket will usually suffice. You'll also need containers that are gas impermeable such as glass jars, or metal cans. There may be plastic containers with high gas barrier properties that will also serve, but I cannot knowledgeably say about this. It is important that your containers be food grade, clean, dry and dust-free.

In keeping with the FDA's GRAS guidelines you want to add 5.3mg of BHT crystals per fluid ounce of oil or fat. If you're using a scale calibrated in grains, such as a reloading powder scale, you may use the following table.

BHT in grains	OIL	BHT in milligrams
0.1 grain	1 fl oz	5.3 mg
0.7 grain	8 fl oz (1 cup)	42.4 mg
1.3 grain	16 fl oz (1 pint)	84.8 mg
2.6 grain	32 fl oz (1 quart)	169.6 mg
5.2 grain	64 fl oz (1/2 gal)	339.2 mg
10.3 grain	128 fl oz (1 gal)	678.4 mg

NOTE: The grain weight measurements have been rounded up to the nearest tenth grain since most powder scales will not accurately measure less than one-tenth of a grain.

IMPORTANT NOTE: If you are using a reloading powder scale, be sure the balance pan is clean and the balance has been calibrated recently with a reliable set of check weights.

Remove the BHT crystals from their gelatin capsules and weigh them, if you're going to. Once you have the appropriate amount, add the crystals to a pint or so of the oil, shaking vigorously. It may take several hours for the preservative to dissolve completely. Bringing the oil up to a warm, NOT HOT, temperature will speed the process. Once completely dissolved, pour the anti-oxidant laden oil into the rest of the oil and mix thoroughly. Once mixed, the oil can then be poured into its storage containers leaving approximately 1/2 inch of headspace. If you have a vacuum sealer the jars or cans may be vacuum sealed to remove most of the oxygen laden air from the container, otherwise just seal the lid. Store in a cool place and if using transparent jars, be certain to put them in a larger container such as a box to keep the contents in the dark. Don't forget to label and date the jars.

Before I close out this section on fats and oils, please allow me to reemphasize that no amount of preservatives that can be added to your stored fats will substitute for proper storage and rotation. Don't sit on your oil supply for years without rotating it. A little bit rancid is a little bit poisonous. `Nuff said.

F. COOKING ADJUNCTS

F.1 BAKING POWDER

Baking powder is a combination of an acid and an alkali with starch added to keep the other two ingredients stable and dry. The powder reacts with liquid by foaming and the resulting bubbles of carbon dioxide can aerate and raise dough. Almost all baking powder now on the market is double acting, meaning it has one acid that bubbles at room temperature and another acid which only reacts at oven temperatures. Unless a recipe specifies otherwise, this is the type to use.

Don't expose baking powder to steam, humid air, wet spoons, or other moisture. Store in a tightly lidded container for no more than a year. Even when kept bone dry it will eventually loses its potency. To test its strength, measure 1 tsp powder into 1/3 cup hot water. The mixture should fizz and bubble furiously. If it doesn't, throw it out.

For those folks concerned with aluminum in the diet, the Rumford brand has none and there may be others.

F.2 BAKING SODA

This gritty powder is sodium bicarbonate also known as sodium acid bicarbonate ($NaHCO_3$), a mild alkali. When combined with an acid ingredient such as buttermilk it is used in baking to leaven quick breads and other baked foods working in the same manner as baking powder. It can also be used to make hominy. When combined with an acid ingredient, the bicarbonate reacts to give off carbon dioxide bubbles which causes the baked good to rise. If kept well sealed in an air- and moisture-proof container its storage life is indefinite. If kept in the cardboard box it usually comes in, it will keep for about eighteen months. Do keep in mind that baking soda is a wonderful odor adsorber. If you don't want your baked goods tasting of whatever smells it adsorbed then keeping it in an airtight container is a good idea.

F.3 HERBS AND SPICES

It is difficult to give exact instructions on how best to store culinary herbs and spices because there are dozens of different seeds, leaves, roots, barks, etc., we call an herb or a spice. There are, however, some general rules that may be followed to best preserve their flavors. All spices, particularly dried, are especially sensitive to heat, air, moisture, and light. Room temperature is satisfactory for storage but refrigeration or freezing is even better. What ever you do they should be kept away from heat sources. It is common for the household spice cabinet or shelf to be located over the stove, but this is really about the worst possible place to keep herbs and spices even if it is convenient. Dark opaque glass is best for storage, but failing that, keeping a tightly sealed glass container in a dark place is next best. The cellophane packets some products come in won't do. Tightly sealed metal containers will work as well. Even dense plastic will do, but glass is best.

Where possible, buy spices whole. Whole nutmegs will keep their flavor far longer than ground nutmeg, the same for other seeds and roots. You'll have to use a grater, grinder or whatever, but the difference in flavor is worth it.

If you buy spices in bulk containers (which is certainly cheaper) consider transferring some into smaller containers and keeping the larger one tightly sealed in a cool, dark place. This will prevent unwanted light and air from continually getting in and playing havoc. My large jars of reserve spices are kept in vacuum sealed jars with smaller jars of ready spices kept in the kitchen.

There are many mail order or online suppliers of bulk herbs and spices. My personal favorite is Penzey's (http://www.penzeys.com). Their products have been consistently excellent with good prices. It's worth investigating some of these companies as they can really take the sting out of purchasing large quantities.

F.4 SALT

Storage life for salt is indefinite. So long as you do not let it become contaminated with dirt or whatever, it will never go bad. Over time, iodized salt may turn yellow, but this is harmless and can still be used. Salt is rather hygroscopic and will adsorb moisture from the air if not sealed in an air-tight container. If it does cake up, it can be dried in the oven and then pulverized again with no harm done.

All salt, however, is not the same. Salt comes in a number of different varieties, and very little of what is produced in the U.S. is intended for use in food. The rest of it, about 98%, has other uses. Therefore, it is important to be certain the salt you have is intended for human consumption. Once you are satisfied it is, you should then determine its appropriateness for the tasks to which you might want to set it to. Below is a list of some of the available salts

TABLE SALT: This is by far the most widely known type of salt. It comes in two varieties; iodized and non-iodized. There is an ingredient added to adsorb moisture so the salt will stay free flowing in damp weather. This non-caking agent does not dissolve in water and can cause cloudiness in solutions if sufficiently large quantities are used. In canning this won't cause a problem since little per jar is used. For pickling, though, it would be noticeable. If you are storing salt for this purpose, you should be sure to choose plain pickling salt, or other food grade pure salt

such as kosher salt. In the iodized varieties, the iodine can cause discoloration or darkening of pickled foods. For folks in areas that are historically iodine deficient a store of iodized salt for table consumption should be kept.

CANNING SALT: This is pure salt and nothing but salt. It can usually be found in the canning supplies section of most grocery stores. This is the preferred salt for most food preservation or storage uses. It is generally about the same grain size as table salt.

KOSHER SALT: This salt is not really, in itself, kosher, but is used in "kashering" meat to make the flesh kosher for eating. This involves first soaking the meat then rubbing it with the salt to draw out the blood which is not-kosher and is subsequently washed off along with the salt. The cleansed meat is then kosher. What makes it of interest for food storage and preservation is that it is generally pure salt suitable for canning, pickling and meat curing. It is of a larger grain size than table or canning salt, and usually rolled to flake the grains for easier dissolving. Frequently it is slightly cheaper than canning salt and usually easier to find in urban/suburban areas.

NOTE: Not all brands of kosher salt are exactly alike. Diamond Crystal Kosher Salt is the only brand that I'm aware of that is not flaked, but still in its unaltered crystal form. The Morton brand of Coarse Kosher Salt has "yellow prussiate of soda" added as an anti-caking agent but unlike other anti-caking agents it does not cause cloudiness in solution. Morton even gives a kosher dill pickle recipe on the box.

Whether flaked or in its unaltered crystal form, kosher salt takes up more volume for an equivalent amount of mass than does canning salt. If it is important to get a precise amount of salt in your pickling or curing recipe you may want to weigh the salt to get the correct amount.

SEA SALT: This type of salt comes in about as many different varieties as coffee and from many different places around the world. The "gourmet" versions can be rather expensive. In general, the types sold in grocery stores, natural food markets and gourmet shops have been purified enough to use in food. It's not suitable for food preservation, though, because the mineral content it contains (other than the sodium chloride) may cause discoloration of the food.

ROCK or ICE CREAM SALT: This salt comes in large chunky crystals and is intended primarily for use in home ice cream churns to lower the temperature of the ice filled water in which the churn sits. It's also sometimes used in icing down beer kegs or watermelons. It is used in food preservation by some, but none of the brands I have been able to find label it as food grade nor do they specifically mention its use *in* foods so I would not use it for this purpose.

SOLAR SALT: This is also sometimes confusingly called "sea salt". It is not, however, the same thing as the sea salt found in food stores. Most importantly, it is not food grade. It's main purpose is for use in water softeners. The reason it is called "solar" and sometimes "sea salt" is that it is produced by evaporation of sea water in large ponds in various arid areas of the world. This salt type is not purified and still contains the desiccated remains of whatever aquatic life might have been trapped in it. Those organic remains might react with the proteins in the foods you are attempting to preserve and cause it to spoil.

HALITE: For those of us fortunate enough to live where it is warm, halite is the salt that is used on roads to melt snow and ice. It, too, is not food grade and should not be used in food preservation. This form of salt is also frequently called rock salt, like the rock salt above, but neither are suitable for food use.

SALT SUBSTITUTES: These are other kinds of metal salts such as potassium chloride used to substitute for the ordinary sodium chloride (NaCl) salt we are familiar with. They have their uses, but should not be used in foods undergoing a heated preservation processing, as they can cause the product to taste bad. Even the heat from normal cooking is sometimes sufficient to cause this.

F.5 VINEGAR

There is vinegar and then there is vinegar and it is not all alike. The active ingredient in all vinegars is *acetic acid*, but how the sour stuff was made can vary widely. The most common vinegar is *white distilled* which is actually diluted distilled acetic acid and not true vinegar at all. It keeps pretty much indefinitely if tightly sealed in a plastic or glass bottle with a plastic cap. The enamel coated metal caps always seem to get eaten by the acid over time. It is usually about 5-6% acetic acid and for pickling it is the type most often called for.

The next most common is *apple cider vinegar* which is available in two varieties. A cider *flavored* distilled acetic acid type and a *true cider vinegar* fermented from hard cider. Either will store indefinitely at room temperature until a sediment begins to appear on the bottom. Non-distilled vinegar will sometimes develop a cloudy substance. This is called a mother of vinegar and it is harmless. As long as the liquid does not begin to smell foul it can be filtered out through cheesecloth or a coffee filter and rebottled in a clean container. The mother can even be used to make more vinegar. If it begins to smell bad, however, it's gone over and should be tossed out.

The more exotic *wine, balsalmic, malt, rice* and other vinegars can be stored like cider vinegar. Age and exposure to light and air, however, eventually begin to take their toll on their delicate flavors. Tightly capped in a cool, dark cabinet or refrigerator is best for their storage.

F.6 YEAST

Yeast is just not a product you can stow away and forget about until you need it in a few years. After all, this single celled microscopic fungus is a living organism so if it's not alive at the time you need it, you'll get no action. When we incorporate yeast into our bread dough, beer wort or fruit juice it begins to ferment madly (we hope) and produce several by-products. If you're baking, the by-product you want is carbon dioxide which is trapped by the dough and subsequently causes it to rise. In brewing or vintning what is wanted is the ethyl alcohol and, if the drink is to be carbonated, the carbon dioxide as well.

Almost all yeasts used for these purposes are in the same genus (*Saccharomyces* or sugar fungi), but several different species or strains within species have evolved and some are more suitable for a particular task than others. It's entirely possible to use grocery store bread yeast to brew beer or ferment wine, but the flavor may leave a great deal to be desired. It's also possible to use yeast from ale brewing to make bread. From my limited experience with trying it myself the results were pretty much indistinguishable from bread yeast.

Types of Baking Yeasts

Leaving aside the brewing and vintning yeasts that are outside the scope of this FAQ I am going to concentrate on bread yeast. It comes in two generally available forms; *compressed* or *fresh* yeast and *dried* yeast which is further broken down into *active dry* yeast and *rapid acting* also known as *rapid rise* or *bread machine* yeasts. Although both of the dry yeasts are in the same species they come from different genetic strains with different performance characteristics and are processed somewhat differently from each other.

COMPRESSED (FRESH) YEAST: Compressed yeast is only partly dried (about 70% moisture), requires refrigeration and keeps even better in a deep freezer. If kept in an air- and moisture-tight container to prevent desiccation this type of yeast will keep for a year in the freezer (0ºF, –17ºC or less), but only about two weeks in the refrigerator. Unless your kitchen is quite chilly it will not keep on the shelf. It should not have a mottled color or a sour odor. Compressed Yeast is generally available in 0.6-ounce and 2-ounce foil-wrapped cakes. For traditional baking, dissolve compressed yeast in warm (90°-95°F, 32º-35ºC) liquids. A 0.6-ounce cake will leaven up to 4 cups of flour (about a pound). A 2-ounce cake will leaven about 12 cups or roughly three pounds of flour.

ACTIVE DRY YEAST: A granular powder with about an 8% moisture content, active dry yeast can be found in either single use foil packets or vacuum packed foil covered one pound 'bricks'. In general bread making active dry yeast is typically dissolved in water (105º-115ºF, 40º-46ºC) along with an equal amount of sugar to give it time to

resuscitate and actively begin growing before being mixed into the dry ingredients. Bread machines, however, are often different in this regard and you should follow the directions your particular machine's manufacturer gives. Mine calls for putting the dry yeast atop the other dry ingredients completely out of contact with the liquid ingredients until the machine mixes them together. One envelope (roughly 2 ¼ teaspoons) is sufficient to leaven about four cups or roughly one pound of flour.

RAPID ACTING & BREAD MACHINE YEAST: A more finely granulated powder with a lower moisture content than standard active dry yeast the rapid acting version is designed to raise bread as much as fifty percent faster. This lends it to the 'quick' or 'rapid' cycles of many bread machines that eliminate one rise cycle of the bread dough to facilitate faster production. This form of yeast is also generally mixed with a small amount of ascorbic acid which acts as a dough conditioner to give improved rise performance. Rapid Acting yeasts often perform poorly in recipes calling for long fermentation periods. Because of its finer granulation it does not need to be dissolved in liquid first and should be added to the dry ingredients instead. In the case of bread machines follow the manufacturer's directions. One envelope (roughly 2 ¼ teaspoons) is sufficient to leaven about four cups or roughly one pound of flour.

Interchanging Yeast Types

Can fresh, active dry, and rapid acting yeasts be used interchangeably?

Yes, to a certain extent.

To substitute Rapid Acting yeasts for Active Dry yeasts reduce the amount of Rapid Acting used by 25% from the amount of Active Dry the recipe calls for then add the dry yeast to the dry ingredients before mixing.

To substitute Active Dry for Rapid Acting increase the amount of Active Dry by 25% over what the recipe calls for of Rapid Acting yeast and dissolve in warm water (105º-115ºF, 40º-46ºC) with an equal amount of sugar before mixing in with the dry ingredients.

Once 0.6 ounce cake of fresh, compressed yeast is roughly equivalent to one pack of active dry yeast (2 1/4 teaspoons) or to about 1 3/4 teaspoons of Rapid Acting yeast.

NOTE: Substituting one yeast type for another can be done, but will oft times require a bit of tweaking. If at all possible use the yeast type specified in the recipe. If you can't be prepared to make adjustments where necessary.

PROOFING YEAST: Although it's generally not necessary anymore if you are concerned that your yeast may be dead due to age or poor storage conditions any type of yeast can be tested for viability by *proofing*. This is nothing more than mixing a small amount of the yeast with an equal amount of sugar in warm water (105º-115ºF, 40º-46ºC for dried; 90°-95°F, 32º-35ºC for fresh). Within about five to ten minutes active yeast will become bubbly and begin to expand (at normal room temperature). Yeast which only slowly becomes active can still be used, but you will have to use more. If there is no activity at all, the yeast is dead and should be tossed. If you've stored your yeast in half-way decent conditions, or better yet in the freezer, proofing will usually not be necessary.

NOTE: Rapid Acting yeast loses its fast rising capabilities if dissolved in liquid for proofing, and will require two complete rises like standard active dry yeast.

STORING YEAST: All of the dry yeasts will last for months on the shelf, until the expiration date which should be clearly stamped on the package. If packaged in an air/moisture tight container and kept in the freezer it may last for several years though one year is the general recommendation most often found among various authorities. I'm presently (12/2003) using yeast stored in my refrigerator freezer in a tightly sealed canning jar with a "Best Used By" date of June, 1998 that is still going strong. The larger packs of yeast should be transferred to an air and moisture tight container after opening. A canning jar with a decent lid will suffice.

There is another means of providing leavening for breads besides buying yeast from a grocery store and that is by using a sourdough starter. I'm not going to address it here, but I will point out that it has a Usenet newsgroup all its

own *(rec.food.sourdough*) which has several FAQ's devoted to it. You can find addresses for these FAQs in the *Resources* section. Drop in and read for awhile and you'll learn more than you thought you could ever want to know.

G. INFANT FORMULA

While not universal, it's safe to say that most folks interested in food storage are planning for families, real or as yet hypothetical. Many of these families include children (or hope to) under the age of two. Very young children such as this have nutritional requirements that are different from adults and require somewhat different preparations than adults or even older children.

If at all possible, it's best for children up to the age of six months to be breast fed by their mothers and up to the age of one year breast milk should contribute a significant portion of the child's nutritional intake. Indeed, breast feeding can supplement a child's diet in an important way until age two. Even the American Academy of Pediatrics now recognizes and recommends this. There are those who nurse even longer, but I mention this only as an observation, not necessarily as a recommendation. For the preparedness-minded breast feeding makes particularly good sense as mama can consume a far wider range of storable foods than a baby can, and she can produce from those foods a nutrition source perfectly suited to her child.

To promote this end here is the contact information for the largest and best known breast feeding support group.

La Leche League International
1400 N. Meacham Road
Schaumburg, IL (USA) 60173-4808

Phone (847) 519-7730 or 1-800-LALACHE (US)
Fax (847) 519-0035
http://www.lalecheleague.org
E-mail: **LLLHQ@llli.org**

They can help you to find local chapters of the League in your area and point out useful books and sources of information. When our daughter, Katie, was born my wife has attended a number of our local chapter's meetings and borrowed books with which to educate ourselves.

Also in this same line, there is a useful document put out by the World Health Organization titled *How to Breastfeed During an Emergency*. It apparently is no longer hosted on the WHO site, but if you do a Google search using the title in quotation marks you should be able to find a copy of it somewhere. It would be an excellent idea to print out a few copies and put them away. You never know who you might come across who'll desperately such information should there come a Fall.

G.1 ALTERNATIVES TO BREASTFEEDING

If breastfeeding should not be a viable option you'll need to find another source of infant nutrition. I STRONGLY RECOMMEND AGAINST USING HOME-MADE INFANT FORMULAS AS A SOLE SOURCE OF NUTRITION FOR A BABY. If you know you're going to have a nursing infant on your hands, if and when the balloon should go up, you should take steps in advance of the crisis to put away a suitable food supply for the child. Young children have nutritional needs that are different from those of adults or even older children. Lacking human breast milk, you should put by a store of commercially made infant formula. Evaporated milk, dry milk, sweetened condensed milk, goat's milk and all the rest can be an important *supplement* for children over the age of six months, particularly over one year of age. For children under six months of age these products simply do not contain sufficient amounts of the appropriate nutrients to provide adequate nutrition when used as the sole source of sustenance.

As for soy milk, there are considerable important differences in soy nutritional content compared to cow's milk which is to say nothing of human milk. Soy milk alone is simply not nutritious enough to serve as a sole source of nutrition for children under the age of six months and should not be used as more than a *supplement* for children over six months of age. This does not apply to commercially made *soy protein infant formula* which is a very different product than *soy milk*.

G.2 SELECTING AND FEEDING AN INFANT FORMULA

If the child you're concerned with is already on the scene then you probably already know which formula you need to put away. Unless instructed against doing so by your doctor, my only suggestion here is to make sure the formula has iron in it. The problems of iron in formulas from the nineteen fifties and sixties have long ago been solved and young children very much need this nutrient.

If you feel the need to store formula in advance for a child not yet on the scene (or who is only a contingency to plan against) I suggest storing one of the *cow's milk based lactose-free formulas*. Two brand names that will work well are "Lactofree" from Mead Johnson and "Similac Lactose Free" from Ross Laboratories. Lactose is the sugar found in milk and an inability to properly digest lactose is the most common source of infant formula feeding problems. Of course, there is the remote chance the child could have a true allergy to cow's milk protein, but the child could be allergic to soy protein too. It's been known to happen for a child to be allergic to both at the same time. There is no *absolute* certainty in preparedness, but you can plan for the most likely problems which is why I suggest storing lactose free cow's milk formula.

Unless you store only disposable bottles and "ready to feed" formula, don't forget that both reconstituting formula from dry powder or liquid concentrates and washing feeding equipment requires the use of clean, *safe* drinking water. You'll need to carefully examine your water storage in this regard.

G.3 STORING INFANT FORMULAS AND BABY FOODS

Storing infant formula and baby food is easy. Infant foods are one of the few areas in which the (US) Federal government regulates shelf life labeling. All containers of infant formula and baby food should have a clear "best used by" or similar date somewhere on the container which is generally longer than a child will require such food. Unopened containers of formula should be stored the same way you would keep dry milk, in a dark, cool, dry place and used before the date on the container is reached. Opened containers of dry formula powder should be used within one month of opening and the contents should be kept bone dry, cool and in the dark.

If it hasn't been needed by the time the expiration date begins to near it's an excellent idea to donate the infant formula to a nursing infant or organization like a food bank that can put it to use before it expires. There's too much valuable high quality nutrition in infant formula to allow it to go to waste.

H. MREs – MEALS, READY TO EAT

This category includes more than the modern day military rations known by the above acronym, but also their civilian equivalents which are marketed by two of the major U.S. military MRE contractors, and a number of other products on the civilian market that fit better into this category than any other. Over the last several years the number of self-contained meals available in either the new style flexible pouches or old fashioned metal cans has greatly increased. I can't cover them all in detail so for this section I will cover only those meals that also include some form of self-contained heating device to warm the food to serving temperature. This allows one to have a hot meal yet needing no equipment other than a spoon to eat with. Whether you buy self-heating meals or supply the heat yourself to non-self heating meals you should investigate the offerings your local grocer may now be carrying. They have great potential for those situations where cooking food would be difficult or impossible.

H.1 U.S. MILITARY MREs

The Meal, Ready to Eat (MRE) is the current U.S. military field ration for those times when troops are out of contact with their regular mess facilities. In the early 1980's they replaced the older C & K-rations that had honorably served since the Second World War. These new rations represented a major leap forward in food preservation

technology by disposing of the heavy, unwieldy metal can and replacing it with the much lighter, flexible "retort pouch." These pouches are the beefier cousins of the aluminized Mylar bag much used in long-term food storage and are basically constructed the same way. A thick outer layer of tough polyester film, a thin middle layer of aluminum foil for its excellent gas barrier properties, and an inner layer of food safe polypropylene film to allow heat sealing. Food is placed in the pouch then specially heat processed for preservation which renders it microbiologically shelf-stable, fully cooked, and ready to eat.

What's in an MRE?

From the Defense Logistics Agency Subsistence web site (**http://www.dscp.dla.mil/subs/rations/meals/mres.htm**) we find this:

The twenty-four different varieties of meals can be seen in the menu table. Components are selected to complement each entrée as well as provide necessary nutrition. The components vary among menus and include both Mexican and white rice, fruits, bakery items, crackers, spreads, beverages, snacks, candy, hot sauce, and chow mein noodles for the pork chow mein entrée. The fruits may be applesauce, pears, peaches, pineapple, or strawberry. The bakery items include a fudge brownie, cookies, fruit bars, a toaster pastry, and pound cake in flavors of lemon, vanilla, orange, pineapple, and chocolate mint. Each meal also contains an accessory packet. The contents of one MRE meal bag provides an average of 1250 kilocalories (13 % protein, 36 % fat, and 51 % carbohydrates). It also provides 1/3 of the Military Recommended Daily Allowance of vitamins and minerals determined essential by the Surgeon General of the United States.

All of which is then placed inside of a heavy plastic pouch and sealed. Being field rations they had to be designed to take considerable punishment in packs, air drops, and other forms of abuse remaining safely intact until consumed. By and large they do just that.

All of this sounds rather attractive to the person interested in emergency preparedness and they are. So much so, in fact, that several years ago the U.S. military finally said "enough!" to the continuing losses of their rations to the civilian market and banned any further civilian sale. All new MRE complete ration packs now bear the words "U.S. Government Property. Commercial Resale Is Unlawful."

This did slow the loss rate somewhat, but anyone that wants the real thing can still get them from military personnel they may know, at gun shows, some military surplus shops, or via E-Bay. Whether you should do this is up to you, but I will give a couple of cautions here:

#1 – Being a back channel acquisition chances are you have no way of knowing the storage history of what you're buying. Maybe it's been sitting in some nice cool warehouse since it was produced or maybe it bounced around in the back of a deuce-and-a-half in the Nevada desert for a month last summer. If you don't know where it's been how can you estimate how much useful shelf-life it may have left?

#2 – Make sure what you're buying really is a military MRE or MRE component. Some of the civilian commercial products can look remarkably similar, but are not quite the same. Know what you're looking at and make it clear with the person you're buying from that you want genuine military issue (if that's what you want).

MRE Heaters: These devices will either come with your MRE at the time of purchase or they can be bought separately. They contain a small amount of salt, magnesium, and iron and when you add a small amount of water they undergo a flameless chemical reaction that will heat an 8 oz MRE entrée by roughly 100° Fahrenheit (37°C) in about ten minutes. As water is what starts the reaction it is imperative the heaters be kept dry until used. If stored in an area of high humidity the heaters can undergo a slow reaction leading to degraded performance later or even complete failure over time. As a part of the chemical reaction the heaters release small amounts of hydrogen gas which is generally harmless but large numbers of heaters in a damp, sealed storage area could conceivably present a danger. This is unlikely unless you're storing many cases of heaters. In such an event keep them in an air tight storage container with some desiccant.

While any MRE can be eaten cold these heaters can certainly improve the palatability of the food. Lacking a heater you can simply boil the individual retort pouches in water for a few minutes, lay them in the sun to warm, or tuck them in your shirt. The one thing you should not do is expose them to direct flame.

For more detailed information on U.S. military, civilian, and some foreign military MREs and other rations please see the excellent MRE Info website at **http://www.mreinfo.com/index.html**

H.1.1 U.S. MILITARY MRE SHELF LIFE

Much discussion has gone into how long one should keep MREs on hand before rotating them out of stock. In this regard they're no different than any other type of preserved food. The longer you keep them on hand the more unpalatable and non-nutritious they will become with heat playing a large role in shortening their useful lifespan.

The short answer to the shelf-life question (from **http://www.dscp.dla.mil/subs/rations/meals/mres.htm**) is simply *"The shelf life of the MRE is three (3) years at 80 degrees F. However, the shelf life can be extended through the use of cold storage facilities prior to distribution."*

Of course, that's at 80° Fahrenheit (27°C). What if your storage temperature is different? Then you need the storage life chart that was developed by the U.S. Army's NATIC Research Laboratories which basically says that at a given storage temperature an MRE will remain palatable for so many months as illustrated below:

Storage Temperature	Shelf Life
120° F (49°C)	1 month
110° F (43°C)	5 months
100° F (37°C)	22 months
90° F (32°C)	55 months
80° F (27°C)	76 months
70° F (21°C)	100 months
60° F (15°C)	130 months (or more)

Note: As with any other stored food time and temperature have a cumulative effect. For example, storage at 100° F. for 11 months moved to 70°F(21°C) would lose one half of the 70°F. storage.

A complete shelf-life chart for all U.S. military rations may be found here:
http://www.dscp.dla.mil/subs/subsbo/qapubs/table.pdf

H.2 U.S. CIVILIAN MREs (WORNICK, SOPAKCO, OTHERS?)

