K-STATE
Kansas State University

Kansas Food*A*Syst

A Food Safety Risk Management Guide for the Producer

Kansas State University Agricultural Experiment Station and Cooperative Extension Service

Authors

Karen Pesaresi Penner, Ph.D., Project Director, Professor and Extension Food Science Specialist, Kansas State University

Scott Beyer, Ph.D., Associate Professor and Extension Poultry Specialist, Department of Animal Sciences, Kansas State University

Donald C. Cress, Ph.D., Extension Pesticide Coordinator, Department of Entomology, Kansas State University

Karen L.B. Gast, Ph.D., Associate Professor and Extension Horticulturist, Postharvest and Marketing, Kansas State University

George Godfrey, Ph.D., Acting Vice President for Academic Affairs, Haskell Indian Nations University

Rhonda R. Janke, Ph.D., Associate Professor and Extension Specialist, Sustainable Cropping Systems, Kansas State University

Dan Nagengast, Executive Director, Kansas Rural Center

Gerald L. Stokka, D.V.M., M.S., Associate Professor and Extension Beef Veterinarian, Kansas State University

Danny H. Rogers, P.E., Ph.D., Extension Agricultural Engineer, Kansas State University

Judy Willingham, Project Manager and Extension Associate, Kansas State University

Publications from Kansas State University are available on the World Wide Web at: http://www.oznet.ksu.edu/library/

Kansas State University Agricultural Experiment Station and Cooperative Extension Service

It is the policy of Kansas State University Agricultural Experiment Station and Cooperative Extension Service that all persons shall have equal opportunity and access to its educational programs, services, activities, and materials without regard to race, color, religion, national origin, sex, age or disability. Kansas State University is an equal opportunity organization. Issued in furtherance of Cooperative Extension Work, Acts of May 8 and June 30, 1914, as amended. Kansas State University, County Extension Councils, Extension Districts, and United States Department of Agriculture Cooperating, Marc A. Johnson, Director.

Kansas Food*A*Syst
Table of Contents

Introduction

Overall checklist for food safety risks during production and marketing

Chapter 1—Beef Cattle Production

Part 1—Feedstuffs and Water Sources 1–1

Part 2—Animal Health 1–3

Chapter 2—Production of Eggs and Home-raised, Home-Butchered Broilers and Turkeys

Part 1—Facilities 2–1

Part 2—Source of Chicks 2–3

Part 3—Feed and Water 2–4

Part 4—Processing Set-up and Procedures 2–5

Part 5—Delivery and Storage 2–7

Part 6—Disposal of Waste 2–8

Part 7—Eggs 2–8

Chapter 3—Growing Vegetables, Fruits and Produce

Part 1—Site Conditions 3–2

Part 2—Wildlife, Vermin, and Other Pests 3–3

Part 3—Water Source 3–3

Part 4—Crop Selection 3–4

Part 5—Crop Production 3–5

Part 6—Post-harvest Operations 3–7

Part 7—Employee Personal Hygiene 3–8

Part 8—Design in Processing 3–8

Part 9—Cleaning and Sanitizing Frequency 3-10

Chapter 4—Safe Water Management

Part 1—Safe Food Processing Water at the Source 4–1
Part 2—Water Treatment and Monitoring 4–3
Part 3—Protection of Water Source 4–5
Part 4—Well/Water System Maintenance 4–7
Part 5—Cross-connection and Backflow Control 4–8

Chapter 5—Wastewater Management

Part 1—Permits and Regulations 5–2
Part 2—Run-off and Crop Production Wastewater 5–3
Part 3—Characteristics of Food Processing Wastewater 5–5
Part 4—Maintenance and Operation 5–7

Chapter 6—Managing Production Waste

Part 1—Reducing and Preventing Waste 6–2
Part 2—Reusing, Recycling, and Composting 6–4
Part 3—Managing Waste and Disposal 6–6

Chapter 7—Processing, Packaging, and Transporting Fresh Foods Safely

Part 1—Packaging and Labeling 7–1
Part 2—Safe Food Temperatures for Transportation 7–4
Part 3—Means of Transportation 7–6

Chapter 8—Safe Handling of Food at Open-air Markets

Part 1—Plan of Operation; Facilities and Utilities 8–1
Part 2—Safe Food Temperatures for Storage and Display 8–3
Part 3—Display 8–5

Introduction

What is Kansas Food*A*Syst?

*Kansas Food*A*Syst* is a confidential, self-assessment program you can use to evaluate the food safety risks in growing and processing foods (both meats and produce) that will be direct marketed to the public. Foods can be contaminated in the field, during harvest/slaughter, during transportation, and while stored or displayed. In many cases, some forethought and planning will prevent or significantly decrease contamination.

We know water quality is important for food processing as well as for drinking, but have you considered the food safety risks if contaminated water is used in irrigating vegetables? What if the vegetable is lettuce—eaten raw and difficult to wash? Composted manure naturally fertilizes and enhances the soil, but it must be handled and applied carefully to avoid food contamination. It makes a difference when the manure is applied, how it is incorporated, and what kind of crop is being fertilized. Again, lettuce fertilized by manure has a higher food safety risk than soybeans.

Who should use Kansas Food*A*Syst?

Many environmental factors can compromise food safety. As a grower interested in producing safe, quality food, you can evaluate the risks that exist on your property, and decide what you can do to decrease those risks. You can complete the assessments one at a time, or all together—it's up to you. The main idea is to take the time to identify the risks that affect your food product's safety; then take voluntary actions to reduce those risks and prevent problems.

Completion of *Kansas Food*A*Syst* materials helps you accomplish three important objectives:

1. Identify situations and actions in your operation that affect food safety.
2. Learn how to manage your operation to decrease food safety risks.
3. Take preventative actions to safeguard against future food safety problems.

What are the Benefits of Kansas Food*A*Syst?

A comprehensive assessment of your operation lays the foundation for planning for the future. Becoming aware of the way you can protect your water sources, improve sanitary food processing procedures, reduce your trash, or choose suitable crops can help you avoid costly mistakes and preserve your financial investment. You can make confident decisions based on accurate information.

It's now up to you.

These *Kansas Food*A*Syst* chapters are not difficult to complete and going through them offers important benefits, the actions you take to prevent problems can also improve your property's resale value. Go through the mini-checklist for an overview assessment.

MINI-CHECKLIST FOR FOOD*A*SYST

This simple checklist highlights areas of concern in food production, and will help you think about the safety risks related to food production. This is a self-evaluation, so be honest with yourself when considering your answer.

The results of your food safety risk assessment are for your use. For more detailed information and a complete checklist, refer to the *Kansas Food*A*Syst* book available through the Kansas State University Research and Extension offices in every Kansas county. In addition to the book, there are bulletins and fact sheets to answer your questions. Specialists are available to help you address the unique issues for your operation.

Each "No" answer indicates where you should look more closely at the conditions and practices in and around your cropland and pasture. *Kansas Food*A*Syst*, various bulletins, and other sources of information can offer you assistance. These resources are available through your county extension office. Start by contacting your county agent. The rest is up to you.

Meat Production	YES	NO
Beef		
1. Are sources of water and feedstuff protected from contamination and inspected regularly?		
2. Are records kept on all animal health products used, including vaccines?		
3. Are pens, processing, and treatment facilities cleaned and inspected regularly?		
Poultry		
1. Are sources of water and feedstuff protected from contamination and inspected regularly?		
2. Are records kept on all animal health products used, observing withdrawal periods?		

Meat Production	YES	NO
Poultry (Cont.)		
3. Is slaughtering done at state or federally inspected facilities or using BMPs for home butchering?		

Fruit/Vegetable Production	YES	NO
1. Are crops grown on land free from sources of contamination		
2. Is irrigation and processing water from a public water supply or a tested well?		
3. Are pesticides and fertilizers always used as the label instructs?		
4. Can field workers easily reach toilets and hand sinks?		

Water Quality	YES	NO
1. Is processing water from a public water supply or a well that meets construction standards and is regularly tested?		
2. If surface water is used for processing, is it continuously disinfected?		
3. If well water is used, has the well construction been checked and found to be in compliance with Kansas standards?		
4. Are all unused wells properly plugged?		

Wastewater Treatment	YES	NO
1. Is all wastewater discharged to a functioning treatment system (no smells or soggy ground)?		
2. Do you use low flow fixtures and make efforts to conserve water?		

Solid & Hazardous Waste	YES	NO
1. Do you compost your organic wastes?		
2. Are your solid wastes stored in vermin-proof containers with lids in place?		
3. Is your solid waste removed to a landfill at least once/week?		

Packaging, Transportation, and Marketing	YES	NO
1. Is all packaging new?		
2. Are all food contact surfaces cleaned and sanitized?		
3. Is the transport vehicle used only for carrying the food products?		
4. Are all potentially hazardous foods stored and transported at hot temperatures of at least 140° F or cold temperatures of 40° F or less?		
5. Are foods sold intact (undamaged, uncut, or in sealed package)?		
6. Are tables and bins clean and used for the same product each market day?		

Chapter 1

Beef Cattle Production

Gerald L. Stokka, DVM, MS, Associate Professor,
Extension Beef Veterinarian, Kansas State University

The goal of this chapter is to assist cattle producers in the production of safe, wholesome and healthy beef and to ensure that cattle produced have met certain standards. To accomplish this goal, standards of production will be emphasized along with record keeping. Hands on training may be necessary to achieve the goals. Although extensive discussion deals with proper record keeping and the use of pesticides and medications, the producer with a small herd may be able to use alternative methods to control illness and insects.

This chapter will cover the following areas:

1. ***Feedstuffs and Water Sources.*** Are water sources and feedstuff storage facilities protected from contamination and inspected regularly? Are records kept on all incoming and raised feedstuffs and water sources?
2. ***Animal Health Products.*** Are all products recorded when used? Are written vaccination and treatment schedules followed on the advice of a veterinarian?

Why should you be willing to make changes to your beef operation?

The demand for safe, wholesome and healthy food is greater than ever. Supplying this demand as beef producers is not difficult, but requires good information, sound decision making and minimal record keeping. This chapter is a guide to help you better understand the condition of your beef operation and how to produce quality animals that meet current demands. Easy-to-understand assessment tables help identify situations and practices that are safe as well as ones that may require prompt attention. Additional information may be obtained from your veterinarian and your county K-State Research and Extension offices.

PART 1—Feedstuffs and Water Sources

A. The water source is protected and checked yearly for contamination. The pasture is protected within reason from chemical, bacterial and viral contamination. The operator maintains a record of any pesticide or herbicide use that could cause a violative residue in grazing cattle or feedlot cattle.

B. Operator maintains a quality control program for water sources and incoming feed ingredients. The program should attempt to eliminate contamination resulting from molds, mycotoxins *(poisons produced by fungi),* and chemical contamination such as pesticides and herbicides.

If feed additives and medications are used the following applies:

a. Only FDA approved medicated feed additives are used in rations.

b. All medicated feed additives are used in accordance with the FDA approved label. Extra-label (over-dosing) use of feed additives is strictly prohibited.

c. Operator assures that all additives are withdrawn at the proper time *in accordance with the label* to avoid violative residues.

d. If the beef operation formulates medicated rations, a formula record of all medicated feed rations produced is kept. Likewise, production records on all batches of feed produced (which contain medicated feed additives), including date run, ration name or number, and amount produced are recorded. *Check with your supplier of the medicated ration for specific information. Don't forget to clean/flush equipment between medicated rations and unmedicated feed.*

e. All records are kept for a minimum of two years from the date of transfer or sale of the cattle, and have the capability of trace-back if necessary.

ASSESSMENT 1—Feedstuffs and Water Sources

Use the table below to rate your risks. For each question, indicate your risk level in the right-hand column. Although some choices may not correspond exactly to your situation, choose the response that best fits. Refer to Part 1 if you need more information to complete the table. Transfer medium-high and high risks to the Action Check list at the end of the chapter on Page 6.

	LOW RISK	LOW-MED RISK	MED-HIGH RISK	HIGH RISK	YOUR RISK
Water Sources (Ponds or streams)	Water source is protected or fenced off and checked quarterly for contamination.	Water source is level with or up-hill from most pollution sources. (No surface water runoff reaches well.)	Water source is downhill from most pollution sources. Some surface contami-nated water runoff may reach well or watering pond.	Water source is directly exposed to runoff from livestock operations or municipal wastewater.	O Low O Low-Med O Med-High O High
Water well	Well uphill from contaminants, properly constructed, protected, and tested quarterly.	Well uphill from contaminants, properly constructed, protected, and tested yearly.	Well level with contaminants, properly constructed, protected, and tested yearly.	Well down-hill from contami-nants, open to run-off, and untested.	O Low O Low-Med O Med-High O High
Feeding facilities	Feed storage is protected from the environment and animal life and is cleaned & inspected for contamination before receiving new loads of feed or feed ingredients.	Feed storage is protected from weather and animal life. No inspection is performed, but cleaning is performed on a regular basis.	Feed storage is in open-fronted commodity sheds with some protec-tion from the weather. No inspection or cleaning is performed.	Feed storage is exposed to the envi-ronment and animal life. In addition, herbicides and insecti-cides are stored in the same area.	O Low O Low-Med O Med-High O High
Forage storage	Enclosed building storage, fed in order of storage (first in, first out).	Covered (tarped) storage, fed in order of storage; moldy material not fed.	Top covered storage, moldy material not fed.	Unprotected from weather; not checking for mold.	O Low O Low-Med O Med-High O High
Pasture contamina-tion	No chemicals applied by self or adjoining landowners.	No chemicals applied by self; adjoining land-owners down hill occasional apply chemicals.	Occasionally apply chemical, usually in accor-dance with label.	Chemical application routine or ignore label instructions.	O Low O Low-Med O Med-High O High
Feed ingre-dients, additives and Medications (if used)	All feeds are sub-ject to testing for feed quality, micro-bial, chemical and mycotoxin con-tamination. Only approved FDA/ USDA/EPA prod-ucts are used.	Minimal testing for quality only. Only approved products used in production.	No testing of ingredients. Most of products used are approved. Minimal supervi-sion of product selection.	No testing of feed ingredients; products are used with-out approval or supervision.	O Low O Low-Med O Med-High O High

PART 2—Animal Health

It is important to make sure that new animals are free from illness before introduction to the herd. Quarantine or isolation may be useful in smaller operations with adequate space. Water and feed sources must also be separate during this time. Producers wishing to raise animals without medications or artificial pesticides will find that extra care initially will prevent illness and decrease the need for treatment. Consult with your veterinarian about standard practices for quarantine and observation, and create a written plan addressing animal health. *If using alternative, nonmedical/nonchemical methods, the producer and his/her veterinarian must develop and follow a written protocol.*

Insect control can sometimes be achieved by eliminating breeding habitat or changing pastures. The first step in insect control is identification. Your county agent has access to identification services and can consult with you regarding the best ways to decrease insect numbers around your operation.

Individual Treatments

K-State Research and Extension offers a program to train producers in the proper use and techniques in administering injections. This program is offered upon demand. Contact your county agent to inquire about participating.

Products and Injections

(Includes hormones, antibiotics, pesticides, etc.)

a. Strictly follow all FDA/USDA/EPA guidelines for product selection.

b. All products labeled for subcutaneous (SQ) use must be administered SQ in the neck or shoulder region.

c. All products labeled for IM (intra-muscular) use must be administered in the neck region only. No injections shall be given in locations other than the neck region, regardless of calf age.

d. Products that cause tissue damage are unacceptable and should be avoided.

e. Products cleared for SQ, IV and oral administration are recommended.

f. Products will never be administered with more than 10 cc per site.

g. Products with low dosage are recommended over those requiring a larger dose.

h. Tag or otherwise identify treated animals so they may be handled properly at sale.

Treatment and Product Use Records

Although sample record forms are shown at the end of this chapter, a complete set of suggested forms are available in the *Beef Quality Assurance Study Manual* as adopted by the Kansas Livestock Association. Contact your county extension office for copies.

a. Treatment regimes shall comply with label directions unless otherwise prescribed by a veterinarian*; this includes dips, boluses and drenches*.

b. Extra-label (dosed more than label directions) drug use shall be kept to a minimum and used only when prescribed by a veterinarian with a valid veterinarian-client-patient relationship.

c. All cattle treated with medications administered extra-label shall comply with prescribed extended withdrawal times that have been set by the veterinarian under the guidelines of a valid veterinarian-client-patient relationship. *Always discuss such changes with your veterinarian.*

Individual Treatments

All animals treated individually for unique problems to the animal shall be recorded individually, include the drug administered, dosage used, approximate weight of animal, route and location of administration, and earliest date the animal could clear the withdrawal period.

Group Processing or Mass Treatments

All animals treated as part of a group (processing or mass medicated) will be group or lot identified, and the treatment information recorded. Identification may be as group or pen, name or lot number, or individual animal identification if available. Reference should be made in the record to the animal lot or group identification, product used, serial/lot number of the product, date treated, dose and withdrawal information assigned to the entire pen. *Recording animals under this system assumes that every animal in the lot or group received the treatment.* All animals treated individually shall be recorded individually, except those mentioned in the next paragraph.

Administering Several Individual Treatments Within a Group Prior to Weaning

a. If several animals within a group of calves are treated with the same drug within a reasonable amount of time, these treatments can be recorded as a group and identification of the individual is not required. This only applies to calves still on the mother cow, prior to any weaning activities. This guideline excludes the need for individual identification while the calf is still on the cow.

b. All such treatments shall be recorded, stating the drug administered, dosage used, approximate weight of the cattle, route and location of administration, and earliest date the entire group of cattle could clear the withdrawal period. An example would be when several calves break with scours and numerous calves are treated within a 10-day period. The entire group of calves would receive a withdrawal date based on the last date of administration of the product with the longest withdrawal period.

c. Animals must be identified individually *when treated after weaning* has taken place.

Withdrawal Prior to Slaughter

a. All cattle shipped to slaughter will be checked to assure that treated animals meet or exceed label or prescription withdrawal times for all products administered.

b. A release slip will be signed and dated by the person who checked the records before animals can be sold into the marketplace or taken to slaughter. The records examination will include processing records, feeding, and hospital notes. *If no products have been administered, a statement to that effect should be provided.*

c. All cattle sold that are not typical of the herd, (medicated culled cows and realizer/salvaged feeder cattle) shall be subject to verification of drug withdrawal. Should there be any question about withdrawal periods being met, the veterinarian will evaluate the treatment history against information provided by the **Food Animal Residue Avoidance Databank (FARAD),** and the animal will be subject to pass a residue screening test such as the **Live Animal Swab Test (LAST)**. Residue screening shall be performed under the supervision of a veterinarian. The results of such testing will determine the appropriateness for releasing for shipment. Negative results from residue screening cannot be used to shorten the labeled withdrawal time. The beef operation will collect random urine samples for residue testing from animals that have received extra-label drugs as directed by their veterinarian and sold for non-performance.

d. The beef producer assures that all pesticides are used according to FDA/EPA label directions. The operation will record all pesticide use such as pour-ons or injectables including product ID, lot/serial, date used, amount used, and withdrawal time.

Record Keeping

a. By law, all records must be kept for a period of two years from the release of the cattle from the operation.

b. A copy of the appropriate records will move with the cattle as they are transferred from one beef operation to another. This paper trail includes:

- all treatment records, individual and group
- all processing and vaccination records
- other information as deemed appropriate

c. Should unacceptable levels of residues be found in any of the cattle shipped for slaughter, the beef operation will make applicable records available to **Food Safety Inspection Service (FSIS)** and FDA personnel and to veterinary personnel to determine the source and cause of the violative residue, and corrective action taken to prevent reoccurrence of such violation.

d. Records can be kept on a computer or in written form, as long as they include the medications/pesticides used and the dates administered to the animal(s), and allow for verification of actions taken. Existing records will do, if all aforementioned qualifications are met.

Carcass Quality

The beef operation will strive to prevent bruising during animal handling. When possible, bruising rates will be monitored at the packing plant.

Cattle Origin

a. All cattle enrolled in the program shall have complete records. This includes the ranch at which the cattle were born, any facility such as a back grounding operation at which the cattle were kept prior to a finishing feedlot, as well as the feedlot that feeds the cattle for slaughter. No operation that houses the cattle for more than two days shall be exempt from this requirement.

b. For participants in the program, all operations that house cattle for less than two days, but administer a product (vaccine, medication, medicated feed, pesticide, etc.), which requires withdrawal, will be required to complete appropriate records and be certified.

c. For participants, a signed copy of the records developed at the ranch and backgrounding facility shall be forwarded to the feedlot at the time of delivery. In essence, these records shall stay with the cattle from birth to slaughter.

d. Complete records offer documentation for designation as "organic" or "natural" in the case of a producer marketing such products.

ASSESSMENT 2—Animal Health

Use the table below to rate your risks. For each question, indicate your risk level in the right-hand column. Although some choices may not correspond exactly to your situation, choose the response that best fits. Refer to Part 2 if you need more information to complete the table. Transfer medium-high and high risks to the Action Check list at the end of the chapter on Page 6.

	LOW RISK	LOW-MED RISK	MED-HIGH RISK	HIGH RISK	YOUR RISK
Cattle handling & facilities	Inspected prior to use for potential repairs and proper design. Cattle and human safety are of paramount importance.	Facilities are tested on the day of need. Emphasis is on smooth flow of cattle.	Facilities are only inspected when in need of repair. Minimal expense and getting the job done is the only consideration.	Facilities are non-existent. Cattle handling becomes a dangerous chore.	O Low O Low-Med O Med-High O High
Cattle health products	Use of all vaccines, antibiotics and other health products on a herd basis are recorded and individual animal treatment records are maintained. A veterinarian is consulted for all of these decisions and a strict schedule is followed.	A veterinarian is consulted for decisions related to health issues, but no written schedule is kept. Individual animal treatment records are kept.	Health products are purchased and used according to information from sales reps, feed dealers and neighbors. No written schedule or individual animal treatment records are kept.	No records of any animal health products are maintained. No information on any animal is available on possible residue withdrawal times.	O Low O Low-Med O Med-High O High
Animal injections	All injections are given as per label and when given a choice only subcutaneous injections are used. Injections are only given when absolutely necessary.	All injections are given as per label. Some injections may not be necessary.	Injections are mostly given in the neck region, unless this is inconvenient. Injections are often unnecessary.	Label instructions are not followed. Injections are given in the top butt without consideration of carcass quality. Injections are given without veterinary advice.	O Low O Low-Med O Med-High O High
Sanitation	All facilities including pens, housing, chutes and feeding facilities are kept clean and disinfected routinely. All procedures including injections or veterinary procedures are done using sanitary practices.	Facilities are cleaned regularly. Sanitary procedures for veterinary procedures are followed.	Minimal cleaning of facilities is followed. Sanitary practices for veterinary procedures are minimal.	Facilities are not cleaned at all, buildup of manure and filth makes sanitation impossible. Sanitary practices are not followed for veterinary procedures.	O Low O Low-Med O Med-High O High

ACTION CHECKLIST

When you finish the assessment tables, go back over the questions to ensure that every high and medium-high risk you identified is recorded in the checklist below. For each risk, write down the improvements you plan to make. Use recommendations from this chapter and from resources elsewhere. Pick a target date that will keep you on schedule for making the changes. You do not have to do everything at once, but try to eliminate the most serious risks as soon as you can. Often it helps to start with inexpensive actions.

ACTION CHECKLIST—Beef Cattle Production

Write all high and medium-high risks below.	**What can you do to reduce the risk?**	**Set a target date for action.**
Sample: Incomplete records on immunizations.	Identify each animal, set up a record chart, and add treatments/ immunizations as they occur.	Begin today

Additional information

Websites:

http://www.oznet.ksu.edu/ Kansas State University Research and Extension; most publications are available through this site.

Beef quality assurance information site maintained by the University of Nebraska at Lincoln: *http://www.bqa.org/ncbqa.htm*

These websites are maintained by North Carolina State University and are environmental risk assessments that relate to the topic indicated. All materials can be downloaded.

Grazing *www.soil.ncsu.edu/publications/farmassist/Grazing*

Natural resource protection *www.soil.ncsu.edu/publications/farmassist/NatResources*

Integrated Pest Management *www.soil.ncsu.edu/publications/farmassist/IPM*

Free Livestock Yards Management Software

A free livestock yards management software program is available on the Internet. The program provides an overview of manure types and proper management systems for different animals including cattle, swine, sheep, poultry, and horses. Users can evaluate their own risk through the interactive questionnaire, and receive suggestions for reducing the threat to their water supply. To download this program, go to the following URL: *http://www.epa.gov/seahome/yards.html*

Kansas State Research and Extension Bulletins:

C-735 *Beef Cow Nutrition Guide*

AF-150 *Beef Records: The Key to Profitability*

MF-185 *Field Record Book*

SB-638 *Growing Cattle on Grass* (electronic only)

C-733 *Questions and Answers for Beef Cattle Nutrition*

Food*A*Syst Helps Ensure Your Safety

This *Food*A*Syst* handbook covers a variety of topics to help you examine and address your most important food safety and environmental concerns. See the complete list of chapters in the table of contents at the beginning of this handbook. The end of each chapter lists resources and other useful information. For more information about topics covered in *Food*A*Syst*, or for information about laws and regulations specific to your area, contact your local environmental health or county K-State Research and Extension office.

Kansas Food*A*Syst Team Members:

Karen Penner, Ph.D., Project Director and Extension Food Science Specialist, Department of Animal Sciences, Kansas State University

Scott Beyer, Ph.D., Associate Professor, Extension Poultry Specialist, Department of Animal Sciences, Kansas State University

Donald C. Cress, Ph.D., Extension Pesticide Coordinator, Department of Entomology, Kansas State University

Karen L.B. Gast, Ph.D., Associate Professor, Extension Horticulturist, Postharvest and Marketing, Kansas State University

George Godfrey, Ph.D., Acting Vice President for Academic Affairs, Haskell Indian Nations University

Rhonda R. Janke, Ph.D., Associate Professor and Extension Specialist, Sustainable Cropping Systems, Kansas State University

Dan Nagengast, Executive Director, Kansas Rural Center

Danny H. Rogers, P.E., PhD., Extension Agricultural Engineer, Biological and Agricultural Engineering, Kansas State University

Gerald L. Stokka, DVM, MS, Associate Professor, Extension Beef Veterinarian, Kansas State University

Judy Willingham, Project Manager, Extension Associate, Department of Animal Sciences and Industry, Kansas State University

Examples of various forms to record animal health and treatments:

PEN TREATMENT RECORD

Pen No._____ Lot No._____ Date Rec'd._____ Date Processed_____ Vaccine _____ Ser. No. _____

No. Head_____ In Wt._____ Implant_____ _____ _____

_____ Dip/Pour-on_____ _____ _____

Date Pulled	Hosp. Tag No.	Diagnosis	Day 1		Day 2		Day 3		Day 4		Pen C
			Temp	Treatment	Temp	Treatment	Temp	Treatment	Temp	Treatment	

Treatment Record for Individual Cattle

Animal ID:_____ **Home Group/Pen:**_____ **Color:**_____

Rx = medication name, WD = withdrawal time

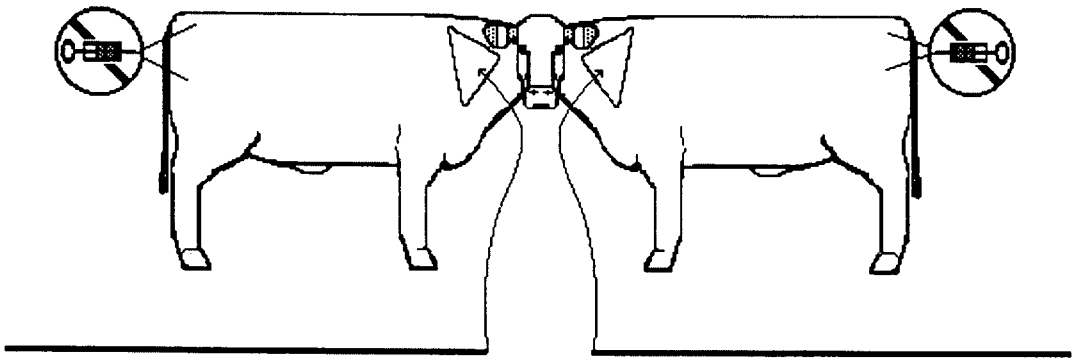
Date:	Diagnosis	Temp	Severity (1-5)	Rx 1	Rx 2	Rx 3	Rx 4	Comments:	WD

Cattle Health and Information Transfer Record

Name: _____, Address: _____

City: _____, State: ____, Zip:_____ Ph:_____

Identify Brand and Indicate Location



List "Procedure Number" on the line above which corresponds to the side of the cattle the injection was given. Give all injections within the Injection Triangle.

