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AZERBAIJAN COMPETITIVENESS AND TRADE (ACT) PROJECT

Poultry STTA Final report

Date of Completion August 2011

This publication was produced by Sibley International LLC, for review by the United States Agency for International Development.

Prepared for the United States Agency for International Development, USAID Contract Number AID-EEM-I-00-07-00003-00, Task Order # AID-112-TO-10-00002

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Azerbaijan Competitiveness and Trade (ACT) Project

Final report- Poultry Biosecurity, Nutrition and Housing consultancy

Submitted By: **Jeffre D Firman, PhD**

1. Contents

Daily activities:

August 3, 2011- Travel day

August 4, 2011- Travel day

August 5, 2011- Met with team, work on materials for translation

August 6, 2011- Work on materials for translation, presentations

August 7, 2011- Day off

August 8, 2011- Work on materials for translation, presentations

August 9, 2011- Visit Garagashli Broiler complex

August 10, 2011- Work on materials for translation, presentations

August 11, 2011- Work on materials for translation, presentations

August 12, 2011- Work on materials for translation, presentations

August 13, 2011- Work on materials for translation, presentations

August 14, 2011- Day off

August 15, 2011- Travel to Gange

August 16, 2011- Presentations to Veterinary group

August 17, 2011- Travel to Ismaylii

August 18, 2011- Presentations to producers, Veterinarians

August 19, 2011- Travel to Baku

August 20, 2011- Work on reports

August 21, 2011- Travel to US

August 22+, 2011- Work on final report, extension type publications

Remodeling plans for the Garagashli Broiler complex

The Garagashli Broiler complex was visited for about 4 hours on 9 August 2011. We were given a tour by the veterinary staff person who spoke some English. The complex is of soviet era and has been updated slightly. I consists of the hatchery, growout facilities, a feedmill and a processing plant. Based on numbers provided, it would appear they are hatching, growing and processing ~3.5 million birds yearly. While the system is currently functioning, there are a number of areas that could be updated, with the processing facility needing the most input. Certainly the entire facility was in poor condition with a multitude of scrap and many areas unkept. There is probably room for expenasion if things were cleaned up.

The feedmill was in overall good condition. Capacity was about 10 tonnes per hour and the pellet quality was good. The mill was relatively new and used turkish equipment. It was unclear how diets were obtained, although a computer was used in some capacity. However, it was stated that they did not change diets very often, so it can be assumed that computer diet formulation was limited. A Hendrix brand concentrate was also seen, which indicates they are not utilizing least cost formulation routinely. They indicated that they did not use animal by-products due to the bacterial content (millions of tones of rendered products are used annually) which may be a problem for local producers that could be easily solved. The addition of least cost software and other ingredients could probably result in a 10% cost savings on feed or about $50/ tone. This could add up to hundreds of thousands yearly in savings. Obviously a bit of effort in this area would have big payoffs.

Growing system: The buildings were old soviet era concrete facilities that had been renovated somewhat to have modern feeding and watering systems as well as tunnel ventilation with cooling pads. The overall system appeared to be working adequately. Litter moisture was a bit high, but we only saw one building and birds were close to market age. Biosecurity was talked about a good bit and they were going through the motions. Mortality was low and they are fortunately isolated from other poultry and even village birds. Much of their biosecurity would be insufficient if they were not as isolated. Footbaths were dry/dirty, the truck wash had never been tested for efficacy, etc. While I would normally recommend more work in this area, they appear to have a minimal disease challenge, so it is probably not a big issue. If new buildings are built to either replace the current facilities (limited lifespan) or to expand, they should look into more modern type steel buildings which could be built on their existing concrete floors. It is difficult to believe the current block construction method is cheaper than more modern designs.

Hatchery: We did not visit the current hatchery as they were building a new hatchery. It will have new equipment and appears well on its way. I would guess that it is 70% complete. They should be able to do well with that system as long as eggs can be supplied steadily from Turkey. At one point there were some broiler breeders in AZ, but I am not sure if they have additional stock to sell. This may become an issue if the industry is to expand in a cost effective fashion as the cost of chicks or eggs, shipping and potential loss of supply (Turkey has had issues in the past) could be a drag on any expansion of the industry. Certification of the hatchery was brought up by Fuad. It is unclear what the benefit of such certification would be since all chicks are used internally. Certainly a set of guidelines for the hatchery need to be put in place once operational.

Processing plant: The processing plant was the most in need of renovation. Actual parts of the walls had fallen down, but the plant was functioning. At this point there is no need to discussion of HACCP or certification beyond the cursory as the plant needs a complete renovation. New equipment was being bought from a Turkish firm Recommendations are below:

- Assure that all new equipment is stainless steel or plastic. This will pay off in the long run even though it may be more expensive initially;
- Building renovations needed, will be expensive and should be complete. Assure that all renovations done are of high quality.

Openings: Any openings into the building should be designed to keep water used in the facility contained and to keep all insects, dirt and debris out of the facility. Where birds are brought into the facility, a screened area or hanging plastic strips should be used to minimize access of insects.

Walls: Should be designed with ease of cleanup in mind. Poured concrete or concrete block are considered ideal when coated with an epoxy based paint. Typical Azeri construction with blocks may be used, but should be top-coated with a fiber-based mortar, type N cement based mortar or similar to resist cracking. Epoxy based paint is more moisture resistant and should be used rather than tile which will break and/or fall off the wall. In areas where the wall may hit by carts or other equipment, stainless steel guards should be put in place to avoid wall damage. At the floor-wall junction, curved joints or other methods should be used to avoid dirt accumulation and ease wash-down with high pressure spray.

Floors: Floors are again similar to walls in that they should be concrete based and designed for ease of wash-down, but with the exception that floors need to have traction aides to avoid

slippery floors. This can be accomplished by using epoxy based floor covering with sand or similar aggregate added for traction.

Drainage: Floors should be sloped for drainage at minimal slopes to avoid making it difficult for employees to stand or walk. In general drainage should move in the opposite direction from flow of birds. Blood collection may be drained separately for recycling of blood as blood meal or placed into the regular waste stream (collection is recommended). A water plume may be used for feather collection as well (for recycling as feather meal) or feathers may be collected dry and recycled or landfilled. Sufficient inherent drainage should be built in to accommodate water used for cleaning as well as for frequent water changes in chilling (assuming dry chilling is not used). Average use of water is ~20L/bird and is a reasonable starting point for determining if sufficient drainage is available. In the many plants, water flow from the kill-bleed-scald area is separated from the eviscerating area. It is probably most important that the chiller area and the packaging area have water flow away from their respective areas. Make sure to follow any AZ government or local regulations.

Sewage: Currently sewage is not being treated. Any renovations should have a sewage treatment facility of some type incorporated. Discussion during the visit suggested that a commercial-type treatment facility was being incorporated into the design. If this is not done, a lagoon at minimum should be designed to handle waste. Lagoons systems are primarily used for handling animal waste. The lagoon or other form of holding tank/facility allows for some digestion of effluent from anaerobic or in some cases aerobic bacteria. The water and nutrients from the holding area are then used for irrigation. Nutrients are then removed periodically from the irrigated land via harvest of crops/hay. Thus nutrient buildup should be minimal in a well managed system. More discussion of sewage may be needed if the commercial-type sewage treatment is not incorporated in to the design.

Lankaren broiler farm design

The accompanying design is based on six, 6m X 8m broiler rooms. These are designed for an approximate capacity of 750 birds per room to approximately 5 weeks of age. Chicks would be brought in at day of hatch and placed in a room. Discussion has been about bringing in 1500 birds (2 rooms) at a time (every 2 weeks) and thus selling birds every 10-14 days once the rotation is going. This would have a net of approximately 25,000 birds yearly if run continuously. No breeding would occur in this design. Thus set-up is relatively efficient, but is somewhat lacking from a biosecurity standpoint of having more than one age at the farm at any one time as well as not having a break between flocks.