Except for contract overruns on individual components actual military MREs, especially complete MRE ration packs, are not legal for sale on the civilian market. Recognizing there was a civilian market for such rations both Wornick and Sopakco through its Crown Point, limited, subsidiary brought out similar products for commercial sale. Their complete civilian ration packs are not precisely the same as their military cousins, but the individual components are usually produced on the same production lines.

Because there are no legal restrictions on their sale these civilian MREs are easier to find and are generally available in three basic forms –individual components, complete ration packs, and multi-serving tray packs meant for group feeding. Exact menus vary over time, usually being a subset of whatever the companies are producing for the military at the time of their production so I'm not going to try to address specific menus.

Some of the typical differences between military and civilian MREs are:

Menu choice. Military MREs presently have twenty four different menu choices. Their civilian equivalents are currently limited to twelve.

Ration heaters. These are standard with military MREs, but you may have to pay extra to get them with the civilian equivalents.

Total amount of food. Many of the civilian offerings contain less total food than military MREs, typically in the form of fewer side items. One notable difference is that fewer of the civilian rations contain the little Tabasco packets than their military counterparts.

The spoon. The spoons in the civilian packets are not the same as in the military rations. The civilian spoon is white plastic while the military spoon is brown and of a longer length which makes it easier to get to the bottom of the pouches without getting food on your fingers. This strikes me as particularly chintzy on the manufacturer's part.

For more detailed information on U.S. military, civilian, and some foreign military MREs and other rations please see the excellent MRE Info website at **http://www.mreinfo.com/index.html**

H.2.1. U.S. CIVILIAN MRE SHELF LIVES

One would think that the shelf lives of U.S. military and civilian MREs would be the same, but are they? If you look at the manufacturer's websites for what they say about their civilian equivalent rations we find:

Crown Point, Ltd (SOPAKCO)
From http://www.crownpt.com/Q&As.htm
How long will these products last?
SOPAKCO Packaging uses an estimated shelf life figure of "3-5 years, plus or minus" for its MRE-type pouched food products. Actual shelf life may vary from this estimate. A key factor effecting actual shelf life is the temperature of the storage environment. Storage at temperatures higher than 85F (85 degrees Fahrenheit) may shorten the shelf life of MRE-type food products. On the other hand, lowering the storage temperature will help extend the products' shelf life. This effect is common to most processed food products.

The shelf life figures given below for MRE's are based on studies conducted by the U.S. Army's NATIC Research Laboratories. This study was conducted by NATIC without participation of the MRE manufacturers. As such, SOPAKCO Packaging cannot verify the test procedures used by the NATIC labs, nor do we adopt these shelf life figures as a guarantee of any sort. The data is useful, though, as a general indication of the effects of storage temperatures on the shelf life of MRE-type food products.

Temperature (Fahrenheit):	*100º*	*90º*	*85º*	*80º*	*75º*	*70º*	*60º*
Storage Life in Months:	*22*	*55*	*60*	*76*	*88*	*100*	*130+*

The above storage data and time periods were based on "acceptable taste" measures, which is a subjective standard that may vary among each individual. Test participants were asked to indicate which products they were presented would be rated to still be of "acceptable taste". Responses were noted, and average values were calculated to yield the data above.

The above data does not indicate the maximum useful life of MRE food products. The NATIC study noted that nutritional value and product safety value of the products often extended far beyond these time points.

Again, SOPAKCO Packaging in no way adopts the NATIC shelf life figures as any form of express or implied guarantee of the actual shelf life of its MRE food products. This information is provided as a general indication of the effects of storage temperature on MRE-type packaged foods.

Long Life Food Depot (The Wornick Company's civilian sales agent)
From http://www7.mailordercentral.com/longlifefood/Faq.asp#heaterpouches
How long do MRE products last - what is their Shelf Life

We guarantee our MRE products to last 5 years from the date of sale, in a room temperature environment (70 deg. F), no matter what the production date.

Of course, the production date is visible on all our entrees and on most side dishes, desserts, and other components.

The production date is a four digit number (date code) on each item, example "2156." In this example the 2 represents the year 2002 (a "3" would represent 2003, etc.), the 156 represents the 156th day of the year. See the top of the individual box or look on pouch for the Date Code.

At this time nearly all of our MRE products were manufactured between 2002 and 2003 and have always been kept in a climate-controlled warehouse to ensure freshness.

The official MRE Shelf Life Chart, created by the Army's Natick Research Lab, gives the whole picture and explains why we are prepared to guarantee our products for 5 years from date of sale. It is clear that the wholesomeness of the products extends well beyond 5 years. To see this chart and a more complete discussion of MRE Shelf LIfe, click ***here****.*

Which takes you to the text below

http://www.longlifefood.com/mre.html#Shelflife
MRE Shelf Life:
A main concern in the development and testing of rations for our armed forces has always been SHELF LIFE. An amazing amount of research has been done in the development of the retort pouch and the MRE to determine the exact length of time and the exact conditions under which it is safe to store the entrees and the side dishes.

The main thing we have to work with is the shelf life chart (shown below) compiled by the Army's Natick Research labs. This gives a very good overview and summary of all the findings gathered from all the testing of MRE products. However, it leaves many questions unanswered. Here are additional facts and observations we have gathered about MRE shelf life:

1) The shelf life ratings shown in the chart below were determined by taste panels, panels of "average" people, mostly office personnel at the Natick labs. Their opinions were combined to determine when a particular component or, in this case, the entire MRE ration, was no longer acceptable.

2) The shelf life determinations were made solely on the basis of taste, as it was discovered that acceptable nutritional content and basic product safety would extend way beyond the point where taste degradation would occur. This means that MREs would be safe and give a high degree of food value long after the official expiration of the products as determined by taste.

3) MRE pouches have been tested and redesigned where necessary according to standards much more strict than for commercial food. They must be able to stand up to abuse tests such as obstacle course traversals in field clothing pockets, storage outdoors anywhere in the world, shipping under extremely rough circumstances, 100% survival of parachute drops, 75% survival of free-fall air drops, severe repetitive vibration (1 hour at 1 G vibration), 7,920 individual pouch drops from 20 inches, and individual pouches being subjected to a static load of 200 lbs for 3 minutes.

4) Freezing an MRE retort pouch does not destroy the food inside, but repeated freezing increases the chances that the stretching and stressing of the pouch will cause a break in a layer of the laminated pouch. These pouches are made to withstand 1,000 flexes, but repetitive freezing does increase the failure rate by a small fraction of a percent.

MRE Storage Life Chart A graphic of the chart I have reproduced above.

As we can see both company's refer to the NATIC shelf-life chart then give qualifiers "*The NATIC study noted that nutritional value and product safety value of the products often extended far beyond these time points."* and *"This means that MREs would be safe and give a high degree of food value long after the official expiration of the products as determined by taste."* Neither state how much or what kinds of nutrition would remain once the food goes beyond it's recommended shelf life, but it can be safely assumed the most sensitive nutrients (notably vitamins A and C among others) will have significantly declined. Old food is not likely to be attractive food, nor will it give long term nutrition, but if it's all you've got it'll still be safe to eat it.

H.3 BRITISH/CANADIAN MREs

These are basically MREs little different in form than the American made product but made by companies in these respective nations. Shelf-life is the same. Menu choices reflect British/Canadian tastes, of course. Company contact information can be found in the Suppliers Section.

One minor difference seems to be with the Hot Pack company of U.K./Canada in that they claim their ration heaters are somewhat larger than the ones packaged with U.S. MREs

From the company's web site:

Will defrost ice or snow for drinking water.

Will heat 300 g (10.6 oz.) of food or water from room temperature to 80°C (178°F) in 12 minutes.

Will provide a source of heat for up to forty five minutes after activation.

Is sometimes reusable for a limited heat cycle (dependent on how much of the heating element was exhausted in the first cycle).

The chemical reaction is totally safe. When water is added to the heater, the mixture bubbling away inside the sleeve (magnesium hydroxide) is a pharmaceutical chemical used by doctors to treat stomach acidity.

Food grade ingredients are used in the manufacturing of the heater.

Once activated, the heater will keep hot for approximately 45 minutes.

It can be used as a body warmer or to heat a drink after heating the meal.

H.4 OTHER SELF-HEATING READY TO EAT TYPE PRODUCTS

As one might expect once the bugs were worked out of retort pouch and flameless ration heater technologies the manufacturing companies that produce them would try them on the civilian market. This has been a little slow in coming, mostly because in the modern day 'fresh is best and refrigeration is cheap' world their market segment is somewhat small, but they are arriving. At the time of this writing there are several products now available, some of them quite new.

H.4.1 HEATERMEALS

HeaterMeals are a type of MRE in casual clothing. Like the rations above they are a retort pouch preserved meal with its own built in heater. The heater itself is the same technology as the MRE heaters (the company makes them for the military), but a little different in form, to include having its own self-contained water to start the heating reaction. The meals themselves aren't packaged with the idea of rough handling in mind, but they'll keep well on the shelf.

The meals themselves come in two basic forms:

An entrée pack with the heater, seasoning packet and cutlery

A complete meal pack with the heater, entrée, seasoning packet, cutlery, side items like fruit, snack, and dessert, and a bottle of water to drink.

If you're not having to use them under rough field conditions they represent a self-heating, completely self contained meal.

These meals can be ordered from the manufacturer, a number of dealers which are listed on the company website, or you can often find them at truck stops, some supermarkets, sporting goods stores, and other such businesses.

Shelf life info for HeaterMeals was found at: **http://www.heatermeals.com/faq.html#shelflife**

What is the shelf-life of HeaterMeals and HeaterMeals Plus Meals?
HeaterMeals are a high quality canned food, so storage is easy.

HeaterMeals Dinner entrees do not require refrigeration, and are shelf-stable for approximately 2 years. HeaterMeals entrees come with a "Please use by" date stamped on each box. This date is two years after we package the meals, as this is the optimum time to eat your HeaterMeals.

The HeaterMeals Breakfast "Pancakes, Syrup & Sausage Links" and all HeaterMeals Plus meals have a one year shelf-life.

HeaterMeals dinner entrees are designed to safely store (at 80 degrees Fahrenheit) for at least two years; three years or more, if stored at a temperature of 60ºF or cooler. The shelf-life of HeaterMeals can be even longer; and the unique packaging of the entree and water pouch permits freezing for unlimited storage.

H.4.2 HOT CANS – UNITED KINGDOM

In the United Kingdom there is another entry in the self-heating meal field. This is the Hot Can from Hot Can UK, Limited. It's an interesting blend of old and different new tech in that the food itself is contained in a run-of-the-mill pop-top metal can, but the food can is contained in a sealed larger can filled with calcium oxide (quicklime) and a separate water capsule. When needed the self-contained water capsule is pierced with the provided tool allowing moisture to seep into the dry quicklime below and the food can pop-top is removed. In twelve to fifteen minutes the can will have heated to 65°-70° Celsius and remains at that temperature for roughly forty five minutes which means once you've finished the food inside you can quickly rinse the can and heat something else, perhaps a beverage.

There are a variety of meals available from the company, each weighing about 400 grams (roughly 14 ozs). Shelf life is *"Three years from manufacturing date, or as indicated on printed bottom end of can."* The heater itself releases no harmful or dangerous gasses and if for some reason you should break one open and spill some of the quicklime on yourself it can simply be washed off again with water.

Company contact information can be found in the Suppliers Section. Hot Cans are probably also available through retail dealers in the U.K. and elsewhere.

H.4.3 ALPINEAIRE INSTANT – SELF HEATING MEALS

New on the market from AlpineAire is their entry into the self-heating meal arena. Uses the same retort and flameless heater technology as MREs but in different packaging. Snap the bottom of the package and in eight minutes your entrée is hot and ready to go. As I write this there are only two entrees with more coming in the near future. They're rather pricey at a suggested retail of $8.95 for a mere 240 calories worth of vegetarian food. Still, it's a start and with time they may both lower the price and increase the menu choices.

Alpineaire advises an eighteen month shelf life for this particular product line.

They may be ordered directly from AlpineAire or through their many stocking dealers.

H.4.4 MOUNTAIN HOUSE MOUNTAIN OVEN

Mountain House isn't really offering a true Meal, Ready to Eat since you still have to add water to their freeze dried/dehydrated food, but I'm including it here since it's close. Basically, what they're offering is their own version of a flameless ration heater and some new packaging of a few of their entrees that allows the pouches to be put into their heaters to be warmed. They call their heater a "Mountain Oven" though they really don't bake anything, just warms things up.

To use their heater you dissolve one of the furnished salt tablets in a plastic bottle that comes in the kit. Place a "heat activation pad" in the bottom of the insulated over pouch then pour the salt water on it. Open up the food pouch, pour in the required amount of water then put the pouch inside the insulated bag and zip it closed (the outer bag is vented). Twenty minutes later the food should be about 100° F. (38°C) hotter than when you started.

Each Mountain Oven kit is good for five uses. At a suggested retail of $11.99 per kit that's about $2.40 per use which makes it rather pricey compared to the ordinary MRE heaters already on the market which can usually be purchased for about a buck apiece or less. Still, like the AlpineAire entry it's a start and with time they may come down in price and perhaps be easier to use as well.

The Mountain Oven kits can be ordered from Mountain House directly or purchased from one of their many dealers as they are distributed.

I. RATION BARS

U.S. Coast Guard approved lifeboat ration bars are not common storage foods. Nevertheless they have a specific use important enough to warrant inclusion in personal preparedness programs.

As many involved with emergency preparedness discover, finding foods capable of being stored for long periods of time under harsh conditions that will remain both palatable and nutritious is a real undertaking. This is especially a problem with vehicle emergency kits where interior temperatures in the Spring, Summer, or Fall may exceed 120°F (50°C) for hours at a time each day. Very little in the way of anything usefully edible will survive such sustained temperatures for long before it breaks down, becomes unpalatable, with most or all of its nutrients damaged or destroyed.

This is a problem not only for those of us trying to build vehicle emergency kits but also for mariners needing to provision life boats that might be exposed to anything from desert temperatures to artic climates. In reaction to this and a number of other marine emergency preparedness needs most of the world's maritime nations met to develop the Safety Of Life At Sea (SOLAS) conventions, one of which concerns itself with emergency provisions for lifeboats. In the United States responsibility for implementing the SOLAS regulations falls to the U.S. Coast Guard

and they have developed guidelines by which manufacturers must abide in order to become Coast Guard approved suppliers of life boat rations.

Among the guideline requirements are:

- Lifeboat rations must be capable of withstanding long periods of high temperatures or sub freezing weather without significant deterioration;
- must not increase bodily water needs with high protein or salt levels yet provide sufficient calories to keep the body from burning its fat reserves which also increases bodily water needs;
- be compact in size and lightweight;
- be sufficiently palatable that injured or ill passengers would be able to eat them;
- not constipate nor cause diarrhea;
- use packaging that is sufficiently durable to withstand rough conditions.

Those manufacturers that meet these guidelines can submit their products for approval to be placed on the *U.S. Coast Guard Equipment List 160.046 - Emergency Provisions for Merchant Vessels* which may be found here: **http://www.uscg.mil/hq/g-m/mse/equiplists/160046.pdf**

Each of these companies produces lifeboat rations. In the U.S. the two most commonly available product lines are the Mainstay Emergency Food Ration and the Datrex Red (or White) or Blue ration.

The Mainstay rations are lemon flavored and available in 1200, 2400, and 3600 calorie packages. The Datrex rations are coconut flavored and available in 2400 (red or white ration) or 3600 (blue ration) calorie packages. As per regulations both have a five year shelf life. Each package from either company has been tabletized and subpackaged to make it easier to serve them out in controlled portions.

Both are primarily composed of complex carbohydrates, fairly low protein, enriched with extra vitamins and minerals then vacuum sealed in heavy aluminized plastic pouches similar to military MREs. Flavors are noted above, textures are similar to a fairly dense pound cake. I've sampled both and while I wouldn't care to eat them for a week straight for the relative few days a vehicle or similar emergency kit is intended to get you through they'll get the job done and not turn into something nasty after a few months of hot weather. In the cool times of the year when vehicle interiors do not climb into oven temperature ranges food options increase considerably with some form of military or civilian-equivalent MRE being well suited to the task.

Something to consider if you're building emergency kits or bug-out bags.

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-- III --

SPECIFIC EQUIPMENT QUESTIONS

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A -- STORAGE CONTAINERS

A.1 WHAT IS FOOD GRADE PACKAGING?

Q: OK, I'm ready to start my storage program. What should I put the food in?

A: You should use food grade packaging for storing anything you intend to eat. A food grade container is one that will not transfer noxious or toxic substances into the food it is holding. If you are uncertain whether a package type is food grade you can contact the manufacturer. Ask if that particular container is (US) FDA approved meaning that it is safe for food use. When inquiring be sure to specify the characteristics of the food you are storing; wet, dry, strongly acidic or alkaline, alcoholic or a high fat content. A container that is approved for one of the above types of food may not be approved for another.

The major functions of a food storage container are to:

#1. Protect its contents from outside environmental influences such as moisture, and oxygen, but possibly also heat or cold, light, insects and/or rodents as well.

#2. Prevent damage during handling and shipping.

#3. Establish and/or maintain microbiological stability. The container should not allow microorganisms such as fungi and bacteria from outside the container to come into contact with its contents. This is of critical importance to wet-pack foods such as canned vegetables, fruits and meats.

#4. Withstand the temperatures and pressures it will be exposed to. This is necessary if the contents are to be pasteurized or sterilized, either immediately before or after filling. It must not have any structural failures nor release any noxious or toxic breakdown chemicals into the food it contains. This is the reason why purpose built canning jars are recommended for home canning and mayonnaise jars aren't. The former are made heavier to withstand high temperatures and handling whereas the latter are not and have an increased risk of breakage if used for that purpose.

Virtually all containers used in home food preservation involving exposure to high temperatures are made of glass or metal, with the exception of some specialized "heat & seal" type of plastic bags. Glass can be used with any food type providing it is clean and in sound condition but the lids, particularly the liner inside the lid, may not be so you'll need to investigate suitability.

Metal cans are more specialized. They must be intended for food use and must also have a lining or coating of the inside that is suitable for the pH level of the food it will be in contact with.

If the foods are not subjected to some form of heat processing before or after packaging your selection of container types for home use is a great deal larger. Virtually any kind of clean, sound glass jar can be used and many types of new metal containers. Several sorts of plastics have become popular. These various kinds of plastics are each suited for different purposes, making selection a more complex task.

A.1.1 WHERE DO I FIND FOOD GRADE CONTAINERS?

Food grade packaging is everywhere. Every time you go into the grocery store you are surrounded by it. Many well known companies such as Tupperware and Rubbermaid manufacture and sell empty packaging for the express purpose of containing repackaged foods. The kinds of containers you are interested in and the types of foods you want to put in those containers will dictate where you need to look for a particular packaging system.

For food storage purposes most folks are usually interested in five and six gallon plastic pails, certain recycled plastic containers such as soda or juice bottles, glass jars from half pint to gallon sizes, metal containers such as the institutional sized #10 cans, and Mylar or other high barrier property plastic bags. Those are the containers most often used, but virtually anything that can protect foods from outside environmental influences, safely contain something you're going to later eat and have a volume capacity large enough to be worthwhile may be used.

A number of food storage retailers such as those listed in the Resources section sell plastic buckets, Mylar bags and a few even sell new #10 cans with lids. It may also be possible to purchase #10 cans through the LDS Family Canneries and dealers such *as Lehman's Hardware*, *Cumberland General Store* or *Home Canning Specialty and Supply*. On the local scene, plastic five gallon buckets are widely available, but only if you purchase them through a company catering to a food related trade will you likely be able to tell if they're safe to keep food in. If you can locate a customer service number for the manufacturer of a container that interests you call them and ask. Many times manufacturers will make products that are FDA approved and sell them as general purpose containers, but you need to ask to be sure.

Packaging supply houses have large FDA approved packaging lines. Several such companies are listed in the *Resources* section and a bit of detective work will certainly turn up more. Some require minimum orders and others don't. The cost of shipping the containers will probably play a major role in your decision making. If you are going to package a great deal of food all at once, perhaps for a group, some of the companies that require minimum purchases may save you a fair amount of money and supply packaging you might otherwise have a difficult time finding. Some time spent searching the *Thomas Register*, available both online (**http://www.thomasregister.com**) and in library reference sections, might turn up some valuable leads.

For glass jars, don't overlook flea markets, yard sales, thrift shops and similar places. Canning jars can sometimes be had for very little. Delicatessens, sub shops and restaurants of all sorts can be a source of one gallon glass jars formerly containing pickles, peppers, etc. If the lids are still in good condition, they are well suited to bulk storage and can be reused over and over. When I need new buckets I go to a neighboring town to buy them from a beekeeping supply house which sells them for bulk honey storage. A bit of looking will turn up other potential sources as well.

Metal cans, by and large, are not reusable for food storage, but some companies might be able to sell you new cans. The traditional single use #10 can is only the beginning of what might be available with a little looking. Gallon sized or larger cans with double friction lids (like paint comes in) make excellent storage containers and some companies make them food safe. One gallon and larger cans with wide diameter screw caps are available from some companies as well. You might have seen some of these holding edible oils, soy sauce, honey and other liquid food. If they come with a cap that will seal air tight they would be well suited for bulk storage of grains and legumes, particularly if they come in a four to six gallon size.

Pick up your local phone book, log on to your favorite search engine or head to your local public library and explore the possibilities. Make it clear that what you want must be FDA approved and be up front about how many you need or can deal with. If one company won't deal with you, try another. You'll eventually get what you want.

From: Denis DeFigueiredo ddefig@newhall.com
Originally posted in: rec.food.preserving

I called Berlin [eds. note, a plastic container mfgr.] 1-800- 4-BERLIN and spoke to them, plus an outfit called Kirk Container (they manufactured some 5 gallon paint buckets I saw in the local hardware store). Both places said that buckets made from High Density PolyEthelene (HDPE) are approved for food. It has to do with the possibility of interaction between any chemicals in the food and the plastic. As it turns out, Kirk manufactures only one kind of bucket, and then markets it for paint, hardware, food, etc. The price is right on the "paint buckets" - much cheaper than the local restaurant supply house.

High density polyethelene buckets will have HDPE stamped on them, or a recycle symbol with a "2" in the middle.

DISCLAIMER: I'm only passing on information I received from the manufacturers. I am in no way professing these things to be absolute fact!

From: "Jenny S. Johanssen" johanssen@matnet.com
Originally posted in: rec.food.preserving

Denis - saw your comments on food grade buckets and thought I'd offer my solution. My son cooks at a local Mexican restaurant. They get all their strawberries (for the strawberry magaritas at the bar) in 3 gallon plastic buckets. Now you know how many margaritas pass through a Mexican bar each night - lots. So I asked my son to save me some buckets. They are ideal for storing flour, rice, I made (from my home grown raspberries) a delicious raspberry cordial in one of the buckets, another I made Raspberry wine in. My motto is why buy when you can recycle! Thanks for giving me the time and space to add my two-bits worth. - Jenny

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From: Woody Harper lager@primenet.com
Originally posted: rec.food.preserving

...I get topping buckets from Dairy Queen and I have to make sure there is no trace of the strawberry syrup left. A little detergent and elbow grease followed by a chlorine solution bath keep everything nice and clean.--

A.2 PLASTIC PACKAGING

Before we can discuss plastic packaging it is necessary to understand what is the substance we call "plastic." Plastics are produced from basic polymers called "resins", each of which have differing physical properties. Additives may be blended in for color or to modify particular properties such as moldability, structural rigidity, resistance to light or heat or oxidation. Additionally, it is common for several different kinds of plastic to be laminated together each performing a particular desired task. One might offer structural rigidity and the other might be more impermeable to the transfer of gasses and odors. When bonded together a rigid, gas impermeable package can be made.

Whether that package is safe for food use will depend on the exact nature of the additives blended into the plastic. Some of them, notably *plasticizers* and *dyes*, can migrate from the packaging material into the food it's containing. This may be exacerbated by the food it's in contact with especially if it is high in fat, strongly acidic, or alcoholic in nature. Time and temperature may also play a prominent role in the migration of plastic additives into food. For this reason, the (US) FDA assesses the safety of packaging materials for food contact and conducts toxicological studies to establish safety standards. Only plastics that are FDA approved for a particular food type should be used for direct contact with that food.

Being FDA approved, however, may not be all of the story. It must still be determined whether the particular plastic in question has the physical properties that would make it desirable for your purpose.

As mentioned above each base resin has somewhat differing physical properties that may be modified with additives or combined by laminating with another plastic or even completely unrelated materials such as metal foils. An example of this is "Mylar", a type of polyester film. By itself, it has moderate barrier resistance to moisture and oxygen. When laminated together with aluminum foil it has very high resistance and makes an excellent material for creating long term food storage packaging. One or more other kinds of plastic with low melting points and good flow characteristics are typically bonded on the opposite side of the foil to act as a sealant ply so that the aluminized Mylar can be fashioned into bags or sealed across container openings. The combined materials have properties that make them useful for long term storage that each separately do not have.

The most common plastic that raises suitability questions is *High Density PolyEthylene* (HDPE). It's used in a wide array of packaging and is the material from which most plastic five and six gallon buckets are made. It has a moderate rigidity, a good resistance to fats, oils, moisture and impacts, a fair resistance to acids, but is a relatively poor barrier to oxygen.

Whether it is suitable for your purpose depends on how sensitive to oxygen your product is and how long you need it to stay in optimal condition. Foods such as whole grains are not particularly delicate in nature and will easily keep for years in nothing more than a tightly sealed HDPE bucket. Most legumes are the same way, but those that have high fat contents such as peanuts and soybeans are more sensitive to O_2. Other foods such as dry milk powder might only go a year before deleterious changes are noticed. If that milk were sealed in an air-tight aluminized Mylar bag with the oxygen inside removed, the milk would keep for much longer. Better still would be to seal the milk in a metal can or glass jar. HDPE alone can be used for long term storage with one or more of the following precautions to keep a high food quality: The food should either be put on a shorter rotation cycle than packaging also using a second gas barrier such as Mylar; be periodically opened and re-purged or fresh absorbers should be inserted.

Another common plastic used in food storage is *polyethylene terephthalate* commonly known as PETE or PET plastic. Used to make soda, juice, and some water bottles among other products it is available for recycling into food storage containers in nearly every home. Properly cleaned and with intact *screw-on* lids PETE plastic containers will serve for keeping nearly any kind of food providing the containers are stored in a dark location. PETE has good barrier properties against oxygen and moisture and when used in combination with oxygen absorbers presents a complete dry-pack canning system in itself. About the only drawbacks to PETE plastics are that they are nearly always transparent to light, container volumes typically are limited to a gallon or less, and when used in conjunction with oxygen absorbers the sides will flex sufficiently to make stacking difficult though you could simply lay them on their sides.

There are other plastics and plastic laminates with good oxygen and moisture barrier properties that are suited for long term food storage, but they are not as easy to find, though some used containers might be available for reuse.

A.2.1 HOW DO I GET THE ODOR OUT OF PICKLE BUCKETS?

I've had fairly good luck doing it in the following way. As vinegar is the primary smell in pickles and it's acidic in nature, we use a base to counteract it. First we scrubbed the bucket well, inside and out, with dish detergent, most any sort will do. Then we filled the buckets with hot water and dissolved a cup of baking soda in each. Stir well, get the bucket as full as you can and put the top on. Put the bucket in the sun to keep it warm so the plastic pores stay open as much as possible. In a couple of days come back and empty the buckets. Rinse them out, fill with warm water again and add about a cup of bleach and reseal. Put back in the sun for another couple of days. Empty out and let dry with the tops off. We completely eliminated the vinegar smell this way. It might be possible to cut the time down a lot, but we haven't experimented that much.

A.3 METAL CANS

Metal cans and glass jars being heat resistant, can both be used for heat processed, wet-pack foods and for non-heat treated dry pack canning. Relative to glass jars though, metal cans have several disadvantages for the do-it-yourselfer. They are hard to come by, and they need specialized equipment to seal them that can be difficult to locate. The greatest flaw which makes them unpopular for home canning is they can only be used once. As the commercial canning industry is not interested in reusing the containers, metal cans make great sense for their purposes. The cans are both cheaper (for them) and lighter than glass jars. This adds to the economy of scale that makes canned foods as cheap as they are in the grocery store.

