Technews

National Dairy Development Board
For Efficient Dairy Plant Operation

April- June 2019 **Issue No. 97**

Integrated Pest Management Programme

This bulletin includes technical information based on latest developments on products, systems, techniques etc. reported in journals, companies' leaflets and books and based on studies and experience. The technical information in different issues is on different areas of plant operation. It is hoped that the information contained herein will be useful to readers.

The theme of information in this issue "**Integrated Pest Management Programme"** It may be understood that the information given here is by no means complete.

In this issue:

INTRODUCTION

Many species of pest are attracted to the food and shelter present in dairy processing facility and can gain entry into food chain at many points, contaminating surfaces, materials, equipment and dairy products. Pest control is maintained by implementing an IPM (*Integrated Pest Management Programme*) under control of competent person. Hence, management of pests in dairy processing facilities requires a high degree of professional knowledge combined with experience.

Pest management includes many items in addition to pesticides. A good definition for pest management: **(IPM is the integration of chemical, physical, biological and cultural controls into a system that minimizes health, economic and environmental hazards, accordingly pesticides are to be used as the last resort or as a method to correct a serious problem.)**

A major consequence in the dairy industry of the phase out has been the switch from a reactive control strategy to one of Integrated Pest Management (IPM). IPM is a systematic approach to pest management, which comprises:

- Building, machinery and materials design
- Building maintenance and exclusion practices
- Advice on good housekeeping practices.

- Inspections and monitoring
- Physical control methods
- Chemical control methods
- Habitat/environmental management

Early detection of pest activity is essential if the impact of corrective control measures is to be optimised. A combination of thorough regular inspections and on-going monitoring using a variety of detectors will provide the information upon which to build control strategies.

One of the first steps in managing pests in dairy plants is a well-planned and constructed Plant building and layout. Preventive design and maintenance is an extremely valuable tool and first step in pest control. When effective design/construction is not in place, then steps must be taken to apply preventive measures to existing facilities to decrease pest problems. Dairy plants must employ periodic ongoing pest management programs including record keeping, to monitor both effectiveness and legality of pest management.

The pest management program must be directed against the threat of pests not only in the facility but also from surrounding areas. Pests may be introduced to the facilities via incoming ingredients, materials and transportation vehicles. Pest management must be directed at preventing favourable environments for the pest to develop.

Food Safety:

The presence of pests in any food handling premises is unacceptable. The risks posed by pests include:-

- The spread of disease – pathogens are transferred from the gut or external surface of the pest
- Damage to property
- Contamination of work surfaces and foodstuffs
- Adverse public opinion and loss of reputation
- Prosecution and closure
- Poor staff relations

Pest management is part of the Good Manufacturing Practices (GMP) for food businesses, which is a prerequisite for the HACCP-based procedures in place. As an integral part of the GMPs, it should be carried out with due diligence and properly documented.

BUILDING DESIGN

The design includes not only the building, walls and interior but also the exterior landscaping, drainage and where usable materials will be stored and very importantly, where unusable (trash) materials will be stored outside the production unit. The location of dairy facility shall be situated away from environmentally polluted areas like open sewage, drain, public lavatory or any factory who does not practice sanitation or is a business which will provide harborage for pests.

Short grass, neatly trimmed shrubs, paved access ways and proper drainage are some of the environmental management strategies that help reduce or eliminate shelter areas for most pests. A vegetation free perimeter around buildings is a must. An 18-24 inch band of pea gravel of 1 inch in diameter at ½ foot (15cm) deep is recommended surrounding the building, which makes it difficult for rodents to burrow into it for nesting.

Ceiling: Roof shall be smooth and free of spills and standing water. R.C.C is widely preferred for ceilings in food processing facility and same shall be designed and executed properly to prevent leakage of water /seepages. The metal sheet are available for making roof, but these can support insect life in the voids. These are temporary fixtures and difficult to clean and maintain, may lead to cross contamination due to pitting and corrosion.

False ceiling in dairy processing unit should be avoided if possible. These are the least attendant areas to clean and inspect and eventually pests take over. If, false ceiling is used, it shall be under master sanitation checklist.