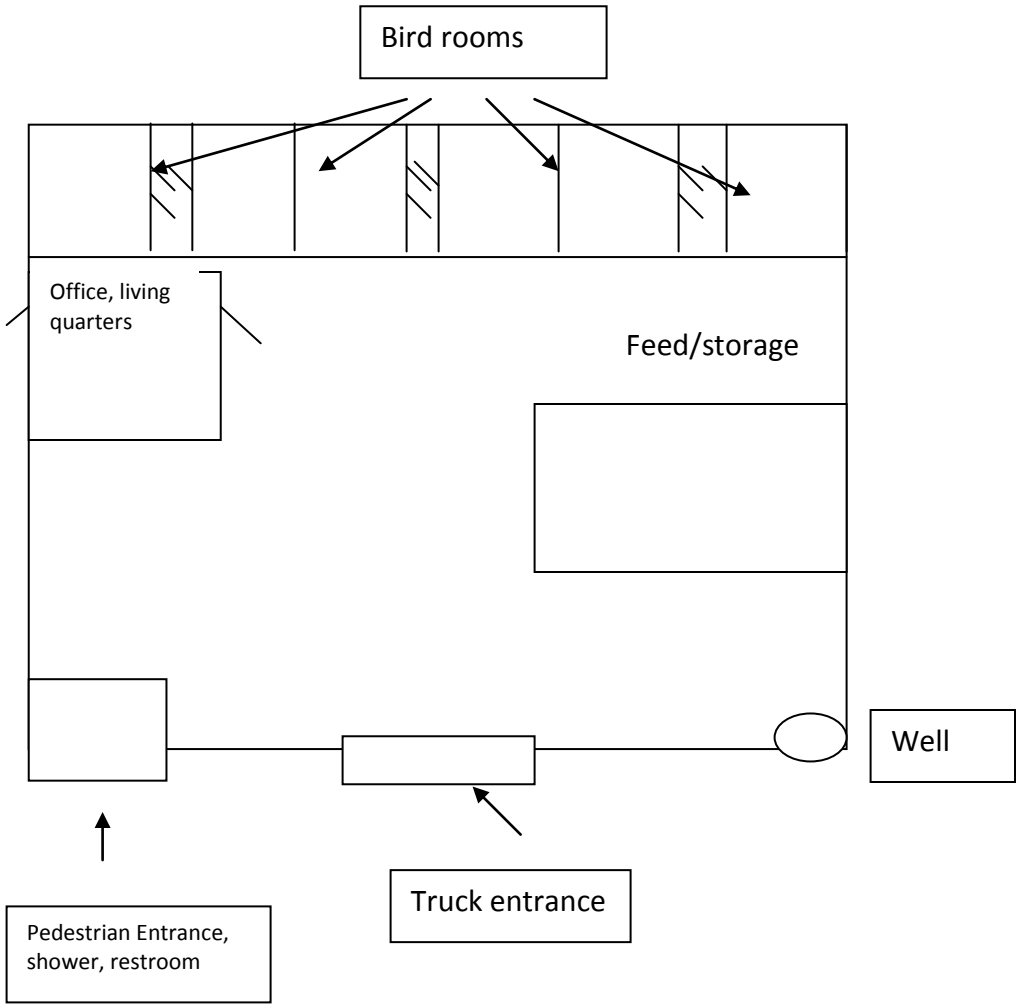
Overall the design is based on a walled enclosure for biosecurity purposes, with walk-in traffic going through an entryway with bathrooms, showers and changing areas for employees and visitors. Visitors that do not have any access to the farm could enter the office as long as this is as far as they are going and separation is maintained. A drive through entrance is also provided, but it would be preferable if feed was delivered to the entrance but trucks did not actually enter. The design provides for longer term storage of feed in a feed shed, while short term feed needs could be stored in the aisle between rooms (~1.5 m wide). An office/living quarters is provided for and another bathroom could be added here if desired.

Bird rooms are designed with 4 windows which can be used for ventilation and a fan in one side. When birds are young they need little air movement which could be provided by windows only. As they get older windows can be used in conjunction with fans. Window opening size can be adjusted to change the velocity of air movement and location of incoming air. The building will most likely be built of stone. Ceiling height can be low to make it easier to heat in the winter and when birds are small. The ceiling should be insulated to maintain heat when needed and keep heat out in the summer. Fans should be sized to have the ability to change the air every 2 minutes and be variable speed. Both a manual rheostat and thermostat should be available to adjust fan speed and thus ventilation to maintain birds comfort and adjust to changing environmental conditions.

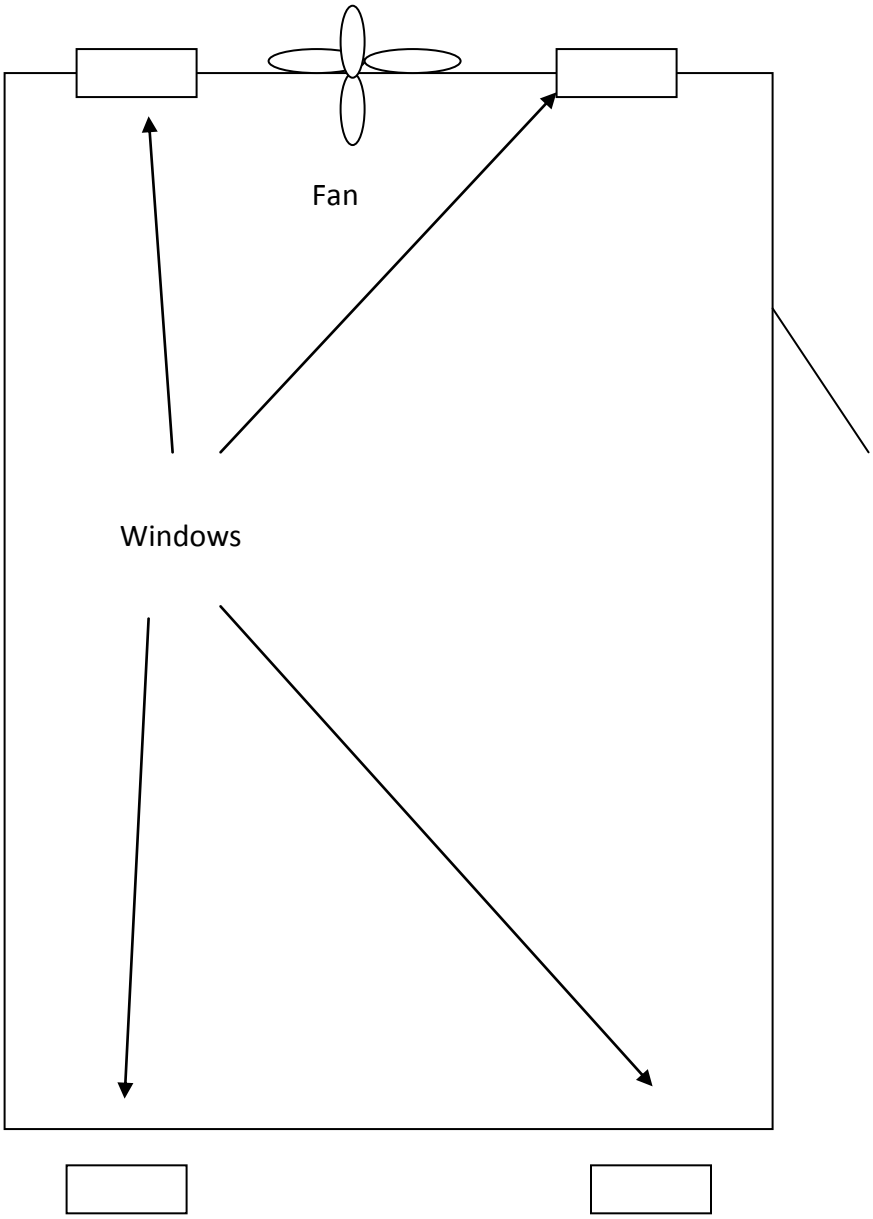
Feed can be provided with tube type hanging feeders and nipple drinkers can be set up. Several types of gas poultry heaters are available as well as electric versions. Gas is generally more economical. A small- scale poultry management guide may be developed, but most birds used in AZ are the Ross 308 and guides on their care can be found at

http://en.aviagen.com/assets/Tech_Center/Ross_Broiler/Ross_Broiler_Manual_09.pdf

Cobb-Vantress also has management guides available on the web, some in Russian and these can be found at http://www.cobb-vantress.com/contactus/brochures/Broiler_Mgmt_Guide_Russian.pdf
Additional information on broilers, breeders, nutrition, etc can be found at the home websites for both of these.


Bird rooms
Office, living quarters
Feed/storage
Well
Pedestrian Entrance, shower, restroom
Truck entrance

6 m x 8 meter representative room



Ishmaylii duck farm: After the training meeting, we visited a new duck operation that was having some difficulties. Initially the birds had been overheating during transport and 1000-1500 were lost by arrival. Just in general birds do not recover well from over-heating at this age, so there may be problems with heat stress in the future, however, most of the summer heat should be over. In general the farm was doing a good job with daily care, but was having major issues with feed. No protein source was available and birds were behind in terms of growth. I have formulated some diets based on their available ingredients and they are below. We had a good discussion of the need for complete rations and they appeared to understand that the growth would be dramatically better with a proper feed.

Basic duck ration below is based on their available feedstuffs which are not ideal

	0-21 days	21+ days
Ingredient	% in diet	% in diet
Barley	10	10
Soybean meal 48%	30	13
Wheat	57	70
Dicalcium Phosphate	1	1
Limestone/oyster shell	1	1
Oil (if available to 100%)		
Vitamin premix	0.1	0.1
mineral premix (if available)	0.1	0.1

Presentations

Update on Biosecurity

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August 16&17, 2011

Ganja & Ismayilli

Overview

- Understand what a disease is
- Biosecurity- disease prevention
- Small flock
- Large flock
- Veterinarians
- Laboratory

Basics of bacteria

- Bacteria are single celled organisms that may be either beneficial or disease causing
- Bacteria grow best in warm moist conditions, with a carbon, nitrogen and phosphorus source
- Removal of any of these (control mechanism) will reduce growth rate and pathogenicity
- Bacteria can be killed by a number of chemicals, but must be free of organic matter (clean) for their use

- Use in dirty areas (such as dirty footbath) will have no effect and may provide an accumulation and distribution point for bacteria

Basics of a virus

- Virus is a microscopic particle that can infect the cells of a biological organism
- Viruses consist of genetic material contained within a protective protein shell called a capsid
- Virus infects cell by taking over function, building more virus and cell lyses
- Virus need a host to replicate
- Will stay in the environment for periods of time, but can be easily destroyed through disinfectants, high heat in most cases

What is a disease?