For home canning, glass jars are better because even the smallest of towns will usually have at least one business that carries pressure and boiling water canners along with jars, rings and lids. With metal cans a sealer is also necessary which usually has to be ordered from the manufacturer or a mail-order distributor. A few of which are listed in the *Resources* section.

Tin cans are not really made of tin. They're actually steel cans with a tin coating on the inside and outside. Some kinds of strongly colored acidic foods will fade from long exposure to tin so an enamel liner called "R-enamel" is

used to forestall this. Certain other kinds of food that are high in sulfur or that are close to neutral in pH will also discolor from prolonged contact with tin. For those foods, cans with "C-enamel" are used.

The excellent food preservation book, *Putting Food By* Chapter 6 (see reference list) has a section on the use of metal cans for wet packed foods as does the *Ball Blue Book*.

Probably the most common use of metal containers is the #10 cans such as are used by the LDS Family Canneries discussed below. This is not the only way metal containers may be used though. It will probably take a bit of searching, but there are various food grade metal containers available of sufficient volume to make them useful for food storage. They usually have double friction lids similar to paint cans or screw caps like jars that can achieve an air-tight seal. If you can find them with a sufficient volume capacity they can be of real use for storing bulky foods such as grains, legumes and sugar. Smaller cans of a gallon or less would be useful for storing items like dry milks. If properly sealed, metal cans have a far higher barrier resistance to gasses such as oxygen, CO_2, and nitrogen than any plastic.

Although they can hardly be considered portable the use of clean metal drums (not garbage or trash cans), either themselves food grade or used with food grade liners, is also a possibility. A fifty five gallon drum of grain will weigh several hundred pounds, but may make for a much easier storage solution than multiple buckets. The advantage of using such a large container is that a great amount of a single product can be kept in a smaller amount of space and fumigating or purging the storage atmosphere would be simpler. The disadvantages are the difficulties of moving it and rotating the stock in the drum. If using oxygen absorbers make sure the drum you want to use is capable of making an air-tight seal, otherwise you should stick with carbon dioxide fumigation.

A.3.1 POOLING RESOURCES: THE CHURCH OF JESUS CHRIST OF LATTER DAY SAINTS -- THE MORMONS

Although the purchase of a can sealer and metal cans for home use is not generally economically feasible for most people there is one method by which it can be made practical. This is by pooling community resources to purchase the equipment and supplies. It may even not be necessary to form your own community to do this. If you live in the right area your local Latter Day Saints church may have facilities they will allow you to use. They may even have suitable food products to sell you. This is an offshoot of the church's welfare programs and is done in their Family Canneries also known as Home Storage Centers. Rather than using plastic buckets they have gone over to using metal cans and aluminized Mylar bags church-wide for dry-pack canning. By sharing the cost of the equipment and purchasing the cans in bulk quantities, they are able to enjoy the advantages of metal cans and professional equipment over plastic containers while minimizing the disadvantages of cost.

--- Please see *VI.D.1 Organizations. The Church of Jesus Christ of Latter Day Saints -- LDS Family Canneries* for more information about where LDS Family Canneries may be found and how best to approach using them. ---

Any food products you want to have sealed in cans or pouches will need to fall within the LDS cannery guidelines of suitability for that type of packaging. This is for reasons of spoilage control as many types of foods aren't suitable for simply being sealed into a container without further processing. If you purchase food products from them, they will already be within those guidelines. A brief treatment of these guidelines may be found in *VI.D.1 LDS Family Canneries Guidelines*.

Once you have your foodstuffs on hand, either supplying your own or by purchasing them from the cannery you're ready to package them. It is here that using some forethought concerning your packaging system can save you much time and aggravation.

IMPORTANT NOTE: Please keep in mind that the individuals responsible for the family canneries are all *volunteers* with demands on their time from many areas. Be courteous when speaking with them and, if there are facilities for use, flexible in making arrangements to use them. You will, of course, have to pay for the supplies that you use, cans and lids at the least, and any food products you get from them. As a general rule they cannot put your food in storage for you. Be ready to pay for your purchases in advance. They do not take credit cards and probably cannot make change so take a check with you.

The following is a list of suggestions to make the most efficient use of your access time:

#1 - Make your appointment well in advance. *If you are a non-LDS member be sure to ascertain whether you are allowed to use the facilities.* Possibly you may be able to go with a church member if you cannot go for yourself alone. Many people may be trying to make use of the canneries so making advanced reservations is a must.

#2 - Have enough people to set up an assembly line type operation. Make sure each of your people knows what they need to do and how to do it. At least four people for any serious amount of food is a good number. Ask the cannery volunteer to go over the process with you and your crew.

#3 - Make sure you have enough muscular helpers to do the heavy lifting so you don't wear yourself out or hurt your back. Some of the supplies you will be working with, such as wheat, come in fifty pound bags and a box of #10 cans or pouches full of sugar or other weighty food is heavy.

#4 - Make labels in advance for any foods you bring with you to pack that the cannery does not carry. This will save time and possibly much confusion after the cans or pouches are filled. Once sealed one anonymous looking can or pouch looks like another.

#5 - Take out only as many as oxygen absorbers as you will use in fifteen minutes. They use most of their adsorptive capacity within two to three hours depending on temperature and humidity so you don't want to waste any by soaking up the oxygen in the room. The ones you don't use right away should be tightly sealed in a gas proof container.

#6 - Save powdery food items such as dry milk powder, pudding mixes, grain flours and meals till last. They can be messy to can and this will keep them out of your other foods. Dust masks may not be a bad idea.

#7 - Leave time to clean up after yourself. The cannery is doing you the courtesy of allowing you to use their equipment and selling you the supplies at cost. You should return the favor by leaving the place *at least* as clean as you found it. If they give you a set amount of time to work in then *finished or not* honor that time slot. Others may be waiting to use the equipment too.

#8 - Always keep in the back of your mind how much volume and weight your vehicle can haul. You'd hate to find you had canned more than you could carry home.

A.3.2 PREVENTING EXTERIOR CORROSION OF CANNED GOODS

Some areas have difficulty storing metal canned goods for long periods of time. This is usually caused by high humidity or exposure to salt in a marine environment. If this is a problem, it is possible to extend the life of metal cans by coating their outsides. I've seen this used on boats here in Florida, especially when loading for a long trip. There are at least five methods that can be used to do this, but for cans that require a can opener only the paraffin or mineral oil methods should be used.

PARAFFIN METHOD: Using a double boiler, paraffin is melted and brushed on the clean, unrusted cans. Be certain to get a good coat on all seams, particularly the joints. If the can is small enough, it can be dipped directly into the wax. Care must be taken to not cause the labels to separate from the cans. Do not leave in long enough for the can contents to warm.

MINERAL OIL METHOD: Use only food grade or drug store (medicinal) mineral oil. Wipe down the outside of each can with only enough oil to leave a barely visible sheen. Paper labels will have to be removed to wipe underneath with the contents written on the outside beforehand with a marker or leave the under label areas

uncoated. Even with a barely visible sheen of oil the cans will tend to attract dust so you will need to wipe off the can tops before opening.

PASTE WAX METHOD: Combine 2-3 oz. of paste or jelly wax with a quart of mineral spirits. Warm the mixture CAREFULLY in its container by immersing it in a larger container of hot water. DO NOT HEAT OVER AN OPEN FLAME! Stir the wax/spirits thoroughly until it is well mixed and dissolved. Paint the cans with a brush in the same manner as above. Place the cans on a wire rack until dry.

SPRAY SILICONE: A light coating of ordinary spray silicone may be used to deter rust. Spray lightly, allow to dry, wipe gently with a clean cloth to remove excess silicone.

CLEAR COATING: A clear type of spray or brush on coating such as Rustoleum may be applied. This is best suited for larger resealable cans, but will keep them protected from corrosion for years.

A.4 GLASS JARS

Compared to metal cans, glass jars are very stable, although they obviously don't take being banged around well. Fortunately the cardboard boxes most jars come in are well designed to cushion them from shocks. The box also has the added bonus of keeping damaging light away from food.

The major advantage of glass jars is they are reusable. For wet-pack canning the lids should be replaced, but the rings can be reused until they finally rust away or become too dented to use. For dry pack canning even the lids may be reused nearly indefinitely if you're careful in removing them. In my personal experience I've grown to prefer Ball lids rather than Kerr, especially for vacuum sealed dry pack canning. The red sealing compound Ball uses seems to more reliably achieve a seal than the gray compound Kerr uses.

When you get right down to the bottom line, it is seldom practical strictly in terms of dollars and cents to wet-pack your own food in jars. When you count the cost of your equipment, including the jars, rings, lids and all the rest, along with a not inconsiderable amount of your personal time, the cost of purchasing or growing your produce, you'll almost always come out ahead to buy food canned for you by the commercial canning industry. That said, forget about the strict bottom line and examine more closely why you want to put up your own food. For many, gardening is a pleasure and they have to have something to do with the food they've grown! There's also the fact that for many, you simply cannot buy the quality of the food you can put up for yourself. The canning industry tries to appeal to a broad spectrum of the general public while you can put up food to your own family's specific tastes. Home canning is not so much about saving money as it is about satisfaction. You get what you pay for.

If home canning appeals to you, please allow me to point you toward the *rec.food.preserving FAQ* where much good information about methods and techniques may be found.

Dry-pack canning using glass jars, on the other hand, may well make a great deal of economic sense. It is usually far cheaper per pound to purchase dry foods in bulk quantities, but often unsuitable to store it that way. Breaking the food down into smaller units allows for easier handling and exposes a smaller quantity to oxygen and moisture before it can be eaten. Of course, packaging used for doing this can be made of many different materials, but glass is often the easiest and most convenient to acquire and use. Used containers are often free or of little cost. One source of gallon sized glass jars are sandwich shops and restaurants that use pickles, peppers and other sandwich condiments. There are also half-gallon canning jars, though they are sometimes difficult to find. Both Ball and Kerr make these jars and I have a local Ace hardware order mine.

A.5 MYLAR BAGS

The word "Mylar" is a trademark of the DuPont corporation for a special type of polyester film. Typically made in thin sheets, it has a high tensile strength and is used in a wide variety of industrial settings.

In food storage, particularly for the long term, it is commonly found as a laminate with Mylar as the top layer, a very thin aluminum foil in the middle and one or more other types of plastic films on the bottom acting as sealant plies.

This laminate combination possesses a high resistance to the passage of oxygen, carbon dioxide, nitrogen, other gasses, water vapor, and light which is what makes it valuable for our purposes. Unfortunately, it has a poor puncture resistance so must be used as an interior liner for more puncture resistant containers rather than as a stand-alone package.

Food grade aluminized Mylar complies with US FDA requirements and is safe to be in contact with all food types except alcoholic.

For food use, Mylar is most commonly available as pre-made bags of various sizes. Flat sheets or rolls of the material might also be found from which bags could be fashioned as well.

When Mylar bags are used by the storage food industry they are generally for products sealed in plastic buckets. The reason for doing this is the High Density PolyEthylene (HDPE) from which the pails are made is somewhat porous to gasses. This means that small molecules, such as oxygen (O_2), can slowly pass through the plastic and come into contact with the food inside. The problem is further compounded if oxygen absorbers are used, as the result of their absorbing action is to lower the air pressure inside the container unless it has first been carefully flushed with an inert gas such as nitrogen. How fast this migration activity will occur is a function of the specific plastic formulation, its wall thickness and the air pressure inside the container. In order to gain the maximum possible shelf life a second gas barrier, the Mylar bag, is used inside the pail.

Whether the use of these bags is necessary for your home packaged storage foods depends on how oxygen sensitive the food item is and how long you want it to stay at its best. If the container is made of a gas impervious material such as metal or glass then a second gas barrier inside is not needed. If it is HDPE or a plastic with similar properties and you want to get the longest possible storage life (say 10+ yrs for grain) then Mylar is a good idea. If you're going to use the grain in four to five years or less then it is not needed. Provided the oxygen has been purged from the container in the first place, either with a proper flushing technique, or by absorption, there will not have been sufficient O_2 infiltration to seriously impact the food. Particularly oxygen sensitive foods such as dry milk powders that are to be kept in plastic containers for more than two years would benefit from the use of Mylar. Naturally, storage temperature and moisture content is going to play a major role as well.

There is also the question of the seal integrity of the outer container. If you are using thin walled plastic buckets in conjunction with oxygen absorbers the resulting drop in air pressure inside the pail may cause the walls to buckle. If this should occur, there would be a risk of losing seal integrity, particularly if the buckets are stacked two or more deep. If the food was packed in Mylar bags with the absorbers inside this would keep the vacuum from seriously stressing the container walls. Better still would be not to have the problem at all by either using containers of sufficient wall thickness or flushing with inert gas before sealing. Heavy wall thickness is one reason why the six gallon Super Pails have become so widespread. It should be noted that Mylar is not strongly resistant to insect penetration and not resistant at all to rodents. If mice chew through your buckets, they'll go right through the bags.

A.5.1 HOW DO I USE MYLAR BAGS?

Sealing food in Mylar bags is a straight-forward affair, but it may take a bit of practice to get it right, so purchase one or two more bags than you think you'll need in case you don't immediately get the hang of it.

#1 - The bags typically sold by storage food dealers look rather large when you compare them to the five or six gallons buckets they are commonly used in. That extra material is necessary though if you are to have enough bag material left over after filling to be able to work with. Unless you are sure of what you are doing, don't trim off any material until after the sealing operation is completed.

#2 - Place the bag inside the outer container and fill with the food product. Resist filling it all the way to the top. You need at least an inch or so below the bucket rim left open to get the lid to seat completely. If you'll be using desiccants and oxygen absorbers together place the desiccant on the bottom of the bag before filling.

#3 - When the pail seems to be full, gently thump it on the floor a few times to pack the product and reduce air pockets. Add any makeup food necessary to bring level back to where it should be.

#4 - Take the bag by the corners and pull out any slack in the material so that all sides can be pulled together evenly. Place your oxygen absorbers inside if you are going to use them. Now place a board over the top of the bucket and fold the bag end down over it keeping it straight and even. Place a piece of thin cotton fabric such as sheet or t-shirt material over the edge of the bag mouth. Using a clothes iron set on the cotton, wool or high setting run it over the cloth-covered Mylar about a half-inch from the edge for about twenty seconds or so until it seals. You'll probably have to do the bag in sections. Temperature settings on irons vary so experimenting on a left-over strip to find the right setting is a good idea.

#5 - When you've done the entire bag allow it to cool then try to pull the mouth of the bag open. If moderate pressure doesn't open it, fold the bag down into the pail until you feel the trapped air pillowing up against the material and wait to see if it deflates. If it stays buoyant, your seal is good. You can seal on the bucket lid at this point or take the further step to vacuum or gas flush the bag.

Once a seal has been obtained the bags can be left as-is, vacuum sealed or gas flushed. To obtain the most efficient oxygen removal the bags can be first drawn down with a vacuum pump and then purged using an inert gas.

Vacuum Sealing Mylar Bags

Once you have obtained a good seal on the bag, pulling a vacuum on the contents is straight forward.

First you'll need something to make a vacuum with. This can be either a regular vacuum pump, a vacuum sealer such as the Tilia Food Saver or even the suction end of your household vacuum cleaner. The end to be inserted into the bag will need to be of fairly small diameter in order to keep the hole in the Mylar from being any larger than necessary. This means that if you use a vacuum cleaner you'll need to fashion some form of reduction fitting. One such that I've seen is a plastic film canister with a hole drilled in the bottom and a piece of plastic tubing epoxied in place.

Cut a hole into the Mylar bag on a corner, making the opening only just large enough to admit the vacuum probe. Insert the nozzle and using a sponge, or something similar, push down on the material over the probe to make a seal. Now draw down a vacuum on the bag. When it's drawn down as much as possible, run a hot iron diagonally across the cut corner resealing the bag.

Gas Flushing Mylar Bags

Flushing with inert gas works essentially like vacuum sealing except that you're putting more gas into the bag rather than taking it out. You'll want to keep the entry hole small, but don't make a seal around it as above. Beyond that, follow the directions as given *in Section III.B.2 - CO_2 and Nitrogen*. When you feel that the bag has been sufficiently flushed, run the iron across the corner as above to seal.

Flushing with dry ice can also be done, but it is important to wait until the frozen carbon dioxide has completely sublimated into gas before making the final seal otherwise the bag will burst like an overfilled balloon.

A.6 REUSING OR RECYCLING PACKAGING

In an effort to save money or because new packaging may be hard to come by, it is common for many people to want to re-use previously used containers. There is nothing wrong with this, but it is sometimes more complicated than using new containers would be. Here are some general rules if you have an interest in doing this.

#1. Do not use containers that have previously contained products other than food. There are two risks this can expose you to. The first is that the particular package type may not have been tested for food use and may allow the transfer of chemicals from the packaging into your food. The second is that all plastics are porous to some degree. Small amounts of the previous contents may have been absorbed by the packaging material only to be released into your food, particularly if it is wet, oily or alcoholic.

#2. Previously used containers should only be used with foods of a similar nature and exposed to similar processes. This means that if a container previously held a material high in fat, such as cooking oil, then it should not be used to store a strong acid such as vinegar. Nor should a container be exposed to extreme conditions, such as heat, if the original use of the package did not subject it to that treatment. An exception to this is glass which is covered below. Generally speaking, dry, non-oily, non-acidic or alkaline, non-alcoholic foods may be safely contained in any food safe container. An example of this is keeping grains and legumes in HDPE buckets formerly containing pickles.

#3. Glass may be used to store any food provided it is in sound condition and has only been used to store food previously. The lid or cap, however, that seals the jar is subject to the cautions given above. Glass jars not specifically made for home canning, either boiling water bath or pressure canning, have a significant risk of breakage if used for that purpose.

#4. Porous packaging materials such as paper, cardboard and Styrofoam should not be reused. Their open texture can trap food particles and are difficult to adequately clean. Packaging formerly holding raw meats, seafoods, or egg products are particularly at risk.

#5. Containers previously holding odorous foods may trap those odors and transfer them to foods later stored. Pickle flavored milk leaves a lot to be desired. Foods such as dry milk powders, fats and oils, flours and meals will absorb any odors seeping from your container material. Be sure to get the smell out before you fill them.

B – CARBON DIOXIDE AND NITROGEN

Carbon dioxide (CO_2) and nitrogen (N_2) are commonly used in packaging both fresh and shelf-stable foods, in order to extend their shelf lives. Fresh foods are outside the scope of this work so attention shall be focused on those foods suitable for use in storage programs.

The most common use of these gasses is for excluding oxygen (O_2) from the atmosphere contained inside of a storage container (called head gas). When head gas oxygen levels can be dropped below 2% the amount of undesirable oxidation reactions in stored foods can be greatly decreased resulting in longer shelf lives. Actually achieving this is not a simple matter when limited to the equipment and facilities typically available in the home. Still, with careful technique and proper packaging materials it is possible to achieve useful results.

In order for either gas to be used most effectively it is should be contained inside of packaging with high barrier properties to prevent outward diffusion over time or allowing oxygen to infuse in. Examples of this kind of packaging are aluminized Mylar or other high barrier property plastics, metal cans or glass jars. Buckets made of HDPE plastic are relatively poor gas barriers and will, over time, allow oxygen to infuse into the container. In order for foods to be kept for their maximum shelf lives the containers would need to be re-purged every three to four years. Foods that are particularly oxygen sensitive, such as dry milk powders, should not be stored in HDPE without a secondary gas barrier. It is possible to use HDPE buckets alone when gas purging if a shorter rotation period is

used. An example would be using wheat in four to five years instead of the eight to ten that would be achievable if a high barrier container were used.

Purging efficiency can be greatly improved when used with a vacuum device. By first drawing down the head gas of the container and then flooding with the purging gas much more oxygen can be removed. Repeating the process once more will improve removal efficiency even more. If a true vacuum pump is not available, the suction end of a home vacuum-cleaner can be made to serve and still achieve useful results. With careful technique, oxygen levels can be dropped to between 0.5-2%. Finely textured materials such as grain flours and meals, dry milk powders, dry eggs, and similar textured foods will purge poorly and are better packaged with oxygen absorbers. Instructions for vacuum usage are given in *A.5.1 Using Mylar Bags*. Instructions for gas purging are given below in *B.1 Dry Ice* and *B.2 Compressed Nitrogen*.

A less common, but important use for carbon dioxide is fumigation. This is killing or retarding insect life contained in a product. Many chemical fumigants are available to do this but are not thought desirable by many who have foodstuffs they want to put into storage. CO_2 is not as certain as the more toxic fumigants, but it can be made to work and will not leave potentially harmful residues behind. It is possible for nitrogen to work in a similar manner, but it must be in a head gas concentration of 99%+ whereas carbon dioxide can be effective over time at levels as low as 3%. The precise amount of time necessary for the gas to do its work will vary according to the specific insect species and its growth stage along with the temperature and humidity level of the product being fumigated. In general, the more active the growth stage and the warmer the temperature the more effective CO_2 is in killing weevil infestations. The gas also exhibits bacterial and fungal inhibiting properties, but for our purposes this will be of little moment since all foods should be too dry to support such growth in the first place.

The procedure for fumigating foodstuffs with carbon dioxide is precisely the same as the one used in purging oxygen from storage containers mentioned below. The only change is that for the fastest effectiveness the sealed container should be left in a warm place for a week or so before moving it into its final storage location. The gas is still effective at cooler temperatures, but because insect life is slowed by lower temperatures the carbon dioxide takes longer to complete its mission.

NOTE: Both Mitsubishi Gas-Chemical, maker of the Ageless line of oxygen absorbers, and Multisorb, manufacturer of the FreshPax D 750 absorbers, state the their products should not be used in a high carbon dioxide environment. There are absorbers that will work well in high carbon dioxide atmospheres but they require an external moisture source which would make them difficult to use for our purposes.

B.1 DRY ICE

Using dry ice to displace oxygen from food storage containers is straightforward. To get the best results it is recommended that all foodstuffs and packaging materials be put in a warm location for a few hours before beginning the purging process. The reason for this is that the cold CO_2 sublimating from the dry ice will be denser than the warmer, lighter oxygen containing air. The cold gas will tend to stay on the bottom, gradually filling the container and pushing the warm air out the top.

When you first pick up your dry ice from the supplier, put it in a moisture proof container so that air humidity will be less able to condense and freeze on it. The sublimating gas will prevent you from achieving a tight seal, but you can slow down the water ice accumulation.

Gather your containers and any interior packaging materials. Break off a piece of dry ice of sufficient size for the volume to be purged. One pound of dry ice will produce about 8.3 cubic feet of carbon dioxide gas so approximately two ounces per five gallon bucket will do. Wipe off any accumulated water frost which should look whiter than the somewhat bluish frozen gas. Wrap in a paper towel to keep foodstuffs out of direct contact. Place in the bottom of the container that will actually contain the food, i.e. the bag. Fill the package with the food product, shaking and vibrating while doing so to achieve the maximum packing density.

If a vacuum process is not to be used then place the lid on the container, but do not fully seal. If a liner bag is being used then gather the top together or heat seal and cut off a small corner. This is to allow the air being purged to escape as it is pushed upward by the expanding gas from the dry ice. Do not move or shake the container while the ice is sublimating so as to minimize turbulence and mixing. After about two hours feel the bottom of the container immediately below where you put the ice. If it's not still icy cold complete the seal. Check the container every fifteen minutes or so to be sure that a pressure build up is not occurring. A small amount of positive pressure is OK, but do not allow the container to bulge.

If a vacuum process is used then cut off a corner of the bag and insert the probe or place the container in the vacuum chamber. Draw a vacuum and when it has reached the desired point shut it off, but do not allow air back inside. When the dry ice has finished sublimating seal the container. If a slightly larger piece of dry ice is used this process may be repeated once more to improve oxygen removal. Watch for pressure signs as above.

NOTE: It is natural for some grains and legumes to adsorb carbon dioxide when stored in an atmosphere with high levels of the gas. This will result in a drop in head space air pressure much like using oxygen absorbers will cause as they absorb oxygen. Precautions should be taken in thin walled containers against buckling and possible loss of seal integrity. When the food products are removed from the container they will release the adsorbed CO_2 and suffer no harm.

WARNING: Dry ice is extremely cold (about –110° degrees F.) and can cause burns to the skin with prolonged contact. Because of this you should wear gloves whenever handling it. Also, dry ice evaporates into carbon dioxide gas, which is why we want it. CO_2 is not inherently dangerous, we breath it out with every breath we exhale, but you should make sure the area where you are packing your storage containers is adequately ventilated so the escaping gas will not build to a level dangerous enough to asphyxiate you. If you must pack your containers in a coat closet, leave the door open <grin>.

IMPORTANT NOTE: Because dry ice is very cold, if there is much moisture (humidity) in the air trapped in the container with your food, it will condense. Try to pack your containers on a day when the relative humidity is low or in an area with low humidity, such as in an air-conditioned house. Use of a desiccant package when using dry ice to purge storage containers may be a good idea.

B.1.1 DRY ICE SUPPLIERS

Dry ice may be found at ice houses, welding supply shops, some ice cream stores, meat packers or you could look in your local phone book under the headings "ice", "dry ice" or "gasses". If you are still unable to locate a source, contact your local hospital and ask to speak to the laboratory manager. Ask where the hospital gets the dry ice they use to ship biological specimens. You may be able to use the same source.

You may also want to check out Dry Ice Info.com (**http://www.dryiceinfo.com**) and click on the directory link to find a dry ice retailer in your area. While you're there check out some of the other uses for dry ice on the site. It's an interesting place.

B.2 COMPRESSED NITROGEN

B.2.1 TYPES OF AVAILABILITY

Both nitrogen (N_2) and carbon dioxide (CO_2) are commonly available in the form of compressed gas in cylinders. In food storage, CO_2 is mainly used in the form of dry ice (see above) which is often easier to acquire with much less necessary equipment. Because of this, I'll be limiting this section to the use of compressed nitrogen. If for some reason you prefer to use compressed CO_2 the information given below will work for both, though cylinder sizes may differ.

In the U.S. there are about eight principal suppliers of compressed gasses: Air Liquide, Airco, Linde, Air Products, Matheson, Liquid Carbonic, MG Industries, and Scott. One or more of these producers should have compressed gasses available in virtually every area of the United States and Canada.

Locating a source of compressed nitrogen is probably as easy as looking in your local phone book under the headings "compressed gas suppliers", "gasses", or "welding supplies". Other sources might be automotive supply houses, university or college research departments, vo-tech schools, and medical supply houses.

Nitrogen is generally available in a number of forms ranging from gas intended for welding, to various purity assured types, to gas mixtures where N_2 would be one of the components.

Unless you are knowledgeable about compressed gasses and the equipment needed to use them it is strongly recommended that you *not* use any gas mixtures in your food storage, but rather to stay with pure nitrogen gas. Use of compressed gas mixtures requires knowledge and equipment beyond the scope of this FAQ.

IMPORTANT NOTE: Welding nitrogen is essentially a pure gas, but it has one important caveat. When a cylinder of welding gas is used there is an unknown possibility that some form of contaminant may have backfed into the cylinder from a previous user. Possibly this could happen if the tank was being used in an application where the cylinder's internal pressure fell low enough for pressure from whatever the tank had been feeding to backflush into the cylinder. Alternatively, the tank pressure may have become depleted and was repressurized using ordinary compressed service air. The most likely contaminants will be moisture, carbon monoxide, carbon dioxide, oxygen and hydrocarbons, but there is the remote possibility of something even more exotic or toxic getting into your tank. Welding gas cylinders may not be checked by the gas supplier before being refilled and sent back out for use. It is this remote, but unknown possibility of contamination that causes me to recommend against the use of welding grade nitrogen in food storage. If your supplier is willing to certify that welding gas cylinders are checked before refilling then they would be OK for use.

The varying types of purity assured nitrogen gas are slightly more difficult to find and slightly more expensive in cost, but I believe this is more than made up for by the fact you know exactly what you're getting. Air Liquide, as an example, offers seven types of purity assured nitrogen ranging from 99.995% to 99.9995% pure with none having a water vapor content over 1 part per million (ppm) or an oxygen content over 3 ppm. Any of them are eminently suited to the task so the most inexpensive form is all you need buy.