When possible select SubQ products, and never give injections in rear leg or top butt.

List of Common Procedures:

Respiratory virals, Clostridials, Pasteurella, H.somnus, Brucella,
Internal Parasites, Coccidiostat, External Parasites, Implants, Antibiotics,
Creep/Bunk Broke, Micro-Nutrients, Medicated Feed

Circle procedure preformed and list on numbered line in table below AND list number on line above that corresponds to the side of the cattle the injection was given.

NOTE: Use the Injection Triangle for all shots.

Procedure / Procedure #	Lot or Serial #	Company	Date Given	Date Withdrawal	Route Admin	Dose	Booster N/Y-when	Crew Initials
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								

Number of Cattle:_____Date Weaned:_____, Dehorned (Yes / No)

Bulls _____,Steers _____(method_____),Heifers ____ (Spayed: No/Yes = method_____),

ID: Right Ear or Left Ear/Group color and number: _____ /Individual (as appropriate):_____.

Description / Comments:_____.

Owner Signature:_____Date:_____

Veterinarians Signature: _____ Phone: _____

Processing Map

When possible select SubQ products,
never give injections in the rear leg or top butt.

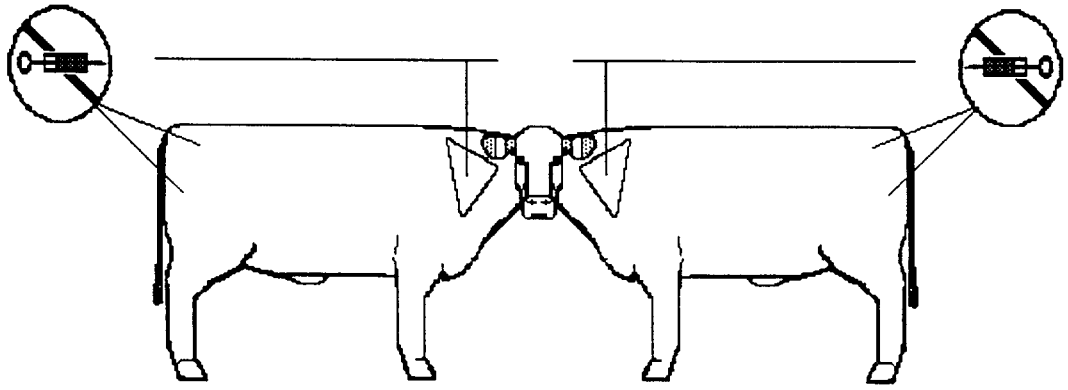
Date: _____ **Time**: _____ **Air Temperature**: _____

In Weight (Average/Variation): _____ / _____ **Breed**: _____

Frame: S, M, ML, L **Muscle**: 1, 2, 3 **Sex**: S, H, B

ID: Right Ear or Left Ear/Group color and number: _____ /Individual:_____

List "Treatment" Number on line connecting Injection Triangle & indicate ear implanted



Identify Brand and Indicate Location

Implant: R /L _____ Serial #: _____Crew: _____

External Parasite control _____ Dose: ____Serial #:_____Crew: _____ WD:____

Internal Parasite control _____ Dose: ____Serial #: _____Crew: _____ WD:____

R1:_____ Dose: ____Serial #: _____Crew: _____ WD:____

L1:_____ Dose: ____Serial #: _____Crew: _____ WD:____

R2:_____ Dose: ____Serial #: _____ _____Crew: _____ WD:____

L2:_____ Dose: ____Serial #: _____Crew: _____ WD:____

Comments:_____

Signature: _____

Chapter 2

Production of Eggs and Home-Raised, Home-Butchered Broiler and Turkeys

Scott Beyer, Ph.D., Associate Professor and Extension Poultry Specialist, Department of Animal Sciences, Kansas State University

Rhonda R. Janke, Ph.D., Associate Professor and Extension Specialist, Sustainable Cropping Systems, Kansas State University

Home-raised, home processed poultry is becoming a popular alternative farm enterprise. The scale of operation may be small; only a dozen or twenty broilers raised in one's back-yard for home consumption, or up to several thousand broilers. Note: Kansas state law allows producers to home process up to 1,000 birds per year for direct marketing to the consumer. More than that must be processed with state or federally inspectors present. Call the Kansas Department of Agriculture meat and poultry inspection program at: (785) 296-3513 for specific information.

With the proper information, individuals may raise and process broilers using simple equipment, and achieve results with no more food safety risk than broilers purchased at the supermarket. However, each step in the process must be considered, and care taken to reduce risk, so that the final product is wholesome and safe. These steps are outlined below, with risk factors noted. The wise producer develops a written plan to address both prevention of diseases and infestation, as well as control measures to be used if necessary.

Some home-raised, home-processed birds are being raised according to certified organic standards, others are raised without the use of medicated feeds or antibiotics, but are not certified organic, and others are raised in varying conditions. Increased consumer demand, premium pricing, and personal preference are reasons for raising meat and eggs without antibiotics. Consult your organic certifier for specific details on guidelines that apply. Most certification standards require 100% certified organic feed and no use of antibiotics. Some allow vaccination; most allow mineral and vitamin additives. Diatomaceous earth and pro-biotics are allowed for parasite and disease control. Pro-biotics are fed to promote animal health by competing with pathogens or by improving digestion and nutrient absorption. Some poultry diseases are more difficult to control without the use of medicated feed or water, but it is possible to keep them at reduced levels. Good sanitation, protected (shaded) and clean pens, balanced rations, clean water, and starting with healthy chicks are good practices for all farms.

The food safety guidelines discussed in this chapter are designed to apply to both the certified organic farms and those that are not organic. The following areas will be covered:

Part 1: Facilities

Part 2: Source of Chicks

Part 3: Feed and Water

Part 4: Processing and Set-up Procedures

Part 5: Delivery and Storage

Part 6: Disposal of Waste

Part 7: Eggs

How to use these self-assessment tables:

Use the tables on the following pages to rate your risks. For each question, indicate your risk level in the right-hand column. If a practice does not apply to you, skip that item and continue. Although some choices may not correspond exactly to your situation, choose the response that best fits. Refer to the information preceding each table if you need explanation. After you complete the tables, transfer all the Medium-High and High risks to the Action Check list at the end of the chapter on Page 2-9.

Part 1—Facilities

(Note: it is assumed that chicks from day 1 to about 3 weeks of age are raised in an enclosed, heated area with fresh food and water. Most of the guidelines below apply to birds that are at least 4 weeks of age, and either being raised as broilers or laying hens).

Good Management practices for home-raised poultry:

- A clean, stress-free environment allows the birds to resist disease.
- Labor decreases when flocks are kept in low-density conditions (3-4 sq.ft/bird) because clean up is easier and the lower density stresses birds less.
- Anytime poultry are tightly confined, the area should be cleaned daily.

- Growing pens and equipment for the poultry operation should be dedicated for that use only.
- Rodents should not be allowed in growing areas, feed storage areas, or near the live birds; they are known carriers of disease.
- Provide adequate shelter; heat and cold stress will increase disease susceptability.
- Mortalities should be removed upon discovery and the flock should be checked at least daily.

Assessment 1—Facilities

	LOW	LOW-MEDIUM	MED-HIGH	HIGH	Your Score
Area	Clean outdoor area or confined grazing pen with grass, moved daily (as with a "chicken tractor"), uncrowded conditions, or raised indoors with little or no crowding.	Confined to grazing pen, moved frequently but not daily. Confined to pens or cages in buildings with some exercise possible.	Confined to grazing pen, not moved frequently, wet or unsanitary conditions, or raised indoors at high density, little or no clean litter on floor.	Raised in closed, dirty building, little air circulation, <0.7 sq. ft./bird. Free-range birds have access to insecticides or other toxic chemicals.	O Low O Low-Med O Med-High O High
Previous use of production area	No previous poultry or other animal production.	Previously used for animal production, but area and equipment thoroughly cleaned.	Previously used for animal production; equipment partially cleaned.	Area previously used; not cleaned between restocking.	O Low O Low-Med O Med-High O High
Rodent control	Rodents are controlled when observed using mechanical means (traps).	Rodents controlled with traps and approved rodent bait, with precautions to prevent bird access to bait.	Rodents not well controlled. Poison is first line of defense. Bird access to bait somewhat limited or prevented.	Rodents not controlled,-or-poison used for control and is within reach of birds.	O Low O Low-Med O Med-High O High
Comfort	Shade and rain shelter provided if out-doors. Draft-free place at night, with off-ground roosts for older birds. If indoors, fresh air and sunlight available.	Only roofed shelter provided with off-ground roosts for older birds.		No shelter for outdoor birds. Indoor birds raised under crowded conditions with little fresh air, high ammonia concentration.	O Low O Low-Med O High
Flock mortality	Pens clear of vision obstructions, checked twice daily and mortalities removed.	Pens clear of vision obstructions, checked daily and mortalities removed.	Pens mostly clear of vision obstructions, checked every two days and mortalities removed.	Areas of pens not easily visible or mortalities become putrid before removal.	O Low O Low-Med O Med-High O High

Part 2—Source of Chicks

The general successful growth and good condition of the flock begins with the chicks. High quality, disease-free chicks are important for a healthy, high-producing flock. Purchase chicks from a reputable company. Look for those that participate in the **National Poultry Improvement Program (NPIP);** they will have met national criteria. The company that produces the chicks should be able to provide information about immunization of their flock and the breed(s) they have. Request chicks that have been vaccinated against Marek's Disease. The lowest risk of disease is found in vaccinated flocks. The time and money spent preventing disease pays off in better growth and condition, not to mention avoiding the expense of treating a disease.

Inspect chicks for lice and mites before releasing them in your facility. If found, either refuse the chicks or isolate them and treat until control is established. In addition, be aware that wild birds are a source of lice and mites and must be prohibited from nesting on or around the enclosure. Your local extension agent can assist you in identifying pests and determining appropriate control methods for your operation.

For most producers, buying chicks fits in with the limits of space and time they face. Breeding your own birds or allowing the hens to brood, is more time consuming than one might think, and requires separate space for breeding. Should you wish to produce your own chicks, be sure that your hens are healthy and that you know their genetics. To further prevent the spread of disease, clean the eggs to be incubated or brooded by the hen.

Choose a breed that is best suited for your specific requirements. For example, never choose a heavy weight breed for egg production.

Assessment 2—Source of Chicks

	LOW	LOW-MEDIUM	MED-HIGH	HIGH	YOUR SCORE
Commercial Flock	Reputable company with history of excellent flock health and genetics; stock vaccinated.	Reputable company with history of excellent flock health and genetics; stock unvaccinated.	Purchased from commercial flock with unknown record; stock unvaccinated.	Purchased from commercial flock with poor history of controlling health problems; stock unvaccinated.	O Low O Low-Med O Med-High O High
Local source	Purchased from local breeder with good flock health history; stock vaccinated.			Local breeder with questionable flock health history or known outbreaks of disease.	O Low O High
Self-raised	Eggs from healthy hens, known genetics, eggs clean during incubation or hatched by hen.			Dirty eggs from unhealthy hens with unknown or poor genetics.	O Low O High

Part 3—Feed and Water

Once healthy chicks are obtained for your flock, you want to keep them that way. Young animals of any sort are more sensitive when exposed to poor quality food and water. Therefore, providing safe food and water is the basis for maintaining a healthy flock until time for harvest.

Feed should be a balanced mixture compounded from freshly processed grains. Fresh means you have had the feed for no more than 3 months. If mold or a rancid odor is noticed, the feed is unsuitable for your flock, and should be discarded. Be sure to check feed labels for added medications and if present, use the food in accordance with the labeled directions. Withdrawal times must be observed if the poultry (or any other product) is to be free from the medication. When needed, it is recommended that adding medications to the water is a better choice than using medicated feed. Withdrawal of medicated water is far easier than attempting to remove scattered feed. Under no conditions should medicated poultry feed be given to another species. For more information about nutritional requirements (including vitamins and minerals), see *Poultry Nutrition for Small Flocks,* (which you can print from the K-State Research and Extension publication Web site: *http//www.oznet.ksu.edu/library/lvstk2/welcome.htm#poultry).*

Water can introduce disease into the flock. The water source is safest if supplied by a public or municipal water supply. If a farm well is used, it should be properly constructed so that it is not subject to contamination, and it should be tested quarterly for both nitrate and coliform bacteria. If coliform bacteria are found, the well should be sanitized and re-tested. Failure to obtain coliform-free water, indicates the need to evaluate construction of the well and water distribution, and may eventually require the use of a disinfection unit. More information is available about well construction, sanitizing, and testing in Chapter 4, Safe Water Management. Observe these cautions about providing water:

- Never use water that is cloudy or rusty in color.
- Keep equipment clean; sanitize before each new batch of chicks (see Chapter 7, Packaging and Transportation, Page 7-2 for use of sanitizing solutions).
- Provide fresh water each day; check later for refill —especially in hot weather.
- Modern “nipple” type drinkers reduce labor and decrease the risk of spreading disease.

Assessment 3—Feed and Water

	LOW RISK	LOW-MED	MED-HIGH	HIGH	YOUR RISK
Feed source[1]	Feed includes a balanced mixed ration from fresh or stored grain in good condition.	Feed includes fresh or stored grain in good condition.	Feed includes any available grain, without regard to balancing the ration or grain quality.	Moldy or other out-of-condition grains fed, inadequate diet for healthy birds.	O Low O Low-Med O Med-High O High
Feed storage	Feed stored in mouse/rat-proof containers, kept clean and relatively insect-free. Used within 1 month.	Feed has been stored on farm 1-3 months before use.	Feed has been stored on farm more than 3 months before use.	Feed may be several years old, stored in the open; rodent droppings evident.	O Low O Low-Med O Med-High O High
Water source	Water is from municipal water supply.	Water is from a properly constructed & recently tested farm well with no coliform bacteria found.	Water from properly constructed, but untested farm well.	Water from farm well with known pollutants, or from surface water without treatment.	O Low O Low-Med O Med-High O High
Water presentation	Water containers sanitized between batches of chicks, and cleaned periodically. Fresh water supplied daily.	Containers cleaned between batches of chicks. Fresh water every 1 or 2 days.	Containers may be rinsed but not cleaned between batches. Fresh water only when they run out - may be 3 days or more.	Containers not clean. Water not fresh.	O Low O Low-Med O Med-High O High
Medications	No medications used or only medications recommended by veterinarian used when needed; withdrawal periods followed closely.	Medications or medicated feed used routinely, withdrawal periods followed closely.	Feed is medicated. Sometimes remember to follow withdrawal period.	Not sure if feed is medicated. Not aware if there is a withdrawal period, or have never taken birds off medicated feed prior to slaughter.	O Low O Low-Med O Med-High O High

1 Note: Certified organic broilers and laying hens must be fed 100% certified organic grains in addition to the management practices listed in this question. The feed ration may also not contain any animal by-products or manures, or medications. Some ethnic groups do not allow feed rations to include animal by-products, e.g. “Halal” meat. If selling to these markets, please be aware of dietary restrictions. The questions in this guide deal primarily with food safety issues related to short-term transfer of pathogenic organisms from food animal to human. Long-term issues such as antibiotic resistance are not dealt with here.

Part 4—Processing Set-up and Procedures

Cleanliness and food safety can be improved before processing begins. Begin with cleaned and sanitized utensils and work surfaces. Easily cleanable, non-corrodible surfaces like stainless steel are best. Plan ahead to keep the processing area clean during use.

Birds raised in clean surroundings carry less dirt into the processing area; therefore, the effort to clean pens daily carries over to processing.

Withdrawal of feed the evening before processing is very important. This allows digestion to be completed so that no feed matter remains in the bird's digestive system. Be sure to remove anything edible from the pen (including old litter) so that the birds do not ingest other things when the feed is withdrawn. The goal is for the birds' digestive systems to be as empty as possible.

Divide the work area into four areas: killing, picking and eviscerating, final rinse, and chilling. The first two steps should be separated from the last two to avoid carryover of contaminants, or cross-contamination. Each step should be progressively cleaner, so that the birds being chilled are the cleanest. See K-State Research and Extension bulletin EP-71, *Processing Farm-raised Poultry*, for complete instructions.

Assessment 4—Processing Set-up and Procedures

	LOW	LOW-MED	MED-HIGH	HIGH	YOUR SCORE
Work area	All surfaces are washed and sanitized prior to use. Are kept clean throughout process. Stainless steel or clean/new plastic surface.	Surfaces washed with soap and water but not sanitized (with household bleach, for example).	Wood or other hard to clean surface used. Area rinsed with fresh water.	Work area subject to dust or other contaminants, not cleaned or sanitized before use.	O Low O Low-Med O Med-High O High
Utensils	Knives and other utensils are sanitized and sharpened frequently.			Soiled knives and other utensils used.	O Low O High
Scalding	Water is from safe drinking water supply, is heated to at least 140°F, and is changed frequently.	Water is from untested water supply, is heated to boiling before use, and is changed frequently.	Water is from untested water supply, is heated to at least 180°F, and is changed frequently.	Water is not from safe drinking water supply, is not maintained at 140 °F, and is never changed.	O Low O Low-Med O Med-High O High
Worker training and technique	Workers use safe procedures[1], hands are washed with soap & disposable gloves are used; no cloth towels used.	Workers use safe procedures[1], hands are washed with soap; no cloth towels used.		Workers hands are not washed, cloth towels in use; intestinal material contaminates outside of carcass.	O Low O Low-Med O High
Chilling tank water source and temperature	Water & ice is from public drinking water; is 33° F (icy slush) for chilling cleaned broilers.	Water & ice is from public drinking water source; is ≤40° F & a layer of floating ice for chilling cleaned broilers.	Water & ice is from tested home well; is ≥40° F & includes some ice for chilling cleaned broilers.	Water is not from safe drinking water supply; no ice present in chill bath.	O Low O Low-Med O Med-High O High
Holding time & temperature	Chilled broilers held between 33–40 ° F for >4 hours or until delivery	Chilled broilers held between 33–40 ° F for 2–4 hours or until delivery.	Chilled broilers held between 40–45 ° F for 2–4 hours or until delivery.	Chilled broilers held above 45 ° F until delivery.	O Low O Low-Med O Med-High O High

[1]Safe procedures: Remove entrails without puncture, keep entrails separate from carcass, or only remove leg and breast meat without removing entrails. Examine organs (intestine, heart, liver) for deformities, lesions, off-color and discard un-healthy birds.

When cutting up the carcass, sharp utensils, used with care, make the job much easier and faster. After the carcass has been eviscerated and washed, it must be chilled as rapidly as possible. **The target temperature for the carcass is 40°F or less within one hour.** Measure temperature with a probe type, dial thermometer inserted in the thigh. These thermometers are usually less than $10.00, and are found in the cooking supply section in most discount or hardware stores.

Ice water slush is a very good way to rapid chill, and keeping the slush bath in an insulated container (like a large cooler) helps to hold the cold temperature longer. Putting warm carcasses into the slush bath will melt the ice, so it is necessary to keep additional ice on hand that can be added to keep ice in the bath. In addition, there should be enough slush so that each carcass can move freely in the bath. Avoid crowding the slush bath. If larger numbers of birds are being processed, plan to have several slush baths to accomplish a rapid chill.

A simple way to monitor the carcass temperature is to insert the probe thermometer in the thigh of the last bird placed in the slush bath. Leave it there. Check the temperature frequently, adding ice to the slush bath as needed so that ice is always present in the water. If there are more than 10 birds being chilled, plan to use a sanitized utensil to "stir" the water to help keep the temperature uniformly cold. All carcasses should reach 40°F within one hour after killing.

Plan to kill and process birds in small batches if you are working alone, or with a small labor force. Only kill the number of birds that you can scald, pluck and eviscerate within 15 to 30 minutes. An eviscerated (gutted) carcass will cool more quickly and thoroughly than a carcass that has not been eviscerated.

When the carcass temperature has dropped to below 40°F, it is a good practice to hold the broilers for a period of time at temperatures as close to 33°F as possible. This allows for rigor mortis to occur and produces tender meat. A good way to safely achieve this is to layer the carcasses with ice in an insulated cooler for the holding time.

This holding time should be 2–4 hours minimum, with 6 hours being preferable.

The food contact surfaces like utensils, table tops, cutting boards, etc. should be smooth and impervious. After cleaning to remove visible soil and debris, sanitizing these surfaces is important to control bacterial growth. A simple, effective sanitizing solution is one tablespoon of household bleach to a gallon of clean tepid water. Because the solution loses strength, it should be made up fresh every hour during use. This solution can be used as the final rinse in utensil washing, and also for final wipe-down of large surfaces. Allow sanitized surfaces to air dry.

Part 5—Delivery and Storage

It is a good practice to individually bag each broiler. Not only does this keep the food from contamination, but it allows the birds to freeze faster and also to thaw more evenly for use. In any event, storage temperature of processed birds must never exceed 40°F.

Assessment 5—Delivery and Storage

	LOW RISK	LOW-MED	MED-HIGH	HIGH	YOUR SCORE
Containers	New plastic bags are used for each broiler; labeling complete.	Broilers are placed into clean, sterilized ice chests; labeling complete.	Broilers are placed into clean but not sterilized ice chests; labeling complete.	Broilers are placed into bags or ice chests that may not be clean; labeling absent.	O Low O Low-Med O Med-High O High
Storage	Broilers are chilled (below 40° F) and delivered or picked up or frozen immediately.	Broilers are chilled and picked up or frozen within 24 hours.	Broilers are chilled and are picked up or delivered more than 24 hours after processing.	**Broilers are not chilled immediately or kept chilled until pick-up or delivery.**	O Low O Low-Med O Med-High O High

Part 6—Disposal of Waste

Processing poultry produces a large amount of wastewater and a lesser amount of solid waste. The amount of waste increases in direct proportion to the increased number of birds being processed. It is a good idea to consider options for handling the waste in the future if you anticipate a larger production.

The best disposal is to a municipal collection system. Wastewater cannot be legally discharged to ponds, streams, or the ground surface. The wastewater from poultry processing will be high in organic matter as well as bacteria, and its discharge to anything other than a treatment system is environmentally irresponsible. Wastewater from smaller production runs may be put into a residential septic system, but be aware that the system was not designed for this type of use and may prematurely fail. Residential waste stabilization ponds (lagoons) may have capacity to treat the wastewater if the pond level is usually at least three feet from the top of the dikes. The use of a holding tank may be an option.

Solid wastes (feathers, heads, feet, and viscera) may be composted successfully if the amount is small and recommended guidelines are followed. Check the resource list at the end of this chapter for extension bulletins covering composting.

Assessment 6—Disposal of Waste

	LOW RISK	LOW-MED	MED-HIGH	HIGH	YOUR SCORE
Waste water	Wastewater disposed of through municipal sewer system or home septic system without surfacing.		Wastewater goes to septic system, but may ooze to surface; local animals have access to the water.	Wastewater discharges to ground surface or into pond or stream.	OLow O Med-High O High
Heads, feet, feathers, and viscera	Waste products incinerated or rendered -or- buried more than 12 inches deep, (only where local water table is deep)- OR- is properly composted. No animal access.	Waste products buried in shallow pit or composted; animal access is prevented	Waste products buried in shallow pit or composted, but animals have access and may dig them up.	Waste products left in pile to decompose. Odor and animal access a problem. Waste products enter a local water body or stream.	O Low O Low-Med O Med-High O High

Part 7—Eggs

Egg quality is best at the moment the egg is laid. Quality deteriorates with time, but the rate of decline can be slowed by some simple safety practices. Eggs should be collected at least daily and cleaned with warm soapy water, then immediately placed under refrigeration at 40°F. Hands should be washed before handling eggs and clean containers should be used to collect eggs.

Nesting boxes should be kept clean, especially from fecal matter. Fecal matter is the usual source of *Salmonella* contamination, not the egg itself. Any eggs left under a broody hen should be dated with a pencil to ensure that these eggs are not consumed. The lowest risk packing container is one that has not been used before. If egg cartons are reused, they must be clean with no egg debris or soil, and relabeled in accordance with Kansas law. Labeling must obliterate the grade, the company name, the USDA seal, and the "K" number (a Kansas permit number). The label must say, "Keep Refrigerated" or something similar. If you want to sell the eggs as graded, you must be in full compliance with Kansas law, and you should contact the Kansas Department of Agriculture at (785) 862-6574. In order to sell to commercial establishments such as a restaurant or grocery store, eggs must be graded. Eggs sold directly to the consumer do not have to be graded.

Assessment 7—Eggs

	LOW RISK	LOW-MEDIUM RISK	MEDIUM-HIGH RISK	HIGH RISK	YOUR SCORE
Gathering Eggs	Eggs are gathered once or twice a day. Hands are clean and nests are clean.	Eggs are gathered once daily. Nests are generally clean.	Eggs gathered daily most of the time but not always. Nests are not clean.	Eggs are not gathered daily. Nests not clean. Eggs found in clusters around farm without knowing when they were laid.	O Low O Low-Med O Med-High O High
Initial container	Baskets or cartons are clean.			Baskets or cartons have dust, manure, or other soil on them.	O Low O High
Cleaning eggs	Eggs are clean to start with or are brushed clean, hands washed.	Eggs washed with warm soapy water if not clean, hands washed.	Eggs are cleaned by wiping with damp cloth, hands washed.	Eggs not washed even if soiled or hands not washed before handling eggs.	O Low O Low-Med O Med-High O High
Final container	Containers are new with complete labeling.	Containers are recycled, but are clean and properly labeled.	Containers recycled, and may be have been stored in barn or garage.	**Containers not clean; labels absent or inaccurate.**	O Low O Low-Med O Med-High O High
Storage & sale	Eggs stored in refrigerator at 40°F once gathered, and sold within one week.	Eggs refrigerated at 45°F, but not sold within one week.	Eggs not refrigerated continuously. Date of sale not noted.	**Eggs not refrigerated.**	O Low O Low-Med O Med-High O High

ACTION CHECKLIST

When you finish the assessment tables, go back over the questions to ensure that every high and medium-high risk you identified is recorded in the checklist below. For each risk, write down the improvements you plan to make. Use recommendations from this chapter and from resources elsewhere. Pick a target date that will keep you on schedule for making the changes. You do not have to do everything at once, but try to eliminate the most serious risks as soon as you can. Often it helps to start with inexpensive actions.