The Ceiling:

- Shall be maintained in sound condition and constructed of materials that are durable, cleanable, and impervious to food, grease and water with no toxic effect in intended use.
- Shall be sealed to prevent the entry of dirt, dust and pests.

- Shall be free from flaking paint or plaster.
- Shall be free from cracks, flaking paint or plaster and open joints, finished and maintained to minimize the accumulation of dust, condensation, mould growth, and shedding of particles and shall be smooth and easy to clean. The area covered under false ceiling shall be accessible for inspection and cleaning.

Floors: Concrete is suitable for floors, but if not properly poured, concrete will crack and hold dust. Coating the floor will help aid in sanitation. Wet processing areas require acid-proof or brick floors for easy cleaning and resistance to erosion. If the floor will be exposed to large quantities of running water or harsh chemicals, the concrete substrate should be protected from erosion with an asphalt membrane over which the tile-cement is applied before laying tiles and grouting to reduce water penetration and pest shelter. Nonproduction zones of dairy plants may be covered with asphalt or straight vinyl tiles. However, these tiles may have cracks or void areas due to incomplete bonding, which will harbour insects, so they should not be used in areas where there is a high potential for insect infestation.

There should be a floor drain every 400 square feet of floor in a wet processing area. Floors should be sloped toward the drain at 3/16 inch per foot into a four (4) inch or larger sanitary line which should be equipped with check valves to prevent the entrance of insects and rodents.

Wall: The materials include precast or poured concrete, concrete block, brick, tile and metal curtain. Whatever the material, it should be sealed or repainted and sealed so that it will be easy to clean and so that pores, cracks and joints will not offer insect shelter. Do not drill or punch holes in these walls because holes provide access to the interior of the wall, which makes excellent insect quarters.

Airbricks supply ventilation to walled cavities but may allow mice and insect pests access. They should thus be fitted only where necessary and protected with a 2mm stainless steel mesh.

Pre-formed corrugated cladding should be avoided as corrugations are difficult to seal adequately against pest entry at the point where they meet conventional walling.

Windows and Doors: It is desirable to have as few windows as possible in a dairy production zone. Windows are hard to clean and allow many pests to enter when left open. Transparent glass block windows should be considered when outside light is necessary.

Doors should be made of stainless steel and have tight-fitting seams. Use of air curtains on delivery doors or other large entries could also prevent certain pest entry. Good lighting with dust-tight fixtures leads to easy inspection, better housekeeping and improved pest management.

Electrical and plumbing services, should be installed so there is adequate access for cleaning behind and through the wall. Pipe insulation should be dense, tough and well-sealed and electrical control panels should be either sealed to or held away from the wall. All such panels should be insect proof.

Equipment layout and design should be roomy, easily accessible for cleaning and should not have rolled edges, ledges, dead ends or pockets in which insect attracting dirt, dust or waste products can accumulate. Equipment should either be raised at least six inches off the floor or sealed to the floor with a pliable material that will resist vibration.

Supply pipes and cables, i.e. gas, electric and water must be tightly sealed where they pass through walls as rodents may gain entry via this route. Sub floor ducting should be made accessible. Pipe and cable ducting are potential pest harbourages and act as communication highways between areas. Ducts can be sub-divided to prevent rodents gaining access along their length.

PEST MANAGEMENT IN THREE SUCCESSIVE STEPS

There are five distinct general areas of activity in dairy plants in which various pests must be managed. In addition to understanding the life cycles and habits of pests, you should consider management in three successive steps:

1. Preventive maintenance
2. Non-chemical management
3. Pesticide management

The aim of an Integrated Pest Management programme is to minimise pest risk through proofing, hygiene and environmental management, there will be occasions when pesticides will be employed to eradicate an infestation on site. The use of pesticides can present a risk of product contamination, risks to the health of users and third parties and a risk to the environment. For these reasons the use of pesticides/insecticides will be a last resort and their use will strictly adhere to the legal requirements.