As you might expect, compressed gas cylinders come in a number of different sizes. For the sake of simplicity I will address only the most common cylinder sizes since they will almost certainly be the most inexpensive as well.

Again using Air Liquide as an example, it is their size 44 and 49 cylinders that are the most common. There are other cylinder sizes of smaller physical dimensions and capacities. However, the logistics of compressed gas production and transport being what they are, they frequently will cost as much or even more than the larger, more common sizes. The actual gas inside the cylinder is cheap. Filling and moving the heavy cylinders around is not.

Table 1. Air Liquide most common cylinder sizes.

Cyl Size	Capy Cu Ft	Filled PSIG	Wt Lbs	Ht In	Dia In
44HH	445	6000	339	51	10
44H	332	3500	225	51	10
49	304	2640	165	55	9.25
44	234	2265	149	51	9
16	77	2000	71	32.5	7

Legend:

The "H" suffix means high pressure.

PSIG = Pounds per Square Inch on the Gauge, this does not reflect atmospheric pressure which would be Pounds per Square Inch Absolute (PSIA). PSIA is the absolute pressure of atmospheric and internal cylinder pressure combined.

Although it is not a common size, I left the #16 cylinder in the above table in case someone really wants or needs to use a smaller cylinder.

Table 2. Cylinder Size Comparison. Abbreviated table.
Alphagaz (Air Liquide) is Column 1

Cyl Size [1]	Airco [2]	Air Prod [3]	Linde [4]	Liq Carb [5]	Math [6]	MG Ind [7]	Scott [8]
49	300	A	T	J	1L	300	K
44L	200	-	K	H	1A	200	A
44	200	B	-	-	-	-	-
44H	-	BY	3K	-	1H	2HP	-
44HH	500	BX	6K	-	1U	3HP	-
16	80	C	Q	M	2	80	B

Legend: [1] Alphagaz (Air Liquide) [2] Airco [3] Air Products [4] Linde [5] Liquid Carbonic [6] Matheson [7] MG Industries [8] Scott

Reference: High Purity Specialty Gases and Equipment Catalog; copyright 1995, Air Liquide America Corporation, Houston TX USA; pages 6 and 7.

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As you can see, the size 49 cylinder from Air Liquide has an equivalent from all eight manufacturers. This size is the one commonly seen being used to fill helium balloons at county fairs and ball games.

B.2.2 OBTAINING THE GAS AND NECESSARY EQUIPMENT

Although you can purchase your own the most inexpensive way to use nitrogen is to rent a cylinder from your gas supplier. This may require filling out an application, paying a refundable cylinder deposit, and buying the gas contained in the cylinder. Tank rental periods can vary, but the most common is for thirty days.

Having rented or purchased the cylinder you must now get the thing home. Delivery by the supplier can often be arranged or they may assist you in getting the cylinder into your vehicle. The preferred method of transportation is for the cylinder to be chained, clamped or otherwise solidly secured in a vertical position in the transporting vehicle with the cylinder cap in place. Transportation requirements vary from nation to nation, state to state, and even city to city so your best bet is to inquire of your gas supplier to find a safe and legal means of moving the tank.

IMPORTANT NOTE: The major expense in using compressed gas is not the cost of the gas itself, but in the equipment needed to safely handle and control it. Unless you can borrow the appropriate mechanisms they will

have to be purchased, new or used, and even the cheapest regulator and gauge are not inexpensive. There is a temptation to forgo the expense and not use a regulator, but I must caution strongly against this. As Table 1 above shows, a full cylinder of compressed gas will have an internal pressure of 2000+ PSIG. Normal atmospheric pressure is about 15 PSIA. If the cylinder valve was opened only slightly too far a great deal of high pressure gas will flow through the delivery hose and metal wand and the potential for serious injury when it began to whip around would be high. For your safety, get the necessary equipment. If you purchase your own regulator/gauge cluster and/or your own cylinder, there is necessity for periodic maintenance. Regulators and gauges need to be calibrated (using a water deadweight calibrator) and cylinders need to be hydrostatically tested, typically every ten years for both. Your gas supplier can provide you with more detailed information.

The only equipment that will come with your cylinder is the cylinder cap. "Don't leave home without it" and they mean it. All of the common cylinder sizes will use the CGA-580 (Compressed Gas Assembly) cylinder fitting. The downstream side of this fitting can be obtained with different threads, but a 1/4" NPT (National Pipe Thread) nipple is normally needed to mate with the regulator body. The nipple is really nothing more than a short length of high pressure pipe. The CGA fittings come in a variety of metal compositions such as carbon steel, stainless steel and brass. The best choice is one which matches the composition of the regulator body. If the CGA fitting and regulator are to be used only with dry, non-oxygen gasses, in a dry environment then galvanic corrosion can be disregarded so the most inexpensive metal composition can be used even if it is not the same as the regulator. If it is to be used in a wet area, or with oxygen containing gasses then matching metal composition becomes important.

When the tank is to be returned there must be some residual pressure still in the cylinder or the renter may have to pay a surcharge or lose their deposit. This is particularly true of purity assured gasses because the residual gas composition will be analyzed. This is done for the safety of all cylinder users.

The regulator/gauge cluster should be carefully removed using the same procedure that is described below to put it all together. Care should be taken not to damage the cylinder valve threads. Replace the cylinder cap and transport in the same manner as you brought it home.

B.2.3 PUTTING IT ALL TOGETHER

If the fitting and regulator are bought separately then some 1/2" wide Teflon tape is recommended for assembly since it is a clean and inexpensive way of sealing pipe joints. Looking into the open end of the nipple wrap the tape clockwise around the threaded end for 1.5 to 2 turns, working from the open end backwards. If you want to do a neat looking job, the tape may be slit lengthways to make it 1/4" wide, but this is not a requirement. A brass nipple may shrink somewhat during tightening and need a bit more tape than a harder metal like stainless steel would. The Teflon tape should only be used on the end of the nipple that attaches to the regulator body, NOT to any part of the cylinder end.

The regulator end has tapered threads and uses them directly for sealing. The cylinder end has straight threads and depends upon the precision mating of machined metal surfaces to seal. The cylinder end threads simply apply the clamping force.

Before attaching the CGA fitting to the cylinder the user should put on safety glasses and good hearing protection. The cylinder valve can then be cracked slightly to blow out any dust or debris. After closing the valve, inspect the cylinder valve and nipple for any abrasions, nicks, gouges, embedded particles, etc., before attachment is made.

You will need two wrenches (not adjustable pliers) to equalize the torque, particularly on the cylinder valve where it should be minimized. Put one wrench on the fitting and the other wrench on the cylinder valve and make the join.

Once the regulator/gauge cluster has been mated to the cylinder, the delivery hose can now fitted to the regulator and the metal wand to the other end of the hose. The wand is nothing more than a short length of metal tubing at least six inches greater in length than the depth of the buckets to be filled. Copper water line works well.

When the joins have been made, a mixture of a short squirt of dish washing detergent and water can be used to check for leaks. Be certain the detergent does not contain ammonia which can be corrosive. Pour some on each fitting working from the cylinder end outward, opening each valve and pressurizing as you go. Once the leak check is finished rinse off and wipe down all surfaces to minimize the chance of accidents in the future.

If the gas is not to be used at that time then the cylinder valve should be closed and all pressure should be drained to zero in the regulator and gauge. This should be done any time that the tank is not in actual use. If you have purchased your own cylinder then it is a good idea to also acquire one of the plastic valve plugs, similar to those seen with propane cylinders, in order to protect the cylinder valve threads and keep dust, debris and insects out of the valve.

WARNING: Care should be taken that the cylinder is used and stored in such a way as to minimize the risk of the tank falling over. With the regulator and gauge attached there is an increased likelihood of damage occurring to the cylinder valve should the tank fall. Catastrophic failure of the cylinder valve will turn the tank into a high-energy, unguided rocket with the capability of doing great damage and/or serious injury.

B.2.4 PUTTING IT INTO USE

Having assembled and tested your gas system, you are now ready to begin the work of packaging your food. You'll need containers, and food grade plastic or Mylar bags that are a bit larger in internal volume than the container. Next is the dry food you intend to package and a pack of matches or a cigarette. You'll also need to wear the safety glasses and hearing protection you wore when you put the gas system together.

Take the containers you are going to use to store your food in, the bags that will line them and the food you are putting up and place them in some warm (not hot) area long enough for them all to equalize to that temperature. This will mean that the air contained inside them will also be at a warm temperature and make it more likely that it will stay on top when the cool gas from the nitrogen cylinder begins to flow in. The warm gas being on top will be the first to purge from the container, taking a good deal of the oxygen with it.

Line the interior of the container with a plastic bag or Mylar bag. Fill the container with the food product shaking to get it as full as possible. Don't forget to put your desiccant package on the bottom if you're going to use one. You don't want any pockets left between the plastic bag and the container. Once you have gotten it full to just short of not being able to fully put on the lid, gather the top of the plastic bag together or heat seal the edges. If you have sealed it, cut a small corner off of the bag just large enough to allow a probe to enter.

At this point you can either simply flush the bag as described below or draw a vacuum on it first and then flush. If using a vacuum the suction probe should be kept at the top of the bag, just inside of the opening. The gas wand should be inserted to the bottom of the container, taking care not to poke any holes in the liner bag. Once both instruments are inserted, draw the vacuum. When it has reached a satisfactory level, shut off the suction, maintain the seal and turn on the gas.

Open the cylinder valve and set the regulator to a very slow gas flow and begin to fill the bag with gas. You want the container to fill slowly so you can minimize turbulence and mixing as much as you can. It'll take a little while to fill each container, a minute or two per bucket. Just as with dry ice, the idea here is for the cool gas to displace the warmer atmosphere from the container. The bag should puff a bit. When I think it's full I'll hold a lit match above the bag in the air that is escaping from it. If it snuffs right out then I let it run for about several minutes longer to flush out more of any remaining oxygen and remove the wand.

For the most efficient oxygen removal, repeat the suction/gas flushing procedure one more time. When satisfied, tie or heat seal the bag off and seal the bucket. Again, you want to have the bucket as full as possible so that there'll be only minimal air space. You should monitor the containers for an hour or two after filling to check for any signs of bulging or other pressure build up as the cool gas inside gradually warms and expands. A slight positive pressure is OK, but serious bulging will need some of the pressure released.

NOTE: Although the procedure for flushing a container with nitrogen is straightforward enough, actually getting a good purge of the container is not. Nitrogen flushing works best when the food particles are fairly large in size so the gas flow around and through the food is free and unrestricted. Foods such as the larger sized grains (corn, wheat, barley, long grain rice, etc.), legumes and non-powdered dehydrated foods are best suited to this technique. Foods with small particle sizes such as flours, meals, and dry milks will flush with mediocre results.

Because of the difficulties in purging sufficient oxygen from a container to lengthen the shelf life of the food it contains many commercial suppliers have dropped this technique in favor of using oxygen absorbers. There is no reason that inert gas flushing and oxygen absorbers cannot be used together and one good reason that they should. If you are using five gallon plastic buckets as your storage containers, it has been observed that absorbers used in unlined pails can cause the air pressure inside the bucket to drop enough for the walls to buckle, possibly leading to a seal breach or a stack collapsing. For this reason, flushing with inert gas (nitrogen or CO_2) might be a good idea, in order to purge as much oxygen as possible so that the pressure drop caused by the absorber removing the remaining oxygen will not cause the bucket to buckle. Liner bags can ameliorate the vacuum problems.

A big note of thanks to Lee Knoper for his assistance in putting together the above compressed gas information.

C -- VACUUM SEALING

Vacuum packing is a simple concept. Lower the air pressure (22 inches of vacuum or more) in a container until sufficient oxygen laden air has been removed to slow the development of rancidity and retard the growth of insects. Within reason, the greater the air removed the better the process will work. I have not yet found any controlled studies that detail exactly how much improvement in shelf-life vacuum sealing can give for dry storage foods, but it is widely used in the commercial food industry and I have read a wealth of anecdotal evidence from individuals which matches my own experiences that indicates that it does work.

Some developmental stages of insect life may not be killed by this process, but if you can draw more than 22 inches of vacuum it will at the least force the more resistant stages into stasis. Over time even the hardiest bugs will eventually asphyxiate. Many people vacuum seal their weevil prone grains and when properly done I have heard no reports of infestations. Certainly I have had none.

How you draw the vacuum to seal your containers is up to you. There are a number of electrically or manually operated vacuum pumps on the market, some made for food storage purposes and others that can be adapted to the task. Of the electric home food storage vacuum pumps the only brand that I have found that receives consistently good reviews are the various Tilia Foodsaver models, of which I presently have their Model 750.

Recently Black & Decker and Sears Kenmore have come onto the market with their own line of home vacuum sealers which bear investigation. I'm still collecting reports so cannot say if their machines are worthwhile as of yet. If you have any personal experience with them I'd like to hear from you.

Of the manual pumps, only the "Pump -N-Seal" is actually sold for food storage use. It looks something like a miniature bike pump. It requires you to punch a small hole in the lid, cover it with a piece of adhesive tape and place the pump over the taped hole. You then pump out the container and when you remove the pump the pressure differential sucks the tape down against the hole, effectively sealing it. I've used it and it does work as they claim. I don't care for having to punch a hole in the container lid but others have found no problem with this and it's in common use. It can also be used to seal plastic bags, but I don't often hear of it being used for this as it calls for having to paint inside the bag mouth with a small amount of vegetable oil.

It's also possible to adapt a hand-pumped brake bleeder vacuum pump for food storage use and some have made their own pumps from old automobile air conditioning compressors.

WARNING: To be clear, allow me to point out what vacuum sealing ***won't*** do for you. *Any food that would need to be refrigerated or frozen to prevent spoilage **before** it was vacuum sealed will still need to be refrigerated or frozen **after** it was vacuum sealed.* Lowering the oxygen content of a storage container can do great things for deterring rancidity, staleness, and insect growth, but if the food has sufficient moisture you'll only be providing optimum growth conditions for some serious oxygen-hating spoilage bacteria such as the notorious *Clostridium*

botulinum. No vacuum sealing process suited to home-use can take the place of pressure canning low-acid high-moisture foods.

C.1 VACUUM SEALING CONSIDERATIONS

#1 - Sucking dust or powder into your pump will eventually lead to degraded performance or even damage. To deter this from happening when sealing dry, powdery foods you can try cutting a piece of coffee filter paper to fit inside of the jar adapter fitting so that any air pulled out of the container must flow through the filter paper before going into the pump lines. I have also seen used a clear, see-through fuel filter in the vacuum line between the jar adapter and the pump. This will block all but the finest dust particles and allows you to see when the filter needs changing. Of course, an opaque fitting will work as well, you'll just have to wait until air flow is significantly restricted to know when to change the filter. If the pump flow rate is adjustable, try pumping more slowly to lessen the amount of dust sucked out of the container.

#2 - The harder the vacuum you draw on a flexible container, such as a bag, the harder the bag will press against its contents. For smooth foods such as beans, corn and wheat this is of no significance. For sharply pointed foods such as long grain rice, rye and some kinds of dehydrated foods it may pull the bag against the food hard enough to puncture the material. This is especially the case if the package is will be handled often. For foods such as this consider putting the food inside of a paper bag first before sealing into the plastic bag.

#3 - Combining vacuum sealing with flushing or purging with inert gasses can improve the efficiency of both. By drawing out most of the oxygen laden air from a container there is less for the inert gas to have to displace. This, in turn, means that the final oxygen content in the head gas will be lower than it otherwise would be if the vacuum process hadn't been used. Combining vacuum sealing with oxygen absorbers means that a lower capacity (and cheaper) absorber can be used. It can also extend the absorptive life of the absorber thus allowing it to remove any oxygen that might infuse through the packaging material or through microscopic leaks.

#4 – All of my most sensitive storage foods such as dry milk powders (especially whole milk), dried fruits and vegetables, oils, dry eggs, etc I now seal in pint, quart, or half-gallon glass canning jars using the jar sealer adapter on my Tilia. This has proven to be an excellent means of preserving oxygen sensitive foods. The jars and lids are reusable and do not absorb odors.

D -- FREEZE TREATING

NOTE: This section is not intended to address freezing high-moisture perishable foods. They are outside the scope of this work and are much more capably addressed in the *Ball Blue Book* or *Putting Food By*. Information on these books may be found in the *Resources Section*.

Freeze treating, like vacuum sealing, is also a simple concept, but it must be done right. The major reason for freezing dry foodstuffs is to kill off any potentially lurking hidden insect infestations. Freezing *will* accomplish this task if you follow the steps I outline below.

#1 - The foods you want to preventatively treat against insect infestations should be at room temperature or even slightly warm and should have been at that temperature for at least several days. This prevents any insects that might be present from becoming acclimated to cold temperatures which would make them more resistant to being killed than they otherwise would be.

#2 - The bigger the package you want to treat, the longer it will take for its contents to fall to the desired temperature all the way through. Freezing the goods in small amounts of five to ten pounds at a time will give a quicker, more certain result than attempting to freeze a five gallon bucket.

#3 - Put the product into your freezer and *freeze it to 0º Fahrenheit (-18º Celsius) all the way through the package and keep it there for three days.* If there is enough air humidity in your house to cause condensation on the outside of a glass of ice water it is a good idea to put the product in a moisture proof container before freezing, otherwise you can leave it the way it came from the store.

#4 - Once the time is up, you can repackage the product into your storage packaging if you have not already done so. Whatever you use needs to be insect proof. Once the food comes back up to room temperature it is as susceptible to outside insect infestation as any other food. Promptly sealing it into your storage packaging will prevent any after-the-fact insects from being able to get into your chow.

There are some other foods that are quite low in moisture, but would benefit from remaining frozen at 0º Fahrenheit or less. Among these are yeast, cultures for yogurt, kefir, tempeh, and herbs and spices amongst others. It is vital they remain quite dry if you are going to store them this way.

E -- OXYGEN ABSORBERS

E.1 WHAT IS AN OXYGEN ABSORBER?

Oxygen absorbers are a relatively recent food storage tool whose arrival has been a real boon to the person wanting to put up oxygen sensitive dry foods at home. The packets absorb free oxygen from the air around them and chemically bind it by oxidizing finely divided iron into iron oxide. This removes oxygen from being available for other purposes such as oxidative rancidity and respiration by insects, fungi or aerobic bacteria. The practical upshot of all this is that by removing the free oxygen from your storage containers, you can extend the storage life of the foods inside. Not all foods are particularly oxygen sensitive but for those that are the absorbers truly simplify getting the job done.

The absorbers themselves have only a relatively short life span, roughly about six months from the time they were manufactured for the types that do not need an external moisture source. They don't suddenly become ineffective all at once, it's just at that point you will begin to notice (if you can measure it) that the absorbers no longer soak up as much as they would when they were new. Better to use them while they're fresh.

E.2 HOW ARE OXYGEN ABSORBERS USED?

In order to make the best use of your absorbers you need to know three things:

#1 – *Is the food I want to put by particularly oxygen sensitive for the time I want to keep it in storage?* Whole grains that have not been polished or hulled such as wheat, corn, and rye are not especially oxygen sensitive. If you intend to use them up in five years or so, there's no great advantage to using oxygen absorbers, unless used to deter weevil infestations. The same for most beans and peas. Processed or high fat grains and legumes such as oats, barley, brown rice, soybeans, peanuts and split peas would benefit from their use if they are to be kept for more than a year. Whole grain products such as whole wheat flour and rolled oats would as well. Refined grain products such as white rice, white flour, degerminated cornmeal will keep fine for a year or so, possibly longer, without oxygen absorbers if kept dry and protected from weevils. Dry milk, dry eggs, dry meats, and many kinds of dehydrated foods and any kind of freeze dried foods would benefit from oxygen absorbers. Foods with an easily transferable fat content should not be used with oxygen absorbers, nor should they be used with foods that are high in moisture or with free liquids in the storage container. These should be preserved using pressure or boiling water bath canning as appropriate.

#2 – *Will the packaging I want to use seal air-tight and is the packaging material itself a good gas barrier?* Obviously if the container won't seal air tight you're wasting your time trying to use oxygen absorbers but the barrier properties of a container stump many folks. Canning jars with good lids, properly sealed #10 (or other size) cans, properly sealed Mylar bags, PETE plastics with appropriate lids or caps, military surplus ammo cans with good gaskets and many other types of packaging will seal air-tight and provide good

barrier properties against oxygen infusing through the packaging material. Non-laminated flexible plastic packaging (bags, sheets, etc.), HDPE plastic buckets and any kind of non-laminated paper or cardboard container have poor gas barrier properties. "Poor" is a relative term, though, and if you're going to use the food up in two or three years, even oxygen sensitive foods can be kept in unlined HDPE buckets if you use an appropriately sized absorber and make sure the bucket is well sealed. You'll be using the food before sufficient oxygen has been able to infuse through the walls of the container to make a significant impact.

#3 – *What is the volume of the container and how much air volume remains after I've filled it with food?* This is important to know if you want to make the most efficient use of your absorbers and be certain your food is adequately protected. Taking the question in two parts, here is how to determine the answer:

A. Absorber capacity is rated by the amount of oxygen in milliliters that each will absorb so you'll need to know what the volume of your container is in milliliters. The table below gives conversions between common U.S. container sizes and their milliliter equivalents.

Pint jar (16 fl oz)	475 milliliters
Quart jar (32 fl oz)	950 milliliters
Half-gallon jar (64 fl oz)	1,900 milliliters
#10 can (112 fl oz)	3,300 milliliters
One gallon jar (128 fl oz)	3,800 milliliters
Five gallon pail (640 fl oz)	19,000 milliliters
Six gallon pail (768 fl oz)	22,800 milliliters
Fifty-five gallon drum (7,040 fl oz)	208,175 milliliters

Fluid ounces x 29.57 = milliliters = cubic centimeters

Now multiply the volume of your container times the 21% (0.21) of the atmosphere that oxygen constitutes and you'll come up with the volume of oxygen, in milliliters, that your container holds when it's empty.

An example: A quart jar (32 ozs) is approximately 950 milliliters in volume. Multiply 950 x 0.21 (21%) and you get 199.5 milliliters of oxygen in an empty quart jar. This leads to the second half of the above question.

B. Determining remaining air volume in a container that has been filled can be difficult. Foods vary widely in their density and porosity from flour, which will pack tightly to elbow macaroni which is mostly air even if you pack it to just short of crushing. The following are three rough and ready rules that can be used and will work.

i> Foods that have a lot of open space between the food particles (called *intersitial space*) such as macaroni, pasta, instant dry milk, instant potato flakes, many coarsely chunky dehydrated foods, cold cereals, etc. should use *one half* the container volume as the remaining air space. Using the example above with the quart jar, there would be approximately 100 milliliters of oxygen remaining.

ii> Foods that pack more densely such as non-instant milk, dry eggs, flours and meals, grains with small kernels, dehydrated foods with fine particles and the like should use *one-third* the container volume as the remaining air space. Using the example above, there would be 66 milliliters of oxygen remaining.

iii> Alternatively, you could do what many of the commercial storage food packagers do and use *the entire container volume*. This is not as efficient as more closely determining remaining air volume but it does add certainty that your absorbers will soak up all available free oxygen and still leave some capacity to deal with any microscopic leaks or infusion through the packaging material.

NOTES: #1 -- Both Multisorb and Mitsubishi corporations advise that their oxygen absorbers should not be used in a high carbon dioxide environment. This is apparently for reasons that the absorbers will also absorb carbon dioxide as well as oxy gen and may run out of capacity before all of the oxygen in the container has been absorbed.

#2 -- If you do choose to use oxygen absorbers in packing your food give some consideration to the sturdiness of your containers. In doing its job the absorber is going be removing the 21% of the atmosphere that oxygen constitutes. Since nothing is replacing the absorbed gas this will leave the storage container with a lower atmospheric pressure inside than outside. If the container is sufficiently sturdy this pressure differential will be of little consequence. For containers with thinner walls the pressure drop could cause them partially collapse or buckle, particularly if other containers are stacked upon them. Should this occur the entire stack could fall causing one or more to burst. Metal cans and glass jars should have no problems, but some plastic buckets made of HDPE have relatively thin walls which can buckle when the internal air pressure drops. To deter this, a liner bag of Mylar or other high gas barrier plastic should used. Heavier walled buckets won't need a liner unless you're trying to achieve the maximum possible shelf life. Seal the absorbers inside of the liner bag so that the pressure drop with not stress the walls of the container. Other containers should probably be tested or first flushed with an inert gas (N2) before the absorber is sealed in.

#3 -- If the pack of absorbers you need to open contains more than you are going to use in fifteen minutes or so, you should minimize exposure of the remaining packets. This can be done by heat sealing the bag they came in with an iron after expelling as much air as possible or better yet by vacuum sealing the bag. You can also put the remaining absorbers in as small a jar or metal can as they will fit in and closing with an air tight lid.

#4 -- The chemical reaction that absorbs the oxygen releases minor amounts of heat. This heat release is trivial in an individual packet but if they are piled one atop another as you're using them they can warm each other and speed the absorptive reaction. This costs you capacity lost to open room air so it's best to spread the packets in immediate use out on a tray so they lay atop each other.

#5 -- If absorbers are sealed in a package with desiccants some thought should be given to how low the relative humidity will become. Silica gel will reduce humidity to approximately 40% which should not interfere with the absorbers oxidation reaction. Other desiccants, however, are capable of reducing relative humidity to very low levels. This might adversely affect your absorber's ability to carry out its mission by removing moisture from the absorber package that is necessary to sustain the oxidation reaction. If you do use desiccants and oxygen absorbers in the same package, place the desiccant on the bottom, fill the package and then place the oxygen absorber on top of the food before sealing.

F – MOISTURE IN PACKAGING AND FOOD STORAGE

F.1 WHY MOISTURE IS IMPORTANT

Moisture in inappropriate amounts and places is damaging to food. Because of this, much effort is put into reducing the water content of dry foods in order to prolong their shelf lives. Once it is reduced to the desired level the product can then be packaged for storage. Unfortunately, merely reducing moisture content is not always sufficient. Environmental conditions can play a role as well.

There are four mechanisms by which environmental conditions may cause a moisture problem in your food storage:

1. - The air trapped in the container with the food may have held sufficient humidity to raise the moisture content of the food to undesirable levels.

2. - Even if the water vapor content wasn't too high, a falling temperature level may cause the trapped humidity to reach its dew point causing water to be squeezed out of the air to condense on your food much the same way as dew forms on your lawn on cool mornings after a warm, humid night. This can be a particular problem if the condensation is localized – say, only the portion of the food next to the walls of the container – resulting in excessive moisture in that local area even though the contents as a whole would be at a satisfactorily low moisture level.

3. - The seal of the container may not be sufficiently tight enough to prevent moisture laden air from leaking in.

4. - The packaging material itself may be porous to water vapor to one degree or another. All paper, wood and cardboard has this fault. Depending upon their particular physical properties some plastics do as well. Metal and glass containers have excellent barrier properties though their seals may not.

The solution for moisture problems is multi-faceted.

1 - Make sure the product to be stored is at an appropriate water content for that particular foodstuff. Beans and grains store well at a 10% moisture level, but milk powders, dried eggs and dehydrated or freeze dried foods should be lower for best results. As a general rule, nearly any dry food will store well at moisture contents between 3%-10% with the lower the better. Don't get carried away with this though. Extreme low moisture levels (below 3%) can make some foods difficult or impossible to reconstitute and damage the viability of seeds.

Ideally, the dry foodstuffs you have on hand will have no more than a 10% moisture content. If they do not then you will need to reduce moisture to a level appropriate for the kind of food you are storing.

One of the following methods might be of use in lowering moisture content.

A - The least involved is to wait until the driest time of year for your location making sure there is plenty of free air circulation around the food product. If this doesn't suit, then turn your air conditioning on a little high. Bring in your buckets, lids, and the storage food. Let everything sit in a well-ventilated place where it's going to get plenty of cool, dry air from the A/C (avoid anywhere near the kitchen or bathroom areas, as they put out a lot of moisture). Stir the food frequently to maximize moisture loss. A few days of cool, constant air flow and low humidity ought to dry things out. Due to its odor absorptive nature, I would not do this with any dried milk products or other powdered foods, flours or meals . This method works best with coarse particles such as grain, legumes and dried foods.