Action Checklist: Production of Eggs and Home-Raised, Home-Butchered Broilers and Turkeys

Write all high and medium-high risks below.	What can you do to reduce the risk?	Set a target date for action.
Sample: Water containers are slimy.	Scrub containers until clean; plan to clean and sanitize thoroughly each Monday.	Begin today.

K-State Research and Extension bulletins available from your county Extension office:

Packing Eggs on the Farm for Direct Sales, MF2307.

Processing Farm-Raised Poultry, EP-71.

Resource Guide for Owners of Small Poultry Flocks, MF2306.

P*oultry Nutrition for Small Flocks,* (electronic only).

Management of the Small Flock of Chickens, MF2390.

Preventing Hens from Eating Eggs, EEP69.

Cannibalism in the Small Poultry Flock, MF2336.

Eliminating Mites in Poultry Flocks, MF2387.

Prevention and Control of Poultry Diseases, L754.

Controlling House Mice, MF1123.

Controlling Rats, AF-43 Revised (this publication may be out of print).

Organic Certification, MF-2344.

Websites:

http://www.ext.vt.edu/pubs/poultry/442-037/442-037.html Composting Dead Poultry is an extension bulletin covering composting of poultry.

http://muextension.missouri.edu/xplor/agguides/poultry/index.htm is a listing of various poultry related publications from University of Missouri; several discuss composting.

http://www.agnr.umd.edu/CES/PUBS/html/fs723/fs723.html Composting Catastrophic Event: Poultry Mortalities is an extension bulletin covering composting of poultry.

Organization websites:

Kansas State University Poultry
http://www.oznet.ksu.edu/pr_poultry

American Egg Board *http://www.aeg.org*

Kansas Poultry Association
http://www.kansaseggs.org

U.S. Poultry & Egg Association
http://www.poultryegg.org/

National Chicken Council
http://www.eatchicken.com

USDA Foodborne Illness Education Information Center
http://warp.nal.usda.gov/fnic/foodborne/statemen.html

Other Resources:

Kansas Department of Agriculture regulates production of poultry and eggs. Call the Meat and Poultry Inspection program (785) 296-5313, and for egg information call (785) 862-6574.

Food*A*Syst Helps Ensure Your Safety

This *Food*A*Syst* handbook covers a variety of topics to help you examine and address your most important food safety and environmental concerns. For more information about topics covered in *Food*A*Syst*, or for information about laws and regulations specific to your area, contact your local environmental health department or county K-State Research and Extension office.

Kansas Food*A*Syst Team Members:

Karen Penner, Ph.D., Project Director and Extension Food Science Specialist, Department of Animal Sciences, Kansas State University

Scott Beyer, Ph.D., Associate Professor and Extension Poultry Specialist, Department of Animal Sciences, Kansas State University

Donald C. Cress, Ph.D., Extension Pesticide Coordinator, Department of Entomology, Kansas State University

Karen L.B. Gast, Ph.D., Associate Professor and Extension Horticulturist, Postharvest and Marketing, Kansas State University

George Godfrey, Ph.D., Acting Vice President for Academic Affairs, Haskell Indian Nations University

Rhonda R. Janke, Ph.D., Associate Professor and Extension Specialist, Sustainable Cropping Systems, Kansas State University

Dan Nagengast, Executive Director, Kansas Rural Center

Danny H. Rogers, P.E., PhD., Extension Agricultural Engineer, Biological and Agricultural Engineering, Kansas State University

Gerald L. Stokka, DVM, MS, Associate Professor and Extension Beef Veterinarian, Kansas State University

Judy Willingham, Extension Associate, Department of Animal Sciences and Industry, Kansas State University

Chapter 3

Growing Vegetables, Fruits and Produce

Karen L.B. Gast, Ph.D., Extension Horticulturist, Postharvest and Marketing, Kansas State University
Dan Nagengast, Executive Director, Kansas Rural Center
Rhonda Janke, Ph.D., Associate Professor and Extension Specialist, Sustainable Cropping Systems, Kansas State University
Donald C. Cress, Ph.D., Extension Pesticide Coordinator, Department of Entomology, Kansas State University

Food safety is a concern to all involved in the production, marketing and consumption of foodstuff. Produce, fruits and vegetables, present unique problems in that they are often consumed raw without processing. In many cases, small produce growers market their crops directly to consumers or outlets where they are sold fresh. Raw foods can carry disease-causing microorganism like *Salmonella* and *E.coli*. Unless these pathogens are killed or washed off, people may become sick. This chapter discusses the risks of microorganism contamination from the time of planting to harvest to preparing for sale.

Risks are related to our actions or lack thereof. When we decide to do something, we should consciously strive for practices that minimize the risks. The microbial food safety risks of growing only one crop that is shipped and marketed directly from field to the processor, is markedly less than that of growing a variety of crops with a variety of exposures to potential contamination. A person growing potatoes for a chipper has less food safety risk than someone growing and direct marketing fresh lettuce, carrots, radishes and strawberries at the same time. Growers are willing to accept this higher level of risk because diversification for a small farm is more profitable. These growers need to evaluate their operations to minimize risk and to promote consumer education in food safety. For example, growers can provide information to their customers about the need to wash all produce before eating.

This self-assessment tool will help diversified growers identify potential risk areas and provide them with information and resources to minimize the risk. The purpose of this section of *Food*A*Syst* is to provide fruit and vegetable growers with a self-assessment tool to determine their level of risk for food contamination.

The following topics are covered:

1. *Site Conditions as Related to Field Selection.* What do my neighbors do, especially those upstream? Are livestock in the area? How has the field been used in the past?
2. *Wildlife, Vermin, and other Pests.* How will the presence of wildlife and vermin affect various areas of my production?
3. *Water Source.* What risks are associated with the water used in various areas of my production?
4. *Crop Selection*. Does the type of crop I grow affect food safety risks? What about risks during cleaning of the crop?
5. *Crop Production.* How do compost and chemical use affect food safety? What about record-keeping? How can harvesting be accomplished safely?
6. *Post-harvest Operations.* Does the packing shed and equipment create food safety problems? How about employees' activities? Is cross-contamination a problem? What should be sanitized and how often?
7. *Employee Personal Hygiene.* Are adequate facilities provided? Are employees trained to wash hands?
8. *Design and Processing.* How can you minimize the potential for cross contamination? At what temperatures should food be stored?
9. Cleaning and Sanitizing Frequency. Check your risk.

Part 1—Site Conditions

Each site or field will have a unique history and location in the watershed. Recognizing that these factors indicate a potential for contamination in a field is the first step in reducing risk levels. Wherever possible, fruit and vegetable crops should be upstream from animal-oriented activities so that they are not in the direct path of runoff carrying bacteria. While wildlife cannot be completely excluded from crops, domestic animals can and should be contained.

Assessment 1—Site Conditions

Use the table below to rate your risks. For each question, indicate your risk level in the right-hand column. Although some choices may not correspond exactly to your situation, choose the response that best fits. Refer to Part 1 if you need more information to complete the table. Transfer medium-high and high risks to the Action Check list at the end of the chapter on Page 3-10.

	LOW	LOW-MEDIUM	MED-HIGH	HIGH	MY RISK
Neighbors' Land	My neighbors are environmentally responsible growers like myself.	Their land is farmed with few chemicals – or – is grazed only a few months/year.	Their land is farmed with chemicals – or– is grazed more than 6 months/year.	Their land is up stream with feed lot(s), and I only use surface water for crop production.	O Low O Low-Med O Med-High O High
History of Land Use	My land is fenced virgin prairie that has not been grazed.	My land is a former farm with no history of animal production.	My land was used for animal production more than 5 years ago.	My land has been used for animal production in the last 5 years.	O Low O Low-Med O Med-High O High
Watershed	My farm is upstream from any sources of contamination.	My farm is downstream from crop land with no animal production.	My farm is downstream from a well-managed feed lot and only receives runoff during flooding.	My farm is downstream from at least one feed lot and runoff is commonly received.	O Low O Low-Med O Med-High O High
Livestock	Neither my neighbors nor I have livestock.		All livestock in the area is fenced and contained.	Animals commonly roam freely in fields and processing areas.	O Low O Med-High O High

Part 2—Wildlife, Vermin and Other Pests

Wildlife are a source of microbial contamination and pose a hazard in all aspects of growing and marketing produce. Deer can contaminate fields and water sources; rodents can contaminate packing facilities and equipment, as well as storage areas for produce, equipment, and supplies.

Assessment 2—Wildlife, Vermin, and other Pests

This table describes risk levels for several areas. Assess each area and determine where the greatest risks exist, and record your risk level in the right-hand column. It makes sense to address the highest risks first.

	LOW	LOW-MEDIUM	MED-HIGH	HIGH	MY RISK
	Ongoing preventive actions using enclosed buildings, fences, monitoring and appropriate controls.	Intermittent vermin monitoring, buildings enclosed, fences and controls initiated when low population levels observed.	No monitoring, controls initiated for infestations; some fencing, buildings partially enclosed.	No monitoring or controls; infestation ongoing; no fences or enclosed buildings.	
Fields					
Packing Facilities					
Container Storage					
Product Storage					
Vehicles					

Part 3—Water Source

Water has been strongly implicated in the contamination of produce. The water may be used for irrigation, packing and cleaning of equipment and facilities. Potable/drinkable water is best for all uses. In rating water sources, rural, public, and municipal water sources are best as they are routinely disinfected and tested for microbial contamination. Private farm wells that are tested and treated are the next best choice. Water tests should be taken routinely but often are not. Although ground water sources from wells are generally better than surface water, only testing can determine water safety. Recent surveys indicate that only 40 percent of Kansas wells meet safe drinking water standards. Without testing, water quality cannot be determined. While infants should not drink water with elevated nitrate levels, nitrate contamination by itself, is not a risk for crop production. See Chapter 4, Water Well Management, for further information. Kansas versions of *Farm*A*Syst* and *Home*A*Syst* are available from your county extension office and provide assistance in evaluating water wells.

Surface water, ponds, irrigation ditches, lakes, streams, and rivers, can be contaminated with runoff from neighboring feedlots, grazing animals and sewage, making these water sources unsuitable for packing/processing produce and for cleaning facilities.

Assessment 3—Water Source

This chart describes risk levels for areas of water use in growing produce. Check the box under the source of each water use to determine where the greatest risks exist, and record your risk level in the right-hand column. It makes sense to address the highest risks first.

	LOW	LOW-MEDIUM	MED-HIGH	HIGH	MY RISK
Water use	Public water	Tested & disinfected water from well or cistern	Untested well or cistern water	Surface water or open cistern	
Irrigation*					
Cleaning					
Packing					

*Irrigation is a good use of low quality water on crops that are not eaten raw (such as cereal grains), or applied so that the food has no direct contact with the irrigation water, such as with deep sub-surface irrigation.

Part 4—Crop Selection

Crop selection is an important consideration when assessing risk for microbial food borne illness. Some risk is inherent (such as the nature of the crop chosen), and steps must be taken to minimize these risks. A crop can be contaminated at various places in the production and processing chain. Some products (like sprouts) can be contaminated as seed, with pathogens being carried into the finished product. Processing water can be a source of microbial contamination. Producing a crop that needs extensive water contact to prepare it for marketing increases the risk of contamination. Knowledge and use of **Good Manufacturing Practices (GMPs)** and **Good Agricultural Practices (GAPs)** can do much to lower the risks. Soil contact can increase the risk for microbial contamination. If crops chosen are either grown on or in the soil, they have a higher risk of contamination, and steps need to be taken to minimize the risk.

See the end of this chapter for more information and resources.

Assessment 4—Crop Selection

Use the table below to rate your risks. For each question, indicate your risk level in the right-hand column. Although some choices may not correspond exactly to your situation, choose the response that best fits. Refer to Part 4 above if you need more information to complete the table. Transfer medium-high and high risks to the Action Checklist at the end of the chapter on Page 3-10.

	LOW RISK	LOW-MED	MED-HIGH	HIGH	MY RISK
Is crop consumed raw or cooked	Always eaten cooked or fully processed.		Sometimes eaten fresh or raw.	Always eaten fresh.	O Low O Med-High O High
Seed source for sprouts	Only purchase seeds certified to be pathogen free.			Seed source is unknown; or not certified pathogen free.	O Low O High
Processing needed	Crop can be, and is, field packed without washing into clean containers: GMPs and GAPs are used.	Crop needs and receives lots of washing before marketing; GMPs and GAPs are used.		Crop needs lots of washing; don't use GMPs and GAPs.	O Low O Low-Med O High
Soil contact of plant part harvested	Grown in sterilized media.	Grown on plant, no soil contact.	Grown on plant and in contact with soil.	Grown in the soil.	O Low O Low-Med O Med-High O High
Crop's cleaning	Always remove all soil and use sanitizing rinse; use GMPs in packing; instruct customers to wash thoroughly before eating.	Remove all soil, instruct customers to wash thoroughly before eating.	Remove heavy soil, leaving some soil.	No removal of soil so produce is often dirty.	O Low O Low-Med O Med-High O High

Foods commonly eaten raw	Foods commonly cooked before eating
Leafy vegetables–lettuce, parsley, spinach	Field crops–wheat, corn, barley
Strawberries, raspberries, blackberries	Sweet corn
Tomatoes, peppers, peapods	Peas, beans, okra,
Melons, radishes, onions, carrots	Squash, potatoes, carrots, asparagus

Part 5—Crop Production

Definition of terms:

- **Biosolids:** Solids originating from a biological source like animals and humans; used interchangeably with "sludge" when referring to solids retained from human wastewater treatment; EPA regulations govern the use of sludge as a soil conditioner because it contains possible pathogens and heavy metals.
- **Compost:** End result of natural bacterial and chemical decomposition of organic materials of animal, human, and plant origin; valuable as a soil conditioner and nutrient source. Properly managed, composting greatly reduces pathogen numbers (see bulletins listed at the end of this chapter).
- **Manure:** Animal feces not composted or incompletely composted; contains pathogens like Salmonella and E. coli.
- **LD_{50}:** (stands for Lethal Dose to 50% of the organisms exposed.) A rating that tells how toxic a pesticide is to mammals; lower numbers are assigned to more toxic chemicals, meaning a small amount will kill. Signal words are included on the label to help you understand how poisonous a product is:
  - "*Danger-Poison*" indicates the most toxic chemicals and has a rating of 1–50; an example is parathion
  - "*Warning*" indicates moderate toxicity and has a rating of 50 – 500; an example is diazinon
  - "*Caution*" indicates lowest toxicity and has a rating of 500 or more; examples are Sevin® and malathion and permethrin (Ambush® and Pounce®)

Crop production planning in order to reduce the risk of food-borne diseases, begins with soil preparation before planting. This includes when and what animals have had access to the field. Also, the timing and application of composted biosolids to the soil in relation to planting and harvesting has a direct relationship to food safety risk.

The use of manures and biosolids as fertilizers presents a risk for microbial food borne illness unless properly applied. Biosolids may also contain toxic organic compounds and heavy metals, which present chemical hazards. Organic growers have acceptable alternative non-manure fertilizers to choose from such as alfalfa pellets and cover crops. Municipal waste biosolids are appropriate only for fertilizing field crops such as cereal grains that will be cooked or commercially processed. EPA regulations (40 CFR 503) require extended periods of at least 14 months and up to 38 months between application of biosolids (from wastewater treatment) and harvesting of foods other than field crops.

Although most of this section deals with microbial hazards, chemical hazards are also sources of foodborne illness. Using chemicals according to the label and respecting re-entry times usually minimize risks. For lowest risk choose a product with a high LD_{50} number, such as Sevin®(LD_{50} =625) or malathion (LD_{50}=1187). Pesticide use is generally governed by label instructions. The label should be legible and will specify the crop and pest, application rates, and time limitations for application before harvest of the food. Records of pesticide use should be kept to verify dates, sites, chemical used, effectiveness, and rate of application. Extension bulletins offer information about chemical application and appropriate choices. Do not hesitate to contact your county extension agent for advice.

Use the following table to rate your risks. For each question, indicate your risk level in the right-hand column. Although some choices may not correspond exactly to your situation, choose the response that best fits. Refer to Part 5 if you need more information to complete the table. Transfer medium-high and high risks to the Action Checklist at the end of the chapter on Page 3-10.

Assessment 5—Crop Production

	LOW	LOW-MED	MED-HIGH	HIGH	MY RISK
Animal access	No livestock in area; crops fenced and netted to reduce access by stray animals and wildlife.	I have no livestock; neighbors livestock confined away from my crops.	My livestock are confined away from my crops which are fenced.	My livestock, ruminants, and poultry have free access to crops all the time.	O Low O Low-Med O Med-High O High
Type of fertilizer	Use only non-manure organic fertilizers or synthetic fertilizers.	Use composted plant waste on growing crops.	Use composted manure on growing crops—or—raw manure applied >12 mo. before harvest; no municipal waste used.	Use raw manure and biosolids on growing crops.	O Low O Low-Med O Med-High O High
Cleaning and use of fertilizer application equipment	I thoroughly wash all equipment used in manure application after each use and it is used for nothing else.		I occasionally use my manure application equipment for other purposes.	I don't clean my application equipment and also use it for harvesting and transporting produce.	O Low O Med-High O High
Type of pesticide	Use biological pesticides, bait stations, or pesticides non-toxic to mammals.	Use pesticides targeted to specific pest only after seeing considerable economic damage.	Use broad spectrum pesticides with high LD_{50} ratings.	Use broad spectrum pesticides with low LD_{50} and/or long duration re-entry times.	O Low O Low-Med O Med-High O High
Pesticide application	No pesticides used—rely on cultivation for weed control and biological agents for insect control.	Weekly monitoring for weeds and pests; apply minimum rates and highest LD_{50} rated chemicals when damage is noted.	Monthly monitoring for weeds and pests; apply maximum rates if any pest organisms found.	Apply maximum rates on a calendar basis, regardless of presence or pest.	O Low O Low-Med O Med-High O High
Label instructions	I always read and follow the label each time I use a pesticide—label is legible.	I usually read and follow the label—label is legible.	I read the label the first time the pesticide is used—label partially illegible.	Label missing or illegible; I've mixed the pesticide the same way for years.	O Low O Low-Med O Med-High O High
Re-entry after pesticide application	Fields kept posted to reflect label's crop and re-entry times.	I respect the label's crop and re-entry times.	I wait a day to re-enter and try not to spray close to harvest.	I pay no attention to label's crop and reentry times.	O Low O Low-Med O Med-High O High
Record-keeping	All chemical applications are logged with date, mix, field notes, weather, location; I monitor inventory and note expiration dates.	All chemical applications are logged with date, mix, field notes, weather, location.	I record that I applied a certain chemical on a date to a crop.	I use pesticides without recording any information.	O Low O Low-Med O Med-High O High
Harvesting	Pickers wash hands before harvesting and after toilet use; clean gloves donned for harvesting.	Pickers wash hands before harvesting and after toilet use.	Pickers don gloves for harvesting.	No hand washing or gloves used.	O Low O Low-Med O Med-High O High

Part 6—Postharvest Operations

Past and Current Building Use

The building used for post-harvest handling should be of easily cleanable construction that provides protection against insects, rodents and weather. It should be equipped with suitable plumbing for handling the crop, cleaning equipment, and for personal hygiene. Use of the structure for other purposes such as housing animals or for storing equipment or chemicals, increases the likelihood of contamination. Plumbing fixtures should be fully operational and undamaged so that they can be cleaned as part of the weekly routine. Hot water must be available for proper utensil washing and for hand washing. Sinks should be equipped with mixing faucets to allow tempering the water. Soap and paper towels should be available at all hand sinks.

The food contact surfaces such as utensils, table tops, racks, bins, etc. should be smooth and impervious. After cleaning to remove visible soil and debris, sanitizing these surfaces is important to control bacterial growth. A simple, effective sanitizing solution is one tablespoon of household bleach to a gallon of clean, tepid water. (See "Sanitizing Solutions," Page 3-10) Because the solution loses strength, it should be made up fresh every hour during use. This solution can be used as the final rinse in utensil washing, and final wipe-down of large surfaces. Allow sanitized surfaces to air dry.

Be aware that post-harvest processing may be subject to regulation, and require a license from the **Kansas Department of Health and Environment (KDHE)**. If the processing involves anything more than removal of soil and excess plant debris, KDHE should be contacted at (785) 296-5600 to discuss possible needs for inspection and licensing.

Assessment 6–Postharvest Operations

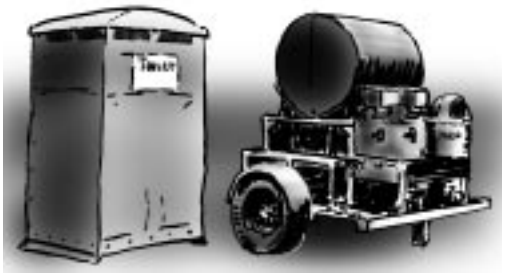
Use the tables below to rate your risks. For each question, indicate your risk level in the right-hand column. Although some choices may not correspond exactly to your situation, choose the response that best fits. Refer to the section above if you need more information to complete the table. Transfer medium-high and high risks to the Action Checklist at the end of the chapter on Page 3-10.

	LOW RISK	LOW-MED	MED-HIGH	HIGH	MY RISK
History of use	New or not ever used for livestock.	Housed livestock more than a year ago and extensively cleaned, sanitized, and remodeled.	Housed livestock more than a year ago, no cleaning or remodeling.	Housed livestock within last year-or-livestock have access.	O Low O Low-Med O Med-High O High
Vermin	Well screened and sealed to exclude vermin.		Vermin have access but not seen.	Rodent droppings and/or insects visible.	O Low O Med-High O High
Licenses	License checked with KDHE, no license needed.	License needed and obtained from KDHE.		Although needed, no license obtained.	O Low O Low-Med O High
Sources of contamination	No livestock or chemicals in or within 500 ft. of building.	Chemicals stored in secured cabinet; any livestock are > 500 ft. away.	Livestock nearby so that dust can enter facility.	Used to store fertilizer, pesticide, livestock.	O Low O Low-Med O Med-High O High
Plumbing	No hoses in use, plumbing only used for production.	Any hoses used are dedicated for production.		Hoses used for multiple purposes.	O Low O Low-Med O High
Water source	Public water supply.	Tested, treated well meeting construction standards.	Untested, untreated well water.	Untested, untreated surface water.	O Low O Low-Med O Med-High O High

Assessment 7—Employee Personal Hygiene

Personal hygiene is closely related to the level of food safety. The simplest and most effective way to prevent spreading germs is to wash hands with soap and water before handling food. Hands can be dried with disposable towels or mechanical blowers. People who handle food should be trained in good practices. As more employees are involved, the risk of potential contamination increases. Clothing should be clean and hair restrained. Footwear can carry in contaminants, and should be changed, covered, or sanitized before entering the food processing areas.

The Kansas 1999 Food Code prohibits individual cloth towels in food preparation areas. The Food Code is available online at: <*http://www.kdhe.state.ks.us/fpch/1999_Ks_Food_Code.pdf*>



Assessment 7—Employee Personal Hygiene

	LOW RISK	LOW-MEDIUM RISK	MEDIUM-HIGH RISK	HIGH RISK	MY RISK
Handwashing facilities	Toilet room and sink with mixing faucet, hot and cold running water, soap, and paper towels provided in work area.		Toilet room and sink with separate hot and cold water faucets, soap, and paper towels provided in work area - or- proper facilities not near work area.	No facilities provided - or - anything less than previously described.	O Low O Med-High O High
Fixture cleanliness	Fixtures of current design and cleaned weekly.	Fixtures old but undamaged and cleaned weekly.	Chipped fixtures in poor repair, no cleaning schedule.	No flush toilet provided or toilet is outhouse.	O Low O Low-Med O Med-High O High
Handwashing practices	Employees trained in handwashing and usually monitored.	Employees trained in handwashing with occasional monitoring.	Employees trained in handwashing but not monitored.	No employee training.	O Low O Low-Med O Med-High O High
Cross contamination	Employees trained in potential trouble spots and monitored (no field clothing worn in packing area).	Employees trained in potential trouble spots,but not monitored.	Employee education limited to washing hands after using toilet.	No employee training (field shoes worn in packing area).	O Low O Low-Med O Med-High O High

Assessment 8—Design in Processing

Failure to observe some simple rules can result in contaminated food. Chemicals may be necessary in the facility, but they must be stored separately from food. Anything that may leak down should be stored at the lowest level with nothing under it. Packaging materials should be in protected storage to stay clean.

Harvested foods entering the packing line can be considered a source of contamination and must be kept separate from the final product. Handling itself may generate dust or splash that should be contained. Different cutting boards should be dedicated to raw and processed foods—label one "Raw" and one "Cooked" (or use words appropriate to your operation). Using different colors or shapes also helps. Sanitizing is the critical final cleaning step for all food contact surfaces.

For information about the next step in marketing your product, transporation, see Chapter 7, Packaging and Transportation for Food Safety. For more information about reduction and management of production waste, see Chapter 6, Managing Production Waste.

Assessment 8—Design in Processing

	LOW RISK	LOW-MEDIUM RISK	MEDIUM-HIGH RISK	HIGH RISK	MY RISK
Working surfaces	Stainless steel tables and counters adequate in area.	Smooth, rust-free metal tables and counters adequate in area.	Sealed wooden surfaces adequate in size.	Rough wooden surfaces, work area too small (product placed on ground).	O Low O Low-Med O Med-High O High
Cross-contamination	Containers labeled and dedicated to use and work area.		Containers labeled but may be found in other work areas.	Containers used for multiple purposes.	O Low O Med-High O High
Product container	New* (or sanitized before reuse) and/or hard food-grade plastic; separate storage.	New* containers or hard plastic containers; separate storage.	Recycled containers cleaned only; separate storage.	Recycled containers not cleaned; storage with ag chemicals.	O Low O Low-Med O Med-High O High
Wastewater (includes gray water) **goes to**:	Public sewage collection system.	Private sewage system designed for production and not seeping or muddy.	Private sewage system of unknown design but not seeping or muddy.	System discharging to ground surface.	O Low O Low-Med O Med-High O High
Cold storage of produce	Provided in work area, temperature 40° F or less.	Provided in work area, temperature 41°to 45°F.	Located away from work area—or–temperature more than 45°F.	No mechanical cooling facilities.	O Low O Low-Med O Med-High O High
Transport vehicles	Dedicated to hauling produce; cleaned before each use; (refrigeration unit if needed).	Dedicated to hauling produce; not always cleaned before each use.	Also used for hauling manure/ag chemicals; usually cleaned before hauling produce.	Also used for hauling manure/ag chemicals; not cleaned or sanitized.	O Low O Low-Med O Med-High O High

*Note: Organic certfication requires new containers or recycled containers that have only been usd for organic produce to prevent cross-contamination of chemicals.

Sanitizing Solutions

First, wash surface with hot soapy water and rinse. For hard, nonporous surfaces:

1. Mix 1 tablespoon liquid bleach with 1 gallon water.
2. Immerse clean utensil for 60 seconds, or apply solution to hard surface.
3. **Allow to air dry, no rinsing.** Do not rinse.

For porous surfaces, like wooden cutting boards:

1. Mix 3 tablespoons liquid bleach with 1 gallon water.
2. Immerse or apply to surface.
3. Keep surface wet for 2 minutes.
4. Rinse with water and let dry. Do not dry off.

Disinfecting Solution *(use when contamination has occurred)*

1. First, remove loose dirt.
2. Mix 3/4 cup bleach with 1 gallon water.
3. Immerse or apply to surface, and keep sur face wet for 2 minutes.
4. Rinse with water and let dry.