Where possible pesticides should not be stored on site as the following risks may be present:

- The handling and use of pesticides by untrained people
- Pesticides being handled or misused by unauthorised people, children, domestic or other animals
- Pesticides being stolen and dispersed due to forced entry to stores
- Continued storing of pesticides that have become unapproved by Government for storage and use
- Storage of excessive quantities which may be inherently hazardous to staff using the store
- Storage of different chemicals that could become hazardous by interaction

- Lack of segregation, for example, of flammable materials or of pesticides, which could taint pesticide baits

Where pesticides/insecticides are stored on site, the store should be located away from dairy production and storage areas, kept securely locked and accessed only by authorised personnel.

I. Grounds:-

1) Preventive Maintenance:

- Eliminate improperly stored equipment, litter, waste, refuse and uncut weeds or grass within the immediate vicinity of buildings or structures to reduce pest harborages.
- **Low Spots-** Areas where water accumulates and becomes stagnate will attract insects, birds and rodents. Eliminate this type of low spots which will deter the pest's activity. Ground should be smooth and properly drained.
- **Trash Spots-** Areas where trash, garbage or litter accumulate should be periodically cleaned to make them less attractive to rodents, flies and birds**.** Such sites should be placed on a Master Sanitation Schedule (MSS) for periodic cleaning and inspection.
- **Landscaping-** Trees that bear fruit, sweet smelling flowers, nuts or seeds are attractive to insects, birds and rodents because they provide food and may provide nesting or roosting sites, so they should not be located near a facility.

- Eliminate excessively dusty roads, yards or parking lots. Pave where necessary and establish well-maintained lawns. This reduces the possibility of food contamination from dirt, microbes and other airborne particles that may drift into the plant.
- **Processing facility**- Properly slope and adequately drain the grounds to avoid contamination of food products through seepage of foot-borne filth. Poor drainage also provides a breeding place for insects, microorganisms and water source for rodents.
- Reduce any waste food product or raw product spillage outside to reduce food potential for birds, insects or rodents.

2) Non-Chemical Management:

- Consider various types of rodent, insect and bird traps/nets/fixtures.
- Use of ultra-sonics to prevent pest
- Maintain adequate housekeeping programs.
- Implement pest monitoring programs including pheromone(s) and sticky traps.

3) Pesticide Management:

Rodents:

- Maintain and inspect bait stations. Install bait stations at adequate intervals and inspect often for signs of activity. Be aware of rodent migration seasons. Rodenticides must be kept fresh under lock and key. Consider solid baits in wet weather and liquid baits in dry weather.

Insects:

- Install solid insecticidal baits in-around breeding sites that cannot be removed
- Treat as needed with approved insecticides, especially with potential insects breeding sites (fodder development area)

II. Buildings:-

1) Preventive Maintenance:

- The colors white and yellow are more attractive as a result of their reflective qualities. If possible, minimize the use of these colors on exterior and in critical interior areas too. If present, minimize the amount of light shining on these surfaces and reflected from them.
- Position outside lighting away from buildings and focus the lights toward buildings to attract night-flying insects away from doors and windows. Low sodium lights attract fewer insects and should be used when possible. (Note: Many insects are attracted by UV light and incandescent bulb emit IR which therefore are good source of warmth.)
- Eliminate cracks, crevices, recesses and ledges for ease of cleaning and elimination of potential insect harborages.
- Floor drains are to be placed on schematic map and document when they are cleaned. Floor drains should be a minimum of four inches in size and equipped with a removable secondary strainer to prevent entry of cockroaches, rodents and other pests that occasionally use drain pipes as an entry point into a facility.

- Control panels installed in manufacturing areas should similarly be designed to be dust and water tight. Panels can be pressurized with clean filtered air. Supporting leg bases should be designed to avoid hollow voids that could allow debris to enter from their sides or at floor attachment.

- Wooden pallets are a sanitation and GMP nightmare in dairy industry.

The wood can splinter and cause foreign material contamination in production areas. Do not only inspect pallets for pest evidence near the floor but also check pallet boards several feet high in a stack.

- Rodent proof all doors, walls, windows and roofs. Even the color of the building can increase insect attraction!
- All HVAC (heating / ventilation / air conditioning) utilities should be properly screened or filtered to keep pests out.
- Roof areas should be part of your at least monthly GMP inspection route and its access points from inside

the plant should be secured and monitored for personnel using them as "break" areas thus leaving behind food debris and cigarette butts.