B - Warm, dry air can also be used to lower moisture content and works well if you have large quantities of grains and legumes. This is similar to what is used on farms for drying harvested grain. You'll need a source of forced, warm, *not hot*, air. Place the grain in a drum or barrel and blow the heat from the bottom so that the warm and the moisture it will carry can exit from the top. It's important to not let the bottom product get too hot. You should also monitor the top, center of the drum to be certain the product there is not getting damp from the moisture escaping other areas. Stirring occasionally may be necessary. I've seen this done with an old, drum style vacuum cleaner that put off fairly warm exhaust air and it worked pretty well. Do be sure to clean the vacuum thoroughly so you don't blow the grain full of dust.

C - If the above methods won't do or you have powdery foods to dry, you can put the food and a large quantity of desiccant (see below) in a storage container. The desiccant should be in its own container placed on top of the food and the container lid sealed on. After about a week, unseal and check the desiccant. If it's saturated, change it out with dry desiccant and reseal. Continue to do this until the contents are sufficiently dry. If it doesn't become saturated the first time, change it anyway before sealing the bucket permanently to deter saturation in storage.

If your food products are sufficiently dry you can pack them in storage containers using the packaging method of your choice and have a reasonable expectation of your food staying in good condition. Whether you will need to use a desiccant will be dependent upon the conditions discussed below.

2 - Try to package your goods in a dry atmosphere and do not allow extreme temperature swings in storage areas. Warm temperatures and a high relative humidity when a container is sealed means the air trapped inside the container will have a high dew point. This will lead to condensation should storage temperatures fall below that dew point. An example of this would be a container sealed on a day that was 70º F and 40% relative humidity. At that temperature the relative humidity would be quite reasonable for all but the most moisture sensitive food. However, should the temperature fall to 44º F the capacity of the air to hold water vapor would have dropped to the point that

it could not contain what was sealed in at 77º F and the excess would be squeezed out to condense on the food, i.e. - it will grow moister. Possibly the food will be able to adsorb this moisture without harm and then again, it may not.

3 - Use appropriate packaging materials and make certain it is sealed correctly. If you are going to consume them in four to five years, storing grains, beans and peas in unlined HDPE buckets at normal humidities is fine. If you want to keep them at their best for many years beyond that, the plastic the pail is made of is too porous to water vapor for best results and should have an interior liner of a material with better barrier properties. Dry milk powders should not be kept for more than a year in unlined HDPE, but can be kept for much longer in #10 metal cans, glass jars or Mylar bags. Naturally, even the most highly resistant packaging material is useless if its seal isn't good so be sure you use good technique when making closures.

Lastly, you may wish to consider using a desiccant if good humidity control at the time of packing is difficult or if the storage area is in a high humidity environment or if the packaging material does not have sufficiently high barrier properties.

NOTE: There has been some confusion in the past over the appropriate use of desiccants in food storage which I would like to address here. Any desiccants you may seal in your storage containers (if you use them) are not for lowering the moisture content of the foods therein, but for moderating any shifts in moisture levels caused by those factors I mention above. If the food you want to put up is too high in moisture for good storage this needs to be dealt with BEFORE you seal the packaging. An example of what I'm trying to communicate here would be 10lbs of wheat with a 15% moisture content. That's too high for safe storage and needs to be lowered, preferably to 10% or less. To lower the moisture content of that grain to 10% you need to remove the 5% excess. 5% of 10lbs is eight ounces of water. Good dry silica gel (one of the most common desiccants) will hold 40% of its mass in moisture so to soak up that extra water you would need 20 ounces of silica gel – quite a large amount – all to remove that 5% excess moisture in ten pounds of grain. Fifty pounds of grain at that same moisture level would require 100 ounces or *six and a quarter pound*s of silica gel. Clearly no practical amount of desiccant you can put inside your storage packaging will do for you what should have been done before the food was put by. Desiccants can be used for lowering food moisture content, but this will involve rotating packages of desiccant in and out of the foodstuff until the desired moisture content has been reached. Once the package is sealed any desiccant you leave inside should be there to control moisture fluctuations or to guard against moisture infiltration from the outside.

F.2 WHAT IS A DESICCANT?

A desiccant is a substance with strong *hygroscopic* properties, meaning it will soak up water vapor from the surrounding air. A number of different substances are capable of doing this, but only a relative few of them are of practical use and fewer still are going to be readily available to the average person. Before elaborating on the different types that might be useful for our purposes it's necessary to explain how to choose a desiccant.

The U.S. military has done much of the best research on the use of desiccants in packaging and have largely set the standards by which they are judged. Each type of desiccant has temperature and humidity ranges where it performs best and particular physical and chemical characteristics that may need to be considered in relation to what you propose to do with them.

The most applicable standard for home food storage defines a unit of desiccant as *the amount of desiccant that will adsorb at least 6 grams of water vapor at 40% relative humidity at 77º F (25º C).*

The following table gives the amount of desiccant necessary per square area for flexible containers such as Mylar bags or per volume of area for rigid containers such five gallon pails or #10 metal cans.

Units of Desiccant Needed Per Given Container Volume.

FLEXIBLE CONTAINERS (Mylar and other plastic bags)			RIGID CONTAINERS (Buckets, cans, jars, etc.)		
			Units of Volume in:		
Area sq ft	Area sq in	Desiccant Required	Gallons	Cu/FT	Cu/In
0.1	30	1/6	1.1	0.14	237
0.3	45	1/3	2.1	0.28	476
0.6	90	1/2	3.2	0.42	714
1.3	180	1	6.2	0.83	1,428
1.9	270	2	12.5	1.67	2,856
2.5	360	3	18.7	2.50	4,284
3.1	450	4	25.0	3.33	5,712

[Table adapted from "Moisture In Packaging: Selecting the Right Desiccant" ©, Multisorb Corp. **http://www.multisorb.com**]

This is all well and good so far as it goes but without knowing how much of a particular type of desiccant is needed to soak up that six grams of water it doesn't do you much good. The next table will reveal all:

Desiccant Needed to Adsorb 6 Grams of Water Vapor

Desiccant	Mass
Silica Gel	15 grams
Indicating Silica Gel	75 grams [1]
Montmorillonite Clay	24 grams
Calcium Oxide (quicklime)	21.5 grams
Calcium Sulfate (gypsum, Drierite)	60 grams
Wood	43 grams [1]

[1]See desiccant descriptions for clarification.

In order to maximize surface area to obtain optimal adsorption, desiccants are manufactured in granular or powder forms. This presents a problem of keeping the desiccant, which may not be safe for direct contact with food, out of the product while still allowing sufficient air flow for it to carry out its task. Manufacturers call this "dusting" and deal with it by packaging the adsorbent in materials such as uncoated Tyvek, a spunbonded high-density polyethylene material produced by the Dupont corporation. Unfortunately, I have not yet been able to locate a retail source of uncoated Tyvek, just the coated variety such as is used in postal envelopes. Second best, and what I use, is two or more layers of coffee filter paper securely sealed over the mouth of the container holding the desiccant. I've also made "cartridges" of filter paper for use in narrow necked containers such as two-liter bottles. For this I used ordinary white glue. Getting a good seal all the way around requires some care in execution. Brown Kraft (butcher paper) may be used as well.

For coarse granular materials tightly woven fabrics might serve the purpose providing the seams are tightly stitched.

F.3 TYPES OF DESICCANTS

F.3.1 SILICA GEL

The most commonly known and used desiccant is silica gel which is a form of silica dioxide (SiO_2), a naturally occurring mineral. It will work from below freezing to past the boiling point of water, but performs best at room temperatures (70-90° F) and high humidity (60-90%). Its performance begins to drop off over 100° F, but will

continue to work until approximately 220º F. It will lower the relative humidity in a container to around 40% at any temperature in its range until it is saturated. Silica gel will absorb up to 40% of its weight in moisture. Some forms are approved by the FDA for direct food use (check with your supplier to be sure). It recharges easily (see below in the indicating silica gel text) and does not swell in size as it adsorbs moisture.

F.3.2 INDICATING SILICA GEL

In the retail trade, the most common form of silica gel is *indicating silica gel* composed of small white crystals looking much like granulated sugar with pink or blue colored crystals scattered throughout. This is ordinary silica gel with the colored specks being coated with cobalt chloride, a heavy metal salt. When the gel has absorbed approximately eight percent of its weight in water the colored crystals will turn from blue to pink making an easy visual indicator of whether the gel has become saturated with moisture. *Because cobalt is a heavy metal,* ***indicating silica gel*** *is not food safe and should be kept from spilling into anything edible.*

The indicating silica gel will still adsorb up to 40% of its weight in water vapor like the non-indicating type will but once it has gone past the 8% level and the crystals have turned pink there is no way to tell how close it is to saturation. This isn't necessarily a problem, you'll just have to treat like the other non-indicating desiccants and either weigh it to determine adsorption or use a *humidity indicator card*. These cards are made to show various humidity ranges and can be had from many desiccant and packaging suppliers.

When saturated, both varieties of silica gel can be dried out and used again. This is done by heating the crystals in an oven at a temperature of no more than 300° F (149° C) for approximately three hours or until the crystals turn blue. Dehydrating the desiccant may also be accomplished by heating in a microwave oven. Using a 900 watt oven heat the crystals for three minute intervals until the color change occurs. The exact amount of time necessary will depend upon the oven wattage. Spreading the desiccant in a broad pan in a shallow layer will speed the process. Heating to 325° F (149° C) or more, or using a microwave oven over 900 watts can damage the gel and render it unable to adsorb moisture.

If your desiccant is packaged in Tyvek, do not heat above 250° F (121° C) or you could damage the material. This leaves a fairly narrow temperature window since silica gel will not begin to desorb moisture below 220° F (104° C). It's a good idea to use a reliable oven thermometer to check your oven temperature as the thermostats in home ovens are often off by more than twenty five degrees. Start with the packets in a cold oven and raise the temperature to 245° F (118° C), keeping it there for twenty four hours. Spread the packets so they are not touching and keep them at least 16 inches from any heating elements or flames so that radiant heat does not damage the packaging. Tyvek should not be microwaved.

F.3.3 CLAY DESICCANT

Although not generally found in the retail market, clay desiccant is fairly common in commercial and industrial use. The primary reason for this seems to be that it is inexpensive compared to any other form of desiccant. Some mail order suppliers offer it for retail sale.

The desiccant material is *Montmorillonite clay*, composed primarily of magnesium aluminum silicate, a naturally occurring mineral. After mining it is purified, reduced to granules and subjected to a controlled dehydration process to increase its sorbent porosity. It recharges easily and does not swell as it adsorbs water vapor. It works well at low and room temperatures, but has a rather low ceiling temperature. At 120º F it will begin to desorb or shed the moisture it has adsorbed. This is an important consideration for storage in hot areas.

Subject to a degree of variability for being a natural material, clay desiccant will adsorb approximately 25% of its weight in water vapor at 77º F and 40% relative humidity.

F.3.4 CALCIUM OXIDE

Also known as "quicklime" or "unslaked lime", calcium oxide is a slow, but strong adsorbent. It is efficient at low humidities and can drop moisture vapor to below 10% relative humidity. Qucklime is ***caustic*** so must be carefully handled, particularly with regards to dust inhalation and exposure to skin and eyes. It expands as it soaks up water vapor and this must be taken into account when packaging. It will adsorb up to about 28% of its weight in moisture, but does so slowly over a period of several days rather than a matter of hours like other desiccants. It is most effective when used in high humidity environment where a very low humidity level is desired. It will release a fair amount of heat if exposed to direct (liquid) moisture or extreme humidities.

Calcium oxide can be recharged, but I do not have any details on how to go about this other than roasting at fire temperatures.

For expedient use, quicklime can be manufactured from clean lime stone (calcium carbonate) or pickling lime (calcium hydroxide) available in the canning sections of many grocery and hardware stores.

F.3.5 CALCIUM SULFATE

Also known as gypsum and commercially as Drierite, calcium sulfate is another naturally occurring mineral. It is produced by the controlled dehydration of gypsum ($CaSO_4$). It is chemically stable and does not readily release its adsorbed moisture. It has a low adsorbency capacity, only approximately 10% of it weight. It can be regenerated, but apparently not easily so.

For expedient use, gypsum is commonly used in household drywall and Kearny mentions using this source in his *Nuclear War Survival Skills*. This makes only a so-so desiccant and you'd be much better off to use a more suitable choice but in an emergency it can get the job done.

F.3.6 OTHER DESICCANTS

From: Pyotr Filipivich pyotr@coho.halcyon.com

Simple trick is to dry a piece of wood in the oven and once it is bone dry (more than usual) then put it in your container and seal it. The wood will suck up any available moisture.

Editors note: Wood can soak up to 14% of its weight in moisture, depending on species. Woods with coarse, open grains work the best. I'm not aware at what temperature it will begin to "desorb" or shed its stored water which might be fairly low. Some empirical experimentation would be in order before relying heavily on it.

F.4 HOW DO I USE DESICCANTS?

Before you get to this point you should have already used the charts above and determined how much of the particular desiccant you're interested in you need for the size of the storage containers you'll be using. Once you know that you're ready to put them it into use.

Although they perform different functions, desiccants and oxygen absorbers are used in a similar fashion. They both begin to adsorb their respective targets as soon as they are exposed to them so you want to only keep out in the open air as much desiccant as you are going to use up in fifteen minutes or so. If you'll be using oxygen absorbers in the

same package, place the desiccant on the bottom of the package and the oxygen absorber on the top. This is to keep the desiccants from robbing needed moisture from your oxygen absorbers which will hinder their operation.

If your desiccant is pre-packaged, that's all there is to it, put it in the package and seal it up. If you have purchased bulk desiccant you'll first need to make your own containers.

I use indicating silica gel for practically everything. My usual procedure is to save or scrounge clear plastic pill bottles, such as aspirin bottles or small plastic jars. Fill the bottle with the desiccant (remember to dry the gel first) and then use a double thickness of coffee filter paper carefully and securely tied around the neck of the bottle to keep any from leaking out (remember the indicating type of silica gel is not food safe). The paper is permeable to moisture, but it's tight enough not to let the crystals out. I use several winds of plain cotton string for this as both adhesive tapes and rubber bands have a way of going bad over time which might allow the cap to come off spilling the desiccant into the food.

For containers that have openings too narrow to use a desiccant container such as described above you can make desiccant packets with the same filter paper. The easiest way I've found is to wrap at least a double layer of paper around the barrel of a marker pen and use a thin bead of white glue to seal. Slide the packet off the pen and allow to dry. When ready, fill with the necessary amount of desiccant. You can then fold the top over twice and tie with string or staple closed. Take care that the top is closed securely enough not to allow any desiccant to leak out. Virgin (not recycled) brown Kraft paper can be used to make the packets with as well.

The above method will also work other desiccants, subject to whatever precautions the individual type may have.

IMPORTANT NOTE: The indicating form of silica gel (has small blue or pink specks in it) is not edible so you want to use care when putting together your desiccant package to insure that is does not spill into your food.

F.5 WHERE DO I FIND DESICCANTS?

I buy indicating silica gel at Wal-Mart in their dry flower section where it is sold in one and five pound cans for flower drying. I've seen it sold the same way in crafts stores and other department type stores that carry flower-arranging supplies. You can also buy it from many other businesses already prepackaged in one form or another to be used as an adsorbent. All of the desiccant that I've found packaged this way has been rather expensive (to me) so shop carefully. There are a number of Internet sources available which will probably provide your best route for finding what you want.

Businesses carrying packaging supplies sometimes also sell desiccants. Some businesses commonly receive packets or bags of desiccants packaged along with the products they receive. I've seen montmorillonite clay in bags as large as a pound shipped with pianos coming in from Japan. Small packets of silica gel seem to be packed in nearly everything. Naturally, any salvaged or recycled desiccant should be of a type appropriate for use with the product you want to package.

It is possible to make your own desiccants using gypsum from drywall and maybe Plaster of Paris. Calcium oxide can also be produced from limestone (calcium carbonate) or slaked or pickling lime (calcium hydroxide) by roasting to drive off the adsorbed water and carbon dioxide. I don't have any clear instructions, as of yet, on how to go about this. Please do keep in mind that calcium oxide (quicklime) is caustic in nature and is hazardous if handled incorrectly.

G -- DIATOMACEOUS EARTH

G.1 WHAT IS DIATOMACEOUS EARTH?

Diatomaceous earth is a naturally occurring substance partially comprised of the fossilized remains of diatoms. Diatoms are microscopic sized hard shelled creatures found in both marine and fresh waters. The diatom shells are covered in sharp spines that make them dangerous to exoskeletal insects, but not to animals with internal skeletons. The spines of the diatom skeletons pierce the soft body tissues of insects between their hard exoskeletal plates and it

is through these numerous microscopic wounds that the insect loses bodily moisture to the point of desiccating and dying. Creatures with internal skeletons such as humans, cattle and pets have means of resisting such damage and are not harmed. Thus, it is possible to mix a small amount of DE into your stored grains and beans to deter insect infestations without having to remove the dust again before you consume them. *Diatomaceous earth works in a purely physical, not chemical, manner thus has no chemical toxicity.*

As neat as this sounds, in the limited number of controlled studies that I have been able to find it seems that DE is not as effective in controlling food storage insects as properly used freezing techniques, fumigation with carbon dioxide (dry ice) or sealing in air-tight containers with oxygen absorbers. This is primarily for reasons that most of the insects that cause a problem in grain storage are hard-shelled weevils which have only a limited amount of soft tissue exposure. I now mostly use DE for controlling ants and roaches in areas where I feed my animals and bedding areas. Still, some folks want to use DE in their food storage so the following information is provided.

G.2 WHERE DO I FIND D.E. AND WHAT TYPE SHOULD I BUY?

IMPORTANT NOTE: There are two kinds of diatomaceous earth to be found on the market and only one of them is suitable for use as an insecticide in your stored grains. *The type you DO NOT WANT FOR FOOD USE is sold by swimming pool suppliers as a filtering agent.* DE to be used for filtering has been subjected to a heat treatment that dramatically increases it's crystalline silicate content which makes it unsuitable for use with your foodstuffs. *The diatomaceous earth that is needed for use in food storage has not been heat treated and has a crystalline silica content of no more than 1-1.5%.* It is commonly sold in hardware and garden stores as an "organic pesticide" and is available from a number of storage food dealers. A few of these suppliers are listed in the *Resources* section.

I have always purchased my DE from my local hardware store and have had no concerns about its safety. However, a number of correspondents have reported to me that their local suppliers keep their DE in the same area as their chemical pesticides. This causes some concern about possible contamination and I no longer recommend using DE from these sources. Since the actual amount of DE (by weight) that is necessary to protect grains is fairly small I recommend ordering yours from suppliers who will guarantee their product is food grade as stipulated by the US FDA. This will insure you receive a product that has no deleterious contaminants and is safe to use.

From: higgins10@aol.com (Higgins10)
Originally posted in: rec.gardens

Good afternoon all. Diatomaceous earth is approved by the USDA as an animal feed additive, however I have found out that there are vast differences between various forms of diatomaceous earth. Some DE products may not be effective in controlling insects, while others may be harmful to humans and pets. The most important differences between individual forms of DE is the shape of the diatom, content of Crystalline Silica, and the purity of the Silica Dioxide. The World Health Organization cautions that DE with a crystalline silica content of three percent or higher is dangerous to humans, (and probably pets and birds as well). Diatomaceous Earth used in swimming pool filters has close to a 60% crystalline silica content. I know of a product called Organic Solutions (insecticide) which is approved by both the EPA and USDA and has a crystalline silica content ranging between 0.36% to 1.12% according to its labels etc. It is classified as Amorphous Fresh Water Diatomaceous Earth (whatever that means). However, all literature I have read assures it is safe for both humans and animals and seems to be very effective at killing insects. I stumbled across all this info. while shopping in the mall. If you're interested in reading it too, go to the Organic Solutions website at http://www.BuyOrgs.com. Hope this helps answer the question and always use environmentally safe products! Higgins10

From: kahless@ns.waymark.net
Date: Sat Aug 24 14:08:48 1996
To: Dunross (A.T. Hagan) Private e-mail

[previous text deleted]

I have always purchased DE at the local feed store. It's cheaper there than at the garden and hardware stores. The feed store I buy at has DE available in bulk, but they'll package up a smaller amount if that's what you want. My package in the garage doesn't have a brand name but says "Nitron Industries" at the bottom. The label recommends 7 pounds of DE for each ton of grain. Ha! As if I had "tons" of grain in storage 8-D

I've been using DE for grain storage for about 15 years now but flea control only for the past 6 years. The only fleas we've seen in that period of time is the ones that hitch a ride in with friends pets. A very light dusting afterward takes care of that problem. Miracle stuff as far as I'm concerned since we'd had an awful time with fleas before we started using DE. Much much much cheaper and as far as I'm concerned the advantages FAR outweigh the risks.

Sam
(hope that was helpful)

G.3 HOW DO I USE D.E. IN FOOD STORAGE?

To use, you should mix thoroughly one cup (8 fl ozs) of DE to every forty pounds of grain, grain products or legumes. This works out to approximately one cup of DE to every five gallon bucket of food you want to treat. You need to make certain that every kernel is coated so it is better to do the mixing in small batches where you can insure more even coating. Both the grain and the DE should be quite dry when doing the mixing otherwise you'll get an uneven distribution.

WARNING: DE is a powdery dust which you need to take steps to keep out of your lungs and eyes. A paint or hardware store filter mask and a pair of goggles will do the job. It's a good idea to do the actual mixing outside in a slight breeze otherwise you'll get DE all over everything. Even whole wheat flour dust can cause lung irritation if you breathe in a sufficient amount.

Being inactive and usually covered in a hard shell, DE works poorly on insect eggs or pupae. It has more effectiveness on larvae and adult insects with a fair amount of soft tissue exposure.

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-- IV --

SPOILAGE

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A -- INSECT INFESTATIONS

A.1 PESTS OF STORED GRAINS, LEGUMES AND DRY FOODSTUFFS

Insect infestations can occur in a wide variety of foodstuffs such as flours, meals, pastas, dried fruits or vegetables, nuts, sweets, whole grains, beans, sugars, TVP, jerky, bird seed and pet foods.

Naturally, the best way to deal with an insect infestation is not to have one in the first place. Try to purchase your goods from suppliers who are clean and who turn over their inventory quickly so the products you purchase will be less likely to have bugs.

When you buy foodstuffs examine them closely to be sure they are insect free. Check for any packaging or use by dates to insure their freshness. Don't shake the package, most adult insects will be found in the top couple of inches of the product and shaking the package will mix them into the contents disguising their appearance. If the package does turn out to be infested, return it for replacement.

If not already packaged for storage when you buy them transfer your foods into air- and moisture-tight containers so they cannot be invaded after you have brought them home. With sufficient time, some adult and larval insect forms can penetrate paper, cardboard and thin plastic packaging. Storage containers should be glass, metal, or heavy plastic with tight fitting lids. As with everything in food storage, you should use older packages before newer ones and opened packages before unopened ones.

Storage areas should be kept clean. Don't allow grain, flour, beans, bits of pasta or other food particles to accumulate on shelves or floors. Cracks and crevices should be sealed or otherwise blocked. Except for sticky spills, vacuuming is the best method of cleaning as soap and water can wash food particles into cracks.

Insects may also get their start in chairs, sofas and carpets where food is dropped and not cleaned up. Don't forget to replace the filter bag on the vacuum as some insects can survive and reproduce in the bag.

Bags of dry pet food and bird seed can harbor insect infestation. Decorative foodstuffs such as ears of colorful Indian corn, colored beans and hard squashes can carry insects that may infest your edible food. Even poison baits can harbor flour beetles.

A.2 CONTROL OF INSECT INFESTATIONS

Should you find that in spite of buying fresh products and using careful packaging techniques you have an insect infestation, you can try some of the following steps:

1. If the food is too heavily infested to try to save it should be disposed of as soon as possible. Remove from the kitchen or food storage area immediately so as to not infest other foods.

2. Large bugs can be sifted or winnowed out if the food's not too heavily infested and you want to try to save it. Then treat by placing into a deep freezer at 0º F (-18º C) for three to seven days depending upon the size of the package. Refrigerator freezers usually do not freeze low enough to effectively kill all of the life stages of insects, but if left there, will slow their development. If freezing is not workable then the product could be spread on baking sheets and heated to 150º F for fifteen to twenty minutes, cooled and repackaged. This will shorten shelf life so heat treated foods should be consumed shortly thereafter.

3. The surface areas where the food containers are stored can be treated with an insecticide. This is not a replacement for clean storage habits and good containers, but is rather a supplement. This will not control insect infestations already in your stored foods.

   Spray the shelf surface with 0.5% chlorpyrifos (Dursban), 1% propoxur (Baygon), 0.5 percent diazinon, or 0.25 percent resmethrin. You can find any of these in the hardware store in ready to apply packages. If a sprayer isn't feasible then they can be applied with a paint brush. Allow the solution to dry thoroughly. Cover the shelves with clean, untreated shelf paper then put properly packaged foods back on shelves. READ THE PRODUCT LABEL FOR SAFETY INFORMATION CONCERNING CHILDREN AND PETS.

Household bleach, Lysol and other sterilizers will not control insect infestation, though they can be used for mold, mildew and algae.

You may continue to find some insects after the cleanup is finished. This could be for several reasons. It may be they escaped from the packages they were infesting and did not get cleaned up. There may be more packages infested than were originally found or, there may be hiding places in the storage area that need attention. Once you have carefully eliminated all food sources, the bugs should disappear in a few weeks.

B -- MOLDS IN FOOD

Molds are fungi like mushrooms and yeast. Also like mushrooms, they reproduce by releasing spores into the air that land on everything, including your food and food storage containers. If those spores begin to grow, they create thin threads that spread through their growing medium. These threads are the roots of the mold fungus, called *mycelium*. The stalk of a mold fungus is the portion above or on the surface of the food. It produces the spores and gives the mold its color. We've all seen examples of this when we discover a dish of something or other left too long in the refrigerator only to become covered in a mold fuzz.

Molds can grow anywhere they have a growing medium (their food), sufficient moisture and warmth. Some can even grow at refrigerator temperatures, albeit more slowly than they would if it were warmer. These fungi can also withstand more salt and sugar than bacteria, which is why you sometimes find mold in jellies and jams with their high sugar content and on dry cured products like ham or bacon with their high salt content.

In the past, a slight amount of mold was commonly felt to be harmless and the food consumed anyway. For molds that were intentionally introduced, such as the mold in bleu cheese, this is fine. For the unintentional molds, it could possibly be a serious error in judgment. These unwanted molds could be producing toxic substances called *mycotoxins* which can be very bad indeed. Mycotoxins are produced around the root or mycelium of molds and these mold roots can penetrate deeply into the food. Mycotoxins can survive for a long time and most are not destroyed by cooking. The molds probably best known for this dangerous spoilage are the various *Aspergillus* species which produces a mycotoxin known as *aflatoxin*, but there are other dangerous fungi as well, such as the *Fusarium* molds. Both of the above affect grains and some legumes. *See B.3 Molds In Grains and Legumes.*

IMPORTANT NOTE: In wet pack foods such as your home canned goodies, molds can do something else as well, possibly with lethal consequences. If they find their way into wet pack acid foods canned by the boiling water bath method, whether by reasons of improper procedure or contamination after the fact, they can consume the natural acids present in the food. The effect of this is to raise the pH of the food in the container, perhaps to the point that it becomes possible for spores of *Clostridium botulinum*, better known as *botulism*, to become active and reproduce. For this reason, moldy wet pack foods should be *safely* discarded. This most deadly kind of food poisoning has an entry of its own in the bacterial spoilage section.

Molds in low acid foods canned by the pressure canning method are equally dangerous and should also be discarded in a safe manner.

B.1 MINIMIZING MOLDS

You can do a number of things to minimize unwanted mold growth in your kitchen, food storage areas and refrigerators. If your kitchen is at all like mine, it is the refrigerator that is going to collect the most fungal growth. This can be dealt with by washing the inside every couple of months with a tablespoon of baking soda dissolved in a quart of warm water. Rinse clean and allow to dry. The black mildew that grows on the rubber door gaskets and other places can be dealt with by wiping down with a solution of three tablespoons of household bleach in a quart of water. I generally use a soft bristle brush for this. A really bad case will not bleach back to a white color, at least it won't for me, but will instead turn pink or red after the bleach has carried out its disinfection mission.