Assessment 9—Cleaning and Sanitization Frequency

This chart describes risk levels for cleaning practices. Check the box to show the cleaning frequency for each area to determine where the greastest risks exist, and record your risk level in the right-hand column. It makes sense to address the highest risks first.

	LOW RISK Clean and sanitize daily and as needed.	**LOW-MEDIUM RISK** Clean periodically or as needed.	**MEDIUM-HIGH RISK** Clean at beginning of season.	**HIGH RISK** Do not clean.	**MY RISK**
Field/harvest containers					
Equipment					
Tools					
Transport vehicles					
Packing line equipment					
Packing facilities					
Storage areas					
Pre-cooling facilities					
Handling containers					
Packing containers					
Delivery vehicles					

Action Checklist

When you finish the assessment tables, go back over the questions to ensure that every high and medium-high risk you identified is recorded in the checklist below. For each risk, write down the improvements you plan to make. Use recommendations from this chapter and from resources elsewhere. Pick a target date that will keep you on schedule for making the changes. You do not have to do everything at once, but try to eliminate the most serious risks as soon as you can. Often it helps to start with inexpensive actions.

Action Checklist—Production of Fruits and Vegetables

Write all high and medium-high risks below.	What can you do to reduce the risk?	Set a target date for action.
Sample: I have seen rodent droppings in the post-harvest processing areas.	*Sample:* Close openings around base of building, set traps & remove floor clutter.	*Sample:* Today, find openings & seal

For More Information

K-State Research and Extension Bulletins:
MF-2260 *Food Safety for Farmers Markets*

MF-2344 *Organic Certification*

Minimizing Microbial Food Safety Hazards for Fresh Fruits and Vegetables Series:
MF-2484 *Introduction*

MF-2479 *Production Water*

MF-2480 *Processing Water*

MF-2481 *Worker Health and Hygiene and Sanitary Facilities*

MF-2482 *Field Sanitation Packing Facilities, Sanitation, Transportation, and Tracking*

MF-2483 *Manures and Municipal Biosolids*

AF-42 Revised *Controlling House Mice*

AF-43 Revised *Controlling Rats*

Solid Waste Management Series. May 1995:
EP-2 *Compost Activators*

EP-3 *The Composting Process*

EP-4 *Using Compost*

EP-5 *Composting Troubleshooting Guide*

EP-6 *Quick Composting*

EP-7 *Direct Application of Organic Materials*

EP-22 *Sewage Sludge Use on Agricultural Land*

Other Resources:

Safer Processing of Sprouts by the California Dept. of Health Available from: Circle Solutions, 2070 Chain Bridge Rd., Suite 450, Vienna, VA. Telephone: 703-902-1300.

Description: This curriculum covers agricultural and postharvest water uses, manure and biosolids, worker health and hygiene, field and facility sanitation, transportation, and trace back. Information is also applicable to all domestic and foreign growers, packers, and shippers of unprocessed or minimally processed fresh fruit and vegetables, not just for sprout growers.

Websites:
http://www.cfsan.fda.gov/~dms/prodguid.html Description: (full text online) *Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables,* is maintained by the FDA, USDA, and CDC. This guidance document addresses microbial food safety hazards and good agricultural and management practices common to the growing, harvesting, washing, sorting, packing, and transporting of most fruits and vegetables sold to consumers in an unprocessed or minimally processed (raw) form.

http://www.pma.com Description: *Food Safety for Produce Distribution.*

Available from: Produce Marketing Association, the guide covers such key topics as management knowledge and responsibility; supplier relationships; transportation; employee health, hygiene and food safety awareness; equipment and facility sanitation; and safety program evaluation.

Food*A*Syst Helps Ensure Your Safety

This *Food*A*Syst* handbook covers a variety of topics to help you examine and address your most important food safety and environmental concerns. For more information about topics covered in *Food*A*Syst*, or for information about laws and regulations specific to your area, contact your local environmental health department or county K-State Research and Extension office.

Kansas Food*A*Syst Team Members:

Karen Penner, Ph.D., Project Director, Professor and Extension Food Science Specialist, Department of Animal Sciences, Kansas State University

Scott Beyer, Ph.D., Associate Professor and Extension Poultry Specialist, Department of Animal Sciences, Kansas State University

Donald C. Cress, Ph.D., Extension Pesticide Coordinator, Department of Entomology, Kansas State University

Karen L.B. Gast, Ph.D., Associate Professor and Extension Horticulturist, Postharvest and Marketing, Kansas State University

George Godfrey, Ph.D., Acting Vice President for Academic Affairs, Haskell Indian Nations University

Rhonda R. Janke, Ph.D., Associate Professor and Extension Specialist, Sustainable Cropping Systems, Kansas State University

Dan Nagengast, Executive Director, Kansas Rural Center

Danny H. Rogers, P.E., PhD., Extension Agricultural Engineer, Biological and Agricultural Engineering, Kansas State University

Gerald L. Stokka, DVM, MS, Associate Professor and Extension Beef Veterinarian, Kansas State University

Judy Willingham, Project Manager, Extension Associate, Department of Animal Sciences and Industry, Kansas State University

Chapter 4

Safe Water Management

Danny H. Rogers, P.E., PhD., Extension Agricultural Engineer, Kansas State University

G. Morgan Powell, P.E., PhD., Extension Natural Resources Engineer, Kansas State University

Keeping your well water free of harmful contaminants should be a top priority — for the quality of your product/produce, and for the safety of your family and employees. This chapter helps examine your water source, how your water source is managed, and how activities on or near your property may affect water quality of the well. The following topics are covered:

1. **Safe Food Processing Water at the Source**. What is your water source? How often is it tested? What kinds of tests are done? Is annual maintenance performed and recorded?
2. **Water Treatment and Monitoring.** Does a trained and certified operator manage water treatment? Is the disinfection equipment consistently operating correctly? Is a record of water residual testing maintained?
3. **Protection of Water Source.** What conditions can potentially pollute your water? Do you take action to control and prevent contamination of your water (protection plan)?
4. **Well/Water System Maintenance.** Do you check your well's condition (perform annual maintenance including shock chlorination)?
5. **Cross-connection and Backflow Protection.** Can contaminated water get into your processing and drinking water? How do you prevent backflows? Are employees trained in backflow prevention?

Why should you be concerned?

Unless you are supplied by public water, you are totally responsible for the quality of your water. Your water could be contaminated unless you take preventative actions and monitor it regularly. The use of contaminated water to process fresh foods substantially increases the risk of food-borne illness. Your private well may be a contaminated water source – recent surveys indicate that only 40 percent of private Kansas wells meet safe drinking water standards. Contaminants that affect health often have no odor, no color, and no taste. They cannot be detected by our senses. Such contaminants can put you and others' health at risk. Additionally, treatment to remove chemical contaminants is often difficult and expensive.

How will this chapter help you protect your water quality?

This chapter is a guide to help you assess the safety of your water supply, and to identify steps you can take to decrease risks and increase food safety. Easy-to-understand assessment tables help identify situations and practices that are safe as well as ones that may require prompt attention. Additional information on how to safeguard all water sources may be obtained from your local health department, your county K-State Research and Extension office, your county conservation district, and the **Kansas Department of Health and Environment (KDHE)**. A list of bulletins and other resources are included at the end of this chapter.

PART 1—Safe Food Processing Water at the Source

If you obtain your processing and drinking water from a public source (Rural Water District, City water), it has the least amount of risk associated with its use. The RWD or City employs people who are trained and certified to operate treatment equipment, and who should maintain continuous mechanical chlorination to control bacteria. Twice each month water samples are analyzed for bacteria and at least once each year for many chemicals. If tests reveal contamination, the public is notified; this assures that their exposure is limited. The well or other water source is required to be protected and constructed so that contaminants are excluded.

Private water sources used for food processing have different degrees of risk. An excellent self assessment system to learn and evaluate your private well can be found in the Kansas *Farm*A*Syst* material. It is available on the web at: *http://www.oznet.ksu.edu/library/ageng2/welcome.htm#Water%20Quality*

The *Kansas Home*A*Syst* manual also deals with private water wells, and can be found on the World Wide Web at:

http://www.oznet.ksu.edu/library/ageng2/h_a_syst/homeasst.pdf

Both are also available from your county extension office.

Operation factors that affect risk level are listed below.

- Does the water come from a properly located, constructed, protected, and maintained well. To judge your well, refer to the K-State Research and Extension bulletins; *Private Wells–Safe Location and Construction (MF-970)* and *Private Well Maintenance and Protection (MF-2396).* If you would like someone to help by looking at your well and offering advice, you can contact your local health department sanitarian or extension office.
- Is disinfection (chlorination) continuously maintained and tested daily?
- How often is the water tested for contaminants? For water testing information, see the list of bulletins under Well Maintenance and Water Testing at the end of this chapter.
- Do you have a safe alternative water source or plan of operation in case of problems?

If irrigation water is applied to produce not commonly cooked, contamination can occur. Using drip irrigation rather than overhead sprinklers can minimize food safety risks. Contamination of food products can also occur when work surfaces, packing boxes, etc. are not clean and/or sanitized. See Chapter 2 Home-Raised, Home-Butchered Poultry and Eggs, and Chapter 3 Growing Vegetables, Fruits, and Produce, for food safety risks related to other conditions.

Assessment 1—Safe Food Processing Water at the Source

Use the table below to rate your water-quality risks. For each question, indicate your risk level in the right-hand column. Although some choices may not correspond exactly to your situation, choose the response that fits best. Refer to Part 1 if you need more information to complete the table, or call your county K-State Research and Extension office.

	LOW	LOW-MEDIUM	MED-HIGH	HIGH	MY RISK
Water source used in irrigation or processing	City or RWD (water billed) **SKIP TO PART 5.** or, Irrigate only root crops or Applied with drip irrigation.	Private well more than 200 ft. from pollutants* and construction meets state standards.**	Private well 50 to 200 ft. from pollutants* and construction meets state standards.**	Private source less than 50 ft. from pollutants*; or well construction does not meet state standards**; or unknown source.	O Low O Low-Med O Med-High O High
Tests for private water quality	Bacteria twice/ month, and chemicals yearly.	Bacteria quarterly, and chemicals yearly.	Bacteria yearly, no chemical tests.	No testing, or unknown if tested.	O Low O Low-Med O Med-High O High
Private water treatment	Maintained by certified water supply system operator and meets public water supply standards.	Disinfection is continuous and tested daily.	Disinfection during production only or daily testing not consistent.	No disinfection equipment or ability to test.	O Low O Low-Med O Med- High O High
Alternative emergency water source	Public water supply or commercially bottled water.	Private source with continuous disinfection and daily chlorine testing.	Private source not disinfected, but tested and found uncontaminated.	No alternative source or plan.	O Low O Low-Med O Med- High O High

* See Section 3, Protection of Water Source for examples of pollutants and their sources.

** See *Farm*A*Syst* for specifics; wellhead is 12" above ground, casing intact, sealing cap approved and properly installed. Your county sanitarian can also offer assistance in evaluating well construction.

Responding to risks

Your goal is to lower your risks. Turn to the Action Checklist on Page 4-10 to record the medium-high and high-risk practices you identified. Use the resources in this section to help plan actions to reduce your risks.

Part 2—Water Treatment and Monitoring

When water is a necessary part of food processing, such as in washing produce that will not be cooked, the water must meet safe drinking water standards. Even if the food being processed will be cooked (such as poultry), you do not want to add contaminates to the finished product. A bacteriological water test will reveal existing contamination. If bacteria are present, sanitize the well and distribution system as described in K-State Research and extension bulletin, *Shock Chlorination for Private Water Systems (MF-911)*. Resample for bacteria following the instructions in extension bulletin, *Taking a Water Sample (MF-963, 2/2000)*. Always keep test results for future reference. A record showing a history of water samples free from contamination speaks well for the producer's intent and good practices.

Do you need to maintain continual disinfection of your water supply?

K-State Research and Extension bulletin, *Water Supply for Food and Beverage Processing Operations, (MF1122, 6/94)*, discusses this question thoroughly. In general, if you are using the water to process foods for retail sale, the water must come from an "approved source." Being an "approved source" means the standards for a public water supply have been met. This includes maintaining continual chlorination of your water, daily chlorine residual testing, and coliform bacteria tests on a regular basis as required by the **Kansas Department of Health and Environment (KDHE)**. KDHE will also periodically conduct an inspection of the well, disinfection equipment, and distribution system. K-State Research and Extension bulletin, *Disinfection of Private Water Supplies, (MF-886, 5/89),* discusses various methods of continuous disinfection.

If you are not required by the KDHE to meet the requirements of a public water supply, you may choose an alternative method of continuous disinfection. Other options include ozonation, ultraviolet light (UV), iodination, and heat pasteurization.

Should testing indicate contamination, take immediate action to make the water safe and reduce the risk of water borne illness. Even though you may not need to meet KDHE requirements, installing and maintaining a disinfection device adds a barrier of protection, lowers the risk of disease, and helps you assure a safe food product.

Assessment 2—Water Treatment and Monitoring

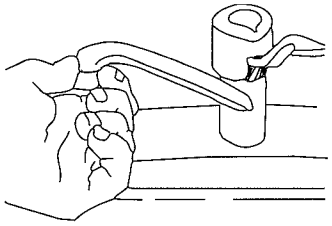
Use the table below to rate your risks related to disinfection and water testing. For each question, indicate your risk level in the right-hand column. Although some choices may not correspond exactly to your situation, choose the response that best fits. Refer to Part 2 above if you need more information.

	LOW RISK	LOW-MED	MED-HIGH	HIGH	YOUR RISK
Disinfection	Disinfection is constant and managed by a certified operator.	Disinfection is constant.	Disinfection only when tests show bacteria.	No disinfection.	O Low O Low-Med O Med-High O High
Monitoring of chlorine residual	Records kept of daily residuals.	Records kept of intermittent residual tests.	Few records kept.	No record keeping.	O Low O Low-Med O Med-High O High
Testing for Coliform Bacteria	Water tested twice/month in accordance with KDHE standards for public water supply.	Regular testing, but not as required by KDHE.	Testing when changes in water are noticed.	No testing program.	O Low O Low-Med O Med-High O High

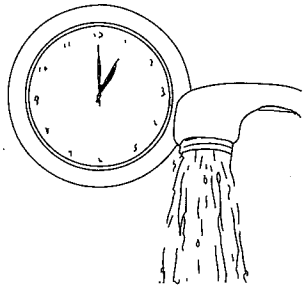
Responding to risks

Your goal is to lower your risks. Turn to the Action Checklist on Page 4-10 to record the medium-high and high- risk practices you identified. Use the information in this section to help plan actions that reduce your risks.

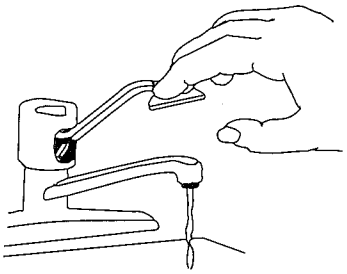
Figure 1—Generalized procedures for collecting water samples from private wells serving a building. If your irrigation/processing water source is different from your home, contact your local Extension office or environmental health department for assistance.



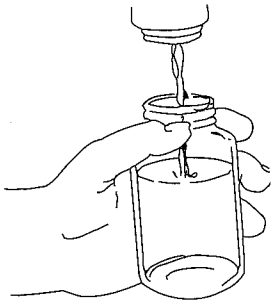
STEP 1: It is important to use an indoor, leak-free tap and to collect water that has not been treated by a water softener or other treatment unit. Remove the aerator from the cold water faucet. If testing for bacteria, disinfect the end of the faucet with alcohol or flame. (Note: Flaming may melt plastic and discolor chrome or gold-finished faucets.)



STEP 2: Let water run for five minutes to bring in water that has not been in contact with household plumbing. This assures your sample is of the well water and not the faucet surfaces.



STEP 3: Reduce the water flow until the water is a clear, bubble-free stream about 1/4-inch in diameter and let the water flow for another two minutes.



STEP 4: Fill a specially prepared laboratory container as instructed by the laboratory. Do not set the cap down or let anything touch the inside of the cap or container.

STEP 5: Recap, close the sample container tightly, and transport to arrive within 24 hours as instructed by the laboratory.

Part 3—Protection of Water Sources

Your source of water may be limited to the water well on your property. Controlling the various pollution sources is primarily up to you. You should locate all pollution sources, and take steps to eliminate or control them. Examples include: abandoned or unused wells, septic systems, waste storage/disposal sites, fuel storage, animal pens, manure piles, chemical storage, and chemical mixing areas. K-State Research and Extension publication, *Farm*A*Syst, Farmstead Assessment System,* offers excellent information to help you identify and control common pollution sources on the farm.

Once a water source is contaminated, it usually takes decades to clear. Allowing conditions to exist that can contaminate your water may result in drilling a new well, installing expensive treatment equipment, and possibly costly environmental damage. There is no better example of the old adage, "An ounce of prevention is worth a pound of cure."

Are there any unused and abandoned wells on your property?

Many properties have wells that are no longer used. Sites with older homes often have an old dug well that was installed when the house was first built. At some sites a new well was dug or drilled about every 30–40 years, so there may be several abandoned wells. If not properly plugged or sealed in accordance with KDHE standards, these wells provide a direct channel for waterborne pollutants to reach the aquifer or groundwater layer that supplies the present well (figure 2).

A state licensed well driller should be hired to close these wells. Plugging a well properly calls for experience with well construction materials and methods, as well as knowledge of the geology of the site and regulations of the state. Kansas regulations govern plugging procedures and materials, and require registering the plugged well with the KDHE. The cost to plug a well will vary with well construction, depth, diameter, and soil/rock type. The money spent plugging a well will be a bargain compared to the potential cost of cleanup or loss of property value if contamination occurs. Liability issues enter if a neighbor's well becomes contaminated because of activities on your property. You can obtain specific information regarding licensed well drillers and procedures to properly plug a well from KDHE, Bureau of Water,
phone: (785) 296-3565.

Are there any fuel tanks or chemical storage/ mixing areas?

Leaking fuel tanks have been linked to numerous contaminations of well and stream water. Tanks that are buried underground can leak for years before the problem is discovered, and by that time, the water is usually already polluted. One gallon of gasoline can contaminate about two million gallons of groundwater, and moves quickly through the soil. Once the ground water is contaminated, many wells can be affected for future years. Therefore, the careful installation and use of fuel storage tanks to prevent leaks, and a plan to control leaks is very important. The *Farm*A*Syst* fact sheet titled, *Improving Fuel Storage* provides excellent

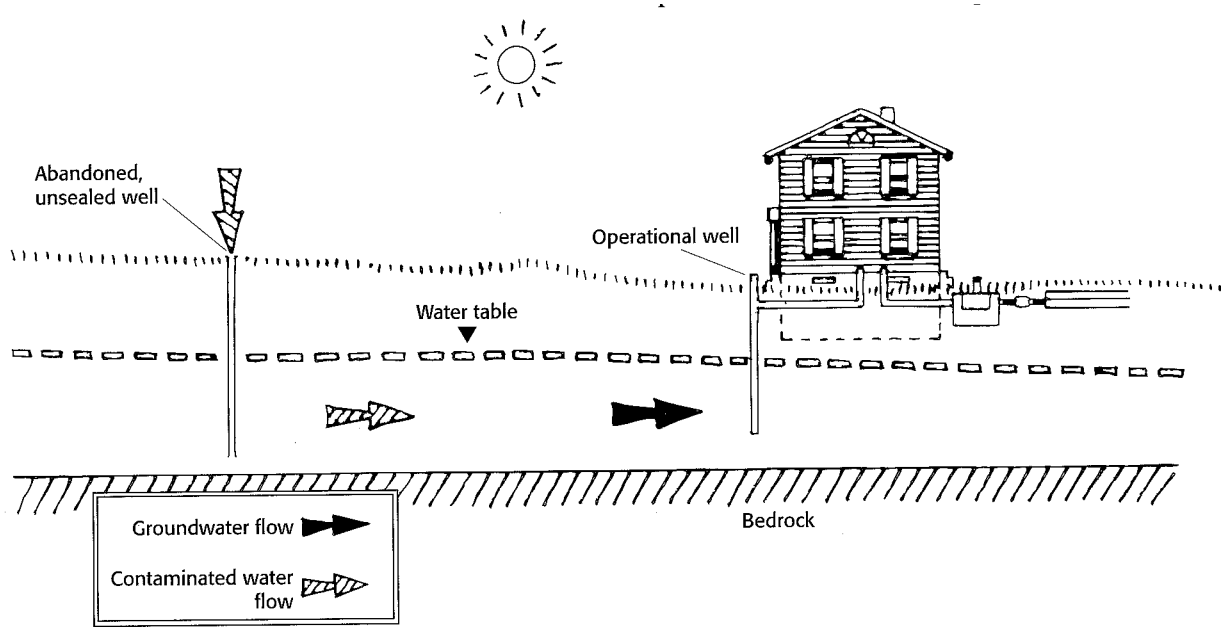


Figure 2—Abandoned wells that are not properly sealed provide a pathway for contaminants to directly reach groundwater that supplies your well.

information and resources for good management of fuel storage.

Common crop production chemicals such as herbicides, insecticides, and fertilizers are also of concern. Two *Farm*A*Syst* fact sheets discuss improving pesticide and fertilizer storage and handling. Conducting the assessments for these activities will enable the landowner to target specific risks and learn how to address them. Specific items to evaluate include: chemical form and type; separation distances; label use; storage, mixing and loading practice; spill control; and security.

What about animal pens and manure handling?

Nitrogen is an important component for plant growth and development; however, when nitrogen enters the drinking water supply as nitrate, it creates a health risk for pregnant women and infants. In addition, animal manure is a source of several human pathogens. Proper handling of manure should control bacteria and nitrate so that drinking and processing water is kept safe. The *Farm*A*Syst* fact sheet, *Improving Animal Waste Management* offers information and resources so that you can handle manure safely. Specific areas to evaluate include: location, design and management of animal lots, storage of manure, handling silage, and crop application of manures.

Assessment 3—Protection of Water Source

Use the table below to rate your risks related to protection of your water source. For each question, indicate your risk level in the right-hand column. Although some choices may not correspond exactly to your situation, choose the response that best fits. Refer to Part 3 if you need more information.

	LOW	LOW-MED	MED-HIGH	HIGH	YOUR RISK
Unused wells on your property or in your area	There are no unused wells within 1/8 mile (660 ft.).	Any unused wells are plugged following KDHE laws and regulations.	Unused, unplugged wells exist more than 400 ft. from drinking water well.	Unused, unplugged wells exist less than 400 ft. from drinking water well.	O Low O Low-Med O Med-High O High
Fuel tanks	There are no fuel tanks.	Fuel tanks are above ground; *Farm*A*Syst* has been used and all corrections completed.	Fuel tanks are below ground; *Farm*A*Syst* has been used and all corrections completed.	No risk assessment on fuel tanks has been done.	O Low O Low-Med O Med-High O High
Chemical use and storage	Chemicals are not used or stored.	*Farm*A*Syst* has been used and all corrections completed.	*Farm*A*Syst* has been used; corrections not completed.	No risk assessment on chemical use and storage has been done.	O Low O Low-Med O Med-High O High
Animal-related sources	There are no animals on or near the property (within 660 feet).	*Farm*A*Syst* has been used and all corrections completed.	*Farm*A*Syst* has been used; corrections not completed.	No risk assessment on animal waste management has been done.	O Low O Low-Med O Med-High O High

Responding to risks

Your goal is to lower your risks. Turn to the Action Checklist on Page 4-10 to record the medium-high and high- risk practices you identified. Use the information in this section to help plan actions to reduce your risks.

Part 4—Well/Water System Maintenance

Just as you should routinely change the oil and filter in your car to keep it in good operating condition, you need to attend to your private well on an annual basis. A written, well protection plan is a good beginning. K-State Research and Extension bulletin, *Private Well Maintenance and Protection,* (MF-2396), details how to do a 12-point well check, describes how to manage the area around the wellhead, and gives an example of a written well protection plan. You may identify a risky practice that can easily be changed to improve water quality protection. Perhaps you have been composting manure 50 feet from the well; you can begin your new composting operation at a safer distance (>400 feet away).

Once the plan has been written down, other responsible people in the family or organization need to know where the plan is and how they might use it. No one knows who will be on duty in an emergency. Annually, use the plan to check for defects in and around the wellhead, and review any changes with the others who might need to use it. In the example above where the new compost pile is moved away from the well, others who might work the pile are to be informed about the new site and reason for the change.

Shock chlorination of the well (shocking the well) is a good annual practice. When performed as described in K-State Research and Extension bulletin, *Shock Chlorination for Disinfecting Water Systems,* (MF-911), the distribution piping is also cleaned out. Many public water supplies have a plan to routinely shock each well in their system.

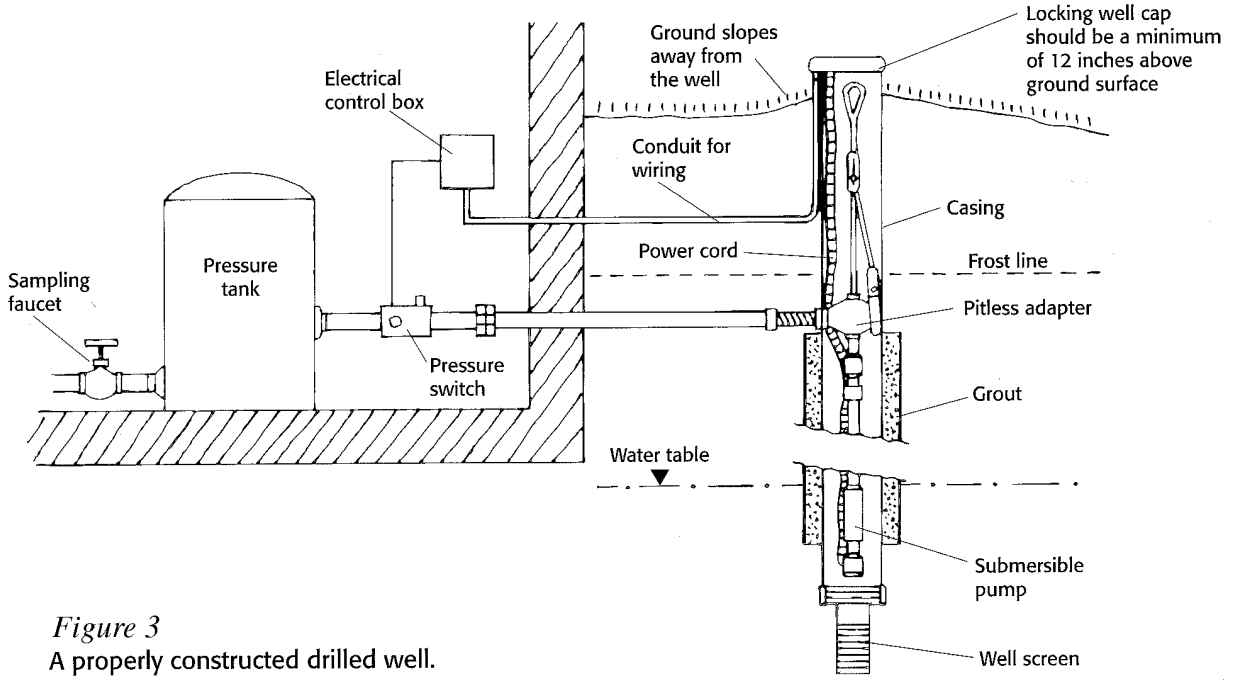


Figure 3
A properly constructed drilled well.