- Screen all windows that can be opened.
- Eliminate access to ledges and roofing areas for birds.
- Locate equipment off the floor and away from walls or seal equipment to walls and floors.
- Eliminate food that may accumulate near dust collection or exhaust systems.

2) Non-Chemical Management:

- Housekeeping – Keep all areas free of loose materials such as cardboard, rags, processing waste and equipment.
- Clean structure frequently with brooms and vacuum, paying particular attention to out-of-the-way places.
- Clean both the interior and exterior of all equipment (electrical and mechanical) often.
- Inside buildings, utilize electrified grids for attracting insects care to be taken not to place above directly above the dairy processing line/equipment.

III. Incoming Ingredients and Material Storage Warehouse:-

1) Preventive Maintenance:

Inspection of all incoming vehicles as well as ingredients and materials is essential to determine that pests are not brought into storage areas.

2) Non-Chemical Management:

Store ingredients and materials away from walls far enough to permit access for inspection and sanitation.

Rodents:
Place rodent traps (windup and snap) at or near all doors and at intervals along walls and maintain a map of trap locations. Record catches for each trap.

Insects:
Utilize air curtains at dock and pedestrian doors. Install insecti-tutors at appropriate location.

Birds:
Selectively use of ultrasonic devices, window labelling, revolving bird lights, wires, prongs or other deterrents to rooftops or roosting sites. Note: all mechanical and electrical units require frequent inspection to ensure proper functioning.

3) Pesticide Management:

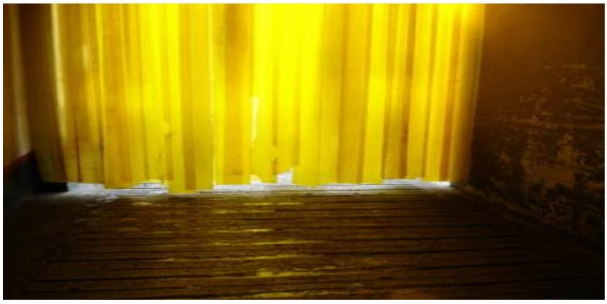
- Use rodent bait stations containing anticoagulants to supplement rodent traps (where company policy permits).
- Space treatment with non-residuals.
- Crack and crevice treatment with residual insecticides.
- Spot treat with residual insecticides.

- Fumigate raw bulk commodities when infested during receiving and, if possible, before entering the processing plant.

IV. Milk Processing and Packaging Area:-

1) Preventive Maintenance:

- Detailed monitoring program
- Total facility IPM program (Building & Processing facility layout)
- Milk spills during unloading / loading of milk at reception dock should be promptly cleaned. Unloading hoeses should be clean/capped/locked when not in use and be stored off the ground in a sanitary manner.
- Emergency exit doors that open directly to the outside should have security alarms. Any doors should be tightly sealed along the bottom sill area so rodents cannot enter.



Damaged bottom of plastic strips doors allows pest

- Dock levellers must be fitted for pest prevention/exclusion. Rodents can easily crawl into

the plant through the leveller pit when the plate is not sealed, usually with brush seals or pieces of heavy rubber.

- Motor / Pumps are often overlooked during cleaning. There are numerous cracks/crevices and ledges in motors where debris accumulates, and they are warm favoring breeding of insects. Clean motors at least monthly and include them on your monthly GMP inspection routes.
- Equipment leg bases that sit firmly on floors also accumulate debris that create a harborage for insects if they are not sealed directly to the floor. Hence, keen attention has to be given in these areas as well.
- Flooring under equipment should be completely smooth to allow thorough removal of waste material.
- Entrance, exit, rail or dock doors should not open directly into plant manufacturing areas. These can be left open for pest entry and it allows unfiltered air into the plant. Negative air pressure inside is needed instead of positive so that no pests are sucked into the plant.

2) Non-Chemical Management:

- Place rodent traps near doors / corners if situation warrants and monitor for activity.
- Avoid the use of air curtain doors, strip curtain doors or rubber flap-back doors around external wall door openings. Most are poor at excluding pest ingress. Automatic high-speed roller doors are preferable but their timing needs to be adjusted so that they are open

for the minimum amount of time. They should also be fitted to create an air lock.