The rest of the kitchen can be kept mold free by keeping the area clean, dry, and spraying occasionally with a product such as Lysol. Patches of mold can be eliminated with the bleach solution used on the refrigerator doors.

Try not to purchase more fresh food than you'll be able to eat in a short period of time. This will keep you from having to deal with the moldy remains that didn't get eaten. If food does go moldy, don't sniff it. This is a good way to give yourself respiratory difficulties if you are at all susceptible to mold allergies. Moldy food should be disposed in such a manner that your animals and children won't be able to get into it. Mycotoxins are every bit as bad for your animals as they are for you.

Obviously, you don't have to throw out everything that shows a spot of mold on it. Some foods can be safely dealt with and still partially saved if they show signs of fungal growth. Below is a set of guideline from M. Susan Brewer, Ph.D., R.D., a specialist in food safety. Her articles and works are found in many state university extension services publications lists.

If the food shows even a tiny mold spot, follow these guide lines:

1. Hard or firm foods with tiny mold spots can be trimmed; cut away the area around the mold (at least an inch) and rewrap in clean wrap. Make sure that knife does not touch the mold.

   TRIM:
   Hard Cheese (Cheddar, Swiss, etc.)
   Bell Peppers, Carrots, Cabbage
   Broccoli, Cauliflower, Brussels Sprouts
   Garlic, Onions
   Potatoes, Turnips
   Zucchini
   Apples, Pears

2. Soft foods such as cheese slices, cream cheese, sour cream and yogurt should be thrown away.

   TOSS:
   Soft Cheeses, (Mozzarella, Brie, etc.)
   Sour Cream, Yogurt, Cottage cheese
   Bacon, Hot dogs, Sliced lunch meats
   Meat pies
   Opened canned ham
   Most left-over food
   Bread, Cakes, rolls, flour, pastry
   Peanut butter
   Juices, berries
   Jam, Jellies, Syrups
   Cucumbers, Tomatoes
   Spinach, Lettuce, other leafy vegetables
   Bananas, Peaches, Melons
   Corn-on-the-cob
   Stored nuts, whole grains, rice

B.2 MOLDS IN CANNED GOODS

If good equipment and proper technique are used, it is unlikely you will ever have mold growth in your unopened canned goods. If you do have such, there was either a flaw in the procedure used, or something affected the jar or can after the fact to break its seal. In any event, once the food has molded, it is past saving and should be discarded in such a way that children and animals will not be able to get into it. The most likely home canned products to show mold growth are jams and jellies sealed with paraffin wax.

There are a number of points in the canning process where this can occur:

(1) In the time after the jar is taken out of its boiling water bath, but before it is filled.

(2) In the time between when the jar is filled and covered with the melted wax.

(3) When the wax cools, if it pulls away from the side of the jar, leaving an opening for the mold to get in.

(4) If bubbles form in the paraffin, which break and leave holes.

For these reasons most canning authorities no longer recommend using this technique. If you must do so, the jars should be boiled for at least 10 minutes before the jelly is poured. The filled and wax capped jars should then be covered with some sort of protective lid. The book, *Putting Food By* has excellent instructions on this or see the applicable section of the *rec.food.preserving FAQ*.

B.3 MOLDS IN GRAINS AND LEGUMES

It has long been known that eating moldy grain is bad for your health with the ugly consequences of eating ergot-infected rye being a well known example. It has only been about thirty years, though, that intensive study has been carried out on other species of grain fungi and their respective mycotoxins. Fortunately, for those of us in the U.S., the USDA and the various state departments of agriculture go to a great deal of trouble to detect grain and legumes infected with these toxic fungi. In some of the less developed countries, the citizenry are not so lucky. It is good to have something of an understanding of what one should do to prevent mold growth in ones stored grains and to have an idea of what to look for and ask about when purchasing grains and legumes.

The one fungal group that has caused the most commotion in recent history are the various *Aspergillus* species of molds. Under certain conditions with certain grains, legumes, and to a lesser extent, nuts, they can produce a mycotoxin called *aflatoxin*. This is a serious problem in some parts of the world, most especially in peanuts, occasionally in corn. I am not aware of any documented deaths in the United States from aflatoxicity, but other nations have not been so fortunate. What makes aflatoxin worrisome in this country is that it is also a potent carcinogen (cancer causing agent).

In addition to the Aspergillus molds, there is also a large family of molds known as *Fusarium* which can produce mycotoxins of their own, none of which do you want to be eating directly or feeding to your food animals where you will get the toxins back indirectly when the animal is slaughtered and eaten.

The Federal and state governments continuously monitor food and forage crops entering the marketplace. Those products found to be contaminated with mold or mycotoxins are not allowed to be sold for food. Once purchased however, the responsibility is yours to keep your food safe from mold growth. If you have already found mold growth in your whole grains, meals, flours or other grain products, they should be discarded. Most mycotoxins are not broken down or destroyed by cooking temperatures and there is no safe way to salvage grain that has molded.

B.3.1 PREVENTING MOLD GROWTH IN STORED GRAINS AND LEGUMES

The easiest method to prevent mold growth in your stored grains and legumes is to keep them too dry for mold to grow. The *Aspergillus* and *Fusarium* molds require moisture contents of 18% and above to reproduce. This is subject to some variability, but in all grains and soybeans, they must have a moisture content of that level. If you are storing raw (not roasted) peanuts, in the shell or shelled, you want to get the moisture content to less than 8% as peanuts are particularly susceptible to mold growth. The recommended moisture content for all other grain and legume storage is no more than 10%. *Please see part 2.A.3.1 Grains and Legumes* for a method to determine moisture content. At 10% moisture, there is simply too little water for fungi to grow.

C -- BACTERIAL SPOILAGE

Like the fungi, bacteria are everywhere, in the water, soil, air, on you, your food and your food storage containers. Fortunately, the vast majority of the bacteria we encounter are relatively harmless or even benign and only a few represent a danger to us and our stored foods.

Bacteria can be much more difficult to kill than molds and insects. Some are capable of continued growth at temperatures that would kill other spoilage organisms. When conditions are such that they are unable to grow, some bacteria can go dormant and form spores. These spores can be quite hardy, even to the point of surviving boiling water temperatures.

In order to grow, bacteria must have water, some species needing as little as a 20% moisture. For properly packaged dry grains, legumes, powdered milk and other low moisture foodstuffs bacterial spoilage will never be a problem as their moisture levels should be too scant to support growth.

WARNING: It is in wet pack canned goods (where the container has free liquid in it) and fresh foods we must be the most concerned about spoilage bacteria. It is here that a little bad luck and a moment's inattention to what you are doing could kill or seriously injure you or some other person who eats the foods you've put by. In both home-canned and commercially-canned goods, IF THE CAN IS BULGING, LEAKING, SMELLS BAD, OR SPEWS LIQUID WHEN YOU OPEN IT THEN THROW IT OUT! But, throw it out safely so that children and animals cannot get into it.

C.1 BOTULISM

Clostridium botulinum is one of the oldest life forms on this planet dating from a time before the Earth had an abundant oxygen atmosphere. Like the gangrene bacteria, it is an anaerobic organism meaning it lives and grows only in the absence of free oxygen. When conditions are not suitable for growth the bacteria can form durable seed like spores which are commonly found in the soil. This means that *C. botulinum* can be brought into your life on raw produce, tools, hands or anything else that came into contact with dirt. To further complicate matters, botulinum spores are extremely heat-hardy. The bacteria itself can be killed by a short exposure to boiling water (212º F AT SEA LEVEL PRESSURE), but its spores can not. To kill them, the food product and container must be exposed to temperatures of 240º F (AGAIN AT SEA LEVEL PRESSURE) for a long enough period of time to allow all of the food in each container to come completely up to the proper temperature. Only a pressure-canner can reach the necessary temperature.

It's not the bacteria or its spores which are directly deadly, but the toxin the bacteria creates when it grows and reproduces. In its pure form, botulism toxin is so potent that a mere teaspoon would be enough to provide a fatal dose to hundreds of thousands of people. It is this lethality that is why every responsible book on home canning, food preservation, and food storage hammers constantly on the need for care in technique and method and why spoilage must be taken seriously.

Like any other life form *Clostridium botulinum* must have suitable conditions for its growth to become a danger. One of the most important of these is water - the botulism bacterium needs moisture in the 35% range to grow making it a danger only in improperly processed high moisture foods. Another requirement is suitable pH, which is the measure of acidity or alkalinity in a substance and is measured on a scale of 1-14. Anything above 7 is considered alkaline and everything below 7 is considered acid. If the acidity of your wet pack food is BELOW pH4.6 then *C. botulinum* is unable to grow. Keep in mind that in foods pH is not necessarily stable and could possibly change if other spoilers like mold are able to grow. If the product should change to a lesser acidity than pH4.6 your previously botulinum proof food may start allowing the lethal spoiler to grow (*see B.2, molds in canned goods*). This is why it is vital to use proper technique, even for acid foods like tomatoes. It has been found that when this pH shift occurs allowing *C. botulinum* to become active producing its lethal toxin the bacterium also produces minute amounts of acid which can lower the pH of the poisoned food back into what should have been the safe zone had the pH not jumped up and allowed the bacteria to grow. Again and again -- use good technique and pay attention to what you are doing.

Unlike fungal mycotoxins Botulinum toxin can be destroyed by boiling food briskly in an open vessel for fifteen minutes. Because of this, if your canned food shows any safety problems you should follow this procedure. If the food shows even the slightest mold growth, keep in mind that mycotoxins are not for the most part broken down by heat and dispose of the food safely.

I won't go into the hows of home canning here. For that I strongly recommend that you read the *r.f.p. FAQ*, the *Ball Blue Book* or most especially the book *Putting Food By* for in depth information on this subject.

D -- ENZYMATIC ACTION IN FOOD SPOILAGE

Every living organism uses enzymes of many sorts in its bodily functions as part of its normal life cycle. Enzymes are used in creating life. After death, enzymes play a role in the decomposition of once living tissue. The enzymes in a tomato help it to ripen and enzymes produced by the tomato and whatever fungal and bacterial spoilers are on it cause it to decay.

Fortunately, slowing down or stopping the action of a food's enzymes is much easier than slowing or stopping some of the bacterial spoilers mentioned above. Enzymes are most active in a temperature range between 85-120º F and begin to be destroyed when the temperature goes above 140º F. Cold also slows down the action of enzymes, which is why fresh tomatoes last longer in the refrigerator than they do on the kitchen table. Most enzymatic action also requires moisture to occur. In foods stored at 10% moisture or less, there is not enough moisture for most enzymes to be active.

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-- V --

SHELF LIVES

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"How long will this keep?" is the defining question of food storage. Everything you read in this work revolves around this central question. The length of time a particular food will remain palatable and nutritious in storage determines its usefulness for our purposes. The fact of the matter is that there are few hard and clear answers. As a result it is not uncommon to find two or more sources that purport to know, but give conflicting advice. The following will hopefully cut through some of the fog.

A. "BEST USED", "USE BY" AND OTHER FOOD PRODUCT DATES

Although there are some twenty States in the U.S. that have food product dating laws the Federal government has little regulation concerning food product dating except for infant formulas and some baby foods. It does, however, require that if a manufacturer puts a calendar date on a food product it must also put wording to the effect of "use by" or "best before" next to it to explain what the date means. This is called "open dating" which is to say that it is a plain, easy to read calendar date rather than "closed or coded dating" that must be deciphered. Another date also commonly seen is the "sell by" date. While not as useful for food storage, it does have importance for day-to-day fresh food purchases.

Because there are few Federal food product dating standards manufacturers use their own to determine acceptable shelf lives. For the most part, these are based upon changes in a product's texture, appearance, taste and cooking qualities. When a food item begins to exhibit signs of aging that would make it unappealing to potential customers it is considered to be at the end of its marketable shelf life. Look for statements such as "use by", "best if used by", "best if used before" or similar wording to find this date. For shelf stable and frozen products it must include both the day, month, and year. These dates are useful for determining how long a product should be retained in storage before it ought to be rotated out. By the time a food begins to undergo taste and appearance degradation the more sensitive nutrient content will have seriously faded so should be rotated out of storage, eaten, then replaced with fresher stock. If the product was properly preserved and not subjected to extreme storage conditions it is not unsafe to use after this date. If there is nothing to replace it with it may be kept still longer, but the palatability and nutritive content will only continue to degrade.

Fresh food items such as meat, milk and eggs use a "sell by" date which simply means that the item should not be purchased beyond that date. Products using this date type are only required to use the day and month. Provided that it was properly transported and stored, an item kept past this date is not unsafe to use, but will begin to exhibit signs of aging that will make it unappealing and should be frozen or consumed shortly thereafter.

NOTE: The shelf life of any food, whether indicated with a "use by" or "sell by" date or found on some chart, is predicated upon assumed storage conditions. If the actual storage conditions are different from these assumptions then the shelf life will naturally vary. As is explained in *Section I: Time, Temperature, Moisture, Oxygen and Light*, environmental storage conditions have a major impact on the length of time any foodstuff will remain palatable, nutritious and even whether it will remain safe to eat.

As a general rule, when a shelf life is given for a non-refrigerated food, it is for conditions of 70° F in a dark, dry location unless stated otherwise. *Be sure to read the fine print on any shelf life chart you may come across so you will know what its values are predicated upon.* There are some floating around giving shelf lives of foods in storage temperatures as low as 40° F. At that temperature you would expect to keep your fresh butter, eggs and milk, but few have the ability to keep any significant amount of canned goods in so cool a storage area.

Regardless of what the date or chart may indicate a food subjected to poor storage conditions will become non-nutritious, unpalatable, perhaps unsafe to eat even though its listed time is not yet up. An example of this would be keeping egg salad at room temperature for several hours at a picnic. The eggs may have been laid yesterday, but

you are taking your chances if you eat it. Never put blind faith in any date. Always keep in mind that they are predicated on unspoken assumptions. IF THE CONTAINER IS BULGING, MOLDED, FOUL SMELLING OR SPEWS LIQUID WHEN OPENED, THROW IT OUT! But throw it out safely so that children and animals cannot get into it.

Please see Section III: Spoilage for further information

B. CLOSED DATING CODES USED BY SOME FOOD MANUFACTURERS

In spite of the fact that increasing numbers of food processing companies are moving to open dating this is not yet universal. For those products that do not come with a plain "best used by" date it is still possible, albeit with more difficulty, to determine the rotation period for that specific product.

For a processor to move their product in interstate commerce it must exhibit a *packing code*. This allows them to easily track their product for purposes of stock rotation and in the event of a recall. These packing codes are usually a series of letters and numbers that indicate dates, times, and sometimes places of manufacture. These dates are not "use by" dates, but the time when the container was actually filled. As they are not intended for general public knowledge these codes are frequently unique to a particular processor and are not commonly published.

It is possible to get the keys to these codes by contacting the processor and asking how to decipher the dating code for specific product lines. Over time, readers have been doing this and the code keys below are the ones that I have found or been sent to me. Obviously, they are only a few of the many, many products that use closed dating and I hope that future readers will continue to send these codes in as they are gleaned from the processors.

Frankly, when it comes to the potential hundreds of products that would require deciphering their packing codes the entire process is a nuisance. While it is better to have an encoded date than not to have one at all, it would be better still if processors would use clear open “best used by” dating so we wouldn't have to carry a book of code keys like covert agents every time we go to the grocery. Should you happen to call a processor customer service number you might encourage them to do just that.

Before I list specific manufacturers there is one fairly widely used code key that may be useful. Some processors use a system where all the days of the year are listed 1-365 (366 for leap year) as the first three digits in the code. This number is then followed by a single letter such as "B" and then by a single digit that represents the year.

Some examples of this might be:

Packing code	Date packed
045B03	February 14, 2003
121H02	May 1, 2002
187K99	July 4, 1999
304U98	October 31, 1998

There may be other widely used coding systems yet to be discovered and as they become available I will include them in this work.

SPECIFIC PRODUCT LINES:

IMPORTANT NOTE: I have not personally verified all of these code keys. Also, closed date coding schemes may change over time. For this reason, the code keys given below may not always be correct. Check a number of containers in a product line to verify that a particular code key will work with the product line in which you are interested.

ARMOUR STAR CANNED MEAT PRODUCTS

Vienna Sausage, Stew, Chili, Deviled Ham, Potted Meat, Slice Dried Beef, Soups, etc. but does NOT include Armour Star Roast Beef or Corned Beef.

The code is on the bottom of the container. The first letter is the month of production; A=January, B=February, C=March and so on. The following two numbers represent the day of the month it was processed and the third number indicates the year.

Example: A code of B148C23 would be B=Feb, 14 = the fourteenth day, 8=1998. B148C23=February 14, 1998 and the last three characters would be plant or processing line locations.

Armour Star Microwaveable Meals have a two line production code on the container lid. The second line is the is date and uses the same code as above.

BERTOLLI OLIVE OIL

Packed two years prior to the use by date on the bottle or can.

BUSH BROTHERS & CO.

Baked beans, chili, etc.

A five digit code on the bottom of the can. The first digit is the month, the next two digits is the day of the month, the next number is the year and the last digit is ignored.

Example: A code of 50173 deciphers to be:

5 = the fifth month or May
01 = the first day of May
7 = 1997
3 = last number is discarded.

Thus 50173 is May 1st, 1997.

CAMPBELL SOUPS

Best by date on cans. Filled exactly two years prior to that date.

DEL MONTE

Canned fruits, vegetables, etc. I'm not sure if it applies to *all* product lines.

A five character packing code, usually on the bottom. The first character is a digit representing the year. The next three characters are digits representing the day of the year the product was packed. The last character is a letter and may be ignored.

Example: A packing code of 8045B deciphers to be:

8 = 1998
045 = The 45th day of the year or February 14th.
B = A plant code.

Thus 8045B is February 14th, 1998.

GENERAL MILLS:

The manufacturing date is coded to their fiscal year that begins on June 1st and ends on May 31st.

Interpret the code as follows:

The first character of the code is a letter and represents the month the product was made.
The second character in the code is a number which represents the year the product was made.
The following two characters are numbers that represent the day of the month the product was made.
The remaining characters following identify plant location and shift information.

Example: A packing code of E731B would translate as follows:

E = October
7 = 1997
31 = 31st day of the month
B = A plant location

The following is their 12 month cycle. The letter "I" is not used because it can be confused with the number "1".

A = June	E = October	J = February
B = July	F = November	K = March
C = August	G = December	L = April
D = September	H = January	M = May

HANOVER FOODS CORP.

Small whole potatoes, green beans, corn, etc.

A five digit code on the bottom of the can. Omit the first digit. The next digit is the year. The remaining three digits are the day of the year the product was packed.

Example: A code of 28304 deciphers to be:

2 - discard this number
8 = 1998
304 = the 304th day of the year or October 31st

Thus 28304 is October 31st, 1998

HEALTHY CHOICE:

First character is a number, second is a letter with the remaining characters being a lot ID. The number is the year it was packed with the letter being the month, October = A, November = B, December = C, January = D, and so on through the year. The recommended shelf life is 2 years.

HORMEL PRODUCTS

Their packing code is a letter followed by five numbers. The letter is their plant location and the numbers are the dating code in a MM-DD-Y format.

Example: A code of G07048 decodes to mean:

G = plant location
07 = July
04 = The fourth day of the month
8 = 1998

The can was packed July 4, 1998 at plant location G.

JELL-O BRAND PUDDINGS & GELATINS

The first four digits are the date coding. The first digit is the year and the following three digits is the day of the year.

Example: A packing code of 804522 10:38 deciphers as:

8 = 1998
045 = the 45th day of the year or February 14th
22 = discard the last two digits.
10:38 = the time it was packed.

Thus 804522 10:38 means that box of pudding mix was packed on February 14th, 1998 at 10:38 a.m.

McCORMICK HERBS & SPICES:

There should be a four digit number of the bottom of the spice package or extract bottle. On foil packages, it will be around the outside edge. This code is more complicated than other manufacturers so read closely.

Example: Using a number 3604 as the packing code:

To derive the year, take the first number and add 5 (3 + 5 = 8) so 1998 is the year of manufacture.

To derive the month and day, divide the last three digits by 50 (604 ÷ 50 = 6 with 4 remaining). The six indicates the last whole or complete month before the month of production, January, February, March, April, May, and then June. The next month, July, is the production month. The 4 remaining is the day it was produced.

Therefore a packing code of 3604 means that product was packed July 4, 1998.

While not as precise, you can save considerable time by just finding the year. The last three digits representing the day and month will increase as the year grows.

MOUNTAIN HOUSE

(From the Mountain House web site)
Manufacture Date
The product manufacturing code appears on the back of Mountain House® pouches and on the bottom of Mountain House® cans. The date in the code represents the date on which the product was packaged. For pouches starting January of 2001 we are now printing BEST IF USED BY dates on the back of each pouch.

1989 and after:
EXAMPLE: 99028 CIA 99 = Year
028 = Julian Date (example = 28th day of the year = January 28)
CIA = Production Operator's Initials

Prior to 1989:
EXAMPLE: T20394D T = Year (example "T" = 1987; see below*)
203 = Julian Date (example = 203rd day of the year = July 22)
94D = Internal tracking system code number

*The year code can be understood as follows:

A 1970	F 1975	K 1980	R 1985
B 1971	G 1976	L 1981	S 1986
C 1972	H 1977	M 1982	T 1987
D 1973	I 1978	N 1983	U 1988
E 1974	J 1979	P 1984	

WORNICK MIL-SPEC CIVLIAN MREs

Long Life Food Depot (The Wornick Company's civilian sales agent)
From http://www7.mailordercentral.com/longlifefood/Faq.asp#shelflife
How long do MRE products last - what is their Shelf Life

We guarantee our MRE products to last 5 years from the date of sale, in a room temperature environment (70 deg. F), no matter what the production date.

Of course, the production date is visible on all our entrees and on most side dishes, desserts, and other components.

The production date is a four digit number (date code) on each item, example "2156." In this example the 2 represents the year 2002 (a "3" would represent 2003, etc.), the 156 represents the 156th day of the year. See the top of the individual box or look on pouch for the Date Code.

At this time nearly all of our MRE products were manufactured between 2002 and 2003 and have always been kept in a climate-controlled warehouse to ensure freshness.

PROGRESSO FOODS

Canned soups, beans, etc.

Two lines of code on top of the can. The top line, the first two characters are the date portion. The first character is a letter indicating the month and the second character is a digit indicating the year.

Example: A packing code of L7N18 1211 (this is the first line) would be:

L = 12th month or December
7 = 1997
N18 = ignored
1211 = ignored.

Thus a packing code of L7N18 1211 indicates the can was packed in December of 1997.

C. SHELF LIVES OF SOME COMMON STORAGE FOODS.

The chart given below has been adapted from a number of different shelf-life charts published by the cooperative extension services of several states. It presupposes no special packaging other than the way the food comes from the store. The general assumption is that when a given foods' taste, appearance or texture begin to take on noticeable changes it has reached the end of its best marketable shelf life and should be rotated out. This is not to say the food is no longer edible, but the nutritional content is declining at the same time so no good purpose is served by keeping the food for longer than is necessary to replace with fresher stock. For what it's worth, I'm not fully in agreement with this chart myself, but it's a good working hypothesis and in my home I modify it by my personal experience which may vary from yours. With dry foods only *dry* utensils should be used to remove them from their containers. The less light, moisture, heat and oxygen that comes into contact with your food, the longer the food will keep.

All of the below are for new, unopened packages as they come from the grocery.

RECOMMENDED FOOD STORAGE TIMES		
FOOD	**At 70° F. Keep the product:**	**STORAGE TIPS**
Baking powder	Till can date	Sealed & bone dry
Baking soda	2 years	Sealed & dry
Biscuit, brownie, muffin mix	9 months	Sealed, cool, dry, weevil proofed
Bouillon, cubes or granules	2 years	Sealed, cool and dry
Cake mixes, regular angel food	9 months 1 year	Sealed, cool, dry, weevil proofed Sealed, cool, dry, weevil proofed
Canned food: metal can, non-acidic metal can, acidic glass jars	2 years 12-18 months 2-3 years	Cool & dry Cool & dry Dark , cool & dry
Chocolate, semi-sweet or unsweetened, bars or chips	18 months	Cool and dark.
Chocolate syrup	2 years	Cool & tightly sealed
Cocoa, powder or mixes	8 months	Sealed and cool
Coffee, regular instant	2 years 1-2 years	Cool, dry and sealed
Coffee creamers, powdered	9 months	Sealed and cool
Cornmeal	1 year	Keep dry & weevil proofed
Cornstarch	18 months	Keep dry
Crackers	3 months	Keep dry & weevil proofed
Flour, refined white whole wheat	8-12 months 4-6 weeks	Dry & weevil proofed Keep dry, refrigerate or freeze for longer shelf life
Frostings, canned mix	3 months 8 months	Cool Dry and cool
Fruits, dried	6-12 months	Cool, sealed, weevil proofed
Gelatin, all types	18 months	Protect from moisture
Grains, whole	2 years	Dry and weevil proofed
Hominy, hominy grits, masa harina	1 year	Dry and weevil proofed
Honey	2 years	Cool, tightly sealed, dark
Jellies, jams, preserves	2 years	Dark, cool, tightly sealed.
Molasses & syrups	2 years	Tightly sealed
Mayonnaise	6 months	Cool & dark.
Milk, condensed or evaporated non-fat dry	1 year 6 months	Turn over every 2 months Bone dry and cool
Nuts, vacuum canned other packaging in shell	1 year 3 months 4 months	Cool and dark Cool and dark – better refrigerated or frozen Cool, dry and dark – better refrigerated or frozen
Pancake mix	6-9 months	Dry and weevil proofed
Pastas (macaroni, noodles, etc)	2 years	Dry and weevil proofed
Peanut butter	6-9 months	Sealed, cool, dark
Peas and beans, dry (not soybeans)	2 years	Dry and weevil proofed
Potatoes, instant	6-12 months	Dry and weevil proofed
Pudding mixes	1 year	Cool and very dry
Rice, white brown flavored or herb	2+ years 3-6 months 6 months	Dry and weevil proofed Dry and weevil proofed, better refrigerated or frozen Sealed, dry and weevil proofed
Salad dressings	10-12 months	Sealed, dark, cool. Better refrigerated
Salad oils	6 months	Sealed, dark, cool. Better refrigerated
Sauce and gravy mixes	6-12 months	Cool and dry
Shortening, solid	1 year	Cool, dark, tightly sealed.
Soup mixes	1 year	Cool, dry, and weevil proofed
Sugar, brown confectioners granulated	2 years 18 months 2+years	Tightly sealed, dry Tightly sealed, dry Dry
Syrups (corn syrup based)	8-12 months	Sealed and cool
Tea, bags instant loose	18 months 3 years 2 years	Sealed and dry Sealed, dark, dry Sealed and dry
Vegetables, dried	1 year	Cool, dark, dry, weevil proofed
Vinegar	2+ years	Sealed
Yeast (dry)	Pkg expiration date	Cool, sealed, dry. Better frozen

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RESOURCES

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This FAQ does not tell me what I need to know!

Please put your question to the *rec.food.preserving*, *rec.food.cooking*, *misc.survivalism*, or *misc.rural* Usenet newsgroups. You could even resort to the tried and true method, a book.

The following is a list of books that have been found useful by many, but is by no means exhaustive on the subject. If you have books you would like to suggest, please feel free to e-mail me with the particulars. Please include the same kind of information about the book in question as you see below, particularly the ISBN #, if it has one.

A. BOOKS

A YEAR'S SUPPLY; Barry G. & Lynette B. Crockett; 1988; ISBN# 0-915131-88-9; Available form the author at P.O. Box 1601, Orem, Utah 84057 and some book or preparedness related stores. Publisher's Press.

BOOK OF TOFU, THE; William Shurtleff & Akiko Aoyagi; 1975; ISBN#0-345-35181-9; Ballantine Books.