- A disease may be defined as an impairment of the normal state of an organism that affects performance of vital functions
- How does disease occur?
- Disease occurs when sufficient quantity of the disease causing agent is present with conditions conducive to affect the host
- Any condition that stresses the host organism will result in a better chance for a disease outbreak
- Control of the environment and isolation of the host are critical

Ecology of disease

- Diseases occur as the result of an interaction between the host (bird), the agent (chemicals, toxins, bacteria, viruses, fungi, parasites, deficiencies) and the environment.
- Host (bird)
- Health/immune status
- Age
- Gender

Agent

- Chemicals
- Toxins
- Bacteria
- Viruses
- Fungi
- Parasites
- Nutritional deficiencies

Environment

- Proper temperature
- Well ventilated houses
- Proper litter moisture
- Solid nutrition
- Prompt removal and disposal of dead birds
- Proper facility maintenance
- Control of insects and rodents

Understanding Disease

- Disease Prevention
- Revolves around an understanding of this relationship between a host, the disease causing agent and the environment
- Reducing the incidence of disease revolves around control of those factors.

Biosecurity

- The prevention of infectious agents from entering the farm or facility
- Involves isolation of the facility as much as is feasible
- Barriers to entry such as screens on buildings and fences around the farm with controlled access points

- Discourage visitors and traffic between farms
- Use of disinfection procedures for necessary personnel and equipment
- Use of all-in all-out management when possible

Biosecurity on the Farm

- Transmission will occur through direct bird contact or through movement of fecal material in most cases
- A virus must have a host to survive and thus will not survive for long on a surface with no organic matter such as a car
- Avoid bird-bird contact such as live markets or allowing poultry to interact with wild birds
- Stop all potential movement of fecal materials through isolation or thorough cleaning and disinfection
- Use common sense- people that have traveled from another poultry farm are far more likely to be carriers than a car from the city

Disease Prevention on the Farm

- Clean stock
- Proper care
- Good environmental conditions (temperature, ventilation, litter, etc)
- Cleanliness
- Good nutrition
- Isolation (biosecurity)
- Appropriate Vaccinations

Vectors for transmission

- Birds (wild and domestic)
- Manure
- People
- Other animals

- Vehicles that have been on other farms
- Veterinarians visiting multiple farms
- Equipment used at multiple farms

Proper sanitation

- Occurs both between flocks and with birds in house
- Clean prior to disinfection
- Work from top down
- Clean and disinfect waterers, feeders, water lines
- Use pesticides to deal with insects, both inside and outside the building
- Neat and clean overall

Biosecurity- Small Flock

- Change systems that allow for transmission such as live bird markets
- Avoid transporting birds except for slaughter or from hatchery
- Move to greater confinement of birds to avoid contact with wild birds
- Periodically depopulate all birds on a premise to break the disease cycle

Biosecurity- Large flock-1

- Training is most important
- While biosecurity is always important, heightened awareness is valuable when an outbreak has occurred
- Must come from top down, but include all workers: President of company will rarely cause a problem, but people who work daily in houses are most likely and thus need training
- Understanding vectors for disease transmission is key

Biosecurity- Large flock-2

- Start by distancing workers from other poultry
- Provide a perimeter with limited access points that are controlled

- Control points should have at minimum a boot change; shower, clothing change better
- Potentially contaminated vehicles should be power washed with disinfectant
- Drive through baths should be changed frequently (daily or more)

Biosecurity Problems

- Actual lack of understanding of the principles, “going through the motion”
- Lack of immediate feedback
- No obvious results
- Apathy
- Disease problems when apparently following biosecurity procedures
- Oversight can be difficult
- Lack of understanding of the big picture

Biosecurity for Veterinarians on the Farm

- Veterinarians are a unique case due to travel to multiple farms
- Care must be taken to avoid carrying a disease to another farm
- Care must be taken to avoid carrying a disease back to the lab
- Care must be taken to avoid carrying a disease from the lab to the farm
- Proper understanding of biosecurity is a must

Farm Visits

- Veterinarians must leave for farm visit in a clean state: avoid contact with disease organisms prior to farm visit
- Prepare supplies needed for visit before leaving: disinfectant, boots, personal protective equipment (PPE), lab book
- Proper protective gear should be worn before entering premises, usually at vehicle
- Minimum: plastic boots (disinfect)
- Better: boots, coveralls, hairnet, gloves

- Do not drive vehicle onto farm or area where contact could be made with potential disease agents

On Farm Visit

- Check animal conditions, symptoms
- Look at overall care situation
- Collect specimens or live animals as appropriate
- Contain specimens to avoid any contamination of vehicle, clothes, etc
- Disinfect boots and dispose of PPE before leaving area, usually by the vehicle

Biosecurity at the Lab

- Biosecurity at the diagnostic center is critical
- Improper biosecurity could lead to the lab being a source of infection
- Having the center set up properly to maintain biosecurity is critical
- Equally critical is proper training of individuals in proper methods
- A good system and equipment will only work with well trained individuals doing a good job

Lab setup

- Principle: To minimize potential for contamination of facility while being able to do diagnostic work
- Access must be controlled
- All sample handling should be done in a specified area that can be contained
- Minimize personnel and assure that everyone is trained on containment

Necropsy Lab setup

- Lab should have supply of gloves, masks, lab coats
- Lab should have trash can for live bird storage
- Lab should have plastic bags in trash can for disposal of contaminated material for incineration

- Lab should have plastic bags in trash can for disposal of contaminated lab coats for washing and disinfection
- Lab should have footbaths for cleaning boots or disposable footware
- Cleaning and disinfecting products should be in lab for immediate use without leaving area

Receiving a Sample Bird

- Clearly mark the location for access to building
- Use PPE before handling animal- minimum gloves and lab coat
- Place birds on lab table if dead, trashcan or other suitable receptacle if live
- Fill out the submission report completely
- Assure that the person bringing sample to lab is decontaminated if needed before leaving

Necropsy

- Necropsy of birds should next be done
- Samples should be taken
- Best to take all samples possible on a suspect case
- Look for gross lesions and record on submission form
- Make preliminary diagnosis and recommend treatment if appropriate

Post-Necropsy Cleanup

- After all samples are collected, begin cleanup
- Bag birds/sample material that may be contaminated and place any other material in bag such as gloves, disposable PPE and tie bag
- Clean and disinfect area including table, walls, floors, boots
- Remove non-disposable clothing into trashcan with plastic bag and tie
- Wash and disinfect hands
- Remove organic material to incineration area
- Remove clothing to washer, wash with heavy bleach solution

Keys to being Biosecure

- Understand the potential for contamination and the dangers inherent- TAKE THIS SERIOUSLY
- Look at each movement for the potential to spread the agent and try to minimize
- Clean and disinfect anything that has potentially been contaminated
- Make working this way a routine, supervisors must enforce until it becomes second nature

Standard Operating Procedures

- Basic to understanding the procedures set up by the GLP plan
- Will take work to implement
- More work should result in improvements
- This is a scientific/logical approach to problem solving
- Standard Operating Procedures
- Should be a methodology for a procedure
- Cookbook like in completeness
- Practice with SOP before adoption
- SOPs should evolve with use and changes in circumstances
- Avoid writing oneself into a corner

SOPs may include:

- Title
- Approvals
- Purpose
- Background
- Materials needed
- Equipment
- Procedures

- Attachments
- Associated SOPs
- References
- Employee certification
- Thank you

Disease Prevention and Control Procedures

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Overview

- Prevention
  - Biosecurity
  - Vaccination
  - Medication
- Control Procedures
  - Control spread
  - Diagnosis
  - Treatment
- Clean-up procedures

Prevention 1

- Biosecurity is the main avenue to prevent disease introduction
- As noted previously, institute program
- Maintenance of programs can be difficult

Prevention 2

- Vaccination is the second step and a necessity for several diseases
- Include Newcastle, Marek's disease, Infectious bronchitis as minimum

- Other vaccinations should be based on local disease load, but include bursal disease, laryngotracheitis
- Assure that vaccination type used is effective for local subtypes

Vaccination Procedures

- Broilers have a short lifecycle and are primarily vaccinated in the hatchery or soon thereafter, breeders are different
- Method of vaccination determined by the vaccine, manufacturer
- Injection, spray or eye drop is most common, water after arrival at farm
- Always follow manufacturers direction explicitly or vaccine may be ineffective

Vaccination continued

- Vaccine must be reconstituted with correct diluent, use diluent to solubilize vaccine
- Must be given in the correct dosage
- Injections are usually given beneath the skin near the neck
- In some cases into the breast or the wing web
- Marek's is usually given by injection

Eye drop vaccination

- Eye drop is another method of vaccination
- Primarily used with chicks
- Dosage is primarily given in one drop directly onto eye ball
- Reconstitute vaccine as direction
- Try to do in as clean an environment as possible to avoid dust, etc

Spray vaccination

- Spray vaccination is similar to eye drop, but usually done on larger birds

- Again, follow manufacturers directions on size of spray (coarse/fine) and amount of dilution
- May need to pen birds in a smaller area
- Make every effort to assure each bird is vaccinated
- Aim for the head region
- Do not use spray equipment for any other use

Water vaccination

- Has been in use for many years, but must be done correctly for accurate vaccination
- 24 hrs prior to vaccination clean all waterers and lines, flush lines with powdered milk 100gms/200 l
- Remove birds from water the night before
- Follow vaccine guidelines for mixing
- Make sure vaccine water lasts until all birds have a chance to drink (2+ hrs)
- Avoid disinfectants (non-chlorinated) prior to and for 24 hrs post-vaccination
- Various type of equipment are available

Medication for prevention

- Medication can be added to feed for prevention of disease
- Most common is anti-coccidial drugs
- Antibiotic usage is also common, but becoming less so
- Used for growth enhancement, prevention of gut diseases such as necrotic enteritis

Anti- coccidial drugs

- Added at low levels, 50-120 gms/tonne
- Continuous use, or removed shortly before sale
- Generally will build some immunity
- Do not withdraw early if symptomology appears (bloody droppings)