Assessment 4—Well/Water System Maintenance

Use the table below to rate your risks related to well and water system maintenance. For each question, indicate your risk level in the right-hand column. Although some choices may not correspond exactly to your situation, choose the response that best fits. Refer to Part 4. if you need more information.

	LOW RISK	LOW-MED	MED-HIGH	HIGH	YOUR RISK
Well inspection	Wellhead and surrounding area checked yearly as in bulletin, MF-2396.	Wellhead checked every 2 or 3 years as in bulletin, MF-2396.	Wellhead checked more than 3 years ago; procedure unknown.	Do not know last time well or area was inspected.	O Low O Low-Med O Med-High O High
Well protection plan	Plan is written and reviewed annually with others.	Plan is written, not reviewed, but have informed others of contents.	Plan is not written and no one else is familiar with it.	No well protection plan exists.	O Low O Low-Med O Med-High O High
Shock Chlorination of well & water system (shocked)	Shocked annually as in bulletin, MF-911.	Shocked every 2 or 3 years as in bulletin, MF-911.	Shocked more than 3 years ago; procedure unknown.	Unknown when last shocked or more than 5 years ago.	O Low O Low-Med O Med-High O High

Responding to risks

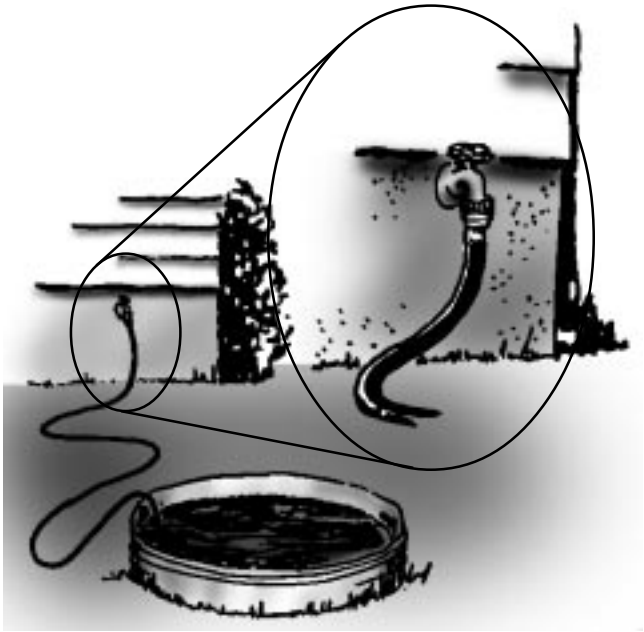
Your goal is to lower your risks. Turn to the Action Checklist on Page 4-10 to record the medium-high and high- risk practices you identified. Use the information in this section to help plan actions to reduce your risks.

Part 5—Cross-Connection and Backflow Control

A cross-connection is simply the connection between safe, potable water and a liquid of unknown safety. The garden hose is the most common way this connection is made. Backflow is the reversal in direction of water flow. This occurs when normal pressure is decreased or lost; in these conditions back siphonage can occur. Backflow control means to prevent flow reversal by proper design or mechanical devices.

Food processes may involve the use of chemicals such as cleaners, disinfectants, or pesticides. that must be mixed with water. The manner of mixing can create a cross-connection between the safe water and the chemical. An example would be using an aspirator connection to draw a chemical into the flowing water as is common in many hose-end chemical sprayers. Cross-connections can also be made with unsafe water, such as leaving a hose in the bottom of a watering trough. Plumbing fixture design or alteration can create a cross-connection. Faucet discharges should be at least two inches above the overflow rim of a sink. If the faucet is altered by putting a tube or hose on the end so that the water discharges below the overflow rim, a cross-connection has been created.

The best method of preventing backflow is to never create a cross-connection. Avoid extending the faucet with a hose into the mixing vessel, water



trough, or other container. Remember that the end of the hose will be contaminated by whatever chemical it may contact, making the practice of putting the hose into the mixing vessel especially dangerous. If a hose must be used, install a state-approved backflow prevention device on the sill cock before attaching the hose.

Assessment 5—Cross-Connection and Backflow Control

Use the table below to rate your risks related to cross-connection and backflow control. For each question, indicate your risk level in the right-hand column. Although some choices may not correspond exactly to your situation, choose the response that fits best. Refer to Part 5 above

	LOW RISK	LOW-MED	MED-HIGH	HIGH	YOUR RISK
Use of hoses	No hoses ever connected to water outlets.	Hoses used and air gap always maintained by hose support.	Hoses used with backflow prevention devices.	Hoses left in bottom of containers being filled, no backflow prevention devices.	O Low O Low-Med O Med-High O High
Chemical use and mixing (for processing and production)	No chemicals mixed or used.	Chemical use and mixing in accordance with label. No hoses used to add water.	Chemical use and mixing in accordance with label, using hose to add water.	Chemicals used and mixed anywhere; label missing or unreadable; hose end into mixture.	O Low O Low-Med O Med-High O High
Chemical application	No chemicals mixed or used.	Chemicals applied without connection to pressured water.	Chemicals fed by aspiration using water pressure.	Chemicals mixed by injection under pressure.	O Low O Low-Med O Med-High O High

Responding to risks

Your goal is to lower your risks. Turn to the Action Checklist on Page 4-10 to record the medium-high and high- risk practices you identified. Use the information in this section to help plan actions to reduce your risks.

ACTION CHECKLIST

When you finish the assessment tables, go back over the questions to ensure that every high and medium-high risk you identified is recorded in the checklist. For each risk, write down the improvements you plan to make. Use recommendations from this chapter and from the resources found in this chapter. Pick a target date that will keep you on schedule for making the changes. You do not have to do everything at once, but plan to eliminate the most serious risks as soon as you can. Often it helps to start with inexpensive actions.

Action Checklist—Safe Water Management

Write all high and medium-high risks below.	What can you do to reduce the risk?	Set a target date for action.
Sample: Water hasn't been tested for 10 years. Smells different than it used to.	Contact county public health department for advice and laboratory water sampling kit.	One week from today: April 8.

For More Information

K-State Research and Extension publications are listed below.

Well location and construction

Groundwater and Well Contamination. MF-932, 8/92.

Private Wells – Safe Location and Construction. MF-970, 8/99.

Private Water Well – Owner/Operator Manual. (file folder). MF-2409,7/99.

Safe Water from Wells (video). SV386, 1/97.

The following materials can be ordered through your county Extension office:

Private Water Systems Handbook, 4th Edition, MWPS-14, 7/79. A 72-page publication available from the Midwest Plan Service (MWPS) $7.00.

Private Drinking Water Supplies, NRAES-47, 8/91. $8.00.

Water Quality Handbook, a 200 page reference handbook, 4/96. $20.00.

Questions about Kansas regulations for water well construction can be directed to the Kansas Department of Health and Environment, Bureau of Water, (785) 296-3565.

Planning for an Individual Water System, 4th Edition, AAVIM 600, 1982. $13.00.

Well maintenance, water testing, and disinfection

Nitrate and Groundwater.(MF-857, 4/99)

Obtaining Safe Water from Private Wells. (MF-2345, 5/99)

Private Well Maintenance and Protection. (MF-2396, 6/99)

Recommended Water Tests for Private Wells. (MF-871, 5/99)

Shock Chlorination for Private Water Systems. (MF-911, 7/98)

Taking a Water Sample. (MF-963, 2/2000)

Testing to Help Ensure Safe Drinking Water. (MF-951), (updated quarterly, latest version on World wide Web: *http://www.oznet.ksu.edu/library/H20QL2/(MF951.PDF).*

Water Supply for Food and Beverage Processing Operations, (MF-1122, 6/94)

Disinfection of Private Water Supplies, (MF-886,5/89)

For additional information, contact your local health department or your county K-State Research and Extension office, private testing laboratories, or the Kansas Department of Health and Environment (KDHE), Bureau of Water, (785) 296-5500.

Unused wells and other holes in the earth

Plugging abandoned Wells. MF-935, 1/98.

Plugging Cisterns, Cesspools, Septic Tanks and Other Holes. MF-2246, 7/98.

Contact a state licensed well driller or the KDHE District office nearest you:

Dodge City (Southwest)	(316) 225-0596
Wichita (South Central)	(316) 337-6020
Chanute (Southeast)	(316) 431-2390
Lawrence (Northeast)	(785) 842-4600
Salina (North Central)	(785) 827-9639
Hays (Northwest)	(785) 625-5664

Groundwater, soil type and geology, well location, and existing well construction log

Contact Kansas Geological Survey, 305 Moore Hall, Lawrence, KS 66045, phone (785) 864-3965. Web site < http://magellan.kgs.ukans.edu/WaterWell/index.html >

Be prepared to provide the legal description (county, township, range, section, and quarter section) of the well's location. If known, provide the year the well was drilled and the names of the original owner and driller.

Your county Conservation District can describe your soil type and general geology.

Web sites:

http://www.kdhe.state.ks.us/water/
Maintained by the Kansas Department of Health and Environment (KDHE), Bureau of Water; contains information about state regulations, water quality, and links to other water related sites.

www.waterwiser.org
Maintained by the American Water Works Association, contains useful information about water from fixtures to testing

Drinking water quality standards

Understanding Your Water Test Report. MF-912, 1/2000

Organic and Radiological Chemicals in Drinking Water. MF-1142, 10/94

Call the U.S. Environmental Protection Agency's Safe Drinking Water Hotline toll-free at (800) 426-4791 from 7:30 a.m. to 4:00 p.m., Central Standard Time, Monday through Friday.
http://www.epa.gov/OST/Tools/dwstds.html
EPA's Web site for water quality standards.

Food*A*Syst Helps Ensure Your Safety

This *Kansas Food*A*Syst* handbook covers a variety of topics to help you examine and address your most important food safety and environmental concerns. See the complete list of chapters in the table of contents at the beginning of this handbook. The end of each chapter lists resources and other useful information. For more information about topics covered in *Food*A*Syst*, or for information about laws and regulations specific to your area, contact your local environmental health or county K-State Research and Extension office.

*Kansas Food*A*Syst* Team Members:

Karen Penner, Ph.D., Project Director, Professor and Extension Food Science Specialist, Kansas State University

Scott Beyer, Ph.D., Associate Professor and Extension Poultry Specialist, Department of Animal Sciences, Kansas State University

Donald C. Cress, Ph.D., Extension Pesticide Coordinator, Department of Entomology, Kansas State University

Karen L.B. Gast, Ph.D., Associate Professor and Extension Horticulturist,

Postharvest and Marketing, Kansas State University

George Godfrey, Ph.D., Acting Vice President for Academic Affairs, Haskell Indian Nations University

Rhonda R. Janke, Ph.D., Associate Professor and Extension Specialist, Sustainable Cropping Systems, Kansas State University

Dan Nagengast, Executive Director, Kansas Rural Center

Gerald L. Stokka, D.V.M., M.S., Associate Professor and Extension Beef Veterinarian, Kansas State University

Danny H. Rogers, P.E., Ph.D., Extension Agricultural Engineer, Kansas State University

Judy Willingham, Project Manager and Extension Associate, Kansas State University

Appreciation is expressed for review and revision to:

G. Morgan Powell, Extension Natural Resource Engineer, Kansas State University

Danny H. Rogers, Extension Irrigation Engineer, Kansas State University

This chapter has been extensively edited from materials adapted by Bill McGowan, Agriculture/ Water Quality Extension Educator, University of Delaware Cooperative Extension. Adapted from *Farm*A*Syst* fact sheet #1,*Reducing the Risk of Groundwater Contamination by Improving Drinking Water Well Condition,* by Susan Jones, U.S. EPA Region V, Water Division,and University of Wisconsin-Cooperative Extension.

Chapter 5

Wastewater Management

Judy M. Willingham, Project Manager,
Extension Associate, Kansas State University

This chapter covers factors that affect storm run-off from production areas, as well as your privately-owned wastewater treatment system and its capacity to properly treat processing wastewater from your operation. Good management practices reduce run-off that may carry contaminants to other crops and waterways. Proper disposal of sewage lowers food safety risks. Be aware that local county sanitary codes may impose additional requirements and mandate a permit to construct or alter the existing system. Contact your county health, public works, or environmental department or your county or K-State Research and Extension office, for technical assistance and problem-solving ideas for your specific situation. This chapter covers the following:

1. **Permits and Regulations. The Kansas Department of Health and Environment (KDHE)** regulates **Concentrated Animal Feeding Operations (CAFOs).** Even if your processing operation discharges to a public or municipal system, there may be limitations on amounts and types of wastewater accepted. Most counties have local sanitary codes that impose specific requirements and permits for privately owned systems.
2. **Run-off and Crop Production Wastewater.** The production of animals and food crops may contribute to the introduction of contaminants such as pathogens, nitrates, and sediment into run-off. This run-off can carry pollutants to waterways and other crops down gradient. There are simple, low-cost management practices that will reduce risks affecting food safety.
3. **Characteristics of Food Processing Wastewater.** Type and amount of contaminants involved, volume, and frequency of generation are factors to be considered when planning how to deal with processing wastewater. If any of these factors can be reduced, risks are lowered and management of the wastewater becomes simpler, easier, and less expensive.
4. **Maintenance and Operation.** Several types of private, onsite wastewater treatment systems are available for use in Kansas. Each has limitations and advantages. Selecting the most appropriate system for your operation and taking good care of it prevents future problems. Good management of any wastewater means reduced food safety risks from exposure to bacteria and chemicals in the sewage.

Why should you be concerned?

Wastewater treatment systems help protect your own health and the environment. Properly used and operated, these systems also lower risks to food safety. Wastewater carries disease-causing bacteria, viruses, and other pathogens. Failing treatment systems that expose pathogens to carriers (like flies) or discharge sewage to growing crops, can affect food safety. This is especially important when the food will not be cooked, such as vegetables that will be consumed raw.

Even wastewater from vegetable washing operations, which only carries soil and limited food debris, can cause food safety problems if it accumulates and attracts insects and rodents. Nutrients like nitrogen, and phosphorus are also carried in wastewater. These nutrients promote weed growth and lower oxygen levels in surface water, thus affecting fishing and recreational use of ponds, rivers, and lakes. When a body of water is used to irrigate vegetables, it should be protected from pollution in order to reduce the risk of food contamination by irrigation water. Run-off from animal production areas may carry pathogens; the use of manure is another potential source of contamination. Other residues that may be found in this wastewater are antibiotics and crop production chemicals, which if present, will play a role in possible treatment and disposal.

Wastewater treatment systems are designed to remove or allow the break down of these contaminants before they enter groundwater (the source of drinking water via wells) or nearby lakes, streams, or wetlands.

PART 1—Permits and Regulations

What regulations affect me? How do I know I need a permit?

Concentrated Animal Feeding Operations (CAFOs) involving at least 300 animal units are required to register with the KDHE and may need to obtain a permit for management of their animal waste. KDHE defines an "animal unit" in K.S.A. 65-171d. with differing values for each species. For example: a steer is equal to one animal unit, a dairy cow is equal to 1.4 animal units, and a mature swine equals 0.4 animal units. Smaller CAFOs that are identified as having significant water pollution potential are also subject to regulation. Any size agricultural production of animals should always be operated with good management practices in the handling of manure and run-off. Good resources for smaller operations are the *River Friendly Farms* or *Farm*A*Syst,* which are available through your county K-State Research and Extension office.

Almost every Kansas county has its own sanitary code that covers minimum standards for domestic wastewater treatment and usually requires a permit for installation. Standards vary from county to county. As an example, the separation distance between a well and a septic system will range from 50 feet to 200 feet based on the county sanitary code.

If the wastewater volume exceeds 1,000 gallons/day, the KDHE may be responsible for issuing the permit and conducting inspections. A good place to get accurate information is your county environmental health department or county extension office. Do not hesitate to ask your county agent to find answers to your questions.

The disposal of hazardous materials such as solvents, paints, oils, and pesticides is regulated by the KDHE. These materials must be properly handled to prevent water pollution and cannot be included in the wastewater stream. Solvent waste should be collected separately, and disposed of as required by the KDHE, Bureau of Waste Management. That office can be reached at: (785) 296-1600.

If large volumes (>1000 gallons), are produced every day, or if the wastewater is high strength, you may fall under the regulation of the KDHE, Bureau of Water, Industrial Waste. That office can be contacted at (785) 296-5547.

Assessment 1—Permits and Regulations

Use the table below to rate your risks. For each question, indicate your risk level in the right-hand column. Although some choices may not correspond exactly to your situation, choose the response that best fits. Refer to Part 1 if you need more information to complete the table. Transfer Medium-High and High risks to the Action Check list at the end of the chapter on Page 5-10.

	LOW	LOW-MEDIUM	MED-HIGH	HIGH	YOUR RISK
Permit obtained for concentrated animal feeding operation	Registered with KDHE; no significant pollution potential.	Registered with KDHE, operation inspected and found in compliance.	Registered with KDHE, no inspection, or none required. (See *River Friendly Farms* for risk assessment.)	No registration request made,or not in compliance, or registration unknown.	O Low O Low-Med O Med-High O High
Use of existing residential wastewater treatment system	Connected to public treatment system.	Connected to residential (septic) system, modified and permitted for additional use.	Connected to unmodified residential (septic) system of unknown age.	Connected to unmodified residential (septic) system with signs of failure, e.g. wet soil, odors, ect.	O Low O Low-Med O Med-High O High
Use of solvents, lubricants, and petroleum products	None used or all such products are collected and taken for disposal.			Such products are mixed in wastewater for disposal.	O Low O High

Responding to risks

As always, your goal is to lower your risks. Use the Action Checklist on Page 5-10 to record your medium- and high-risk practices. Use recommendations in this section to help make plans to reduce your risks.

PART 2—Run-off and Crop Production Wastewater

What animals and/or crops are produced and how might they affect run-off?

The term **Good Management Practices (GMPs)** means a combination of techniques that are intended to preserve soil fertility and reduce water pollution and soil erosion. It involves controlled use of chemicals and management of discharges to lower risks of water pollution. An example of a GMP for a Concentrated Animal Feed Operation (CAFO) would be diverting stormwater from the animal pens as well as collecting and treating feedlot runoff that does occur. An example of a GMP for a field crop would be measuring existing soil nitrogen and applying no more fertilizer than necessary to provide optimum nitrogen levels.

Confined, large numbers of animals mean a concentration of manure and the loss of vegetative cover holding the soil. The amount of manure and degree of soil cover loss increases with the number of animals, their size, and the density of their confinement. Location of the animal pens down slope of cropland reduces exposure of food crops to pathogens in manure. Construction of stormwater diversion dikes up slope decreases the amount of water flowing into the pen. The use of grassed areas below pens helps slow run-off so that many pollutants are retained. Even a small number of animals (a few calves or a horse) can produce enough manure to be a problem if run-off is not controlled and reaches vegetable production areas.

The same concerns hold true for manure piles. Proper management is the key. As size increases, so does the intensity of management. Piles must not be placed in the path of stormwater run-off. Composting manure converts a waste product into a valuable soil conditioner, and is a worthwhile effort. The composting operation must be managed properly to deactivate pathogens and convert the manure into a material that will not “burn” plants. Locating manure storage and treatment sites as far away from fresh produce cropland decreases food contamination due to wind spread and run-off. Covering piles of manure helps control blowing dust and leachate from rainfall. Once composting is complete, covering until application helps control re-contamination and loss of nutrients.

There is a greater risk of contamination when uncomposted (raw) manure is used for fruits and vegetables—especially true for leafy greens. If uncomposted manure must be applied, it should be incorporated into the soil before planting. The minimum time to be allowed between manure application and harvest is 120 days before harvest. Consider the path the application equipment takes as a trail of contamination. Avoid passing through growing crops after application and be sure a tractor is not driven through manure before entering a produce field. Your county K-State Research and Extension agent can assist with advice specific to your operation and region. See Chapter 3, Growing Vegetables, Fruits, and Produce, for more specific information.

Can crop production run-off risks be reduced?

Run-off occurs due to excess irrigation or storm events. Irrigation should be monitored and controlled as a matter of water conservation. Inadequate monitoring of irrigation results in wasted water and higher pumping costs.

Storms are not controllable, but modern meteorology offers generally reliable predictions. It is common sense to apply chemicals in accordance with the label and when forecasts predict dry conditions for at least 24 hours. Chemicals washed off by rain produce no gain for the investment; reapplication means unnecessary expenses. Following label instructions for application rates and procedures gives the best chance for good results with decreased pollution and food safety risks.

Assessment 2—Run-off and Crop Production Wastewater

Use the table below to rate your risks. For each question, indicate your risk level in the right-hand column. Although some choices may not correspond exactly to your situation, choose the response that best fits. Refer to Part 2 if you need more information to complete the table. Transfer medium-high and high risks to the Action Checklist at the end of the chapter on Page 5-10.

	LOW RISK	LOW-MED	MED-HIGH	HIGH	YOUR RISK
Concentrated Animal Feeding Operation (CAFO) >300 animal units	Registered and in compliance with KDHE permit.			Not registered -or- not in compliance with KDHE permit.	O Low O High
Concentrated Animal Feeding Operation (CAFO) <300 animal units	Observing written GMPs in manure storage and composting, use containment, and divert run-off.	Observing unwritten GMPs in manure storage and composting, use containment, and divert run-off.		Manure not managed with regard to storage, run-off, or pathogen control.	O Low O Low –Med O High
Manure management	Manure piles are covered, located downgrade from cropland, and storm run-off diverted.		Manure piles are covered, storm runoff diverted, but located upgrade of cropland.	Manure piles uncovered, no diversion of storm run-off.	O Low O Med-High O High
Quality of crop land run-off	Crop protection chemicals not applied.	Crop protection chemicals applied only when 24 hours without rain predicted, and incorporated.		Crop protection chemicals applied without regard to forecast.	O Low O Low-Med O High
Quantity of cropland run-off	Cropland level grade with high residue (mulch).	Cropland slopes slightly with high residue (mulch).	Cropland slopes slightly with little residue (mulch).	Cropland slopes steeply and no residue (mulch).	O Low O Low –Med O Med-High O High

Responding to risks

Your goal is to lower the risks. Use the Action Checklist on Page 5-10 to record medium- and high-risk practices. Use recommendations in this section to help make plans to reduce your risks.

PART 3—Characteristics of Food Processing Wastewater

What types and how much of each contaminant is in your wastewater?

The first step in processing foods is washing with clean water to remove excess soil and chemical residues. The most common contaminants are inorganic dirt or sediment (containing bacteria) and whatever crop protection chemicals may have been used. If the food receives further processing that involves trimming and culling, then organic food debris is an additional contaminant. As more processing steps are added, the wastewater becomes "stronger" (carries more contaminants) because of soaps and detergents, disinfectants or sanitizers, and oils or greases. The addition of wastes from animal processing (such as blood and body fluids) greatly increases the "strength" of the wastewater. Both the types and amounts of contaminants govern the best way to treat wastewater, with the "stronger" wastewater requiring the more complex treatment.

Finding ways to decrease the "strength" of wastewater, the amount of inorganic particles, and the types of contaminants makes it easier to treat. This can be as simple as physically removing as much soil as possible from vegetables before beginning processing. Following chemical label directions so that residuals have degraded or are at very low levels before harvest is another simple step. Using the least hazardous material for the task is another wise choice.

In Kansas, soil absorption systems may receive only domestic type wastewater, which does not include highly organic wastes such as blood, or hazardous chemicals such as paints, solvents, acids, drain cleaners, oils, and pesticides. It is illegal to discharge hazardous chemicals into soil absorption systems due to the potential for groundwater contamination. Solvents may be needed to degrease processing equipment, but should never be added to the wastewater stream. Solvent waste should be collected and disposed of as required by the Kansas Department of Health and Environment (KDHE), Bureau of Waste Management. That office can be reached at: (785) 296-1600.

How much wastewater is generated and can your system handle it?

As a general rule, wastewater can be measured as equal to the water used in the operation. In other words, if your water is metered so that you can tell how much water is used, that same figure can be used to determine how much wastewater you produce. If the metered water serves both a residence and a processing operation, the amount can be closely estimated by noting the meter reading at the beginning of operation and again at the end of operation. Residential use should be avoided during hours of operation to provide the most accurate information. If there is no water meter, it is suggested that you contact your county extension office for assistance. Knowing the amount of wastewater produced helps determine the best treatment system.

Whether or not your wastewater treatment system can treat the sewage depends upon how it is designed. Unless connected to a municipal or public system, the best approach is to have a system designed to serve only the processing operation. Problems are most common when the processing wastewater is discharged to an existing residential system. It is a little like using the family sedan to pull a loaded cattle trailer; the sedan was not intended for that kind of use and will break down under continued abuse.

Water use in excess of the system's design capacity leads to inadequate wastewater treatment or system failure. Conserving water or more frequent pumping of the septic tank may extend the life of the system. Any activity that increases water use increases the load on the wastewater treatment system. For example, if you begin washing and cleaning market garden vegetables in your home kitchen, be prepared to pump the septic tank more frequently due to the increased accumulation of solids. The additional liquid volume may overload the soil absorption field. Large facilities, like a packing house, should be provided a separate system designed to treat the wastewater produced.

Sometimes changing a process in the operation can reduce the volume of wastewater to be treated. For example, water from pre-washing produce for removal of excess soil contains no organic matter; therefore it could be collected separately and reused immediately for irrigation. It could also be discharged into a grass filter or waterway to be absorbed. For food safety, it is important to avoid accumulations of such water that would draw vermin and breed insects.

How often is the wastewater produced?

Wastewater from seasonal operations that last a few months generally require smaller and simpler treatment systems. If large volumes are produced (>1000 gallons) every day, you may fall under the regulation of the Kansas Department of Health and Environment (KDHE), Bureau of Water, Industrial Waste. That office can be contacted at: (785) 296-5547.

Use the table below to rate your risks. For each question, indicate your risk level in the right-hand column. Although some choices may not correspond exactly to your situation, choose the response that best fits. Refer to Part 3 if you need more information to complete the table. Transfer medium-high and high risks to the Action Check list at the end of the chapter on Page 5-10.