- Exterior Milk storage tanks are to be covered with protective head house /bird proofing.
- Ensure proper sanitation and elimination of pest harbourages.
- Clean both the interior and exterior of all equipment (electrical and mechanical) often.
  Inside buildings, utilize electrified grids for attracting insects- care to be taken not to place above directly above the dairy processing line/equipment. However, outside buildings electrified grids may do more harm than good, hence shall be placed only at strategic locations where there is chances of contamination through insects.

3) Pesticide Management:

- Space treatment with non-residuals.
- Spot treatment with non-residuals.
- Crack and crevice treatment with residuals.

Note: As far as possible pesticide treatment/usage inside the dairy processing and packaging facility shall be limited only for drains and outside corridors paths. Utmost hygiene shall be ensured with well-defined and set PRP's. Cracks and crevices in processing/packaging sections shall be immediately fixed. Frequent inspection of pest control programs are necessary.

V. Vehicles:-

The need for an effective vehicle inspection program cannot be overemphasized. If pest-free finished products are placed on a pest-contaminated carrier. Vehicles must be clean and free of infestation prior to loading final product.

Vehicles before loading:

- Visual inspection
- Space treatment-if required
- Crack and crevice treatment-if required

PESTICIDE FORMULATION & TRAPS PLACEMENT

1. **Pest attractants:**

For each insect and sampling requirement, the user must decide what kind of trap and if there are needs for attractants. A pheromone is a chemical attractant released by an insect to affect the behavior of the same species of insect. Two commonly used pheromones for insects are sex and aggregation pheromones.

- Sex pheromones are used to facilitate mate location and mating. There are several commercially available sex pheromones for use in traps to improve sampling. Most commonly used is the Indianmeal moth pheromone.

- Aggregation pheromones are chemical substances released to attract members of the same species. The most commonly used is the confused flour beetle pheromone.

- Food attractants are often used in corrugated traps and have significant advantages because the food attracts all species of food-processing insects. An obvious limitation to the use of food attractant in a food warehouse is the competition with food odors surrounding the traps.

2. **Wettable powders (WP):** It consist of an inert powder impregnated with the active ingredient and usually incorporating a wetting agent to aid dispersion in water. WPs can be used on all surfaces but are particularly useful on absorbent surfaces where the insecticide particles remain on the surface, making it available to insects walking over it.

3. **Suspension concentrates (SC):** The active ingredient is ground to a fine form in a liquid base and when diluted with water forms a fine suspension of particles. This formulation combines the ease of liquids with the efficacy of powder-based formulations.

4. **Emulsion concentrates (EC):** These are oily liquids in a solvent. When diluted with water a milky emulsion forms in which the oily droplets of insecticide are finely

dispersed. They should not be used on absorbent surfaces.

5. **Dusts:** These contain a low concentration of active ingredient mixed with an inert powder. In domestic and food premises they should be applied only to inaccessible places.

6. **Ultra low volume (ULV):** ULV formulations use much less chemical than other formulations. They are intended for space spraying large areas. They must be applied with specialist ULV application equipment.

7. **Smokes:** The active ingredient is formulated with pyrotechnic compounds which when ignited burn to produce smoke which carries the insecticide through space. Smoke generators are a useful method of applying insecticide in confined spaces where other methods are not practical.

8. **Baits:** The active ingredient is formulated in edible bait that is consumed by the target pest.

Application techniques:

1. **Spraying:** Spraying is usually the chosen application method where a surface treatment is required. It is also the chosen technique for crack and crevice treatments.

2. **Dusting:** An insecticide dust can be used to give a long (residual) period of control in areas not usually entered by humans, such as basements and roof spaces, ducts, cavities and electrical conduits etc.

3. **Space treatment:** The use of insecticidal smoke, misting or fogging all fill the space to be treated with small particles of insecticide on a carrier or in the case of a thermal fogger, vaporized insecticide.

4. **Baits:** The use of insecticide baits is becoming increasingly common especially against cockroaches and ants. Insecticide baits have a very low mammalian toxicity, making them safer to use where humans and other non-target organisms are present.

   Some insects will return to their harbourages having ingested bait and after they have died their carcasses will be consumed by other insects, which are also subsequently poisoned (a domino or cascade effect). Baits are not suitable where a quick kill is required and are therefore usually used combined with other treatments.