A COMMON LEAST COST EXAMPLE:
TO DAY 16 DAY 17 TO 28 AFTER 28
SALINOMYCIN ----------

44 PM 55 PPM WD

Possible drugs for use

- Maxiban, Nicarasin, Lasalocid, Semduramycin, Narasin, Monensin, Salinomycin
- Individual drugs should not be used continuously, but a shuttle system used on 3-6 month intervals
- If problems persist, some have used combinations of drugs at lower levels

Feed Antibiotics

- Long history
- Promotes growth, feed efficiency, Improves gut health
- Looked upon with disfavor as potential for drug resistant bacteria has increased
- Banned or low use in EU, USA
- Helpful in less than ideal conditions
- When not used, generally increase therapeutic use (provided high dose in water)

Control procedures- Controlling spread of disease

- If a disease is suspected, immediately increase biosecurity efforts, avoid movement to other farms/birds
- Remove any dead birds more frequently and remove sick birds as well to a sick pen or kill
- Sick birds will shed the virus/bacteria in feces and potentially through respiration so should be isolated

Diagnosis 1

- Get initial diagnosis on farm
- Select birds that are freshly dead or still alive

- Post birds at farm for gross diagnosis
- Determine if respiratory, intestinal, etc
- Send birds to diagnostic laboratory for final diagnosis

Diagnosis 2

- Absolute diagnosis may be difficult to determine
- Need extensive laboratory facilities
- Initial disease may lead to secondary bacterial infections due to immune compromised state
- This can also compromise diagnosis

Treatment

- Generally best to start treatment based on initial diagnosis
- Viral diseases generally are not treatable
- In some cases, if infection rate is low, vaccination may be warranted
- Antibiotic/sulfa treatment may be initiated based on best diagnostic case
- Generally treat for 5-7 days even if birds appear to have recovered

Clean up procedures

- After disease outbreak, necessary to clean and decontaminate premises
- Remove all litter, dead birds to compost or distant location, in some cases burn/bury
- Clean building/equipment from top down
- After removal of all organic matter, disinfect building
- Allow to dry and wait 2 weeks to repopulate building

Summary

- Prevention- must do best possible

- Biosecurity

  - Vaccination
  - Medication

- Control Procedures- use antibiotics as needed

  - Control spread
  - Diagnosis
  - Treatment

- Clean-up procedures- make sure clean before repopulation

Major Poultry Diseases

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Overview

- A number of diseases affect poultry
- Variety of symptoms
- Some are serious, others less so
- Prevention is always better
- Good to become familiar with basic understanding of disease

Types of diseases

- Bacterial diseases
- Viral diseases
- Fungal Diseases
- Parasitic diseases
- External parasites
- Internal Parasites
- Protozoal diseases
- Nutritional Diseases
- Toxins

Understanding how the book is organized

- Name: Example would be Newcastle
- Other names used: ND, pneumoencephalitis
- Etiology: Basics about the disease and how it occurs
- Susceptibility: Age, type of fowl
- Occurrence: Worldwide
- Transmission: Manure, respiratory
- Clinical signs: What the disease looks like on a gross level
- Lesions: Actual damage to tissues
- Diagnosis: How we are sure of the disease
- Treatment: Antibiotics, etc
- Prevention: Vaccination, biosecurity
- Photos: Disease lesions (color available???)

Bacterial disease

- Common example: Necrotic enteritis
- Bacterial diseases are usually treatable by use of antimicrobial drugs such as antibiotics, sulfas
- If unknown disease, treat with a broad spectrum antibiotic such as penicillin, oxytetracycline

Viral disease

- Notable examples would be Marek's, Newcastle, infectious bronchitis, avian influenza
- Viral diseases are preventable through vaccination in most cases
- Generally not treatable with antibiotics although antibiotics may help (due to secondary infections)

Fungal diseases

- Fungi are single or multicellular eukaryotes that absorb nutrients, reproduce and have cell walls.
- Fungi do not act as infectious agents per se and are thus not contagious bird to bird
- Example would be aspergillosis

External parasites

- Lice, mites, flies, mosquitoes, beetles
- Generally affect bird through bites
- May spread disease or maintain diseases between flocks (beetles) as well
- Thorough cleanout will help control
- Control with safe pesticides if problematic
- Permethrins are generally considered safe

Internal Parasites

- Various types of worms
- Mild infections go un-noticed
- Generally not an issue with broilers
- Severe case will kill birds, mild cases reduce production
- More common in breeders, backyard flock, layers on floor
- Treat periodically or if worms are found
- Piperazine or other wormers effective

Protozoal diseases

- Coccidiosis is very common
- Results in hemorrhage in ceca
- Mortality can be 50%+ if untreated

- Most birds on floor should be on prevention program, ingestion of feces needed for disease to occur/spread
- Feed additives can be used (see next presentation)
- Vaccine is available, but some difficulty with effectiveness
- May be able to get by with clean litter

Toxins

- Primary toxin of interest is the mycotoxins
- Many different varieties
- Cause many different symptoms
- May be measured in feed, but can be difficult to assay accurately
- Feed can be screened with rapid tests
- Control is through binders (clay products that bind toxin)
- Severe cases, dilute feed with clean feed

Nutritional diseases

- Generally vitamins and minerals
- Should not be a problem in commercial setting
- Small scale feeding must know about nutritional requirements
- Complete feeds are a necessity

Common diseases- Avian influenza

- Avian influenza is an infectious respiratory disease caused by an orthomyxovirus.
- Readily grows in most species of bird that are of commercial importance.
- Low pathogenicity or high pathogenicity (big problem)
- Symptoms vary dramatically, but is most often seen as respiratory distress, depression, reduced egg production and death.
- Difficult to vaccinate for due to high number of subtypes, no treatment

- Generally depopulate, good biosecurity

Common diseases- Newcastle

- A highly contagious respiratory disease
- Typical symptoms are respiratory (gasping) or encephalitis or both.
- This is extremely lethal to young birds and may cause a dramatic drop in egg production in layers.
- Incubation period is 5-7 days and the virus can survive for several months in litter.
- The virus is easily killed by most disinfectants.
- Vaccination is needed

Common diseases- Marek's

- DNA-cell associated type B herpes virus disease of chickens
- Shows infiltration of tumors in nerves.
- The virus survives at room temperature for several hours and is killed by freezing and thawing.
- It is resistant to ammonias.
- Incubation period is as little as 14 days.
- Vaccination in most parts of the world

Common diseases- Coccidiosis

- Protozoal disease of chicken
- Affects ceca, causes bloody droppings
- Control has been discussed
- Common diseases- Infectious bronchitis
- An acute infectious viral respiratory disease caused by a coronavirus.
- It is highly contagious and characterized by gasping in younger birds and reduced egg production in layers.

- Incubation time of the virus is 18-36 hours.
- The virus is easily destroyed by common disinfectants.
- Pathogenicity of the various strains is variable. It generally runs its course in 10-14 days.
- Vaccination is a must
- At hatchery, boosters for breeders, layers

Summary

- Diseases can be devastating to poultry farms large and small
- Prevention through proper vaccination, biosecurity, etc is the best
- Treatment can be difficult, ineffective
- Must work continuously to stay ahead of the disease

Basics of Nutrition for Poultry

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August 16&17, 2011
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Overview

- Nutrition = money
- Easy to provide a good diet to the broiler
- Difficulty is the cost of the diet
- Must look for least cost per unit gain
- Low cost without good performance is not cheap
- Good growth, low cost, good feed efficiency

Nutrients- Compounds needed for survival

- Vitamins
  - Fat soluble
  - Water soluble
- Minerals
  - Macro
  - Micro or trace
- Protein/amino acids
  - Essential
  - Non-essential

- Energy (carbohydrate, fat, protein)
  - Fatty acids
- Water

Ingredients- Provide nutrients

- Protein sources- soybean meal, meat-bone meal, sunflower meal
- Energy sources- corn, wheat, oil
- Minerals- Salt, limestone, dicalcium Phosphate, premixes
- Vitamins- found in ingredients, premixes
- Purified ingredients- amino acids, choline
- Feed additives: mycotoxin binders, antibiotics, anti-coccidials, enzymes

Ingredients continued

- Corn is an energy source, but also has protein, minerals, etc
- Ingredients provide nutrients, but are not required themselves
- There are not good or bad ingredients, only cost effective or not

Requirements

- Requirements are always for nutrients
- Can be found in many locations
- Understand that bias may be involved in the requirement
- For example- amino acid manufacturers may call for high amino acid requirements

Barrel theory of nutrient use
Barrel theory-amino acids

Nutrient use

- Must have enough of each nutrient
- Performance is limited by limiting nutrient

- To little nutrient reduces performance and costs money
- Providing excess nutrient is wasted
- Excess nutrients cost money
- Exact balance of ingredients to provide nutrients is key

Making a diet

- Diets formulated by hand or with computer
- Computer enables a matrix inversion routine to provide best cost solution based on inputs
- Cannot do by hand
- Diets can be changed as prices change
- Software can be free/simple
- Software can be expensive ($10,000+/year)/complicated

Options for feed- Complete mixed ration

- Purchased from a large company and may be marketed through a local distributor
- May appear to be the most expensive option, as the company will certainly sell the feed at a profit for them.
- The advantages of a complete feed are many and may include:
- -excellent feed mixing equipment
- -excellent pellet quality
- -high levels of quality control
- -volume purchasing of ingredients for low prices
- -access to local and international ingredient purchases
- -wide variety of feedstuffs and additives
- -technical expertise from the local and perhaps international experts
- -computer formulated least-cost rations
- -on-farm technical support and technical bulletins

- -excellent animal performance
- Disadvantages: The primary disadvantage and potentially a large one, is cost.