COOKIN' WITH POWDERED MILK and COOKIN' WITH POWDERED EGGS; Peggy Layton; Both 1994; No ISBN; Available from the author and some preparedness related suppliers. P.O. Box 44, Manti, Utah, 84682.

COOKIN' WITH HOME STORAGE; Vicki Tate; 1993; ISBN# none; Published by the author; Address: 302 East 200 North, Manti, Utah, 84642; Tel # (801) 835-8283

COUNTRY BEANS; Rita Bingham; 1996; ISBN 1-882314-10-7; Published by Natural Meals In Minutes 30500 SE Jackson Rd, Gresham, OR 97080.

HOME FOOD SYSTEMS; Edited by Roger B. Yepsen, Jr.; 1981; ISBN# 0-87857-325-9; Rodale Press.

HOW TO DEVELOP A LOW-COST FAMILY FOOD-STORAGE SYSTEM; Anita Evangelista; 1995; ISBN 1-55950-130-8; Loompanics Unlimited.

HOW TO DRY FOODS; Deanna DeLong; 1992; ISBN 1-55788-050-6; HP Books

KEEPING FOOD FRESH; Janet Bailey; 1985; ISBN# 0-385-27675-3; Doubleday & Co.

KEEPING THE HARVEST; Chioffi and Mead; 1991; ISBN# 0-88266-650-9; Storey Communications.

MAKING THE BEST OF BASICS - FAMILY PREPAREDNESS HANDBOOK; James T. Stevens; 1996; ISBN #1-882723-25-2; Gold Leaf Press or from the author: 15123 Little Wren Lane, San Antonio, TX 78255

MARLENE'S MAGIC WITH FOOD STORAGE; Marlene Petersen; 1991; No ISBN; Published by the author; Marlene's Magic, 4958 Alpine Circle Highland, Utah 84003

NUTRIENT CONTENT OF THE U.S. FOOD SUPPLY, 1909-1988; 1992; Nutrient Education Division; Human Nutrition Information Service of the USDA.

NUTRITIVE VALUE OF AMERICAN FOODS; Catherine S. Adams; 1975; No ISBN; USDA Handbook No. 456

PERMACULTURE BOOK OF FERMENT & HUMAN NUTRITION, THE; Bill Mollison; 1993; ISBN 0-908228-06-6; Tagari Publications

PRUDENT PANTRY, THE; A.T. Hagan; 1999; No ISBN #; Borderline Press. ; Second Edition in Development.

PUTTING FOOD BY; Greene, Hertzberg and Vaughn; 1982 (14th edition); ISBN# 0-525-93342-5; Penguin Group.

RECOMMENDED DIETARY ALLOWANCES (The RDA Book); National Research Council; 1989 (10th edition); ISBN 0-309-046335 (paper); National Academy Press

ROOT CELLARING (1994); Mike and Nancy Bubel; ISBN 0-88266-703-3.

TOFU & SOYFOODS COOKERY; Peter Golbitz; 1998; ISBN 1-57067-050-1; Book Publishing Company; P.O. Box 99, Summertown, TN 38483

WHOLE GRAINS; Sara Pitzer; 1981; ISBN #0-88266-251-1; Garden Way Books

B. PAMPHLETS

Consumer Information Center, Department EE, Pueblo CO 81009. Ask for the Consumer Mailing List Catalog. You can order those nifty USDA pamphlets from this catalog.

Check your extension service office for pamphlets, which can usually be bought for a dollar or so. Especially important for high altitude canning, getting recipes specific for locale, even information on U-Pick sites and local farmers' markets.

Controlling Indianmeal Moths in Stored Shelled Corn and Soybeans; Phil Harein and Bh. Subramanyam; FS-0996-A-GO Revised 1990 Minnesota Extension Service, University of Minnesota

Food Storage Cooking School: Use It Or Lose It FN-503; Rebecca Low, M.S. USU Extension Home Economist and Deloy Hendricks, Ph.D. Nutrition and Food Science Specialist; Utah State University Extension.

Food Storage In The Home FN502; Utah State University Cooperative Extension Service Bulletin

Frequently Asked Food Questions FN 250; 1993 Utah State University Cooperative Extension Service Bulletin

Home Food Storage Management FN 500; Rebecca Low, Georgia C. Lauritzen; Utah State University Extension

Home Storage of Wheat FN-371; Ralph E. Whitesides; Utah State University Extension

How to Turn Your Kitchen into a Lab! FN 257; Charlotte P. Brennand, PhD, Food Science Specialist; Utah State University Extension

Ingredient Substitution FN 255; Georgia C. Lauritzen, PhD, Food and Nutrition Specialist; Utah State University Extension

Molds And Mycotoxins In Feeds; C.M. Christensen, C.J. Mirocha, R.A. Meronuck; FO-3538-C-GO 1988; Minnesota Extension Service, University of Minnesota

Molds In Grain Storage; Richard A. Meronuck; FO-0564-C-GO; Revised 1987; Minnesota Extension Service, University of Minnesota

Nonfat Dry Milk FN142; Utah State University Cooperative Extension Service Bulletin

Storage of Dry Milk FN 177; Charlotte P. Brennand, Food Science Specialist; Utah State University Extension
Use of Oxygen Absorbers in Dry Pack Canning; Albert E. Purcell, Theodore C. Barber, John Hal Johnson; Benson Quality Assurance Laboratory Department of Food Science, Brigham Young University

USDA Complete Guide to Home Canning AIB 539; U.S. Department of Agriculture Extension Service. 1994

Water Storage FN 176; Georgia C. Lauritzen, Food and Nutrition Specialist; Utah State University Extension

C. ELECTRONIC

C.1 INFORMATION SOURCES

Food Preservation & Storage, General Cooking

National Center for Home Food Preservation
http://www.uga.edu/nchfp/index.html

"The National Center for Home Food Preservation is your source for current research-based recommendations for most methods of home food preservation." Look in the publications area for such works as the *USDA Complete Guide to Home Canning* and links to many states cooperative extension web sites leading to even more useful information.

Utah State University Cooperative Extension Service
http://extension.usu.edu/cooperative/publications/

The publications pages of the Utah State University Cooperative Extension Service web site. Many of the best cooperative extension works on food storage can be found here. A definite must for anyone interested in food preservation or storage.

Walton Feed's Self Reliance/Information Area
http://waltonfeed.net/self/

The how-to area of the Walton Feed site. Information about food production, preservation and storage, nutrition, storage planning, grain mill comparisons, and more.

HomeCanning.com
http://www.homecanning.com

Altrista manufactures the Ball, Kerr, and Bernardin lines of home canning supplies. Much good information on boiling water bath and pressure canning of all kinds of foods.

CountryLife.net
http://countrylife.net

Articles and discussion forums about baking, grains, fermented milk products, edible wild plants and more.

Bread World
http://www.breadworld.com

The Fleischmann Yeast web site. Great information on baking and yeast topics.

Rec.food.preserving FAQ
http://www.gbronline.com/jacke/rfpfaq/rfpFAQ.htm#toc

A companion FAQ to this one. What I don't cover here Jack Eddington does and vice-versa. Very much worth your time if you are interested in food preservation.

Rec.food.cooking FAQ and conversion file
ftp://rtfm.mit.edu/pub/usenet/rec.food.cooking
http://vsack.bei.t-online.de/rfc_faq.html *Easier to navigate version*

From the FAQ - "The primary purpose of this document is to help cooks from different countries communicate with one another. The problem is that measurements and terms for food vary from country to country, even if both countries speak English." Even if you don't plan to cross so much as a county line this FAQ is worth reading. Many sometimes confusing food terms are made clear.

The ftp site also carries the Chocolate FAQ.

Rec.food.sourdough
http://www.nyx.net/~dgreenw/sourdoughfaqs.html
ftp://rtfm.mit.edu/pub/usenet/rec.food.sourdough/

A number of FAQs and files for sourdough breads. Much in-depth knowledge here.

rec.food.sourdough FAQ Starter Doctor
rec.food.sourdough FAQ Questions and Answers
rec.food.sourdough FAQ Recipes (part 1 of 2)
rec.food.sourdough FAQ Recipes (part 2 of 2)
rec.food.sourdough FAQ Basic Bread

Meat Smoking and Curing FAQ
http://www.bbqguide.com/meat_smoking_and_curing_faq.htm
http://www.romwell.com/cookbook/Preserve/smoking.shtml

Hasn't been updated in a long time, but the Meat Smoking and Curing FAQ by Richard Thead still has much good information.

Alternative Cooking Methods

International Dutch Oven Society
http://www.idos.com

A large resource of information concerning virtually anything that can be done with a Dutch Oven. If you can bake it in your kitchen you can bake it in a Dutch Oven.

The MacScouter
http://www.macscouter.com

One of the best Scouting (boys and girls) sites around. Click on the cooking directory for some really good information on Dutch Oven and other kinds of camp cooking.

The Solar Cooking Archive
http://solarcooking.org

A major source of information and access to equipment. There are explanations of the physics of how solar cooking works, plans for cookers, commercial suppliers, books, other reading and more. If you're interested in solar you really want to visit this site.

Doug Edwards Solar Cooking site
http://home.earthlink.net/~drduggee/solar.htm

An excellent site with clear photographs of a number of solar cookers. A good links page to many other solar cooking resources. Some interesting crystal radio info as well.

Home Power Magazine
http://www.homepower.com

They frequently run solar articles, including solar cooking. Many of the articles are available for online viewing or you can subscribe.

Food Safety

U.S. Food and Drug Administration Bad Bug Book
http://vm.cfsan.fda.gov/~mow/intro.html

The FDA's *Bad Bug Book*. Using information compiled from the FDA, CDC and other sources it provides basic facts regarding foodborne pathogenic microorganisms and natural toxins. A good source of information if you're looking for details on food borne pathogens and how to prevent or control them.

National Food Safety Database
http://www.foodsafety.gov/
http://foodsafety.ifas.ufl.edu/indexNFSDB.htm

A large source of food-safety information of all kinds.

Food Safety Answers.Org
http://www.foodsafetyanswers.org/
A pilot project of the Iowa State University Extension service to help provide answers to common food safety questions and to provide an interactive resource with the input from experts from industry, academia, associations, and the Federal government.

Disaster Preparedness. Mitigation, Relief

Federal Emergency Management Agency

http://www.fema.gov/library/prepandprev.shtm	*Preparation and Prevention*
http://www.fema.gov/library/dizandemer.shtm	*Disasters and Emergencies*
http://www.fema.gov/library/respandrecov.shtm	*Response and Recovery*
http://www.training.fema.gov/emiweb/cert/	*Community Emergency Response Teams*
http://www.fema.gov/kids/	*FEMA for Kids*
http://www.fema.gov/help/site.shtm	*Site Index (better than their search engine)*

The FEMA site with files and publications on disaster preparedness, post disaster response, mitigation and more. A good starting place to begin learning. Many will find preparedness literature more palatable if it comes with a Federal agency's name on it and this is the place to get it. Be sure to investigate the Community Emergency Response Team (CERT) materials. Your tax dollars went to pay for this stuff, you should use it.

American Red Cross

http://www.redcross.org/pubs/dspubs/genprep.html	*General preparedness materials (.pdf)*
http://www.redcross.org/pubs/dspubs/childmatls.html	*Materials for children (.pdf)*
http://www.redcross.org/pubs/dspubs/cde.html	*Community disaster education materials (.pdf)*

The Disaster Services portion of the American Red Cross site. Many good how-to type of publications for coping with various natural and man-made disasters can be found here.

IFAS Disaster Handbook
http://disaster.ifas.ufl.edu

The University of Florida's Institute of Food and Agricultural Sciences (IFAS) has compiled a *Disaster Handbook* for many natural and man-made crises. Some excellent information and well worth a look.

Disaster Relief Organization
http://www.disasterrelief.org/Library

Some good preparedness information. The address is case sensitive so make sure to include the capital L.

Water, Sanitation, General Knowledge

The Hesperian Foundation
http://www.hesperian.org

While the Foundation has nothing to do with food, they are the publishers of some important books that anyone with an interest in long-term preparedness should have such as *Where There Is No Doctor, Where There Is No Dentist* and *A Handbook For Midwives* among others. You can order them directly from the source.

U.S. Army Training and Doctrine Digital Library
http://155.217.58.58/atdls.htm

Many useful training and field manuals that can be hard to find elsewhere can be found here. I especially recommend *FM 21-10 Field Sanitation and Hygiene*. This site can be slow at times, so be patient.

La Leche League
http://www.lalecheleague.org

The La Leche League is the oldest and largest breast-feeding education and support group in the world. If you have an interest in feeding a baby the natural way, these are the people to ask for information.

Rec.backcountry Distilled Wisdom Panel 9 – Water Filter Wisdom
ftp://rtfm.mit.edu/pub/usenet/rec.backcountry

A good discussion of the hazards of backcountry water, water purification, and water filters as applied in the backcountry. The above address will list all of the rec.backcountry Distilled Wisdom panels – sort by date and find the latest posting of the Water Filter Panel.

FATFREE: The Low Fat Vegetarian Recipe Archive
http://www.fatfree.com

A "low-fat vegetarian" web site. Even if you're not a vegetarian it has one of the best search engines for using the USDA Nutrient Database (food nutrient compositions) that I've found. Do turn your pop-up blocker on.

Henriette's Herbal Homepage
http://metalab.unc.edu/herbmed/

Medicinal and culinary herb FAQs, archives of the medicinal herb, culinary herb, and herb-info lists. More than a thousand plant pictures and a plant name database. One of the oldest and largest herbal information sites on the WWW.

The Food Insects Newsletter
http://www.hollowtop.com/finl_html/finl.html

In case you think you might ever have to.

C.2 SOFTWARE SOURCES

I do not use these programs myself, but have listed them for those who might be interested. Most are free, but a few charge a nominal fee.

http://www.waltonfeed.com/grain/calc.html

There are two Excel spreadsheets here that can also be imported into Lotus 123, Quattropro or Works For Windows. The first spreadsheet is a nutritional calculator showing the breakdown of 65 nutrients for 167 foods with more being importable. The second spread sheet is a yearly supply calculator.

http://waltonfeed.com/self/plan.html

A nutritional calculator that you enter your food supply into and it gives you a daily nutritional printout. It's a smaller, less versatile version of the one from Revelar below, but is less resource intensive and will run on a DOS machine.

http://www.revelar.com/fsp.html

A more extensive, versatile version of the above program, makes it much easier to modify for personal use. It also requires at least a 486, Windows and 8mb of Ram. A version for the Mac is available as well.

http://www.permapak.net/ freesoftware.htm

The first program is an LDS Food Storage Planner designed to help prepare a food storage program using the food storage recommendations made by LDS church leaders. This program starts out with only the basics and it is strongly recommend that you add fruits and vegetables etc., once you have the basic foods. The second program is a more advanced version of the first which includes more foods beyond the basic ones of the first.

D. ORGANIZATIONS

D.1 THE CHURCH OF JESUS CHRIST OF LATTER DAY SAINTS

The LDS church, commonly known as the Mormon Church, has long had a social welfare program for the benefit of its members in need. Believing the best way to deal with the problem of needy members is not to have any, the church also strongly encourages its membership to be as self-reliant and self-dependent as possible. To further this end it provides access to church owned cannery facilities and makes large, bulk purchases of storage foods to sell at cost to any member with an interest in starting a personal food storage program.

Most facilities will be at one of the LDS Bishop's Storehouses located in various places around the country, but some churches will also have their own local facilities. The easiest means of finding one is simply to ask the LDS church member you know. If they don't themselves know, or you don't know any Mormons, then a little phone book research will be necessary. Find your nearest local Mormon church and ask to speak with the local Bishop of the Ward or Relief Society president. Either one of those two individuals should be able to give you the information you seek.

The Church also has it's own web site at http://www.providentliving.org and there you can find further information on geographic locations of church owned Home Storage Centers and instructions for how to begin your own home food storage and emergency preparedness programs. Even if you aren't an LDS member and don't intend to use their facilities the food storage and emergency preparedness areas are worth a look.

If you find that you have a cannery within striking distance give them a call. If you are not LDS inquire as to whether they allow non-church members to use their facilities, any available times, and what you need to provide. Be up front and honest, you'll hardly be the first to talk to them about food storage. Ask for a copy of the cannery guidelines and a price list of what is available. There may also be classes or seminars as well. There is a degree of variability between the canneries so what is available at one may not be at another.

IMPORTANT NOTE: Policies about non-members using the LDS Family Canneries may vary from location to location so you'll need to investigate the specific cannery you are interested in. Please keep in mind that the individuals responsible for the family canneries are all *volunteers* with demands on their time from many areas. Be courteous when speaking with them and, if there are facilities for use, flexible in making arrangements to use them. You will, of course, have to pay for the supplies that you use, cans and lids at the least, and any food products you use. As a general rule they cannot put your food into storage for you. Be ready to pay for your purchases in advance, if necessary. They do not take credit cards and probably cannot make change so take a check with you.

Any food products you want to have sealed in cans or pouches will need to fall within their guidelines of suitability for that type of packaging. This is for reasons of spoilage control since many types of foods aren't suitable for simply sealing in a container without further processing. If you purchase food products from the cannery, they will already be within those guidelines. A brief treatment of these guidelines can be found below.

D.1.1 LDS FAMILY CANNERY GUIDELINES

Subject to some variability among storage centers, the following foods are generally available at the canneries:

Apple Slices	Hot Cocoa Mix	Pudding, Vanilla
Beans, Great Northern	Macaroni	Soup Mix
Beans, Pink	Milk, Non-fat Dry	Spaghetti
Beans, Pinto	Oats, Rolled	Sugar
Beans, Refried Dry	Onions, Dry	Wheat, Red or White
Carrots, dry	Potatoes, dry	White Flour
Fruit Drink Mix	Pudding, Chocolate	White Rice

In addition to what foods may be available for purchase from the cannery you may also be able to bring your own to put up. These will need to be low-moisture in nature, of a high enough quality for storage, and free of insects.

Approved Dry-Pack Products	
Milk	Non-fat dry milk and milk or whey products such as hot cocoa.
White flour	Bleached or unbleached, but not self-rising.
Whole grains	Not milled or cracked, no oily seed coat.
Rolled oats	Quick or regular.
Legumes	Dry peas and beans, including dehydrated refried beans.
Pasta	Pasta products that do not contain egg.
Fruits and vegetables	Dehydrated or freeze-dried products that are dry enough to snap. (Best items: apples, bananas, potatoes, onions, carrots, corn, peas. Marginal items: apricots, peaches, pears, tomatoes, green beans).
Sugar	Granulated or powdered, but not brown or other damp sugars.
Miscellaneous	TVP (textured vegetable protein), cheese powder, gelatin, soup mixes (without bouillon).

You will be able to purchase the necessary cans or pouches, oxygen absorbers, boxes and plastic lids for what you want to can.

Some foods do not keep well simply sealed inside a can or pouch even with oxygen absorbers so are not approved for canning.

Non-Approved Dry Pack Products	
Milled grain	Whole wheat flour, cornmeal, cereal.
Oily grains/seeds	Nuts, coconut, brown rice, pearled barley, sesame.
Baking mixes	Anything that has self-contained baking powder is not suited to long-term storage
Leavenings	Baking powders, baking soda, and yeast.
Egg noodles	Any noodles, pasta, or macaroni that contains egg yolks.
Cold cereals	Ready to eat breakfast cereals, granolas, etc.
Miscellaneous	Spices, oils, bouillon, dried meats, dried eggs, brown sugar, candy, first-aid supplies.

Although I am not in complete agreement with the above list, it is workable and will get the job done. Make sure the food you want to pack has little fat or moisture content and you should be OK. For grains, legumes, flours, meals and dried fruits and vegetables do make sure to use the oxygen absorbers. You should not assume the food is insect free. When the packets remove the available oxygen any insects in the can will die or at least go dormant.

E. FOOD AND EQUIPMENT SUPPLIERS

E.1 MAIL ORDERING STORAGE FOODS -- WHAT YOU SHOULD KNOW

When it comes to building a food storage program, sooner or later you may need to seriously consider mail ordering at least a part of the foods you want. Even for those of us who try do as much as we can locally there are some things which are not going to be easily available in our areas. To help with this I have included below a list of food and equipment suppliers where nearly anything can be found.

Because many do find it necessary or desirable to purchase via mail order I am including some points to consider before shelling out your cash.

1.-- *Find out how much the shipping costs are going to be.* Grains and legumes are relatively cheap, but weigh a lot when bought in bulk. Because of this, shipping charges can sometimes double (or more) the actual cost of the product by the time it reaches your door. Adding insult to injury is the round bucket fee UPS charges in addition to their regular shipping charges. This fee has become sufficiently high that many companies now find it cheaper to buy boxes to ship their buckets in. Compare carefully each company's list price and their shipping charges, <u>combined</u>, when deciding who to order from. Saving up for a larger order, or finding someone to combine orders with might enable you to make a large enough order to get a price break on shipping. Alternatively, you could take a vacation in the area of the company's location or swing through the area on the way back from one. If you choose to do this, be certain to call ahead and let them know your date of arrival so they'll have your order ready and waiting for you. The company in the next state may be higher on their list price, but end up being cheaper than having it shipped in from six states away.

2.-- *Ask the supplier when your order is going to ship.* Some suppliers are behind in filling orders so you could be waiting and waiting. Slowness in shipping is not necessarily a sign of bad business though. Some suppliers may drag their feet, but others may be genuinely swamped by the volume of business they are receiving because they have a good product at a fair price.

3.-- *How fresh is the product you are ordering?* Freshness is what it's all about when it comes to storage foods. If a food has a five year shelf life in its container then you want as much of those five years to be on your shelf, not the supplier's.

4.-- *Be clear as to how the product you are ordering is packaged.* Many suppliers offer identical foods packaged several different ways. Be certain the product number you are giving the salesperson is for the product packed in the manner you want.

5.-- *What is the head gas analysis?* If you are ordering foods packed in a nitrogen flushed oxygen free container (with or without an oxygen absorber packet added) then ask about the laboratory test results that measure the oxygen content of the head gasses in the container. This is of great importance if you are counting on the extra storage life such packaging will give you. There are but a few companies such as Perma Pak, Ready Reserve, and Walton Feed that actually produce packaged storage foods and most dealers only distribute and retail their products. If the dealer can not produce the manufacturer's test data measuring the head gasses of the products they are selling then keep looking.

6.-- *If you are purchasing wheat and intend to use it primarily for bread making then be sure to ask about its protein content.* The best breads need at least 12% protein with 13-14% better still. Unusually high protein levels though might indicate a problem. When considering grain wheat subtract 1-2% of

the protein content of the berries to arrive at the probable gluten content of that lot of grain. *Also take a close look at the weight of the product.* One company's five or six gallon bucket of wheat may not weigh the same as another's. The same applies to dehydrated foods such as fruits, vegetables, TVP, etc. *Ask about the moisture content of bulk foods which are not already packaged for long term storage.* 10% or less moisture is where you want to be for grains, legumes and most everything else.

7.-- *What is the company's damage and return policy?* If your carefully packed SuperPails and #10 cans get dented or cracked in shipping you'll need to have them replaced. Most mail order companies will require you to contact the shipper (such as UPS) for a claim number. The shipper may or may not require an inspection so don't destroy any packaging or containers until you know for sure.

Does anyone else know of anything else a person should look out for or ask about when mail ordering storage food?

E.2 ADDRESSES OF SUPPLIERS

DISCLAIMER: The companies listed below were either found by me, sent in by the business owners, or volunteered by interested readers. *I make **NO** representation as to their worthiness to do business with.* Most of these merchants or manufacturers have been in their field for many years, will be around for many more, and are honorable in their dealings. However, with every update of this FAQ there are businesses that spring up only to have disappeared when I do the next update. In addition to the precautions mentioned in *G.1* above take all of the usual precautions in mail or phone ordering.

The following listings are roughly categorized by type:

STORAGE FOOD MANUFACTURERS: The actual producers or packagers of storage foods. Some do retail sales of their products, others do not.

FOOD PRESERVATION DEALERS AND SUPPLIERS: These are businesses dealing with the aspects of food preservation as opposed to storage. Canning, meat curing, fermented milks, pickling, spices, soybean products, brewing, vintning, etc.

FOOD STORAGE AND PRESERVATION EQUIPMENT MANUFACTURERS: The actual manufacturers of equipment. Some will do retail sales and some do not.

DIATOMACEOUS EARTH MANUFACTURERS AND DEALERS: Self-explanatory.

STORAGE FOOD RETAIL DEALERS: Retail sales of all of the above.

Naturally, addresses, phone numbers, web sites, etc., change over time so if you have more current information than I'm giving here, please be so kind as to let me know. Additionally, I'm always looking for new companies so if you have some that you'd like to see in this FAQ send me their info and I'll take a look.

When contacting any of the businesses listed here I'd appreciate if you'd let the business owner now if you found their business by looking in this FAQ. I don't sell advertising, but it does make it easier to keep the listings here current and fresh if the owner's feel it's good for their business which makes for less time I must spend doing the footwork to verify all of the information. Keeping this section fresh and current has become the most time-consuming part of maintaining this FAQ. Thanks.

E.2.1 STORAGE FOODS MANUFACTURERS

ADVENTURE FOODS
481 Banjo Lane
Whittier, North Carolina 28789
(828) 497-4113 Voice
(828) 497-7529 Fax
E-mail: **CustomerService@AdventureFoods.com**
http://www.adventurefoods.com

Online sales. Manufacturer of the Adventure Food line of products, also MRE components, and bulk foods (some unusual ones too - wine powder?).

ALPINEAIRE FOODS
TyRy, Inc.
P.O. Box 1799
Rocklin, CA 95677
(800) 322-6325 - Toll Free (USA)
(866) 322-6325 - Toll Free (USA)
(916) 624-6050 - Local & International
(916) 624-1604 - Fax
E-mail: **info@aa-foods.com**
http://www.alpineairefoods.com

Online sales. Storage food manufacturer. Shelf stable foods with a long storage life. Many foods that require no cooking. Also backpacking meals. Good FAQ section.

BACKPACKER'S PANTRY
6350Gunpark Drive
Boulder, CO 80301.
(303) 581- 0518 Voice
E-mail: **info@backpackerspantry.com**
http://www.backpackerspantry.com

Manufacturer of the Backpacker's Pantry, Camp Food, and Astronaut Food (freeze dried ice cream!) lines of food products as well as camping/backpacking cooking gear. List of dealers on site. No online retail sales.

FREEZE DRY FOODS, LIMITED
579 Speer Rd
Oakville, Ontario L6K 264 Canada
(905) 844-1471 - Voice
(905) 844-8140 - Fax
E-mail: **info@freeze-dry.com**
http://www.freeze-dry.com

CANADA. A freeze-dried foods manufacturer. Produces the Hardee Camping Foods brand. No online retail sales.

HARVEST FOODWORKS
445 HWY 29
RR#1
Toledo, Ontario KOE 1YO, Canada
(800) 268-4268 - Toll Free
(613) 275-2218 - Local & International
Fax: (613) 275-1359
E-mail: **thefolks@harvest.on.ca**
http://www.harvest.on.ca

CANADA. Online sales. A producer of primarily vegetarian (some have meats) dehydrated and freeze dried foods. Ingredients and nutrition information on site.

HEATERMEALS
311 Northland Blvd
Cincinnati, OH 45246
(800) 503-4483 - Toll free
(513) 772-3066 – Local & International
(513) 772-3269 – Fax
(800) 589-1528 - Fax Toll free
E-mail: **info@heatermeals.com**
http://www.heatermeals.com

Online sales. Free sample HeaterMeals and pricing information. Also produces the ZestoTherm FRH Flameless Food Heater used by the U.S. Army.

HOTCAN UK LIMITED
Unit 7
Carrwood Road
Chesterfield Trading Estate
Chesterfield, Derbyshire S41 9QB
Tel: (01246) 26 89 88 -
Fax: (01246) 45 10 46 -
E-mail: **hotcanlimited@aol.com**
http://www.hotcan.com

UNITED KINGDOM. Online sales. A British manufacturer of self-heating meals. Uses a different heating technology than with US MREs. Product ingredient and nutritional info on web site.