Assessment 3—Characteristics of Food Processing Wastewater

	LOW	LOW-MED	MED-HIGH	HIGH	YOUR RISK
Types of contaminants	No chemicals used; only dirt washed off—or—connected to public system.	Dirt plus chemicals: label directions are followed for harvest times.	Dirt and chemicals, plus some organic food debris.	Dirt, chemicals, organic food debris (blood), plus soaps and sanitizers.	O Low O Low-Med O Med-High O High
Cleaners, solvents, and other chemicals	No cleaners, solvents, fuels, or other hazardous chemicals are used.	Only biodegradable soaps and cleaners are used.	In addition to cleaners, sanitizers are used.	In addition to cleaners and sanitizers, solvents or other chemicals are used.	O Low O Low-Med O Med-High O High
Water conservation	Only water conserving fixtures and practices are used. Drips and leaks are fixed immediately.	Some water conserving steps are taken (such as using low-flow fixtures).	Standard high-volume fixtures are used, but water-conserving practices are generally used.	Standard high-volume fixtures are used. No effort is made to conserve water. Leaks are not repaired.	O Low O Low-Med O Med-High O High
Frequency wastewater is produced	Less than 90 days/year—or—connected to public system.	90 to 120 days/year.	120 to 180 days/year.	More than 180 days/year.	O Low O Low-Med O Med-High O High
System design	Connected to public system.	Separate system for processing operation designed for the purpose.		Unknown system or using existing residential system for extra wastewater.	O Low O Low-Med O High

Responding to risks

Your goal is to lower the risks. Use the Action Checklist on Page 5-10 to record medium- and high-risk practices. Use recommendations in Part 3 to help make plans to reduce your risks

PART 4—Maintenance and Operation

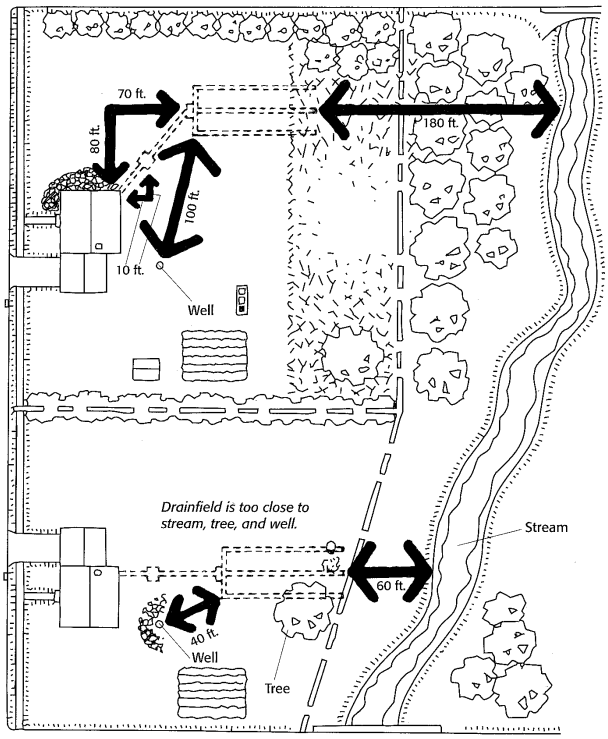
Septic Systems—the most common private method of wastewater treatment.

Throughout Kansas, the septic system is the most common method of treating wastewater for individual residences and small commercial operations. It consists of a septic tank and an underground absorption field. Proper operation requires a watertight tank large enough to hold at least two days of sewage production. The absorption field must be adequate in size and placed in a suitable soil so that the wastewater is treated adequately, and there is no liquid discharge to the ground surface. A thorough discussion of design, operation, and maintenance for septic systems is included in *Kansas Home*A*Syst, Chapter 4.* Several K-State Research and Extension bulletins dealing with septic systems are listed at the end of this chapter. What follows is a brief review of septic system use and alternative wastewater treatment systems used in Kansas.

Do you know exactly where your septic system is located?

To take proper care of a septic system, you must know where it is. Exact locations of septic system components are not obvious because they are below ground. If the location of your system is not in your records, then a previous owner, county environmental health department, or pumper's records may hold the answer. Once you have located the septic tank, sketch a map of your buildings and property boundaries. Note the distances from the septic tank opening to at least two permanent points such as the corner of a foundation or survey stakes on the property line (see figure 1 below). As long as the distances are correct, the map does not have to be drawn to scale.

Figure 1: *Site map showing location of septic system.*



KEEP A MAINTENANCE RECORD—Example below

Keeping good records each time your septic system is pumped, inspected, or repaired will help you make cost-effective maintenance decisions. *Your Wastewater System Owner/Operator Manual* is a handy file folder available from your county extension office and from many contractors. Don't forget to check out the informative brochures too.

Date	Work done	Work performed by
May 20,1997	*Installed septic system, diagram in files*	*John Installer, (222) 090-1000*
April 1,2001	*Septic tank pumped, effluent filter cleaned*	*Jerry Pumper, (222) 090-3400* *License #Rural County 23*

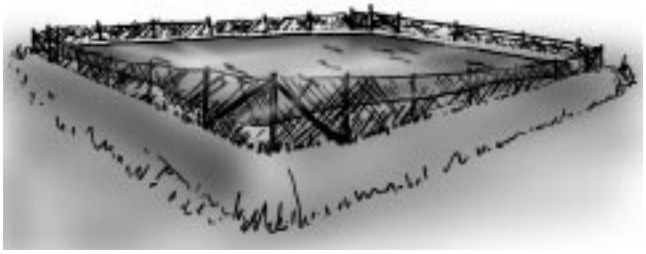
How often should your tank be pumped?

The septic tank should be large enough to hold at least two days' worth of wastewater with some space for storage of settleable solids. (Two days is long enough to allow solids to settle out by gravity.) Regular pumping is the most important action you can take to maintain your system. As more solids accumulate in the tank, particles are more likely to flow out of the tank and into the soil absorption field. The cost of pumping a septic tank ($80 to $250) is far less than the expense (many thousands of dollars) of replacing a soil absorption field, which has been clogged by escaping solids. An effluent filter is an inexpensive protection against escaping solids. (See: *Why Do Onsite Wastewater Septic Systems Fail?* MF-946.)

Most county codes require at least a 1,000 gallon septic tank; however, the expense of installing a larger tank is modest and well worth the money in terms of extended use and in providing for future expansion. A larger tank, a two-compartment tank, or a second tank in series should improve sludge and scum removal and help prevent clogging of the soil in the absorption field. If an existing residential septic system is used also for food processing wastewater, it is likely that the tank is too small and capacity should be increased.

What about the soil absorption field?

The required size of the soil absorption field is based on how much wastewater will be put in the system and how much water a unit area of soil can treat. The better the soil type or larger the soil absorption system, the higher the system's capacity for wastewater treatment. Contact your contractor, septic system installer, or local health department for information they may have on file about your septic system age, design, and location. Keep this information in a file for future reference.



What are some alternative systems?

If soil or site conditions are not suitable for a conventional soil absorption field, an alternative system might be used. The use of lagoons, also called waste stabilization ponds, may be an appropriate treatment for increased and variable volumes of wastewater. In the case of concentrated animal feeding operations, the Kansas Department of Health and Environment (KDHE) generally regulates these ponds. Otherwise, lagoon permits for domestic wastewater are obtained from the county health department.

With suitable climate and soil conditions, other alternative systems such as mounds, sand filters, mechanically aerated systems, and constructed wetlands are approved for wastewater treatment in some counties. Descriptions of these systems are beyond the scope of this publication; please see "For More Information" beginning on Page 5-10 for additional resources.

Holding tanks are sometimes allowed in *temporary* situations such as when awaiting a new system hookup or serving a very limited seasonal operation. Unlike a septic tank, a holding tank has no outlet and must be pumped frequently by a septage hauler who takes the waste to a permitted treatment site.

Assessment 4—Maintenance and Operation

Use the table below to rate your risks. For each question, indicate your risk level in the right-hand column. Although some choices may not correspond exactly to your situation, choose the response that best fits. Refer to Part 4 if you need more information to complete the table. Transfer medium-high and high risks to the Action Check list at the end of the chapter on Page 5-10.

	LOW RISK	LOW-MEDIUM RISK	MEDIUM-HIGH RISK	HIGH RISK	YOUR RISK
Wastewater discharges to:	Municipal or public system.	Private system inspected yearly and no sign of discharge.		Unknown or discharges on top of ground.	O Low O Low-Med O High
Maps and records	A map and good records are kept of repairs and maintenance.	System location and date of maintenance are known but not recorded.	System's location is known, but no knowledge of repairs or maintenance.	The system's location is unknown. No records are kept.	O Low O Low-Med O Med-High O High

Assessment 4—Maintenance and Operation

	LOW RISK	LOW-MEDIUM RISK	MEDIUM-HIGH RISK	HIGH RISK	YOUR RISK
Septic tank pumping (if present)	The septic tank is pumped on a regular basis as determined by an annual inspection, or about every three to five years.	The septic tank is pumped, but not regularly.		The septic tank is not pumped.	O Low O Low-Med O High
Soil absorption field protection (if present)	Vehicles and other heavy objects or activities are kept away from the soil absorption field area.		Occasionally, the soil absorption field is compacted by heavy objects or activities.	Vehicles, livestock, heavy objects, or other disturbances are permitted in the soil absorption field area.	O Low O Med-High O High
Diverting surface water	All surface runoff is directed away from the soil absorption field.		Some surface water flows into the soil absorption field area.	Runoff from land, rooftops, driveways, etc. flows onto the soil absorption field.	O Low O Med-High O High
Plantings over the soil absorption field (if present)	Perennial grass or other shallow-rooted plantings are mowed and densely cover the soil absorption field	Grasses and other shallow-rooted plantings over the field are not mowed, allowing spotty cover.	A garden is planted over the soil absorption field.	Trees and shrubs are growing over or near the soil absorption field.	O Low O Low-Med O Med-High O High
Alternative treatment system used	Maintenance performed as manufacturer recommends by trained service provider.	Maintenance performed as manufacturer recommends.	Maintenance occurs, but usually at longer interval than manufacturer recommends.	No maintenance program.	O Low O Low-Med O Med-High O High

Responding to risks

As always, your goal is to lower your risks. Use the Action Checklist on Page 5-10 to record your medium- and high-risk practices. Use recommendations in this section to help make plans to reduce your risks.

ACTION CHECKLIST

Go back over the assessment tables to make sure that you recorded all the high and medium risks you identified in the Action Checklist. For each medium and high risk discovered, write down improvements you plan to make. Use recommendations from this chapter and from other resources to decide upon an action you are likely to complete. A target date will keep you on schedule. You do not have to do everything at once, but try to eliminate the most serious risks as soon as you can. Often it helps to tackle the inexpensive actions first.

Action Checklist—Wastewater Management

Write all high and medium-high risks below.	What can you do to reduce the risk?	Set a target date for action.
Sample: Low area over soil absorption field is always wet.	Have soil absorption field inspected for blockages and clean as needed. Divert runoff water. Check for leaks and repair.	One week from today: May 2

For More Information

No matter where you live, there are people who can help. Check with agencies such as your county extension office, county environmental health department, and the Kansas Department of Health and Environment (KDHE) for assistance. Septage pumpers, contractors, and laboratories are valuable sources of information as well.

http://www.oznet.ksu.edu/
Kansas State University Research and Extension; most publications are available through this site.

Bulletins available from your county K-State Research and Extension office:

Get to Know Your Septic System. MF-2179.

Minimum Standards for Design and Construction of Onsite Wastewater Systems. MF-2214 11/97.

Rock-Plant Filter Design & Construction. MF-2340, 6/98 $0.15.

Rock-Plant Filter Operation, Maintenance & Repair. MF-2337, 6/98, $0.15.

Septic Tank Maintenance: A Key to Longer Septic System Life. MF-947, 8/98, $0.15.

Soil Evaluation for Home Septic Systems, MF-945. 3/93, $0.15.

Wastewater Pond Design and Construction. MF-1044, 11/97. $0.30.

Wastewater Pond Operation, Maintenance and Repair. MF-2290, 11/97. $0.15.

Why Do Onsite Wastewater (Septic) Systems Fail? MF-946, 12/98, $0.30.

Your Wastewater System Owner/Operator Manual (File Folder). S-90, 1/96, $0.35.

On-Site Domestic Sewage Disposal, (38 pages). MWPS-24, First Ed., 8/82, $6.00.

River Friendly Farms–Environmental Farm Planning 1999, by Rhonda Janke and Dan Nagengast. Kansas Sustainable Agriculture Series Paper Number 7, Contribution No. 99-390, Kansas Agriculture Experiment Station, Kansas State University.

The National Small Flows Clearinghouse (NSFC) has several publications on septic system design and maintenance, as well as information about alternative systems. Contact them at: NSFC, West Virginia University, P.O. Box 6064, Morgantown, WV 26506-6064, or call (800) 624-8301 to request a catalog or ask questions. Their Web site is: *http://www.estd.wvu.edu/nsfc/nsfc_homepage.html*

The following publications are available from NSFC:

Your Septic System: A Reference Guide for Homeowners, WWBRPE17. This brochure describes a conventional septic system and how it should be cared for to achieve optimal results.

The Care and Feeding of Your Septic Tank System, WWBRPE18. This brochure describes septic tanks and soil absorption fields and provides guidelines to prolong their usefulness.

So...Now You Own a Septic Tank, WWBRPE20. This document describes how a septic tank system works and how to keep it functioning properly.

Preventing Pollution Through Efficient Water Use, WWBRPE26. This brochure describes efficient water use and its role in preventing pollution.

Homeowner's Septic Tank System Guide and Record Keeping Folder, WWBLPE30. The National Onsite Wastewater Recycling Association developed this folder to provide septic system owners with simple operation and maintenance guidelines to ensure their system will work properly. Their Web site is: *http://www.nowra.org*

Groundwater and Geology

Contact the Kansas Geological Survey at: (785) 864-3965; the KGS Web site is: *http://www.kgs.ukans.edu/kgs.html*

You can also check with USDA Natural Resource and Conservation Service (NRCS) or your county Soil Conservation District for your soil description.

Water Conservation

The Kansas Rural Water Association has water conservation information and devices which reduce water use; call: (785) 336-3760 or write them at P.O. Box 226, Seneca, KS 66538; their Web site is: *http://www.krwa.net/*

Many local water utilities have booklets of water conservation tips available. Publications are also available from the American Water Works Association; call (303) 794-7711 for more information, or go to their Web site: *http://www.awwa.org/*

The US Environmental Protection Agency has publications as well, such as document number EPA/841/B-95/002, *Cleaner Water Through Conservation;* to order, contact the National Center for Environmental Publications and Information, P.O. Box 42419, Cincinnati, OH 45242-2419; fax (513) 489-8695. Their Web site is: *http://www.epa.gov/ow/pubs.html*

Kansas Food*A*Syst Helps Ensure Your Safety

This *Kansas Food*A*Syst* handbook covers a variety of topics to help you examine and address your most important food safety and environmental concerns. See the complete list of chapters in the table of contents at the beginning of this handbook. The end of each chapter lists resources and other useful information. For more information about topics covered in *Food*A*Syst*, or for information about laws and regulations specific to your area, contact your local environmental health or county K-State Research and Extension office.

Kansas Food*A*Syst Team Members:

Karen Penner, Ph.D., Project Director, Professor and Extension Food Science Specialist, Kansas State University

Scott Beyer, Ph.D., Associate Professor and Extension Poultry Specialist, Department of Animal Sciences, Kansas State University

Donald C. Cress, Ph.D., Extension Pesticide Coordinator, Department of Entomology, Kansas State University

Karen L.B. Gast, Ph.D., Associate Professor and Extension Horticulturist, Postharvest and Marketing, Kansas State University

George Godfrey, Ph.D., Acting Vice President for Academic Affairs, Haskell Indian Nations University

Rhonda R. Janke, Ph.D., Associate Professor and Extension Specialist, Sustainable Cropping Systems, Kansas State University

Dan Nagengast, Executive Director, Kansas Rural Center

Gerald L. Stokka, D.V.M., M.S., Associate Professor and Extension Beef Veterinarian, Kansas State University

Danny H. Rogers, P.E., Ph.D. Extension Agricultural Engineer, Kansas State University

Judy Willingham, Project Manager and Extension Associate, Kansas State University

Appreciation is expressed for review and revision to:

Debra Baker, Environmental Scientist, Bureau of Water, Kansas Department of Health and Environment

Barbara Dallemand, Assistant. Extension Engineer, Kansas State University

This chapter was extensively revised and edited based on materials written by Barbara Kneen Avery, College of Human Ecology, Cornell Cooperative Extension.

Chapter 6

Managing Production Waste: Reduce, Reuse, Recycle, and Compost

Judy M. Willingham, Project Manager,
Extension Associate, Kansas State University

There are many ways to reduce solid wastes and many alternatives for disposing of the waste you make. This chapter will help you examine your current waste disposal and consumption practices and how they may affect not only food safety, but also the air, soil, and water quality on your property or in your home or community. It covers the following:

1. *Reducing and Preventing Waste*— How can I choose products and services to reduce waste ("precycling" or "enviro-shopping")?
2. *Reusing, Recycling, and Composting*— What creative ways can I use to decrease wastes?
3. *Managing Waste and Disposal*— How can I prevent food contamination and what are alternatives to on-site dumping and burning? What is hazardous waste and how can I handle it?

Why should you be concerned?

Any business generates wastes and has costs for clean up associated with it—this includes food production on the farm. The types of wastes start with purchased containers of chemicals and supplies through organic wastes like manure or plant debris. While some wastes can be converted into an asset through composting, other wastes only accumulate to become vermin habitat and an eyesore. Even if waste disposal is on the farm in a well-managed legal manner, time and equipment costs are involved. Every action taken to reduce waste (and the need for disposal) equals savings in time, labor, and money.

What would you find if you examined wastes from *your* operation over a year's time? Could you find ways to purchase less trash—perhaps buy materials in smaller quantities you will use up quickly, or in compostable paper containers? Are some items recyclable so that you don't have to pay someone to haul them away? Have you considered composting all organic wastes—even paper? Finding ways to reduce waste is like finding money.

Figure 1.

DEFINING PRODUCTION WASTE

What do you call the stuff you want to get rid of? Trash? Garbage? Solid waste? Recyclables? Refuse or junk? Here's how we define terms for this chapter:

1. "Trash" and "waste" refer to items and materials that are no longer wanted—anything discarded or useless.
2. "Reusables" are items that are used again by a different user or for a different purpose, like a hand-me-down jacket or a jar used for a cup. They are not reprocessed into raw materials.
3. "Recyclables" are materials like glass, metal, paper, and even refrigerators that are collected, separated, processed back into raw materials, and made into new products.
4. "Compostables" are primarily organic and food wastes that can decompose and return to the earth as nutrients or soil.
5. "Garbage" is generally food waste or wet food either of animal or plant origin.
6. "Municipal Solid Waste" (MSW) is household waste combined with commercial, business, and institutional waste.
7. "Hazardous waste" is defined and regulated by EPA and the **Kansas Department of Health and Environment** (**KDHE**). Check the **Material Safety Data Sheet** (**MSDS**) that comes with the chemical to see if the management instructions refer you to an agency for disposal; if so, the material is likely to be considered hazardous. It is best to contact KDHE at (785) 296-1600 with your questions.

The problem with waste

Producing less waste and finding creative alternatives for dealing with waste not only saves dollars but also helps protect air, soil, and water quality and the health of your family and livestock. Protecting your land and environment also protects your investment. In addition, accumulations of waste provide attractive habitat for rodents and insects. These vermin are known to carry disease and are considered a food safety problem. Proper waste management is critical for food protection. Improperly handled waste can create pollution on your land, resulting in potential health concerns as well as a lower value at sale.

PART 1—Reducing and Preventing Waste

If you do not produce waste, you will not need to get rid of it—it's that simple. But since we all generate at least some waste, we need to think about ways to make less. By making thoughtful choices when we buy products and plan activities, we can consciously decrease the waste we produce.

Can you find ways to buy and sell that reduces waste produced?

You make purchasing decisions every day, and each purchase involves a certain amount of waste production and use of natural resources. Whatever is being purchased, your decision to select a certain product or no product at all will determine the type and volume of waste that you must someday discard. If you buy with disposal costs in mind, you will select products that produce a minimum of waste, last longer, and use fewer natural resources. "Precycling" and "enviro-shopping" are terms that refer to this kind of purchasing. Perhaps you can encourage your customers to bring containers back for you to re-use appropriately.

An "enviro-shopper" typically asks the following questions before making a purchase:

1. *How much do I need?* Among other things, enviro-shopping means buying only what you need so that there is no waste to throw away. A good price or bulk packaging may tempt you to buy more paint or cleaner than you may really need. But what may seem like a "good deal" may end up wasting money and natural resources, because the unused or spoiled product will eventually have to be thrown away. Make sure you can use what you buy, or find someone who can use your leftovers. Remember that latex paint and many pesticides are time and temperature sensitive, so that **storage under low temperatures renders many of them worthless**. Check the label for storage instructions and "use by" dates.

2. *Are my purchases long lasting, repairable, and reusable?* In our "throw-away" society, it is sometimes hard to find good quality products at an affordable price. Although durable products may be more expensive, they are usually a better investment in the long run. Look for equipment that can be fixed when broken. Long-lasting products are a good choice; not only is the initial cost spread over a longer time, but reliability saves downtime. Also, select products that are energy-efficient for even greater savings.

   Products, packaging, and materials that can be reused—passed along to someone else or used for other purposes— save money and conserve resources. For example, you can purchase supplies that come in plastic buckets that can be used for other purposes. One caution is that chemical containers must never be used for holding food.

3. *Is the product package recyclable?* As a producer, are you using materials that are recyclable? Many product containers and packaging materials are potentially recyclable—such as glass bottles, paper, plastic bags, and cardboard boxes. To promote recycling, many manufacturers use a chasing-arrows recycling symbol (Figure 2). But be careful; your local recycling program may not take them. If a product cannot be recycled locally, then the product packaging is *not* truly recyclable—at least not where you live. The list of materials that your local recycling program will accept probably changes over time, so call first. Your county Noxious Weed Department is the local contact for recycling options.

   If you cannot recycle something locally, you might be able to take it to a close neighboring community that will accept it. But do not waste more natural resources (such as gasoline) than you will save by recycling. Combine trips to recycling facilities with other tasks. Neighbors can cooperate in recycling by taking turns transporting everyone's recyclables to the center.

4. *Is the product or its packaging made from recycled materials?* There is a surprising variety of products made from recycled material: everything from carpets to

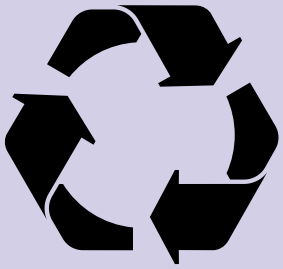


Figure 2: The recycling symbol means the product or packaging is recyclable. But if your local recycling program won't accept the product, it isn't really recyclable—at least not where you live.

detergent bottles. On product packaging, look for the words "made from recycled materials" or, even better, "made from *post-consumer* recycled materials." Each year, for example, billions of recycled aluminum beverage cans are melted down and made into new cans. But remember—just because you see a chasing arrow, do not assume that the product or packaging can be recycled locally.

5. *Do I buy and produce products with the least amount of packaging*? About a third of the paper, plastic, glass, cardboard, and metal we throw away comes from packaging. Look for ways to buy less trash. Buying in bulk (if the item will not be wasted) and selecting concentrated products are examples of minimizing waste from packaging.

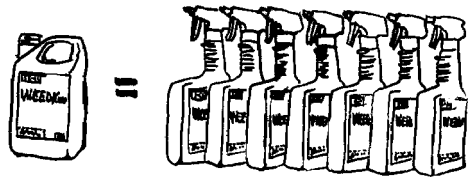


Figure 3: Selecting concentrated products is one way to minimize waste from packaging.

HOW MUCH WASTE DOES YOUR OPERATION PRODUCE EACH DAY?

This project could be called "garbology." Designate an area and some large containers located close to your processing area(s). For one day, simply separate and collect the waste by type: metals, paper, plastics, wet (compostable) waste, and other. Don't throw anything away…yet.

At the end of the workday, look at what you have collected, and analyze your waste: How much of the total weight or volume is paper? How much is recyclable, and how much is potentially hazardous? How much could have been avoided?

Think about how much it costs for your waste disposal in a year. Don't forget to count your time spent hauling and disposing of the waste. Many businesses have found cost benefits in reducing waste production.

ASSESSMENT 1—Reducing and Preventing Waste

Part 1 will help you examine your potential for cutting the amount of waste you produce and preventing some kinds of waste completely. Fill out the assessment table below to determine your ***waste potential***—to identify areas where you can minimize waste. Indicate your waste potential in the right-hand column.

Although some choices may not correspond exactly to your situation, choose the response that best fits.

	LOW	LOW-MEDIUM	MED-HIGH	HIGH	YOUR WASTE POTENTIAL
Quantities purchased	I only buy what I can use and avoid accumulating unused products.	I sometimes buy more product than I can use, but I use up the remainder quickly or store it safe from vermin.	I sometimes buy more product than I can use and leftovers are thrown away.	I often buy more product than I can use and leftovers are thrown away.	O Low O Low-Med O Med-High O High
Product durability and potential for reuse	I select products based on their durability, ease of repair, and potential for reuse.	I sometimes consider durability, ease of repair, or potential for reuse.	Occasionally I consider durability, ease of repair, or potential for reuse.	I never consider durability, ease of repair, or potential for reuse.	O Low O Low-Med O Med-High O High
Type of packaging for supplies	I regularly purchase containers/ packaging that are small or compostable or can be recycled locally.	I sometimes purchase supplies with waste disposal in mind.		I never consider waste disposal when purchasing.	O Low O Low-Med O Med-High O High

Responding to your waste potential

Your goal is to reduce the amount of waste you produce—especially waste that ends up in a landfill or incinerator. Turn to the Action Checklist on Page 6-10 to record the high and medium-high waste potentials you identified in the assessment table. Use the ideas in this section to help reduce your waste potential.

Part 2—Reusing, Recycling and Composting

Once you make waste, it has to go somewhere. Part 2 reviews three ways to keep materials out of a landfill or incinerator.

For each item of waste, there are three questions to ask:

First, is it reusable? Reuse should be your first objective, as it typically is the easiest. Often, reuse is limited only by the imagination—you can usually find uses for more materials than you realize. Sharing old clothes and used furniture is a common form of reuse. See if neighbors can use your excess paint, lumber, or empty plastic pails—if the items can be reused safely.

When accumulating reusables, store them so that they remain useful and do not create habitat for vermin. For example, keeping stacks of display trays on the floor of a shed provides sheltered breeding areas for mice. If mouse urine contaminates the trays, they become unfit for use and must be discarded.

Second, is it recyclable? Any time you can dispose of waste for free, you lower your costs. Check with your city or county agencies, trash haulers, and local or area recycling business to see what is recycled in your area, where items are recycled, and how to prepare items for recycling. Plastic containers are marked with a number, usually inside the recycling symbol. Numbers 1 and 2 are most easily recycled, and should be your first choice in plastic packaging.

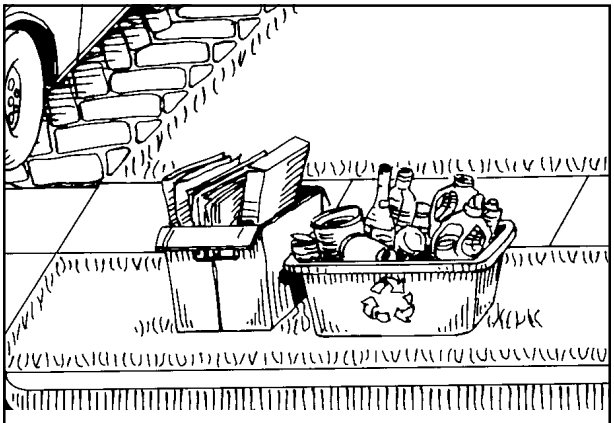


Figure 4: Find out what is recyclable in your area and prepare items for recycling.

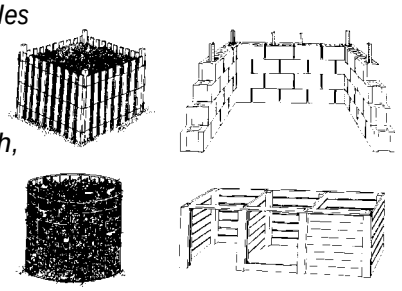
Again, storage of recyclables should be for short times, and managed so as not to attract insects and rodents. Plastic containers holding rainwater are ideal for mosquito breeding. Piles of wood make fine rodent homes.