Options for feed- Concentrates

- Concentrate feeds are generally also purchased from a large company and thus have some of the advantages noted above.
- The major advantage may be price of the final feed if local ingredients are available cheap enough. May not be cheaper.
- Disadvantages include: the lack of pelleted feed (5-7% loss in feed efficiency), less quality control, more work on the farm to both acquire, store and mix the final feed.
- This would be considered an intermediate step between a complete feed and an on-farm mix.

Options for feed: On-farm mix

- Farmer/company takes complete responsibility for the diet/feed.
- Purchases all ingredients, premixes and additives and the feed is mixed on the farm
- Advantage is that the cost may be low, either through use of the farmers own crops or through local purchase at good prices
- Potential for cost savings with opportunities available locally such as small quantities of a by-product from a local food manufacturing operation that can be profitably used when feed is mixed on-farm.
- This may make on-farm mixing of feed a cost saving procedure.
- Disadvantage is need to obtain steady supply of all feed ingredients needed, sometimes in small quantity

Decision time: Questions?

Making a decision on whether to use a complete feed, a concentrate or mix feed yourself is based on a number of questions.

- Is making feed on the farm a true cost savings? Include costs for labor, feed acquisition and potentially reduced performance when compared to the additional cost for complete feed?

- How much will be saved overall? Per tonne of feed?
- Do you have the technical expertise needed? Making your own feed requires a formula and may mean no technical support since you do not have a consistent feed supplier. Most diets are formulated by trained nutritionists with 10 years of college, highly specialized computer software and many years of experience in this field. Are you confident you have the expertise or can hire a consultant that is competent for this?
- Are low cost feeds readily available that could be used to reduce ration cost?
- Do you have the equipment to adequately weigh, mix and bag feed?

Decisions

- Cost is big issue
- Performance is an issue
- Time/effort is big issue
- Steady supply is a big issue
- All of this should be weighed carefully

Summary

- Look at situation carefully before investing in equipment
- Do not underestimate the level of expertise needed
- Cost needs to be a major criteria in the decision

Basics of Poultry Nutrition

Goal: Provide a completely balanced ration that maximizes performance at minimal cost

Overview: Nutrition can be divided into nutrients and ingredients. Nutrients are those substances (such as protein) that are required by the body for function and ingredients are those dietary components that are used to provide for those nutrients. Occasionally an ingredient is also a nutrient such as methionine, an amino acid that can also be an ingredient provided in purified form. The correct mix of ingredients is needed to provide all of the nutrients required by the bird for proper performance and health.

Nutrients include the following:

Vitamins

- Fat soluble
- Water soluble

Minerals

- Macro
- Micro or trace

Protein/amino acids

- Essential
- Non-essential

Energy (from carbohydrates, fats/oils, protein)

- Fatty acids

Water (a nutrient, but not typically of practical significance)

Vitamins and mineral: Vitamins are diverse organic compounds with a variety of biochemical functions and may be insufficient in a typical diet. Thus vitamins are generally added to the diet in the form of a premix or individually. Fat soluble vitamins can in theory be overfed and create a toxicity, water soluble vitamins are flushed easily from the system. Minerals are found as macro-minerals and trace or micro-minerals. Macro minerals are sodium, chloride (provided by salt), calcium (provided in large part by limestone or oyster shell), phosphorus (provided in meat and bone products, dicalcium phosphate) and potassium (common in feedstuffs). Trace minerals may be deficient in feeds and will be provided in a premix form. Insufficient levels of vitamins or minerals can have severe consequences as noted below:

Deficiency symptoms

Vitamin A- Roup: Reduced growth rate, ruffled feathers, nasal discharge, pustules with sticky exudates from mouth and esophagus.

D3, Calcium, Phosphorus-Rickets: Deficiency of imbalance of these nutrients. Abnormal skeletal development, especially long bones. Bones remain soft and can be flexible rather than cleanly breaking at necropsy. Reduced growth rate may be first symptom.

Mineral deficit- Osteolmalacia: This is a mineral-electrolyte imbalance sometimes referred to as caged-layer fatigue. Bones become soft and breakage may occur. Rickets may also be seen. Calcium, Vitamin D, and phosphorus should all be examined for adequacy. If this recurs, insufficient calcium in the pre-layer stage may be to blame.

Mn (choline, niacin, biotin)-Perosis: Slipped tendon in young poultry may be the result of a Mn, choline, niacin or biotin deficiency or combinations. The hocks enlarge and eventually the tendon slips out of the condyle and the leg extends abnormally. No treatment is available for birds at this stage. Restoration of vitamin and mineral balance is needed to prevent other birds from problems.

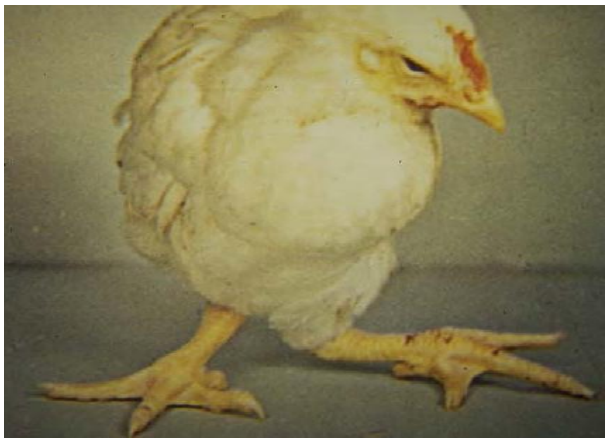
Thiamine (B1)-Polynueritis: Excitable, reduced appetite, eventual nerve degeneration leading to lameness and paralysis. The coccidiostat amprolium may affect thiamin use and should not be fed in excess. Injection will speed recovery.

Vitamin E: E deficiency can cause encephalomalacia or crazy chick disease where the chick appears drunk and causes brain lesions; exudative diathesis causes severe edema and weeping through the skin followed by gangrenous lesions and is exacerbated by selenium deficiency; nutritional muscular dystrophy where degeneration of muscles occurs when methionine/cystine are also deficient.

Riboflavin- Curled toe paralysis: Toes of riboflavin deficient chicks and poults curl medially. Stunting, diarrhea and mortality may also occur. Birds brooded with infrared brooders may have a higher incidence.

Pantothenic acid- dermatitis: Deficiency leads to skin inflammation on unfeathered parts of bird, especially near eyes and mouth, eye-lids may stick together.

Vitamin A deficiency



Perosis/slipped tendon, Mn (choline, niacin, biotin)-deficiency

Calcium, Vitamin D, Phosphorus deficiency

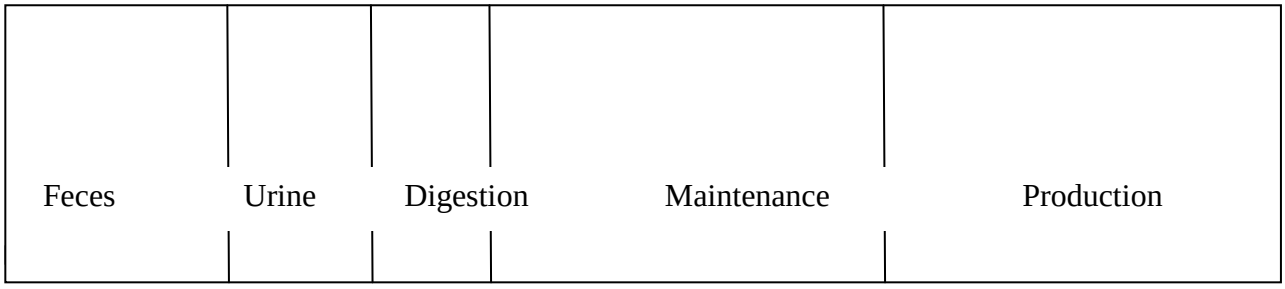
Curled toe paralysis (riboflavin deficiency)

Proteins/amino acids: Protein is the primary constituent of meat and thus is very necessary for growing birds. Insufficient protein or insufficiency of a single amino acid will result in very poor or no growth. Protein consists of chains of amino acids. A protein cannot generally be absorbed

into the bloodstream and proteins are broken down into the constituent amino acids in the gut of the bird. Thus there are actually no requirements for protein per se, although it is used as a convenience. There are requirements for essential amino acids (must be provided in diet) and for non-essential amino acids (can be formed in the body). In practical diet formulation for poultry, formulation to meet the requirements for lysine, the sulfur amino acids (methionine and cystine), threonine and valine is typically sufficient. A protein constraint is commonly used to aid in provision of the other amino acids.

Energy/fatty acids: Energy is used for all of the energetic functions of the body such as maintenance of body temperature. Energy primarily comes from carbohydrates, but is also found in fat and protein that is not used for muscle growth. Energy levels in the diet affect feed intake and providing too little energy will result in increased feed intake for a given unit of growth. Energy is provided for maintenance and growth or egg production. Much of the energy from a feed is lost in feces and urine and is not available to the birds. Thus we talk in most cases about metabolizable energy, a useful measure of energy based on these inherent losses.

Disposition of energy by a bird



only way to significantly increase the energy content of the typical diet when corn and soybean meal is used.

Nutrient Requirements: Nutrient requirements are experimentally determined and have been developed by universities and industry over many years. Requirements for some vitamins and trace minerals are extremely difficult to obtain accurately and thus are estimated. Requirements for important nutrients such as lysine have been researched extensively. In the appendix of this document is a set of nutrient requirement data as well as growth data from an older publication. It is accurate enough for small scale feedmilling, but larger scale producers should look at the current scientific literature or use as consultant for diet formulation due the potential cost savings.