Trap Placement:

Trap placement is a key component in managing food processing insects. Placement of traps is dependent upon:

1. **Time of Year –** Different times of the year have different temperature profiles within the processing area and warehouse. When temperatures are 32°C, extensive movement within and around the facility will occur.

2. **Outdoor Use –** If outdoor traps are used to measure movement into a facility, the traps should be placed in areas that will not collect extensive amounts of dust but are close to areas of entry.

3. **Number of Traps Per Square Feet** – The number of traps required depends on the risk the manager is willing to take, personnel time available and pest level at which the manager wants to maintain the population. A rule of thumb may be one trap per 4,000 to 5,000 square feet. A key part is putting traps in high-risk areas where there have been insect problems before. This practice can prevent build-up and the requirement for extensive insecticide application or fumigation and/or product removal.

4. **Interpreting the Trap Catch** -A better practice may be examining the trends in trap catch and attempting to modify management practices to reduce populations. Insect population grow exponentially, and when outbreaks occur, they are often easy to measure.

5. **Future Application**- With decreased pesticide alternatives and increased regulations, the processing

industry will have to begin looking for alternatives to pesticides. These alternatives will have to be based on the ecology of the system with an emphasis on system regulatory mechanisms.

MOST COMMON DAIRY PEST

1. Cockroaches:

Cockroaches are the most abundant and troublesome pests in dairy industry. They contaminate product with their droppings, their bodies and the bacteria they carry. Cockroaches can carry organisms that can cause diarrhea, dysentery, cholera and many strains of *Salmonella* and *Staphylococcus* bacteria known to cause food poisoning.

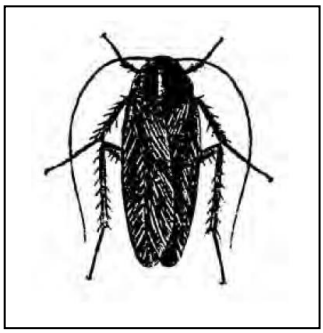
Cockroaches hide during the daylight hours in cracks and crevices in walls, doorframes, equipment and furniture, secure places in bathrooms, utility closets, steam tunnels, animal houses, basements and sewers. They are highly gregarious and nocturnal in habit. Because of their night time activity, their feeding habits are seldom observed.

Note: A high level of sanitation will reduce the number of cockroaches, but not eradicate them.

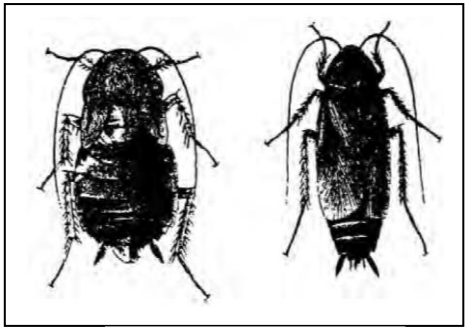
When cockroaches of various sizes of the same species are seen during an inspection, this is an indication of a well-established cockroach colony. When making

surveys, food auditor frequently note these three signs of cockroach infestation: cast cockroach skins, egg cases and stains or excretion of cockroaches.

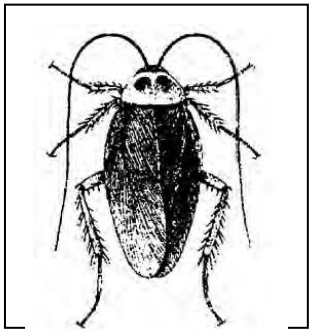
Identification of Cockroaches (there are more than 57 species of cockroaches)**:**



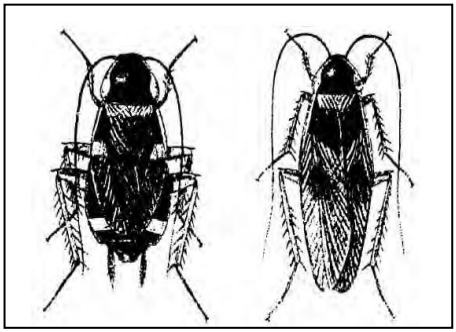
German Cockroach



Oriental Cockroach



American Cockroach



Brown-banded Cockroach

Excreta of the larger adults are almost as large as small mouse droppings but differ in having six lengthwise ridges. When cockroach infestations are heavy, people can detect a characteristic must odour.