Third, can it be composted? Organic wastes like produce culls and trimmings and animal manure, can be composted with minimal trouble. The amount of such wastes you generate depends on your food product, the processes used in your operation, the climate, and the type of plant or animal. Composting—or "nature's recycling"—is an effective way to handle organic waste with the compost produced becoming an extra benefit. In Kansas, if composting operations involve more than simple yard waste composting bins, the Kansas Department of Health and Environment, Bureau of Waste Management must be contacted. Simple registration of the operation is appropriate for sites smaller than one-half acre; larger composting operations will be permitted. Call (785) 296-1121 for further information.

It is important to place the composting site where it will be well separated from any food processing areas. If properly managed, animals will not be attracted to the compost, but to be sure, allow at least 100 feet between the composting site and any food processing areas. Placement should also be distanced from nearby waterways or water bodies. When an exposed composting operation is located on a slope or stream bank, rainfall washes off chemical residues before they can be deactivated. In addition, the nutrients that make compost so valuable may leach out and be carried off by storm water to the nearest water resource, where water quality and fish habitat are compromised.

Composting is a natural process that (with the help of microbes, earthworms, and fungi) turns organic processing wastes into a high-quality soil conditioner. Many common materials can be composted on site: food waste, leaves, grass clippings, plant trimmings, straw, and even shredded paper. The final product is a dark brown, crumbly compost that has a clean, earthy scent. It can be spread on cropland or mixed with garden soil as an excellent natural soil conditioner. Properly sited and managed, animal wastes like manure (except pet manure), offal, and even carcasses can also be composted. Your county K-State Research and Extension office will be able to provide specific information to help you compost the wastes from your operation. Figure 5 shows some examples of small composting operations.

Figure 5: Examples of compost bins made with snow fence, concrete blocks, wire mesh, and pressure-treated wood.



ASSESSMENT 2—Reusing, Recycling, and Composting

Use the table below to identify preferred methods to keep waste out of the landfill. Indicate your waste potential level in the right-hand column. Although some choices may not correspond exactly to your situation, choose the response that best fits.

	LOW POTENTIAL	LOW-MED POTENTIAL	MED-HIGH POTENTIAL	HIGH POTENTIAL	YOUR POTENTIAL
Reusing	I reuse as many items as possible.	I reuse most items.	I reuse items when it is convenient to do so.	I never reuse items.	O Low O Low-Med O Med-High O High
Storage of recyclable items	I store for less than a month & protect from contamination.	I store for a few months & protect from contamination.	I store for up to a year & usually protect from contamination.	I store indefinitely & items are unprotected.	O Low O Low-Med O Med-High O High
Recycling	I recycle as many wastes as possible.	I recycle some, but not all recyclable wastes.	I recycle when it is convenient to do so.	I never recycle.	O Low O Low-Med O Med-High O High
Storage of hazardous materials (see definition Page 6-8)	None stored—no leftovers.	Stored in locked area separate from food processing areas, in accordance with label.		Storage not locked—or—not separate from food processing areas—or—not as labeled.	O Low O Low-Med O High
Composting	I compost and manage all organic wastes onsite at least 100 feet from processing areas.	I compost most organic wastes; the site is at least 50 feet from processing areas.	Sometimes organic wastes are composted; the site is between 20 and 50 feet from processing areas.	I never compost, or the site is less than 20 feet from the processing areas.	O Low O Low-Med O Med-High O High

Responding to your waste potential

Your goal is to reduce waste or find the best alternatives for dealing with it. Turn to the Action Checklist on Page 6-10 to record the high and medium-high waste potentials you identified above. The information in this section can help you plan improvements.

PART 3—Managing Waste and Disposal

Your goal in managing waste is to handle and dispose of it so that you can market a safe product and protect your farm's environmental resources. How you manage the processing waste from your operation can affect the safety of your food product through cross-contamination. This occurs in various ways such as:

- Splash or drips or drainage from waste located near the food or processing operation
- Vectors (insects, rodents) that are attracted to and congregate around the waste
- Personnel activities bringing debris into the facility

Disposing of processing waste by burning it or dumping it on private property can compromise food safety and pose threats to your health and the environment. Although these disposal methods have been used in many rural areas for decades, local and state laws are becoming more restrictive. Many counties ban dumping or burning of waste in order to protect soil, water, and air quality. At certain times of the year or during a drought, burning is only allowed with a permit or prohibited due to wildfire hazard.

Do you control cross-contamination?

After you have made every effort to reduce the waste associated with production and processing, you will need to consider disposal. Where and how you do it can affect the safety and quality of your food product.

Insects and rodents (vectors) are to be expected around human activity, but by following some simple guidelines, their presence can be limited. The use of poisons is **not** the first step in control. Unless carefully used, poisons can contaminate the food you are trying to protect. It is far safer to control by eliminating the habitat or by using traps. Should baits become necessary, use non-toxic formulations. Poison-type baits should never be used in areas where food is stored or processed.

Understanding that disease vectors (rodents and insects) need food, water, and shelter helps you see changes you can make. Just as people avoid deserts where these things are unavailable, removing accessibility to water, food, and shelter will discourage vectors. Piles of waste may provide all three; therefore, reducing the amount of waste and making it inaccessible by removal or containment will help control these undesirable animals. If daily removal is not possible, leak-proof, heavy walled containers with tight-fitting lids are best for holding waste; garbage bags are suitable only for lining containers or temporary collection prior to removal.

Within the processing area, adequate containers should be readily available where ever waste is generated. The containers should be placed so that waste is deposited without dripping or splashing on food products or on the surfaces where they might be processed. In open-air conditions, it is a good idea to have some means to cover the waste can when it is not in use. At the end of the day, all waste should be collected and removed from the facility for proper disposal or vermin-proof storage.

Figure 6.

BYPRODUCTS OF OPEN BURNING

Smoke, particles, or ash from burning waste may contain some of the following pollutants:

Arsenic from some wood preservatives or pesticides

Benzene and other solvents from some paint or varnish strippers

Cadmium from nickel-cadmium batteries and plastics such as PVC

Carbon monoxide from incomplete combustion

Chromium from colors in some colored paper and paints

Dioxin from byproducts formed when chlorine-containing products such as some plastics are burned

Formaldehyde from some particle board and fabric treatments

Hydrochloric acid from some mixed waste paper

Lead from some paint on old boards, batteries, and PVC plastics (lead is used as a stabilizer in PVC)

Mercury from some batteries, paints, plastics, and fluorescent lights

Nitrogen oxide from some colors and inks

Sulfuric acid from some chemicals, dyes and pigments, rayon, and film

NOTE: Some of these chemicals have burning points higher than a burn barrel will reach. However, they might end up in ash on the ground or as floating particles.

The waste holding area outside should be at a distance from the processing area and follow the same guidelines as locating a composting site. (Location of composting operations has been discussed in Section 2.) Should vectors be attracted to the holding area, separation makes it less likely that they will also enter the facility. Distance also decreases the possibility of people inadvertently carrying the waste into the processing area on shoes or with supplies.

Do you burn the waste from your operation?

In the past, some businesses used burn barrels to get rid of waste. When paper, plastics, printing inks, batteries, and other common materials are burned, a noxious mix of chemicals can be released into the air (See figure 6 on Page 6-6). Some of these—such as lead or mercury or even the byproducts given off when plant debris is burned—can be hazardous to breathe.

Eventually, most byproducts from burning are removed from the air by rain or snow and are deposited on land or in water. Due to concerns about such depositing of hazardous air pollutants, laws exist that restrict if, or what, you can burn. Generally, open burning of waste has been banned. Always check with local authorities before burning.

Do you dump waste on your land?

With the exception of personal domestic waste in agricultural areas, it is generally illegal to dispose of waste on your land. Waste dumped on your property is not only unsightly, it may contain harmful chemicals that can leach out and contaminate groundwater (Figure 7), or be spread by wind and rain. Discarded paint, for example, may contain lead or mercury. Pesticide containers may contain toxic residue, and used oil filters usually harbor petroleum products and harmful metals. These pollutants can soak into the soil, pollute well water, and find their way into nearby lakes, streams, or wetlands. If your waste contains hazardous substances—even in small quantities—it should be disposed of in a properly constructed and regulated hazardous waste landfill. Discarded tires, which provide a haven for mosquitoes, are another concern.

Lending institutions are commonly requiring an environmental assessment before they will consider loaning money on rural property. Property owners should be prepared to disclose environmental information such as known dumpsites or other hazards on the property being sold. So if you have a dump or burn site, such as an oil or pesticide dumpsite, be prepared to tell potential buyers.

For more information about disposing of waste on your property, contact your local environmental or health department, codes department, or a licensed landfill operator.

Do you dump waste down a drain or storm sewer?

Especially for operations served by street drains and storm sewers, any solid or liquid wastes exposed to the weather—including animal wastes, motor oil spills, solvent spills, solvent-based paints and products, and other product spills—can wash directly into lakes and streams. Storm sewers, remember, are rarely connected to wastewater treatment facilities. ***It is illegal in most places to dispose of waste in storm drainage systems.*** Never dump waste onto the ground or into a water body, stream or river.

Some materials, like foam "peanuts" and other plastic debris, can be transported by storm runoff to open water where they may be mistaken for food and eaten by fish or birds.

Dumping potentially hazardous substances down a drain that leads to a septic system or sewer system can also cause problems; see Chapter 5, Wastewater Management, for more information.

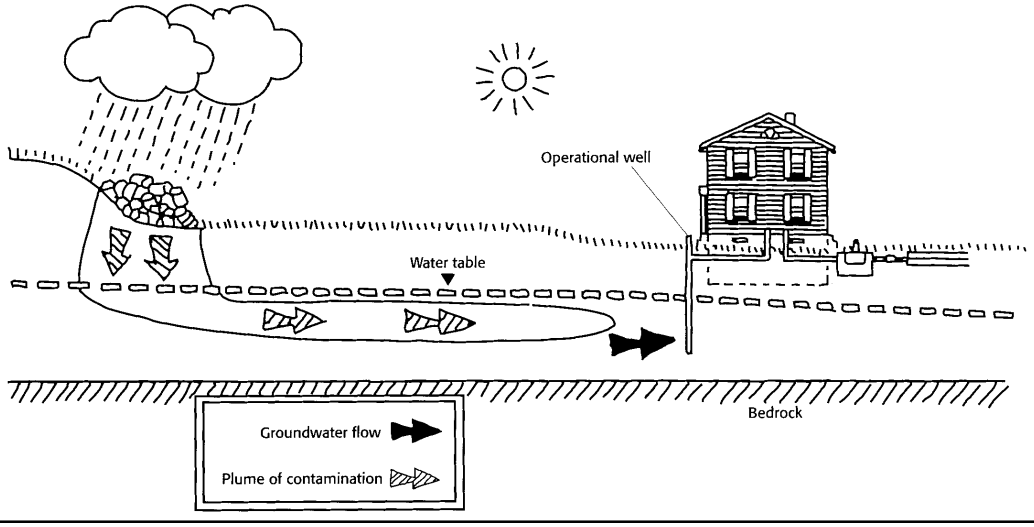


Figure 7: Waste dumped on or near your property may contain harmful chenicals that can leach out and contaminate groundwater.

WHICH WASTES ARE HAZARDOUS?

Figure 8.

By reading product labels, you can generally tell which ones have hazardous ingredients. Look for words like *WARNING, CAUTION, DANGER, FLAMMABLE, POISON, VAPOR HARMFUL, or FATAL IF SWALLOWED.* These are clues that a substance in the product is potentially hazardous to your health and the environment.

Carefully dispose of such products—especially if unused portions of the product are in liquid form. Although dry chemicals can be hazardous, liquids can more easily injure waste haulers, react with other discarded chemicals to start fires or create deadly gases, or seep through soils and into water sources. The best approach for dealing with these products is to use them up, if it is safe and legal to do so, so nothing is left to discard. *Check with your county Noxious Weed program to see if your community has implemented a Household Hazardous Waste collection program.*

Always read the MSDSheet or label for disposal recommendations, or contact the manufacturer. Remember that empty pesticide containers are considered hazardous waste.

ASSESSMENT 3—Managing Waste and Disposal

Complete the table below to determine your risks and consider alternatives to on-site methods of disposal. Choose the statement from the right-hand columns that best fits your situation. Refer to the information in Part 3 to help you respond.

	LOW RISK	LOW-MEDIUM RISK	MEDIUM-HIGH RISK	HIGH RISK	YOUR RISK
Avoiding cross-contamination	Waste is in proper containers with lids, removed daily; held at least 100 ft. from open-air processing areas.	Waste is in proper containers with lids, less than 100 ft. from open-air processing areas, no vectors seen.	Waste is in bags; holding area is 20-50 ft. from open-air processing areas; vectors seen occasionally.	Waste is uncontained, accumulates for several days, less than 20 ft. from processing areas; vectors are common.	O Low O Low-Med O Med-High O High
Vector control	Habitat not conducive to vectors, no bait required.	Non-hazardous bait or traps used.	Toxic baits used only in out-buildings, not in food-processing areas.	Toxic baits used in food processing areas.	O Low O Low-Med O Med-High O High
Burning waste	No waste is burned on site.	Only non-toxic materials are burned. If burning is legal, burning guidelines are strictly followed.	Sometimes mixtures of waste are burned with legally burnable materials.	Mixtures of waste (including paper, solvents, batteries, and plastics) are commonly burned. **Burning when it is illegal.**	O Low O Low-Med O Med-High O High

	LOW RISK	LOW-MEDIUM RISK	MEDIUM-HIGH RISK	HIGH RISK	YOUR RISK
On-site dumping (Excluding properly managed composting sites.)	No waste is dumped on my property or on public property.	Only non-toxic wastes are dumped on-site—in an approved, properly designed site.		All wastes and liquids, appliances, tires, and other junk are dumped on-site. **Dumping onsite when it is illegal**	O Low O Low-Med O High
Dumping near water ways or down storm sewers or drains	No hazardous materials are discarded in a sewer system, septic system, or storm drain.		Some runoff carries spills and chemicals away; runoff occasionally flows into waterways or storm sewers.	Hazardous and other wastes are discarded in a waterway, sewer system, septic system, or storm drain.	O Low O Med-High O High

Responding to risks

Your goal is to reduce your risks. On the Action Checklist on Page 6-10, write all high and medium risks you identified. Use the ideas in this section to help plan your actions.

ACTION CHECKLIST

Managing Production Waste: Reducing, Reusing, Recycling, and Composting

Go back over the assessment tables to ensure that all medium-high and high waste potentials and risks you identified are listed in the Action Checklist on the following page. For each item listed, write down the improvements you plan to make. Use recommendations from this chapter and other resources to decide on actions you are likely to complete. A target date will help keep you on schedule. You don't have to do everything at once, but try to eliminate the most serious problems as soon as you can. Often it helps to tackle the inexpensive actions first.

Write all high and medium-high waste-making potentials and risks below.	*What can you do to cut waste or reduce the risk?*	*Set a target date for action.*
Sample: Products are purchased without considering whether the packaging is recyclable.	Find out about our area's recycling program and try to buy products with packaging that can be recycled locally.	One week from today: March 8

For More Information

Recycling, composting, and waste disposal

Contact your local environmental, health, or sanitation department, recycling center, fire department, city office, or your county K-State Research and Extension Office. Get the latest list of what is locally recyclable and how to prepare items for recycling. Ask for information on composting and other disposal alternatives and a schedule of hazardous waste collection days. Find out where to take used motor oil, batteries, and appliances.

Internet resources

http://www.oznet.ksu.edu/ Kansas State University Research and Extension; most publications are available through this site.

http://www.cfe.cornell.edu/compost/composting_homepage.html Cornell University; information on carcass composting.

http://www.kdhe.state.ks.us/waste.html Kansas Department of Health and Environment; offers information about waste disposal, hazardous waste, and regulations.

Local regulations on burning and dumping

Most communities ban dumping and/or burning waste on your land. Check with local zoning or environmental health agencies for regulations in your area.

Publications

These bulletins are available from your county K-State Research and Extension Office or by calling K-State Extension Agronomy, (785) 532-5776:

Considerations for Direct Land Application of Organic Waste Products. MF-2224 (8/98)

*Disposing of Pesticide Containers.*EP13 (5/95)

Making and Using Compost. MF1053

Guide for Community Yard Waste Composting in Kansas. MF-2275

Sustainable Agriculture Composting dead livestock: A new solution to an old problem. Iowa State University, Extension Publication #SA 8 (rev. Nov 99).

Composting Manure and Other Organic Residues in the North Central Region. North Central Regional Extension Publication #600.

Lund, Herbert F., ed. *The McGraw-Hill Recycling Handbook,* New York: McGraw-Hill, Inc. 1993.

Rathje, William and Cullen Murphy. *Rubbish! The Archaeology of Garbage*. New York: Harper Collins. 1992.

Wackernagel, Mathis and William E. Rees. *Our Ecological Footprint: Reducing Human Impact on the Earth.* Philadelphia: New Society Publishers. 1996.

*Kansas Food*A*Syst* Helps Ensure Your Safety

This *Kansas Food*A*Syst* handbook covers a variety of topics to help you examine and address your most important food safety and environmental concerns. See the complete list of chapters in the table of contents at the beginning of this handbook. The end of each chapter lists resources and other useful information. For more information about topics covered in *Food*A*Syst*, or for information about laws and regulations specific to your area, contact your local environmental health or county K-State Research and Extension office.

*Kansas Food*A*Syst* Team Members:

Karen Penner, Ph.D., Project Director, Professor and Extension Food Science Specialist, Kansas State University

Scott Beyer, Ph.D., Associate Professor and Extension Poultry Specialist, Department of Animal Sciences, Kansas State University

Donald C. Cress, Ph.D., Extension Pesticide Coordinator, Department of Entomology, Kansas State University

Karen L.B. Gast, Ph.D., Associate Professor and Extension Horticulturist, Postharvest and Marketing, Kansas State University

George Godfrey, Ph.D., Acting Vice President for Academic Affairs, Haskell Indian Nations University

Rhonda R. Janke, Ph.D., Associate Professor and Extension Specialist Sustainable Cropping Systems, Kansas State University

Dan Nagengast, Executive Director, Kansas Rural Center

Gerald L. Stokka, D.V.M., M.S., Associate Professor and Extension Beef Veterinarian, Kansas State University

Danny H. Rogers, P.E., Ph.D. Extension Agricultural Engineer, Kansas State University

Judy Willingham, Project Manager and Extension Associate, Kansas State University

Appreciation is expressed for review to:
Bill Eberle, Extension Land Resources Specialist, Kansas State University.

This chapter has been extensively revised, based on original materials written by Shirley Niemeyer, Professor and Extension Specialist, Environment of the Home/Housing, University of Nebraska-Lincoln; Michael P. Vogel, Professor and Extension Housing Specialist, Montana State University Extension Service; and Kathleen Parrott, Associate Professor and Extension Housing Specialist, Virginia Polytechnic Institute and State University.

Chapter 7

Processing, Packaging, and Transporting Fresh Foods Safely

Judy M. Willingham, Project Manager,
Extension Associate, Kansas State University

Once food has been harvested and processed, it is usually packaged and moved to the location of sale or to the purchaser. Maintaining a safe food product means protecting it from contamination, assuring proper temperatures, and preventing damage. This chapter will help you identify the critical control points in transportation that are important to food safety. Planning ahead so that your product arrives in excellent condition establishes a good reputation and improves sales.

The following topics are covered:

1. **Packaging and Labeling.** What information should be on your label? Could your customer identify the product if recalled? Are delivery records available to help tracing for recall? Does the packing material offer adequate protection against damage and contaminants?
2. **Food Temperatures.** Do you know the proper temperatures to keep the food safe? How can the temperature be maintained? Do you keep records?
3. **Means of Transportation.** Do you keep the vehicle clean? Does it also carry loads of possible contaminants? In what condition is the vehicle—is it reliable for timely delivery?

Why should you be concerned?

No one wants to be the cause of illness. Contaminants often have no odor or color and therefore are hard to detect. They can put your customer's health at risk. Bacteria and other microorganisms are present all around us, and controlling their growth means controlling temperature, contamination sources, and time for growth. Food safety risks decrease with the use of some simple, proven practices. Liability is certainly a concern, and using good food safety practices offers some protection.

How will this chapter help you protect your product quality?

This chapter is a guide to help you better understand and identify the conditions under which foods can deteriorate and/or become unsafe during packaging and transportation. Easy-to-understand assessment tables help identify situations and practices that are safe as well as ones that should be addressed promptly. Additional information on how to safeguard particular foods may be obtained from your local county Extension office.

PART 1—Packaging and Labeling

Packaging includes both materials that protect food from physical damage and those which are a barrier against contamination. Labels are often required by law and if designed well, can also be a marketing tool

What information should be on your label?

Signs are a kind of label that describe fresh fruits and vegetables at an open-air market. They should do more than indicate price. Let your customer know a little about your growing practices and the unique qualities of the food. This is also an opportunity to remind people of good practices like thorough washing or proper refrigeration of your produce.

Labels on specific items sold within the state are governed by the state of Kansas. **The Kansas Department of Health and Environment (KDHE)** regulates processed or cooked foods such as dried food mixes, canned foods, and baked goods. Those engaging in this type of food processing should contact KDHE at (785) 296-5600 for necessary requirements and licensing.

The **Kansas Department of Agriculture (KDAg)** regulates labeling of meats, dairy products, and eggs. Contact KDAg at (785) 296-3511 for questions on meats, and (785) 296-3786 for questions on dairy products. Products that cross state lines come under the **U.S. Food and Drug Administration (FDA).** Current labeling information can be obtained by contacting the K-State Value-Added Support Facilities at the Department of Animal Sciences and Industry, Call Hall, Kansas State University, (785) 532-1668.

Are you protecting your product from contamination and damage?

It is wise to prevent unnecessary contamination. If using an open truck bed to haul unprotected produce, line it and cover the food with clean washable covers. New, unused containers are the lowest risk; however, if containers are reusable, clean, sanitize, and air-dry them before use. Use new disposable paper or plastic liners in reused boxes. Softer fruits (tomatoes, peaches) benefit from packing materials that offer protection from bruising. Check with the local newspaper for newsprint roll ends—it's usually low cost or free, and is a good packing material. Under no conditions should buckets, bags, or other containers that have held hazardous chemicals be used for food contact. Any reused containers should be clean and free from debris.

Hands must be washed before packaging foods. To reduce the risk of food contamination, be sure to sanitize any surface or counter top used in packaging or sorting. (See Sanitizing Solutions for directions) If the solution will be used over a period of time, label the container and leave the wiping cloth in the sanitizer. This solution loses strength and should be made fresh every hour. Avoid mixing sanitizer with more bleach; if it is too strong, a residual can be left on the dry surface. The stronger solutions are disenfects and are used when contamination is known to have occurred.

Sanitizing Solutions

First, wash surface with hot soapy water and rinse.

For hard, nonporous surfaces:

1. Mix 1 tablespoon liquid laundry bleach with 1 gallon water.
2. Apply solution to hard surface or immerse for 60 seconds.
3. Allow to air dry, no rinsing. Do not rinse.

For porous surfaces, like wooden cutting boards:

1. Mix 3 tablespoons liquid laundry bleach with 1 gallon water.
2. Apply to surface or immerse.
3. Keep surface wet for 2 minutes.
4. Rinse with water and let dry. Do not dry off.

Disinfecting Solution *(use when contamination has occurred)*

1. First, remove loose dirt.
2. Mix 3/4 cup liquid laundry bleach with 1 gallon water.
3. Apply to surface, and keep surface wet for 2 minutes.
4. Rinse with water and let dry.

What might determine the type of packaging?

Packaging should be appropriate to the product. If the food is high in moisture or will be exposed to wet conditions, a water resistant or waterproof wrapping is needed. Produce with soft, creviced surfaces, like raspberries, can be difficult for the consumer to wash clean; therefore such foods should be loosely covered to exclude dust and dirt during transportation.

When temperature requirements must be met, packages should withstand the necessary temperatures without deteriorating. Packing materials can provide insulation to help hold temperature. Fresh fruits and vegetables might need air circulation so that good quality can be maintained.

Consider the distance to be traveled and the protection provided to the product in deciding the type of packaging. Rigid, protective containers and cushioning become more important as the distance of transport increases.

Where do you get your materials and how should they be stored?

New containers, plastic film, bags, etc. should be packaged and stored so that they remain clean. Refuse to accept packing materials with stains—you have no idea what kind of contamination may have occurred. Keep packaging from being contaminated in storage by keeping it elevated above the floor at least four inches and reclosing boxes or bags of opened materials. If chemicals are stored in the same area, keep them at the lowest level and separate from your food packaging. Control mice and insects as well. The reuse of egg cartons should be discussed with KDAg. See Chapter 2, Production of Eggs and Home-raised, Home Butchered Broilers and Turkeys for more details.

Does your label meet requirements?

A label must first be legible and fixed in place. Signs for fresh products displayed in bulk at open-air markets are a type of label. Labels are an advertising opportunity to at least inform your customer about the product and your business; they may also need to meet a legal requirement. Health codes will differ from one county and state to another; it is best to check with the local health department for their requirements. You may be referred to the state agency. An important part of labeling is a code that allows for the food to be traced in case of an investigation. In addition, you should document your coded products and where they go. This information will be needed for your financial records, and also allows tracking and recalls should they be necessary.

The following are examples of items to include in your label:

- Name of product
- Business name and address, phone number, email, website
- Storage requirements (temperature requirements)
- Weight or volume, if appropriate
- Date of production or use by date
- Ingredients in descending order, if appropriate
- Production code for recall purposes
- Price

Assessment 1—Packaging and Labeling

Use the table below to rate your risks. For each question, indicate your risk level in the right-hand column. Although some choices may not correspond exactly to your situation, choose the response that best fits. Refer to Part 1 above if you need more information to complete the table. Transfer medium-high and high risks to the Action Checklist at the end of the chapter on Page 7-7.

	LOW	LOW-MEDIUM	MED-HIGH	HIGH	YOUR RISK
Packaging and food containers	All packaging is new, clean, and stored properly.	Reused containers are properly sanitized and all stored properly.	Reused containers are properly sanitized; storage is subject to contamination.	Reused containers not cleaned; storage subject to contamination.	O Low O Low-Med O Med-High O High
Labeling	All labels approved by ap propriate agency; codes and records allow recall.	Although not required, labels include necessary information.	Labels not required & include only minimal information.	No labels used or illegible.	O Low O Low-Med O Med-High O High
Hand washing	Hands always washed before handling harvested foods.		Hands sometimes washed before handling foods.	Rarely or never wash hands before handling foods.	O Low O Med-High O High

Responding to risks

Your goal is to lower your risks. Turn to the Action Checklist on Page 7-7 to record the medium-high and high- risk practices you have identified. Use the recommendations in this section to help plan and schedule actions to reduce your risks.

PART 2—Safe Food Temperatures for Transportation

All foods are better protected if temperature is controlled. Canned goods and dry products such as herbs or grain meals and flours, retain quality better at moderate temperatures than at high temperatures. Raw fruits and vegetables that have not been cut up or otherwise altered do not require refrigeration and can be transported without special measures when outside temperatures are above freezing. Fresh produce quality is generally prolonged by cool conditions. All meat, dairy products, poultry and eggs must be kept cold at refrigeration temperatures (below 40°F) until received by the customer. Frozen foods must be held at no higher than 0°F. In general, foods that have been processed and contain moisture are considered potentially hazardous and are more at risk to contamination from bacteria or fungi.

Foods that are cooked or processed for sale fall under the regulations of KDHE, and involve obtaining a food service license. KDAg regulations allow the sale of some farm-grown products from the farmstead, but limit advertising and require the buyer to come to the farm for purchase. Be sure to contact those agencies with your questions.