Diet formulations: A diet formula is basically a recipe on what goes into a diet so that the feedmill can mix the diet. Formulas can be made by hand or standard formulas can be used. In larger scale operations a sophisticated computer formulation package and a PhD nutritionist

are used to obtain the least-cost diet formula. If a company manufactures 1000 tonnes daily, savings of a few dollars can add up substantially. A basic corn-wheat- soybean meal diet set for broilers is found in the appendix.

Feed milling: A feed mill is responsible for putting the correct levels of each ingredient into a mixer and blending the ingredients. Feed mixing equipment is relatively simple and inexpensive based on its capacity. A basic mixer that will mix 200 kg at a time can be purchased for a few thousand dollars. A complete small scale mill with pelleting capabilities may be in the hundreds of thousands and a large mill can be many millions of dollars.

Basic Broiler diets

Ingredient	0-17 days % in diet	18-28 days % in diet	28+ days % in diet
Corn	47.1	45.5	46.3
Soybean meal 48%	35	32.5	27.5
Wheat	10	15	20
Oil	3.5	3.9	3.9
Dicalcium Phosphate	1.75	1.3	1.1
Limestone/oyster shell	1.2	1.25	1.2
Salt	0.4	0.32	0.25
Methionine	0.18	0.055	0.035
Lysine 78%	0.064		
Vitamin/mineral premix	0.25	0.25	0.2
Anticoccidial drug	Yes	Yes	Maybe
Antibiotic	Maybe	Maybe	Maybe
Enzyme	Maybe	Maybe	Maybe

**Please note: An anticoccidial drug or other control mechanism is generally recommended. Antibiotic use is common and generally beneficial, but not required. Enzyme addition may be useful, especially if greater levels of wheat are substituted for corn.

Nutrient Requirements of Chickens and Turkeys

*Jeffre D. Firman **

Tables from Nutrient Requirements of Poultry, 8th revised edition, 1984, National Academy Press, 2101 Constitution Ave., N.W. Washington, DC 20418.

Conversion chart: 454 grams/lb; 1,000 grams/kilogram; 2.2 lbs./kilogram

Table 1. Body weights and feed requirements of broilers. * (Table is split into two sections.)

Age (weeks)	Body weights (g) M	Body weights (g) F	Weekly feed consumption (g) M	Weekly feed consumption (g) F
1	130	120	120	110
2	320	300	260	240
3	560	515	390	355
4	860	790	535	500
5	1,250	1,110	740	645
6	1,690	1,430	980	800
7	2,100	1,745	1,095	910
8	2,520	2,060	1,210	970
9	2,925	2,350	1,320	1,010

* Typical for broilers fed well-balanced diets containing 3,200 ME kcal/kg

Table 1. Body weights and feed requirements of broilers. * (Continued.)

Age (weeks)	Cumulative feed consumption (g) M	Cumulative feed consumption (g) F	Weekly energy consumption (ME kcal/bird) M	Weekly energy consumption (ME kcal/bird) F	Cumulative energy consumption (ME kcal/bird) M	Cumulative energy consumption (ME kcal/bird) F
1	120	110	385	350	385	350
2	380	350	830	770	1,215	1,120
3	770	705	1,250	1,135	2,465	2,255
4	1,305	1,205	1,710	1,600	4,175	3,855
5	2,045	1,850	2,370	2,065	6,545	5,920
6	3,025	2,650	3,135	2,560	9,680	8,480
7	4,120	3,560	3,505	2,910	13,185	11,390
8	5,330	4,530	3,870	3,105	17,055	14,495
9	6,650	5,540	4,225	3,230	21,280	17,725

* Typical for broilers fed well-balanced diets containing 3050 ME kcal/kg

Conversion chart: 454 grams/lb; 1,000 grams/kilogram; 2.2 lbs./kilogram

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Table 2. Nutrient requirements of leghorn-type chickens as percentages or as milligrams or units per kilogram of diet. (Table is split into two sections.)

Energy base	Growing 0-6 weeks	Growing 6-14 weeks	Growing 14-20 weeks

kcal ME/kg diet *	2,900	2,900	2,900
Protein (%)	18	15	12
Arginine (%)	1.00	0.83	0.67
Glycine and serine(%)	0.70	0.58	0.47
Histidine (%)	0.26	0.22	0.17
Isoleucine (%)	0.60	0.50	0.40
Leucine (%)	1.00	0.83	0.67
Lysine (%)	0.85	0.60	0.45
Methionine + cystine (%)	0.60	0.50	0.40
Methionine (%)	0.30	0.25	0.20
Phenylalanine + tyrosine (%)	1.00	0.83	0.67
Phenylalanine (%)	0.54	0.45	0.36
Threonine (%)	0.68	0.57	0.37
Tryptophan (%)	0.17	0.14	0.11
Valine (%)	0.62	0.52	0.41
Linoleic acid (%)	1.00	1.00	1.00
Calcium (%)	0.80	0.70	0.60
Phosphorus, available (%)	0.40	0.35	0.30
Potassium (%)	0.40	0.30	0.25
Sodium (%)	0.15	0.15	0.15
Chlorine (%)	0.15	0.12	0.12
Magnesium (mg)	600	500	400
Manganese (mg)	60	30	30
Zinc (mg)	40	35	35
Iron (mg)	80	60	60
Copper (mg)	8	6	6
Iodine (mg)	0.35	0.35	0.35
Selenium (mg)	0.15	0.10	0.10
Vitamin A (IU)	1,500	1,500	1,500
Vitamin D (ICU)	200	200	200
Vitamin E (IU)	10	5	5
Vitamin K (mg)	0.50	0.50	0.50
Riboflavin (mg)	3.60	1.80	1.80
Pantothenic acid (mg)	10.0	10.0	10.0
Niacin (mg)	27.0	11.0	11.0
Vitamin B12 (mg)	0.009	0.003	0.003
Choline (mg)	1,300	900	500
Biotin (mg)	0.15	0.10	0.10
Folacin (mg)	0.55	0.25	0.25
Thiamin (mg)	1.8	1.3	1.3
Pyridoxine (mg)	3.0	3.0	3.0

* These are typical dietary energy concentrations.

Table 2. Nutrient requirements of leghorn-type chickens as percentages or as milligrams or units per kilogram of diet. (Continued.)

Energy base	Laying	Laying, daily intake per hen (mg) **	Breeding
kcal ME/kg diet *	2,900		2,900
Protein (%)	14.5	16,000	14.5
Arginine (%)	0.68	750	0.68
Glycine and serine (%)	0.50	550	0.50
Histidine (%)	0.16	180	0.16
Isoleucine (%)	0.50	550	0.50
Leucine (%)	0.73	800	0.73
Lysine (%)	0.64	700	0.64
Methionine + cystine (%)	0.55	600	0.55
Methionine (%)	0.32	350	0.32
Phenylalanine + tyrosine (%)	0.80	880	0.80
Phenylalanine (%)	0.40	440	0.40
Threonine (%)	0.45	500	0.45
Tryptophan (%)	0.14	150	0.14
Valine (%)	0.55	600	0.55
Linoleic acid (%)	1.00	1,100	1.00
Calcium (%)	3.40	3,750	3.40
Phosphorus, available (%)	0.32	350	0.32
Potassium (%)	0.15	165	0.15
Sodium (%)	0.15	165	0.15
Chlorine (%)	0.15	165	0.15
Magnesium (mg)	500	55	500
Manganese (mg)	30	3.30	60
Zinc (mg)	50	5.50	65
Iron (mg)	50	5.50	60
Copper (mg)	6	0.88	8
Iodine (mg)	0.30	0.03	0.30
Selenium (mg)	0.10	0.01	0.10
Vitamin A (IU)	4,000	440	4,000
Vitamin D (ICU)	500	55	500
Vitamin E (IU)	5	0.55	10
Vitamin K (mg)	0.50	0.055	0.50
Riboflavin (mg)	2.20	0.242	3.80
Pantothenic acid (mg)	2.20	0.242	10.0
Niacin (mg)	10.0	1.10	10.0
Vitamin B12 (mg)	0.004	0.00044	0.004

Choline (mg)	?	?	?
Biotin (mg)	0.10	0.011	0.15
Folacin (mg)	0.25	0.0275	0.35
Thiamin (mg)	0.80	0.088	0.80
Pyridoxine (mg)	3.0	0.33	4.50

* These are typical dietary energy concentrations.

** Assumes an average daily intake of 110 g of feed/hen daily.

Table 3. Body weights and feed requirements of leghorn-type pullets and hens.

Age (weeks)	Body weight (g) *	Feed consumption (g/week) **	Typical egg production (hen-day %)
0	35	45	--
2	135	90	--
4	270	180	--
6	450	260	--
8	620	325	--
10	790	385	--
12	950	430	--
14	1,060	460	--
16	1,160	460	--
18	1,260	460	--
20	1,360	460	--
22	1,425	525	10
24	1,500	595	38
26	1,575	665	64
30	1,725	770	88
40	1,815	770	80
50	1,870	765	74
60	1,900	755	68
70	1,900	740	62

* Pullets and hens of Leghorn-type strains are generally fed ad libitum but are occasionally control-fed to limit body weights. Values shown are typical but will vary with strain differences, season and lighting. Specific breeder guidelines should be consulted for desired schedules of weights and feed consumption.

** Based on diets containing 2,900 ME kcal/kg, consumption will vary depending upon the caloric density of the diet, environmental temperature and rate of production.