HOT PACK MEALS

United Kingdom
Canland UK Ltd
Wellington House
Lower Icknield Way
Longwick
Bucks
HP27 9RZ
United Kingdom
01844 344474 Telephone and fax
E-mail: **info@hotpackmeals.co.uk**
http://www.hotpackmeals.co.uk/index.html

Canada
369 Holliday Point Road
R.R. #1
Wolfe Island ON K0H 2Y0
CANADA
(613) 385-1212 Voice/Fax
E-mail: **dands@hotpackmeals.com**
http://www.hotpackmeals.com

UNITED KINGDOM/CANADA. Online sales. A manufacturer of self-heating MRE style ration packs and a supplier to the British and Canadian militaries. Nutrition info and product labels available on the web site.

LONG LIFE FOOD DEPOT (Exclusive agent for Wornick Company MRE and MRE-Style civilian sales)
P.O. Box 8081
Richmond, Indiana 47374
(800) 601-2833 Toll free (USA)
(765) 939-0110 Local & international
(765) 939-0065 Fax
E-mail: **sales@longlifefood.com**
http://www.longlifefood.com

Online sales. Wornick appears to work through this company now for civilian sales of their surplus MRE components and their civilian MRE-Style products. Good information on military and civilian MRE's on their site.

LUMEN FOODS
409 Scott Street
Lake Charles, La. 70601
(800) 256-2253 – Toll Free Order Line (USA)
(337) 436-6748 – Local & International
(337) 436-1769 – Fax
E-mail: **support@soybean.com**
http://www.soybean.com

Online sales. A manufacturer of soy and other "non-animal" foods. TVP products, soyfoods, grains and more.

MOUNTAIN HOUSE (Oregon Freeze Dry, Inc.)
525 25th Ave SW
Albany, OR 97321
(800) 547-0244 – Toll free (USA)
(877) 366-3877 – Toll free (USA)
(541) 812-6601 - Fax
E-mail: **MH-info@ofd.com**
http://www.mountainhouse.com

Online sales. Manufacturer of Mountain House freeze dried foods in pouches and larger cans. Manufacturing date decoding info on web site.

READY RESERVE FOODS, INC.
1442 S. Gage Street
San Bernardino, CA 92408
(800) 453-2202 Toll free (USA)
(909) 796-0098 Local & international
(909) 796-2196 Fax
E-mail: **readyreserve@aol.com**
http://www.readyreservefoods.com/contact.htm

Online sales. #10 and 2 ½ size cans, bulk units.

RICHMOOR CORPORATION
6923 Woodley Ave
Van Nuys, CA 91406
(800) 423-3170 Toll free
(818) 787-2010 Fax
E-mail: **mail@richmoor.com**
http://www.richmoor.com

Online sales. Manufacturer of the Richmoor and Natural High line of food products. Good FAQ section with pack date decoding info. List of dealers on site.

SOPAKCO (Crown Point ltd.)
P.O. Box 1129
215 South Mullins St
Mullins, South Carolina 29574
(800) 276-9678 Toll free (USA)
(888) 276-9678 Toll free (USA)
http://www.sopakco.com
http://www.crownpt.com/MREs.htm

Manufacturer of military MRE's, their civilian M RE equivalent brand *Camp & Trail* and humanitarian pouch meals. Some product info on site. No online retail sales, but does have dealer contact info.

WALTON FEED,INC
135 North 10th St.
P.O. Box 307
Montpelier, ID 83254
(800) 269-8563 Toll free (USA)
(208) 847-0467 Local & international
E-mail: **info@waltonfeed.com**
http://www.waltonfeed.com

Online sales. Major packager and supplier of storage foods. Bulk & N2 packed dehydrated foods, grains/legumes bulk and N2 packed, oxygen absorbers. Free food storage planning software. Can labels and head gas analyses of most products available for viewing on site. Click on the "Using Whole Foods" and "Pack Your Own Foods" links in the Information Area of the site to access most of the best information. Very informative web site.

WAYFAYRER FOODS
Westler Foods Ltd
Amotherby
Malton
North Yorkshire
YO17 6TQ
+44 (0) 1653 693 971 Voice
+44 (0) 1653 600 187 Fax
E-mail: **info@wayfayrer.co.uk**
http://www.wayfayrer.co.uk/index.asp

UNITED KINGDOM. Pre-cooked, ready to eat meals in retort pouches. Some now also with accompanying heaters. Not presently taking online orders, but you can fill out an inquiry form on the web site and they will contact you regarding your needs.

E.2.2 FOOD PRESERVATION DEALERS AND SUPPLIERS

Canning, meat curing, food drying, spices, pickling, cultured milk products, soybean products, etc.

ALLIED KENCO SALES
26 LYERLY ST.
HOUSTON, TEXAS 77022
(800) 356-5189 Toll free (USA)
(713) 691-2935 Local & international
(713) 691-3250 Fax
E-mail: **aks@alliedkenco.com**
http://www.alliedkenco.com

A butcher supply house specializing in sausage and jerky making supplies and equipment. Seasoning, sausage casings, meat grinders, sausage stuffers, commercial vacuum sealing machines and more.

CANNING PANTRY.COM
Highland Brands, LLC.
1780 W. 9000 S., Suite 128,
West Jordan, Utah 84088-6501.
(801) 280-3241 Voice
(775) 206-3262 Fax
E-mail: **Info@HighlandBrands.com**
http://www.canningpantry.com/index.html

Pressure & boiling water bath canners, canning supplies, grain mills, Excalibur food dehydrators, books.

CON YEAGER SPICE COMPANY
144 Magill Rd
Zelienople, PA 16063 USA
(800) 222-2460 Toll free (USA)
(724) 452-4120 Local & international
(724) 452-6171 Fax
E-mail: **spicesales@zoominternet.net**
http://www.yeagerspice.com

Meat curing, casings, smoking, herbs, spices and hardware. Bulk sales.

COOKBOOK SHOPPE, THE
Vickie Tate
302 East 200 North
Manti, Utah 84642
(435) 835-8283

Home Storage & Preparedness Books including Cooking With Home Storage. Country Living grain mills.

CUMBERLAND GENERAL STORE
#1 Highway 68
Crossville, TN 38555
(800) 334-4640 Toll free (USA)
(931) 456-1211 Fax
E-mail: **info@cumberlandgeneral.com**
http://www.cumberlandgeneral.com

A good deal of food preservation and storage equipment with the emphasis on non-modern gear. Can sealers, grain mills, water pumps and other non-electrically powered equipment.

DAIRY CONNECTION, INC
8616 Fairway Place, #101
Middleton, WI 53562 U.S.A.
(608) 836-0464 Voice
(608) 836-7791 Fax
E-mail: **getculture@ameritech.net**
http://www.dairyconnection.com

Cheese coagulants, colors, cultures, and starter flavors. Also yogurt, buttermilk, and sour cream cultures.

DOUBLE SPRINGS HOMEBREW SUPPLY
8345 Main St.
Mokelumne Hill, CA 95245
(888) 499-2739 Toll free (USA)
(209) 286-0506 Local & international
(209) 754-4888 Fax
E-mail: **homebrew@goldrush.com**
http://www.doublesprings.com

Home brewing and vintning supplies of all sorts. Preservative chemicals and oxygen absorbers. Many books, including vinegar making. Vinegar mothers. A lot of equipment.

G.E.M. CULTURES
30301 Sherwood Road
Fort Bragg, CA 95437 USA
(707) 964-2922 (mornings after 7 a.m. Pacific time)
E-mail: **gemcult@mcn.org** for enquiries outside the US only please
http://www.gemcultures.com/

Fermented food starter cultures such as natto, tempeh, amazake, miso, shoyu, tamari, koji, miso, sourdough and other bread leavens (barm, etc.), fil mjolk, viili, and kefir gra ins. Also natural nigari (bitterns) and calcium sulfate (gypsum) as well as a form box for tofu making.

HOME CANNING SUPPLY
PO Box 1158-WW
Ramona, CA 92065
(800) 354-4070 Toll free (USA)
(760) 788-0520 Local & international
(760) 789-4745 Fax
E-mail: **sales@homecanningsupply.com**
http://www.homecanningsupply.com

Home canning and food preservation supplies such as bulk pectin, low-methoxyl pectins, pressure and water-bath canners, dehydrators, and other food preserving supplies.

LEHMAN'S HARDWARE
One Lehman Circle
P.O. Box 321
Kidron, OH 44636 U.S.A
888-438-5346 Toll free (USA)
330-857-5757 Local & international
888-780-4975 Fax toll free
330-857-5785 Local fax
E-mail: **getinfo@lehmans.com**
http://lehmans.com

Quite a lot of food related equipment, grain mills, can sealers, water pumps, butchering, cheese making, dehydrators, pitters, peelers, etc. Most of it non-electric. Many books. Free shipping on many orders.

NATURAL MEALS PUBLISHING
9745 Kristen Drive
Sandy, UT 84070
(888) 232-6706 Toll free phone/fax (USA)
E-mail: **getinfo@naturalmeals.com**
http://www.naturalmeals.com

Publisher of Rita Bingham's book - Natural Meals In Minutes; Country Beans; and The NEW Passport To Survival

NEW ENGLAND CHEESEMAKING SUPPLY
P.O. Box 85, Ashfield MA 01330
Phone (413) 628-3808
Fax (413) 628-4061
E-mail: **info@cheesemaking.com**
http://www.cheesemaking.com

Supplier of virtually everything related to home cheese making.

PENZEYS, LTD. SPICE HOUSE
P.O.Box 933
Muskego, WI 53150-0933
(800) 741-7787
(414) 679-7207 voice
(414) 679-7878 fax
E-mail: **info@penzeys.com**
http://www.penzeys.com

Herb and spice supply house. Excellent prices on bulk quantities of herbs and spices. Good quality and variety.

POLSTEINS HOME CENTERS
7615 13th Ave.
Brooklyn, NY 11228-2411
(800) 492-3288 Toll free
(718) 331-1613 Fax
E-mail: **store_01@polsteins.net**
http://www.polsteins.com

Wide line of home canning supplies and equipment. Also a general hardware store carrying kitchen and other housewares.

SAUSAGE MAKER, THE
1500 Clinton St., Bldg. 123
Buffalo, New York 14206
888-490-8525 Toll free (USA)
716-824-5814 Local & international
716-824-6465 Fax
E-mail: **sausmaker@aol.com**
http://www.sausagemaker.com

Mail order sausage making, meat curing and smoking supplies, training videos, equipment, etc

STUFFERS SUPPLY COMPANY
22958 Fraser Highway,
Langley,
British Columbia,
V2Z 2T9 Canada
(604) 534-7374 voice
(604) 534-3089 fax
E-mail: **bleathem@telus.net**
http://www.stuffers.com

CANADA. A Canadian source of sausage making and meat curing supplies.

E.2.3 FOOD STORAGE AND PRESERVATION EQUIPMENT MANUFACTURERS

CONSOLIDATED PLASTICS
8181 Darrow Rd.
Twinsburg, OH 44087
(800) 362-1000 Toll free (USA)
(330) 425-3333 Fax
http://www.consolidatedplastics.com

Online sales. FDA approved plastic food storage containers, food grade plastic bags, screw off bucket lids and more. Ask for their Rubbermaid, laboratory/industrial catalogs and bags/packaging/shipping catalogs.

COUNTRY LIVING PRODUCTS
Country Living Products
14727 56th Ave. NW
Stanwood, WA 98292
(360) 652-0671 Voice
E-mail: **jjenkins@mstar2.net**
http://www.countrylivinggrainmills.com

Online sales. Manufacturer of the Country Living grain mill. They're now offering a spare parts kit.

DESICCARE, INC. .

West Coast Manufacturing Facility
3400 Pomona Blvd.
Pomona, CA 91768 USA
(800) 446-6650 Toll free
(909) 444-8272 Local
(909) 444-9045 Fax

East Coast Manufacturing Facility
211 Industrial Dr.
Richland, MS 39218 USA
(888) 932-0405 Toll free
(601) 932-0442 Fax

E-mail: **desiccant@desiccare.com**
http://www.desiccare.com/

Online sales. Manufacturer of desiccants, oxygen absorbers, and humidity indicator cards.

DIXIE CANNER EQUIPMENT CO.
786 East Broad St
Athens, GA 30601 USA
(706) 549-1914 voice
(706) 549-0137 fax
E-mail: **sales@dixiecanner.com**
http://www.dixiecanner.com

Mostly electric can sealing equipment, but some manual types. A list of companies that sell low-volume can orders may be found on-site.

FREUND CAN COMPANY
155 West 84th Street
Chicago, IL 60620
(800) 363-9822 Toll free (USA)
(773) 224-8812 Fax
E-mail: **customerservice@freundcontainer.com**
http://www.freundcan.com

Online sales. Metal, glass and plastic containers. Can sealers of several sorts. Claims will sell any quantity. Merged with Berlin Packaging.

HEINHOLD ENGINERRING & MACHINE CO, INC.
2910 Directors Row
Salt Lake City, UT 84104
(800) 262-4275 Toll free (USA)
(801) 974-0613 Local & international
(801) 974-0616 Fax
http://www.cansealer.com

Manufactures a small-scale electric can sealer.

INDEPENDENT CAN COMPANY
1300 Brass Mill Rd
P.O. Box 370
Belcamp, MD 21017
(410) 272-0090 – voice
(410) 273-7500 – fax
E-mail: **salesdept@independentcan.com**
http://www.independentcan.com

Metal can packaging supplier. Has distributors nationwide and internationally and a factory outlet in Belcamp.

INTERTECK A.S.
P.O. Box 86
East Amherst, New York 14051
(716) 472-0060 voice
(716) 662-9059 fax
E-mail: **info@foodsave.net**
http://www.foodsave.net

Online sales. Oxygen absorbers, desiccants, Mylar and other food grade packaging.

K-TEC (K-TEC KITCHEN MILL)
1206 South 1680 West
Orem, Utah 84058
(800) 748-5400
(801) 222-0888
http://www.k-tecusa.com/index.html

Online sales. Manufacturer of the K-Tec Kitchen Mill electric grain mill.

SORBENT SYSTEMS (IMPAK Corporation)
2460 East 57th St
Los Angeles, CA 90058
(323) 277-4700 voice
(323) 277-9400 fax
E-mail: **sales@sorbentsystems.com**
http://www.sorbentsystems.com

Online sales. Oxygen absorbers, desiccants, Mylar, and other food grade packaging.

UNITED STATES PLASTICS
1390 Neubrecht Rd
Lima, OH 45801-3196
(800) 809-4217 Toll free (USA)
(800) 854-5496 fax
E-mail: **usp@usplastics.com**
http://www.usplastic.com

Online sales. FDA approved plastic food storage containers, food grade plastic bags, screw off bucket lids, etc.

WELLS CAN COMPANY, LTD.
8705 Government St
Burnaby, British Columbia V3N 4G9 Canada
(604) 420-0959 voice
(604) 420-0975 fax
E-mail: **sales@wellscan.ca**
http://www.wellscan.ca

CANADA. Online sales. A manufacturer of pressure canners & cookers, can sealers, metal cans, canning jars, plastic and metal buckets, vacuum sealers.

E.2.4 DIATOMACEOUS EARTH MANUFACTURERS AND DEALERS

DIATECT INTERNATIONAL
875 S. Industrial Parkway
Heber City, Utah 84032
(800) 227-6616
(435) 654-4370
(435) 657-9794
E-mail: **diatect@diatect.com**
http://www.diatect.com

Producer of food grade DE

FOSSIL SHELL SUPPLY COMPANY
P.O. Box 50225
Amarillo TX 79159-0225
(806) 355-4236 voice
(806) 351-0777 fax
E-mail: **fssc@amaonline.com**
http://www.amaonline.com/fssc/Default.htm

Perma-Guard diatomaceous earth

E.2.5 STORAGE FOOD RETAIL DEALERS

ADVENTURE1
38 Dundas Street
Glasgow
G1 2AQ
United Kingdom
0141 353 3788 Voice
E-mail: **bill@adventure1.co.uk**
http://www.adventure1.co.uk

UNITED KINGDOM. A British adventure, camping, military surplus supplier. Offering MRE packs, camp cooking gear, water filtration or purification gear.

ARMED FORCES MERCHANDISE OUTLET
111 N. Central Expressway
Richardson, TX 75080
(800)282-3327
(972)235-9781
E-mail: **info@afmo.com**
http://www.afmo.com

Carries the Back Packers Pantry line of camping foods, cooking gear, and MREs.

B&A PRODUCTS
Rt 1 Box 100
Bunch, OK 74931-9705
(918) 696-5998 voice
(918) 696-5999 fax
E-mail: **annie@baproducts.com**
http://www.baproducts.com

Ready Reserve, Alpineaire foods, Heater Meals, water filters, and other emergency preparedness supplies.

BARRY FARM
20086 Mudsock Road
Wapakoneta, Ohio 45895.
(419) 228-4640 Voice
E-mail: **info@barryfarm.com**
http://www.barryfarm.com

Bulk grains and grain products, legumes, dry dairy products, cooking and baking adjuncts, dried fruits & nuts.

BOB'S RED MILL
5209 SE International Way
Milwaukie, OR 97222
(800) 349-2173 Toll free
(503) 653-1339 Fax
http://www.bobsredmill.com

Bulk grains and grain products, legumes, baking and cooking adjuncts, nuts, sweeteners.

BREAD BECKERS, THE
305 Bell Park Drive
Woodstock, GA 30188
(770) 516-5000 Voice
(770) 516-7588 Fax
http://www.breadbeckers.com

Grains, grain products, legumes, organic or not, in six gallon buckets, #10 cans, and bulk. Dehydrated foods, sprouting seeds, honey, and cooking adjuncts. Grain mills, pressure cookers, and other food equipment.

BULKFOODS.COM
3040 Hill Ave
Toledo, Ohio 43607-2931
(419) 324-0032 Voice
(888) 285-5266 Fax toll free
E-mail: **Vip@BulkFoods.com**
http://www.bulkfoods.com

Bulk dried fruits, vegetables, herbs & spices, nuts, grains and grain products, legumes, sprouting seeds, baking adjuncts, dried dairy products, mushrooms, and TVP. Nothing packed for long-term storage, but a big selection of products you can repackage yourself.

CAMPINGSURVIVAL.COM (JHL Supply, Inc.)
P.O. Box 720
191 W First St North
Fulton, NY 13069
(800) 537-1339 Toll free
(315) 592-4794 Local
(315) 592-4796 Fax
E-mail: **sales@campingsurvival.com**
http://www.campingsurvival.com

Provident Pantry freeze dried and dehydrated foods, Alpenaire foods, MREs, grain mills, ration bars, water filters and sanitization chemicals.

COMBAT READY PRODUCTS
P.O. Box 285
Kalamunda
WA 6926
(08) 9291 0133 Voice/Fax
0411 126 310 Mobile
E-mail: **kitbag@linet.net.au**
http://www.kitbag.com.au

AUSTRALIA. Military ration packs, military food gear, survival kits.

DIXIE DINER
POB 1969
Tomball, TX 77377
(800) 233-3668 Toll free
(800) 688-2507 Toll free fax
E-mail: **info@dixieusa.com**
http://www.dixiediner.com

TVP and other soy products of many kinds - including egg replacers, low-carb foods, soymilk and other drinks, baking mixes, soy flours, and dairy replacers.

EMERGENCY ESSENTIALS
362 S Commerce Loop, Suite B
Orem, UT 84058
(800) 999-1863 Toll Free (USA)
E-mail: **webmaster@beprepared.com**
http://www.beprepared.com

A long-time preparedness retailer. Storage foods of all types, MRE's, water purifiers, storage containers, grain mills and other food equipment.

EPICENTER, THE (EMERGENCY PREPAREDNESS INFORMATION CENTER)
384 Wallis #2
Eugene, OR 97402
(541) 684-0717 voice
(541) 338-9050 Fax
E-mail: **bjnelson@TheEpicenter.com**
http://TheEpicenter.com

MREs and components, water storage, water filters.

FIRST CHOICE EXPEDITION FOODS
Stape
Pickering
North Yorkshire
United Kingdom
YO18 8HX
+44 (0) 1751-473330 Voice
+44 (0) 1751-476811 Fax
E-mail: **info@expeditionfoods.com**
http://www.expeditionfoods.com/index.html

UNITED KINGDOM. Online sales. Ready to eat meals (MRE type meals), freeze dried foods, water filters and purification chemicals. Product ingredients and nutrition info on site.

GRANDMA'S COUNTRY FOODS
391 South Orange Street, Suite C
Salt Lake City, UT 84104
(800) 216-6466 Toll free
(801) 886-1110 Local
(801) 886-3211 Fax
E-mail: **grandma@grandmascountry.com**
http://www.grandmascountry.com

Grains, grain products, legumes, TVP, veggies, fruits, cooking and baking adjuncts, freeze dried foods in #10 cans, grain mills, empty buckets.

GRAIN STORE, INC
121 Myles Manor Ct.
Franklin, TN 37064
(615) 595-6000 Voice
(615) 591-2121 Fax
E-mail: **WellTree@aol.com**
http://www.grainstore.com

Grains, grain products, beans, dairy products and other storage foods packed for long term storage or in bulk, grain mills.

HOMESTEAD PRODUCTS
Homestead Products
Rt. 1, Box 84
Kooskia, ID 83539
(208) 926-7137 voice
E-mail: **dany@efn.org**
http://www.homestead-products.com

Grain mills, pressure canners, cream separators, cheese presses, can sealers, water filters, manual desalinators..

HONEYVILLE GRAIN
3750 W 7200 N
Honeyville, Utah 84314
(435) 279-8197 Voice
(435) 279-8111 Fax
E-mail: **info@honeyvillegrain.com**
http://www.honeyvillegrain.com

Grains, grain products, legumes, oils and fats, soy products, and other baking and cooking adjuncts in bulk and pre-packaged.

THE INTERNET GROCER (Best Prices Storable Foods)
1737 Cascade St
Mesquite (Dallas), Texas 75149
(972) 288-0262 - voice
(972) 356-6233 – fax
E-mail: **txfooddude@internet-grocer.net**
http://web2.airmail.net/foodstr2/
http://www.internet-grocer.net

Pre-packaged dehydrated foods, bulk foods, grains, legumes, and grain mills. Mylar bags, oxygen absorbers, containers and DE. Mountain House freeze dried foods. Organic foods. Good line of canned meats, cheese and butter.

LDP CAMPING FOODS
113 Gill Dr.
Lafayette, LA 70507
(800) 826-5767 Toll free
(337) 235-4695 Voice
E-mail: **Marcus@LDPCampingFoods.com**
http://www.ldpcampingfoods.com

Adventure Foods, AlpineAire, Backpacker's Pantry, Campfood, Mountain House, Natural High, Richmoor, MREs, Aquamira Water Treatment, backpacking cooking gear.

MAJOR SURPLUS & SURVIVAL
435 W. Alondra, Gardena, CA, 90248
(800) 441-8855 Toll free
(310) 324-8855 Local
(310) 324-6909 Fax
E-mail: **info@MajorSurplusNSurvival.com**
http://www.majorsurplusnsurvival.com

MREs, freeze dried and air dried bulk foods, camp cooking equipment, Mylar bags.

MEYERS CUSTOM SUPPLY
P.O. Box 212
Cassel, CA 96016
(800) 451-6105 Toll free (USA)
(801) 681-8203 Fax
E-mail: **info@mcs-i.com**
http://www.meyerscustomsupply.com

Alpineaire foods, civilian MREs, Mainstay ration bars.

MY BRANDS, INC.
300 Commerce Drive
Rochester, NY 14623
(888) 281-6400 Toll free
(585) 273-8480 Local
(585) 321-9906 Fax
E-mail: **Comments@MyBrandsInc.com**
http://www.mybrandsinc.com

Mail order source for hard to find regional or international brand grocery items. Nido and Klim whole milk powder, Media Creama and Table Cream canned creams, several flavors of canned corned beef I've never heard of before, European, Asian, and Australian grocery items.

NITRO-PAK PREPAREDNESS CENTER
475 West Be Prepared Way
Heber City, Utah 84032
(800) 866-4876 Toll free
(888) 648-7672 Fax toll free (USA)
E-mail: **info@nitropak.com**
http://www.nitro-pak.com

Bulk dehydrated, freeze-dried, storage foods. Datrex and Mainstay ration bars. Mountain House foods and civilian MREs. Water storage containers and filters. Grain mills, #10 can sealer. Oxygen absorbers and Mylar bags.

OUTDOORGEAR UK, LTD
72/74 Palmerston Road
Bournemouth, Dorset, BH1 4JT
00 44 (0)845 644 3270 Voice
00 44 (0)1202 397274 Fax
E-mail: **sales@outdoorgear.co.uk**
http://www.outdoorgear.co.uk

UNITED KINGDOM. A British outdoors shop that carries Vango boil-in-bag food pack entrees and desserts, Kendal mint cake, water purification chemicals, camp cooking gear.

PONDEROSA SPORTS & MERCANTILE, INC.
6854 Highway 55
Horseshoe Bend, Idaho 83629
(208) 793-3121 voice
(208) 793-3133 fax
E-mail: **cliff@ponderosasports.com**
http://www.ponderosasports.com

Food Products: Military MRE's, commercial MRE's, HeaterMeals, and more.

PREPARE 2 SURVIVE
19 Donnelly Drive
Kallangur QLD 4503 AUSTRALIA
(07) 3886 5660 Voice
E-mail: **service@p2s.com.au**
http://www.p2s.com.au

AUSTRALIA. Backpackers Pantry, Back Country Cuisine (New Zealand), AlpineAire, Adventure Foods (Australia) lines of foods. Mainstay rations, camp cooking gear, water filters and purification chemicals.

READY MADE RESOURCES
239 Cagle Road
Tellico Plains, TN 37385
(800) 627-3809 Toll free
(423) 253-2113 Fax
(423) 253-6789 Local
E-mail: **robertg@iol24.com**
http://www.readymaderesources.com

AlpineAire, Mountain House lines of foods. Walton Feed line of dehydrated foods in six gallon super pails, #10 cans, and in bulk. Grain mills, books, water filters, and other preparedness related equipment.

SOUTH SUMMIT CORPORATION
783 N. Grove, #111
Richardson, TX 75081
(800) 234-8654 Toll free
(972) 690-6903 fax
E-mail: **questions@southsummit.com**
http://www.southsummit.com

Mountain House foods, plastic food storage buckets, water filters, water purification chemicals and kits.

SPRINGFIELDS ARMY STORE
76 Station Street/Cross Street,
Burton on Trent
Staffordshire
DE14 1BT
0870 4430364 Voice
0870 4430365 Voice
01283 535616 Fax
Email: **sales@springfields.co.uk**
http://www.springfields.biz/Index.asp

UNITED KINGDOM. A British military surplus store offering GP boil in bag type rations, Reiter ration packs (main meals and desserts), camp cooking gear.

SURVIVAL CENTER, THE
19223 Cook Road
P.O. Box 234
McKenna, Washington 98558
(800) 321-2900 toll free
(360) 458-6778 voice
(360) 458-6868 fax
E-mail: **sales@survivalcenter.com**
http://www.zyz.com/survivalcenter

Pre-packaged food plans. Mountains House freeze dried foods. MRE's. Grain mills. A lot of books.

SURVIVAL UNLIMITED (A division of Picou Builders Supply)
235 N. Airline Hwy
Gonzales La. 70737
(800) 455-2201
(225) 647-2171,
(225) 647-7899 fax
E-mail: **survivalunlimited@hotmail.com**
http://www.survivalunlimited.com

Alpineaire, Mountain House, ration bars, grain mills, Berkefield filters, buckets, Mylar bags, o xygen absorbers, etc.

USA EMERGENCY SUPPLY
238 E. State Rd.
Pleasant Grove, UT 84062
(801) 796-1501 Voice
(801) 796-1512 Fax
E-mail: **info@usaemergencysupply.com**
http://www.usaemergencysupply.com

Bulk foods in #10 cans and six gallon buckets, several year supply packages, MRE components, water filters, and water purification chemicals.

WHEAT MONTANA FARMS
10778 Highway 287
Three Forks, MT 59752
(800)535-2798
(406)285-3614
(406)285-3749 fax
E-mail: **info@wheatmontana.com**
http://www.wheatmontana.com

Wheats, other grains, grain products, beans, small qty and bulk flours as well.

WILDGULF NT
PO Box 476 Borroloola
Northern Territory 0854
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