How can microbes make food unsafe?

Pathogenic bacteria need several conditions in order to grow in foods: adequate pH, oxygen (or lack thereof) moisture, temperature, and time to reproduce. Pickling foods changes the pH to an unacceptable level for many bacteria. Replacing oxygen with a vacuum or another gas stops the growth of most types of bacteria; however, the bacteria that causes botulism grows in the absence of oxygen. One way we can stop bacterial growth is by removing moisture, such as when herbs are dried. Another way to control growth is with temperature. Most pathogens are killed or can't grow if the food is either quite hot (at least 140°F) or cold (below 40°F). The third growth control, time, relates to foods kept at temperatures between 40°F and 140°F. We can still control growth by limiting the time food is held in this temperature range to no more than two hours.

Another consideration is the number of microbes present. Most pathogens cause illness only after a minimum number of organisms have been produced. That number can range from one organism (like *Cryptosporidium*), to many thousands (like *Streptococci*). If the food has been contaminated with only a few organisms, it takes longer to reach the numbers necessary to cause illness. When many organisms are present, it takes less time to reach this dangerous number. Anything that decreases the amount of bacteria therefore increases the food's safety factor. Preventing contamination by microbes makes food safer. Consider a cantaloupe melon; as long as the rind is undamaged, the interior is uncontaminated and the melon is not potentially hazardous. When the melon is cut open, it becomes potentially hazardous because the interior is exposed to bacterial contamination. Therefore, once cut open, the melon temperature must be kept below 40°F to control bacterial growth.

Highly processed foods are at a greater risk to become contaminated. In general, the more a food is handled and altered, the greater care must be observed to control contamination. Processing removes natural barriers to contamination, making these foods potentially hazardous. Therefore the natural competition that normally limits bacterial growth is altered. Heating (cooking) vegetables not only breaks down cell walls, but also kills microorganisms on the food. Should a disease-causing bacteria then contaminate the food, it can multiply unhindered by barriers or competition, and become dangerous more quickly. This is why keeping cooked foods safe, involves controlling both time and temperatures. Remember that cooking foods for sale requires a KDHE food service license.

FAT TOM TABLE
Factors necessary for bacterial growth
Control these, and you control bacteria

Food	all organisms need a source of energy
Acidity	pathogens grow in pH ranging from 4.6 to 9.0; very acid (sour) foods discourage bacterial growth
Time	bacteria can double in number every 15 to 20 minutes
Temperature	"Danger zone" for foods is 40°F–140°F
Oxygen	the presence or absence of oxygen limits most bacteria
Moisture	as water becomes unavailable, bacteria cease to grow

What potentially hazardous food temperatures are safe?

You may think you can judge temperature by feel or by seeing steam, but the only sure indicator is a thermometer inserted in the food. As mentioned before, foods that have been heat treated or physically altered, are potentially hazardous and must be kept hot (at least 140°F) or cold (below 40°F). It is a good idea to document food temperatures, with date and time on a log sheet. Record food temperatures before transporting and whenever more than one person is involved in handling temperature sensitive foods. There is no other way to know the food temperature history.

How can you maintain proper temperatures in potentially hazardous foods?

During transportation, it is necessary to have some means to maintain the appropriate temperature. Although insulated containers slow heat movement, remember that two-hour time limit for foods in the danger zone between 40°F and 140°F. Any time transportation takes more than two hours, mechanical "hot carts" or refrigerators are best to safely transport food. If using mechanical refrigeration, be sure there is a thermometer in the unit so that you can monitor and record air temperature around the food, and know the unit is working. There are units that operate on current from the vehicle battery.

Sometimes crushed ice is used to maintain cold temperatures. In this case, the crushed ice should be in an insulated, lidded cooler, with a drain in the bottom for discharge of melt water. The food should be bagged or in a container to prevent direct contact with the ice. Health codes forbid the holding and display of ready to eat foods submerged in ice water. Temperature sensitive foods should be surrounded by ice. If the food is ready to eat and will not be cooked, it should be inside a covered container bedded in ice.

ASSESSMENT 2—Safe Food Temperatures for Transportation

Use the table below to rate your risks related to safe food temperatures during transportation. For each question, indicate your risk level in the right-hand column. Although some choices may not correspond exactly to your situation, choose the response that best fits. Refer to Part 2 above if you need more information.

	LOW POTENTIAL	LOW-MED POTENTIAL	MED-HIGH POTENTIAL	HIGH POTENTIAL	YOUR RISK
Thermometer use	Thermometers available and used daily as appropriate.	Thermometers available, used occasionally.		No thermometers in use.	O Low O Low-Med O High
Records of temperatures	Temperatures recorded and logs kept showing safe temperatures.	Temperatures occasionally recorded, logs show safe temperatures.		No records of temperatures—or—unsafe temperatures recorded.	O Low O Low-Med O High
Temperature maintenance of potentially hazardous foods	Powered hot carts or refrigeration used during transportation.	Transportation time less than 2 hrs. and rely on ice or insulation properly used.	Transportation time more than 2 hrs. and rely on ice or insulation properly used.	Transportation time more than 2 hrs. without ice or insulation.	O Low O Low-Med O Med-High O High
Cooked or heat processed foods	Have food service license from KDHE and meet requirements.		Have food service license from KDHE, but do not meet requirements.	No food service license from KDHE.	O Low O Med-High O High

Responding to risks

To protect your produce from possible contamination, you should minimize your risks by adopting actions and practices that result in lower risks. Turn to the Action Checklist on Page 7-7 to record the medium-high and high-risk practices you have identified. Use the recommendations in this section to help plan actions to reduce your risks.

PART 3—Means of Transportation

Whether using a family vehicle on an occasional basis or a business-owned vehicle on a routine route transporting the food, following a few simple guidelines will improve food safety. You should consider what other uses have been made of the vehicle. Is it clean? Is the vehicle suitable and reliable?

What non-food items have been in the vehicle?

The dedicated use of a vehicle for food transportation is the safest situation. There have been instances where a truck carried hazardous waste or live animals just prior to transporting a load of produce—resulting in food contamination. Anyone who has ever cleaned out a horse trailer understands that it is impossible to completely remove the animal waste. Liquid chemical spills are another example of permanent contamination. Even spills of dry chemicals may leave residues. As a general rule, transport food products in a vehicle that has not been used to carry animals, chemicals, trash, or anything else that could contaminate the food.

Is the vehicle clean? Is it suitable?

Even a dedicated vehicle gets dirty. Food debris must be cleaned out before it deteriorates. Not only is cleaning easier if accomplished soon, but microbes and insects do not get a chance to breed there. Surfaces should be smooth, non-porous, and washable. Wooden flooring and sideboards are difficult to clean, making them unsuitable for direct contact with some food products. Rough wood surfaces should be lined or otherwise kept separated from the food, not only for cleanliness but also to keep splinters out of the food. Perishable foods should be transported in a reliable vehicle so that losses will not be suffered in the event of a break-down.

Assessment 3—Means of Transportation

Use the table below to rate your risks related to means of safe food transportation. For each question, indicate your risk level in the right-hand column. Although some choices may not correspond exactly to your situation, choose the response that best fits. Refer to Part 3 above if you need more information.

	LOW	LOW-MEDIUM	MED-HIGH	HIGH	YOUR RISK
Previous use of vehicle	Vehicle is dedicated to food transport.	Vehicle occasionally carries dry non-foods, but no potential contaminants.		Previous loads unknown—or—also carries contaminants.	O Low O Low-Med O High
Cleanliness and suitability of vehicle	Vehicle is swept and washed as necessary; construction is easily cleanable.	Vehicle appears clean even though construction is not smooth.	Some visible dirt and food debris, appears recent.	Much old food debris and dirt, insects observed.	O Low O Low-Med O Med-High O High

Responding to risks

Your goal is to lower your risks. Turn to the Action Checklist on Page 7-7 to record the medium-high and high- risk practices you have identified. Use the information above to help plan actions to reduce your risks.

ACTION CHECKLIST

When you finish the assessment tables, go back over the questions to ensure that every high and medium-high risk you identified is recorded in the checklist below. For each risk, write down the improvements you plan to make. Use recommendations from this chapter and from resources elsewhere. Pick a target date that will keep you on schedule for making the changes. You do not have to do everything at once, but try to eliminate the most serious risks as soon as you can. Often it helps to start with inexpensive actions.

Action Checklist
PACKAGING AND TRANSPORTATION FOR FRESH FOOD

Write all high and medium-high waste-making potentials and risks below.	*What can you do to cut waste or reduce the risk?*	*Set a target date for action.*
Sample: No thermometers available to check food temperatures.	Purchase food thermometers and begin recording temperature, date,and time.	Before next market day on April 8.

For More Information

K-State Research and Extension bulletins are listed below.

What's on a Food Label? L-883 (rev), 2000.

Thermometer Calibration Guide. MF2440,2000.

E. coli 0157-H7 and Foodborne Illness. MF2138, 1995.

Salmonella and Eggs. MF2139, 1995.

Microorganisms and Foodborne Illness. MF2269,1997.

Web sites:

http://www.oznet.ksu.edu/ Kansas State University Research and Extension; most publications are available through this site.

http://www.foodsafety.ufl.edu/index.html The National Food Safety Database

http://www.kdhe.state.ks.us/bch/
The Kansas Department of Health and Environment, Bureau of Consumer Health

http://www.ink.org/public/kda/
The Kansas Department of Agriculture; links to Meat & Poultry and to Dairy

*Kansas HomeFood*A*Syst* Helps Ensure Your Safety

This *Kansas Food*A*Syst* handbook covers a variety of topics to help you examine and address your most important food safety and environmental concerns. See the complete list of chapters in the table of contents at the beginning of this handbook. The end of each chapter lists resources and other useful information. For more information about topics covered in Food*A*Syst, or for information about laws and regulations specific to your area, contact your local environmental health or county K-State Research and Extension office.

*Kansas Food*A*Syst Team Members:*

Karen Penner, Ph.D., Project Director, Professor and Extension Food Science Specialist, Kansas State University

Scott Beyer, Ph.D., Associate Professor and Extension Poultry Specialist, Department of Animal Sciences, Kansas State University

Donald C. Cress, Ph.D., Extension Pesticide Coordinator, Department of Entomology, Kansas State University

Karen L.B. Gast, Ph.D., Associate Professor and Extension Horticulturist, Postharvest and Marketing, Kansas State University

George Godfrey, Ph.D., Acting Vice President for Academic Affairs, Haskell Indian Nations University

Rhonda R. Janke, Ph.D., Associate Professor and Extension Specialist

Sustainable Cropping Systems, Kansas State University

Dan Nagengast, Executive Director, Kansas Rural Center

Gerald L. Stokka, D.V.M., M.S., Associate Professor and Extension Beef Veterinarian, Kansas State University

Danny H. Rogers, P.E., Ph.D. Extension Agricultural Engineer, Kansas State University

Judy Willingham, Project Manager and Extension Associate, Kansas State University

Chapter 8

Safe Handling of Food at Open Markets

Judy M. Willingham, Project Manager,
Extension Associate, Kansas State University

Once food has been harvested, processed, and packaged, it can be offered for sale to the public. Maintaining a safe food product means protecting it from contamination, assuring proper temperatures, and preventing damage. This chapter will help you identify the critical control points in storage and display that are important to food safety in the market. Safe, fresh foods go hand in hand with clean, attractive displays.

The following topics are covered:

1. *Plan of Operation; Facilities and Utilities.* What products will be offered? Will this be a permanent structure, a tent, a shed? What is important about access to water, wastewater collection, trash service, and electricity? Do you need a food service license?
2. *Food Temperatures.* What temperatures keep the food safe? How can the temperature be maintained? Do you keep records?
3. *Display.* Do you keep tables and bins clean? Is packaging needed to protect food from possible contaminants?

Why should you be concerned?

A basic plan of operation will be useful in determining necessary equipment and standard procedures so that you offer safe foods for sale.As noted in previous chapters, safe foods involve controlling temperature, contamination sources, and time at improper temperatures allowing microbial growth. Your efforts in food protection give you confidence in your product with the added benefit of attractive displays, which can increase sales.

How will this chapter help you protect your product quality?

This chapter is a guide to help you better understand the conditions under which foods can deteriorate and/or become unsafe, and how to identify those points and improve food safety. Easy-to-understand assessment tables help identify situations and practices that are safe as well as ones that should be addressed promptly. Additional information on how to safeguard particular foods may be obtained from your local county extension office.

PART 1—Plan of Operation; Facilities and Utilities

Do you have a plan of operation based on food safety?

A plan of operation sets out what you want to do and how to accomplish your goals. Having it written out, sets guidelines for employees and is a reference for you in evaluating success and future improvements. Your plan will follow the path the food takes to reach sale. It will include when and where you get the product, how and where it will be displayed, any special handling or protection needed, hours of operation, and what will be done with unsold product. In Kansas, unregulated farmers' markets may sell only fresh fruits and vegetables. If your plan includes processing, you need to contact the **Kansas Department of Health and Environment (KDHE)** at (785) 296-5600 to discuss obtaining a food service license.

It is most important to note the critical points where control is necessary to keep food safe. Although each food is different, the common critical control points are:

- Food temperature
- The time potentially hazardous food is held without refrigeration or heat
- Potential paths of contamination/adulteration

Your plan should include the action you require to correct a failure in controlling each of these critical points. For example, if an employee uses the toilet and fails to wash hands before returning to setting up a fruit display, the correction is to isolate the possibly contaminated fruits for discard or rewashing, and proper hand washing by the employee before handling any more food.

What might determine the type of operation and facility needed?

The complexity of the operation is based on the foods' potential to cause food-borne illnesses. Fresh whole tomatoes are not potentially hazardous and are safe to sell without packaging, refrigeration, or even an overhead cover. Frozen meats, are potentially hazardous and must be carefully processed

and packaged, labeled, held under refrigeration, and protected from the weather. The potential hazard level of each product dictates the operation as well as the number and kind of critical controls.

Other considerations might include:

- Is the operation seasonal or year round—What about weather protection?
- Other time demands—if your time is limited, the operation should be simple.
- Location of processing and sale—Are surfaces paved? Are animal pens nearby?
- Employees—if needed, are they trained and supervised?

Are processed foods sold, or does any processing occur at the market place? In Kansas, the definition of a "farmers' market" does not allow the sale of anything other than fresh produce; remember, a food service license may be necessary for the sale of processed food.

Do you need utilities? Which ones?

Simple seasonal operations like selling freshly harvested tomatoes or ears of corn function very well without power, running water, etc. If you decide to become a licensed retail market, utilities will be required. See Chapter 4 Drinking Water Well Management, Chapter 5 Wastewater: Septic Systems and Other Treatment Methods, and Chapter 6 Managing Production Waste for discussions on these areas.

Your plan of operation should alert you to utility needs. Be sure to confirm availability of utilities before committing time and money to establishing your facility. In general, a safe water supply and an acceptable wastewater treatment method are necessary when food processing involves water, or when sinks and toilets are in use. In some cases, the water supply may be required to meet public water supply requirements. A source of power is required for refrigeration, lighting, and machinery operation. Be sure to consider waste management so that insects and rodents are controlled.

Assessment 1—Plan of Operation; Facilities and Utilities

Use the table below to rate your risks. For each question, indicate your risk level in the right-hand column. Although some choices may not correspond exactly to your situation, choose the response that best fits. Refer to Part 1 if you need more information to complete the table.

	LOW	LOW-MEDIUM	MED-HIGH	HIGH	YOUR RISK
Operation without utilities	Marketing of only unprocessed produce. Sales on one day/week. (No need for utilities.)	Marketing of only unprocessed produce. Sales through week during harvest.	Some processed foods (baked goods) marketed. Sales through several months.	Processed foods marketed on an on-going basis throughout year; no utilities available.	O Low O Low-Med O Med-High O High
Food service license	Sell only fresh produce.	License obtained and in compliance.	License obtained, > year since last inspected, compliance unknown.	No license and selling processed foods.	O Low O Low-Med O Med-High O High

Responding to risks

Your goal is to lower your risks. Turn to the Action Checklist on Page 8-6 to record the medium-high and high- risk practices you identified. Use the recommendations in this section to help plan actions to reduce your risks.

PART 2—Safe Food Temperatures for Storage and Display

All foods are better protected if temperatures are controlled. Even canned goods and dry products such as herbs or grain meals and flours retain quality better at moderate temperatures than at high temperatures. Raw fruits and vegetables that have not been cut up or otherwise altered can be displayed without refrigeration if air temperature is above freezing. Fresh produce quality is generally prolonged by cool conditions. Processed meat like dressed poultry, must be kept cold at refrigeration temperatures (40°F or less) until delivered to the customer. Frozen meats must be held at or below 0°F.

In general, foods that have been processed and contain moisture are considered *potentially hazardous* and are more at risk from growth of bacteria or fungi.

How can microbes make food unsafe?

Pathogenic bacteria need several conditions in order to grow in foods: adequate pH, oxygen (or lack thereof) moisture, temperature, and time to reproduce. Pickling foods changes the pH to an unacceptable level for many bacteria. Replacing oxygen with a vacuum or another gas stops the growth of most types of bacteria; however, the bacteria that cause botulism grow in the absence of oxygen. One way we can stop bacterial growth is by removing moisture, such as when drying herbs. Another way to control growth is with temperature. Most bacteria cannot grow if the food is either quite hot (at least 140°F), or (below 40°F). The last growth factor—time—relates to foods kept at temperatures between 40°F and 140°F. We can still control growth by limiting the time potentially hazardous food is held in this temperature range to no more than two hours.

Another consideration is the number of microbes present. Most pathogens cause illness only after a minimum number of organisms have been produced. That number can range from one *Cryptosporidium*, to many thousands of *Streptococci.* If the food has been contaminated with only a few organisms, it takes longer to reach the numbers necessary to cause illness. When many organisms are present, it takes less time to reach this dangerous number. Anything that decreases the amount of bacteria therefore improves the food's safety factor. Preventing microbial contamination makes food safer. Consider a cantaloupe melon; as long as the rind is undamaged, the interior is uncontaminated and the melon is not potentially hazardous. When the melon is cut open, it becomes potentially hazardous because the interior is exposed to bacterial contamination. Therefore, once cut open, the melon temperature must be kept below 40°F to control bacterial growth.

Some processing techniques may physically alter the food or remove natural barriers to contamination, making them potentially hazardous. Cooking alters vegetables by weakening cell walls, allowing microbes to grow better. If the variety and number of microbes change through the processing—as happens when cooking kills all bacteria—the natural competition that normally limits growth is altered. Should disease causing bacteria then contaminate the food, multiplication is unhindered by barriers or competition, and the food becomes dangerous more quickly. This is why keeping cooked foods safe involves controlling both time and temperature.

FAT-TOM TABLE
Factors necessary for bacterial growth
Control these, and you control bacteria

Food	all organisms need a source of energy
Acidity	pathogens grow in pH ranging from 4.6 to 9.0; very acid (sour) foods discourage bacterial growth
Time	bacteria can double in number every 15 to 20 minutes
Temperature	"Danger zone" for foods is 40°F - 140°F
Oxygen	the presence or absence of oxygen limits most bacteria
Moisture	as water becomes unavailable, bacteria cease to grow

What potentially hazardous food temperatures are safe?

You may think you can judge temperature by feel or by seeing steam, but the only sure indicator is a thermometer inserted into the food. As mentioned before, foods that have been heat treated or physically altered, are potentially hazardous and must be kept hot (at least 140°F) or cold (below 40°F). It is a good idea to document food temperatures, with date and time on a log sheet. Whenever more than one person is involved in processing temperature sensitive foods, there is no other way to know what the temperature history is.

How can you maintain proper temperatures in potentially hazardous foods?

During display it is necessary to have some means to maintain the appropriate temperature. Although insulated containers slow heat movement, remember the two-hour time limit for food out of temperature. Any time potentially hazardous foods will be out of temperature for more than two hours, mechanical devices are best to safely hold the food at the proper temperature. Be sure there is a stem thermometer to check food temperatures and a thermometer to monitor the unit's temperature. Checking the thermometer also lets you know that the unit is functioning properly. There are portable units that use a vehicle battery or a generator for a power source.

Sometimes crushed ice is used to maintain cold temperatures. In this case, the crushed ice should be in an insulated, lidded cooler, with a drain in the bottom for discharge of melt water into a bucket. (Health codes forbid the holding and display of ready to eat foods submerged in ice water.) Temperature sensitive foods should be surrounded by ice and not simply set on top. If the food is ready to eat and will not be cooked, it should be inside a covered container bedded in ice.

Assessment 2—Safe Food Temperatures for Storage and Display

Use the table below to rate your risks related to safe food temperatures during storage and display. For each question, indicate your risk level in the right-hand column. Although some choices may not correspond exactly to your situation, choose the response that best fits. Refer to Part 2 if you need more information.

	LOW RISK	LOW-MED	MED-HIGH	HIGH	YOUR RISK
Thermometer use	Thermometers available and used daily.	Thermometers available, used occasionally.		No thermometers in use.	O Low O Low-Med O High
Records of temperatures	Temperatures recorded and logs kept showing safe temperatures.	Temperatures occasionally recorded, logs show safe temperatures.		No records of temperatures—or—unsafe temperatures recorded.	O Low O Low-Med O High
Temperature maintenance of potentially hazardous foods	Powered hot boxes or refrigeration used.	Sale lasts less than 2 hrs. & ice or insulation properly used to hold temps.	Sale lasts more than 2 hrs. & ice or insulation properly used to hold temps.	Sale lasts more than 2 hrs; no ice or insulation.	O Low O Low-Med O Med-High O High

Responding to risks

To protect your produce from possible contamination, you should minimize your risks by adopting actions and practices that result in lower risks. Turn to the Action Checklist on Page 8-6 to record the medium-high and high-risk practices you identified. Use the recommendations in this section to help plan actions to reduce your risks.

PART 3—Display

What is the potential for contamination?

An attractive display enhances sales and should keep food safe. Temperature control has been discussed, but remember that the table, bin, or rack that contacts the food may be laden with microbes. Therefore, all such food contact surfaces must be kept clean and should be easily cleanable. Contamination risks can be decreased by dedicating the bin or container to the type of crop. For example, the same container should not be used for root crops and fruits. Kansas regulations require that foods be at least 18 inches off the ground for sidewalk (outdoor) display. Wrapped products sold intact, are protected from exposure to dust and insects. Baked goods should always be prewrapped for sale and never portioned at the sale.

Live animals increase the risk of contamination of nearby food displays. Not only does the animal manure attract flies, but blowing dust from their pens or cages can carry microbes to the food. If the community open-air market includes vendors selling live animals, those vendors should be grouped and separated from food booths.

Animals should be down wind from food displays, and as far away as possible. Privately owned markets on the farm site should be located up wind and well away from animal pens.

Are the surfaces clean and suitable?

Rough wooden tables and bins are difficult to clean, making them unsuitable for direct contact with some food products. Wood surfaces should be smooth and sealed with enamel or paint for ease of cleaning. Washable or disposable covers and liners are additional protection for the food, and make clean-up simpler. They present a more attractive display too.

You have control over the use and storage of your tables and display bins. It is best to dedicate these items for like products such as tubers, or fruits grown off the ground, or processed foods. This means that the bin used for potatoes is not later used for displaying apples. Display items should be stored where they cannot be contaminated by manure or chemicals.

Assessment 3—Display

Use the table below to rate your risks related to means of safe food display. For each question, indicate your risk level in the right-hand column. Although some choices may not correspond exactly to your situation, choose the response that best fits. Refer to Part 3 if you need more information.

	LOW RISK	LOW-MED	MED-HIGH	HIGH	YOUR RISK
Food displays	Food is displayed at least 18 in. off of the ground, covered, & under a roof.	Food is displayed at least 18 in. off of the ground & under a roof.	Most food displays are off of the ground, but less than 18 in.; some foods are covered—no roof.	Foods are on the ground; nothing is covered—no roof.	O Low O Low-Med O Med-High O High
Live animals	Animals are down wind more than 200 ft. from open-air food displays.	Animals are down wind &100 -200 ft. from open-air food displays.	Animals are down wind & 50 -100 ft. from open-air food displays.	Animals are upwind—or—less than 50 ft. from open-air food displays.	O Low O Low-Med O Med-High O High
Cleanliness and suitability of tables, bins, boxes, etc.	All surfaces are smooth and sealed, clean. Food bins are labeled and used as dedicated.	All surfaces are smooth and sealed, not all are clean. Food bins are unlabeled but used for specific foods.	Most surfaces are smooth and sealed, but dirty. Food bins sometimes used interchangeably.	Most surfaces are rough and dirty. Food bins routinely used interchangeably.	O Low O Low-Med O Med-High O High

Responding to risks

Your goal is to lower your risks. Turn to the Action Checklist on Page 8-6 to record the medium-high and high- risk practices you identified. Use the information in this section to help plan actions to reduce your risks.

ACTION CHECKLIST

When you finish the assessment tables, go back over the questions to ensure that every high and medium risk you identified is recorded in the checklist below. For each risk, write down the improvements you plan to make. Use recommend- ations from this chapter and from resources elsewhere. Pick a target date that will keep you on schedule for making the changes. You do not have to do everything at once, but try to eliminate the most serious risks as soon as you can. It helps to start with inexpensive actions.

Action Checklist Safe Handling of Food at Open Air Markets

Write all high and medium risks below.	**What can you do to reduce the risk?**	**Set a target date for action.**
Sample: Same baskets used to display potatoes and tomatoes.	Clean baskets after market; label and dedicate use for each product.	Before next market day on April 8.

For More Information

K-State Research and Extension bulletins are listed below:

Food Safety for Farmers Markets, MF2260.

A Guide to Starting, Operating, and Selling in Farmer's Markets, MF1019.

Farmers Markets in Kansas: A Profile of Vendors and Market Organizations, SRP658 (electronic only).

Web sites:

http://www.oznet.ksu.edu/—Kansas State University Research and Extension; most publications can be found here.

http://www.foodsafety.gov/~dms/prodguid.html—U.S .Food and Drug Administration document, *Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables.*

*Kansas Home Food*A*Syst* Helps Ensure Your Safety

This Kansas Food*A*Syst handbook covers a variety of topics to help you examine and address your most important food safety and environmental concerns. See the complete list of chapters in the table of contents at the beginning of this handbook. The end of each chapter lists resources and other useful information. For more information about topics covered in Food*A*Syst, or for information about laws and regulations specific to your area, contact your local environmental health or county K-State Research and Extension office.

*Kansas Food*A*Syst* Team Members:

Karen Penner, Ph.D., Project Director, Professor and Extension Food Science Specialist, Kansas State University

Scott Beyer, Ph.D., Associate Professor and Extension Poultry Specialist, Department of Animal Sciences, Kansas State University

Donald C. Cress, Ph.D., Extension Pesticide Coordinator, Department of Entomology, Kansas State University

Karen L.B. Gast, Ph.D., Associate Professor and Extension Horticulturist, Postharvest and Marketing, Kansas State University

George Godfrey, Ph.D., Acting Vice President for Academic Affairs, Haskell Indian Nations University

Rhonda R. Janke, Ph.D., Associate Professor and Extension Specialist Sustainable Cropping Systems, Kansas State University

Dan Nagengast, Executive Director, Kansas Rural Center

Gerald L. Stokka, D.V.M., M.S., Associate Professor and Extension Beef Veterinarian, Kansas State University

Danny H. Rogers, P.E., Ph.D., Extension Agricultural Engineer, Kansas State University

Judy Willingham, Project Manager and Extension Associate, Kansas State University