Table 4. Nutrient requirements of broilers as percentages or as milligrams or units per kilogram of diet.

Energy base kcal	0-17	18-28	28+
ME/kg diet *	3050	3100	3100
Protein (%)	22.0	20.0	18.0
Arginine (%)	1.44	1.20	1.00
Glycine + Serine (%)	1.50	1.00	0.70
Histidine (%)	0.35	0.30	0.26
Isoleucine (%)	0.80	0.70	0.60
Leucine (%)	1.35	1.18	1.00
Lysine (%)	1.20	1.00	0.85
Methionine + Cystine (%)	0.93	0.72	0.60
Methionine (%)	0.50	0.38	0.32
Phenylalanine + Tyrosine (%)	1.34	1.17	1.00
Phenylalanine (%)	0.72	0.63	0.54
Threonine (%)	0.80	0.74	0.68
Tryptophan (%)	0.23	0.18	0.17
Valine (%)	0.82	0.72	0.62
Linoleic acid (%)	1.00	1.00	1.00
Calcium (%)	1.00	0.90	0.80
Phosphorus, available (%)	0.45	0.40	0.35
Potassium (%)	0.40	0.35	0.30
Sodium (%)	0.15	0.15	0.15
Chlorine (%)	0.15	0.15	0.15
Magnesium (mg)	600	600	600
Manganese (mg)	60.0	60.0	60.0
Zinc (mg)	40.0	40.0	40.0
Iron (mg)	80.0	80.0	80.0
Copper (mg)	8.0	8.0	8.0
Iodine (mg)	0.35	0.35	0.35
Selenium (mg)	0.15	0.15	0.15
Vitamin A (IU)	1,500	1,500	1,500
Vitamin D (ICU)	200	200	200
Vitamin E (IU)	10	10	10
Vitamin K (mg)	0.50	0.50	0.50

Riboflavin (mg)	3.60	3.60	3.60
Pantothenic acid (mg)	10.0	10.0	10.0
Niacin (mg)	27.0	27.0	11.0
Vitamin B12 (mg)	0.009	0.009	0.003
Choline (mg)	1,300	850	500
Biotin (mg)	0.15	0.15	0.10
Folacin (mg)	0.55	0.55	0.25
Thiamin (mg)	1.80	1.80	1.80
Pyridoxine (mg)	3.0	3.0	2.5

* These are typical dietary energy concentrations.

Small Scale Poultry Processing Plans

Overview: Poultry processing involves the sanitary slaughter of birds such that the resulting product can be sold to the consumer in an acceptable fashion. Steps in poultry processing are below:

Remove feed from birds 4 hours before catching

Live bird catching (crates or cages)

Movement to processing facility

Holding of live birds (fans may be needed in summer periods)

Removal of bird to shackle or cones

Stunning (electrical or gas: note may not be done in Halal)

Killing via knife cut to carotid arteries

Bleedout 1-2 minutes

Scalding (58-62C) for 1-2 minutes

Picking 1-2 minutes

Removal of head, feet

Evisceration, cutting uropigial gland or tail (may save heart, liver, gizzard)

Removal of lungs, kidneys (use scrapers)

Cleaning

Chilling (water/air)

Cleaning/packaging

Refrigeration/freezing

Slaughter can be in a very small scale to very large. Backyard operations may kill just a few birds each day while a small scale commercial facility might be considered 500 birds/day. There are two basic methods of slaughter. The first of these is what is referred to as batch slaughter. In this system a “batch” of birds, which may be from 2 to 30 birds is killed in a short period of time and placed into the scalder and picker as a group or “batch”. Batch processing is preferred for small scale operations as the equipment needs are much less due to the low level of automation (high labor needs of course). The speed of a system is labor dependent as well as based on the size of the scalder/picker. Smallest scale is about 5 broilers, while largest scale

batch picker is about 25-30 broilers. Single bird pickers are also available as well as simple manual scalders. The speed of the system is based on the scald and pick time (1-2 minutes) as well as the time to move birds from scalder to picker. Obviously the actual slaughter and other steps must keep up with this speed to determine the overall speed of the plant. Equipment manufacturers tend to overestimate the speed of a processing line relative to actual experience. While the speeds noted may be theoretically possible, it is difficult to see how a plant using 10 killing cones (a batch size of 10 birds) could process 800,000 birds yearly with one shift/day. It would clearly take more than 90 seconds to remove 10 birds from a crate, put them into the cones, cut throats, allow for 60 seconds of bleed time (90 is more realistic bleed time),then remove the birds from cones and hang them (or other based on system) on the scalding shackles. While a pair of experienced workers may do this for an hour at 40 times/hour, it is not likely they could maintain such a pace for 8 hours daily. Twelve to 15 turns per hour (120-150 birds/hr) is more realistic than the manufacturers 400/hr estimate. A large scale batch system with sufficient labor may do 300+ birds per hour. Total number of birds killed in a 10 bird batch system can be quite high on a yearly basis. If one processes 150 birds/hr x 16 hrs (2 shifts) x 250 working days/yr = 600,000 birds yearly.

The next step up in poultry processing is a continuous line system although some of these may in fact not, use a continuous line throughout. In the smallest scale system, a line is used for kill, bleed, scald, pick, followed by evisceration by hand on a table. This automates the most difficult part of the process and keeps the automation (and thus costs) low. A full scale, automated plant can do more than 400,000 birds daily, although more common size in the US is probably 200,000 daily (50 million/year). Obviously such a plant can invest over $100 million. The designs shown below will involve a small scale batch system (5 birds/batch), a larger scale batch system (25/batch) and a small scale partial continuous system. Anything larger than this probably would require a design staff working with a large scale processing equipment manufacturer to assure that all equipment matches up with each other, etc. In other words, beyond the scope of this report.

Building

Processing plant facilities can be made for many materials, but in all cases should have the following characteristics. Buildings and individual rooms should be sized sufficient to not only do the job, but allow for room for expansion/modifications of equipment. The entire design of the buildings and equipment should be based on ease of cleanup, wash-down and disnfection. Walls should be made of water proof materials that can be power-washed without loss of integrity. Concrete with epoxy coating is considered the best, although sealed plastic/metal/fiberglass panels may be used. Tile is a lower end choice as in all cases broken

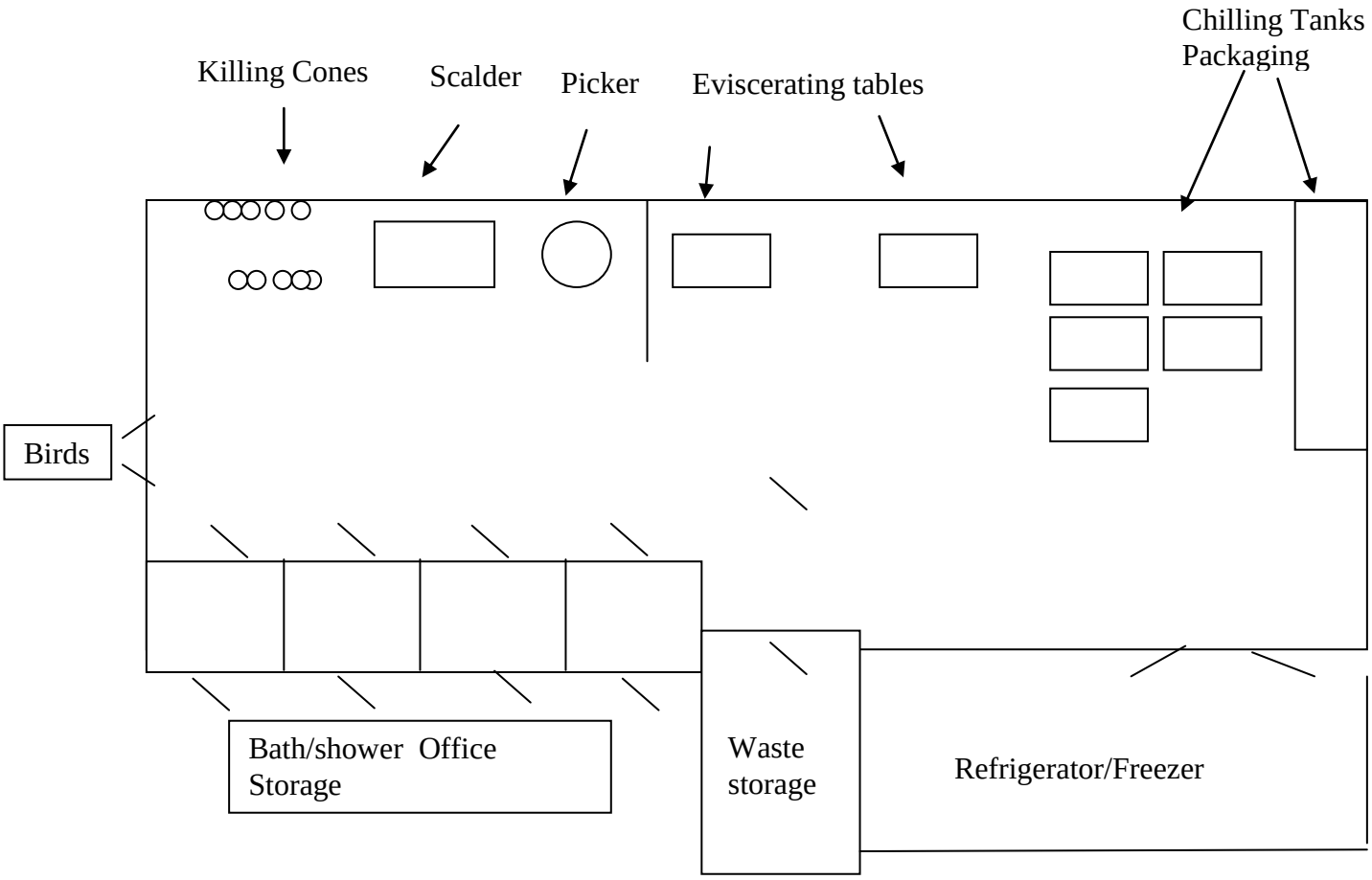
tiles will occur over time. The wall-floor connection should be rounded so water runs away from the wall and no areas for dirt accumulation area available. Doors should be large enough to bring in equipment easily and have a lip separating the inside from the outside of the building. Floors should be of concrete and designed for wet traction as well as ease of cleanup. All floor areas should slope to drains, but be as level as possible. Drains should be of sufficient size as to handle particulate matter and have stainless steel or plastic grates. All outdoor areas (such as bird holding areas) should slope away from the processing areas. All openings should be screened or have other means of keeping birds, flies, etc out of the building. Ventilation should be provided for as well as a capable HVAC system. Hot and cold water outlets should be found in each room and sufficient water heating capability should be designed into the facility. Continuous flow water heaters are useful during cleanup operations. Water drainage flow should be counter to the flow of birds to maintain a clean operation. Packaging and subsequent refrigeration/freezing should be physically separated from other processing operations.

Waste handling needs to be designed into the building. Waste will include, blood, feathers, offal (term used for entrails, head, feet, other non-edible portions) and fat as well as large quantities of water used in both processing and cleanup. Access to a municipal sewage system or other system for handling waste water is needed. Approximately 25% of the bird will be considered waste, so a disposal methodology must be determined. In advanced systems the waste product is cooked to kill bacteria and dried to remove water followed by grinding to make into a valuable feed stuff currently worth $500/tone. In Azerbaijan, landfill of waste is common.

Chilling and refrigeration of birds should also be considered early in the design process. Chilling prior to packaging may be done in either cold water or refrigerators (air-chilled). Water chilling is more common due to the overall lower cost. Cold water is run into a tank which has birds placed inside. In many cases the basic water supply is sufficiently cold for initial chilling (such as 10C) to take the heat from the bird. Water should be changed sufficient times to bring the entire body temperature down to this level. It may then be chilled further through addition of ice to the bath or packaging followed by refrigeration or freezing. Make sure that sufficient space is found around the birds for proper chilling or freezing to occur.

Batch processing: 5 bird/batch system: approximately 72 -100 birds/hour (Equipment photos below)

25 bird/batch system: approximately 200-300 birds/hr (The design below would be increased in size by 25% and refrigeration/waste storage by 2-3X to accommodate increased bird numbers.



Approximate size: 25 x 15 m. Refrigerator/freezer size and waste storage size are dependent on the frequency of removal. In other words, the waste must be removed at the end of each day or be refrigerated/frozen (expense associated). Processed birds must be stored until removed for sale. Insufficient storage will be problematic if birds are not moved out as new birds are processed. Freezing allows for longer term storage. Off site cold storage may be needed as well.

Examples photos of small scale equipment that may be purchased

Equipment list and costs are below. Please note that the capacities and number of birds/hour/day are highly labor dependent. Costs are in USD for US equipment. Cheaper equipment may be found locally or through Turkish companies. In almost all cases, stainless steel is recommended or plastic in some cases. Galvanized metal can be used, but the cost savings are generally not realized long-term. Additionally, supplies such as aprons, packaging bags, etc must be replaced continuously. The costs below **do not** include costs for land, building, plumbing, wiring, etc. The consultant does not have access to such costs and these costs may vary widely even based on locale within a region.

Killing cones	$600
Scalder	2500
Picker	1200
Tables	1000 plastic, 4000 stainless
Chill tanks	1200
Barrels	750
Cooling Trays	3000
Bird hauling crates	500
Bagging equipment	500
Miscellaneous (knives, aprons, etc)	500
Total equipment	$11,750-$14,750

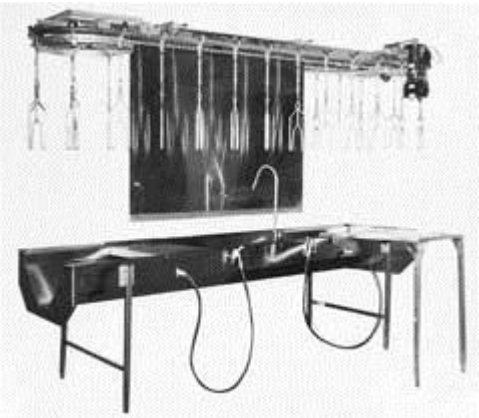
Larger scale would be $40-50,000 with small improvement in automation (pictures below) such as an auto emptying picker

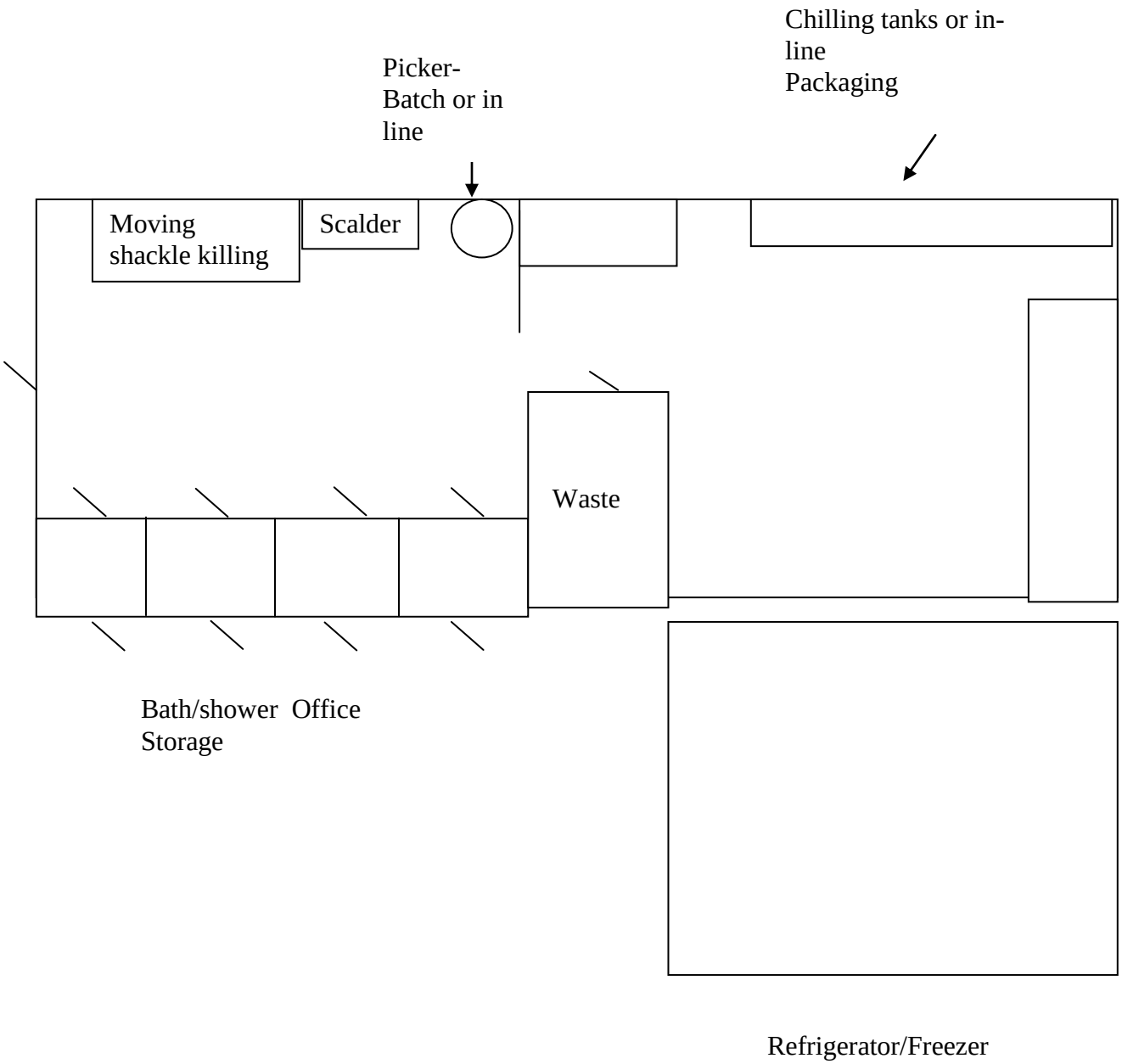





Small scale continuous plant

The equipment needs and cost for setting up a small scale continuous line plant are significantly higher than for that of a batch system. The main reason that continuous line systems were devised was to reduce labor needs and associated costs. As integrated structures became prevalent in the industry, the need for high speed processing became necessary to keep up with the expanding scale of the production and feeding capacities. A large scale batch system (300/hr) may run a single shift and process approximately 2500 birds per day or 625,000 birds yearly. Obviously, a second shift will enable twice this capacity. A very small scale continuous system that is still doing hand evisceration will start at this capacity and go up to approximately twice this size, but will run into constraints on speed unless further automation is brought in. Obviously refrigeration/freezing space and waste storage space must be increased, but basic plant layout does not change. Cost for such a hybrid continuous batch system would be between $100,000 and $200,000 and size would be that of the larger batch system.




Chilling tanks or in-line
Packaging
Picker-
Batch or in
line
Moving
shackle killing
Scalder
Waste
Bath/shower Office
Storage
Refrigerator/Freezer

Acronyms: NA