- **German cockroaches** are considered the most common household insect pest, they usually thrive in cooking areas, as they prefer heat and moisture.
- **American cockroaches** prefer basements (near pipes and plumbing fixtures) and steam heat tunnels or warm sewers. They feed on a variety of foods, but can survive without food for 2 to 3 months as adults.
- **Oriental cockroaches** feed on all kinds of filth, rubbish and other decaying matter and prefer to congregate in dark secluded areas, such as crawl spaces, basements and water drains.
- **Brown banded cockroaches** are generally found high on walls or on ceilings in protected areas. They also frequent electrical appliances. Although they feed on almost anything, they seem to prefer starchy foods. Other cockroach species infest buildings in other areas.

Food contamination problem:

Cockroaches foul their environment with faeces, regurgitated food and they taint materials with their characteristic smell. The air in infested premises may contain fragments of their exoskeletons and cockroach excrement. Cockroaches also contaminate food directly as they move from filth to food indiscriminately and are therefore implicated in the mechanical transmission of many pathogens, such as those causing food poisoning and wound infections. Because residual allergens can remain as active contaminants for some time following a

treatment, a thorough cleaning regime should be carried out afterwards.

Control:

- Apply insecticides as crack and crevice or spot treatments to places where the cockroaches hide. Label directions of residual pesticides permit only crack and crevice treatment to be used in commercial food handling areas.
- Dusts can sometimes be blown into places difficult to reach with spray. Use ULV (ultra low volume) and aerosol application of contact sprays and flushing agents to supplement residual sprays and dusts.
- The removal of food and water sources and destruction of breeding places is essential in obtaining satisfactory cockroach control.
- The use of insecticide baits.

2. Flies:

The main flies that food-processing facilities may experience include the house fly, fruit fly and the green bottle fly. In dairy industry it is common to spot flies where milk spillages found or hygiene not maintained.

Control of flies and other Insects: Management of flies starts with sanitation in the removal of breeding locations and a good cleaning program followed by various mechanical and insecticidal controls. Wind

curtains can prevent many flies from entering areas of the plant and all windows should be screened.

- **Electric Fly Control Units (EFK):**
  Flying insects are attracted to the ultra-violet light emitted by the unit and are either trapped on an adhesive board or killed by means of a high voltage electric charge. As UV emission from the unit degrades rapidly lamps should be replaced at between 6-12 months, preferably in spring.

- **Pheromone traps:**
  As with adhesive traps the male insect is attracted by the pheromone released by the lure. Once in the trap the insect may be trapped with an adhesive insert or simply be unable to find its way out. The pheromone is specific to one or a number of related species and acts as an indicator rather than a control method.

3. Ants:

Normally only adult ants are seen. These ants eat many foods, but sweets and grease are preferred by the food pest ants. Dairy products section where sweets are being prepared are common places to spot them.

Control of indoor or outdoor nesting ants can be accomplished by direct treatment of the nest. Locate the entries of the ant, then blow an insecticide into the

nesting area. If you cannot locate the nest site, apply insecticides where the ants gain entry or hide (along foundation walls, doorways, window sills, baseboards, behind built-in cabinets and furniture or beneath equipment's and other heavy appliances).

4. Bees and Wasp:

Bees and wasps present problems to dairy/food processing facilities when they build their nests near or on buildings, equipment or when they inhabit the surrounding areas. They pose threats to workers in plants because of their annoying threats and stings. Although they may not sting employees, they can cause employees to be injured by attempting to avoid bees or wasps. These insects present a particular risk to people who are hypersensitive to stings.

Control: Special protective clothing is needed when controlling wasps and desirable when controlling bees to protect against stings. Insecticide sprays directed into the nests work well, particularly with wasps and hornets.

The sprays must be applied at night with an applicator large enough to do the job quickly without getting too close to the nest. Dusts may be blown into the nest openings of hornets and yellow jackets.

5. Birds:

The most common sited in the dairy industry are feral pigeon *(Columba livia)* is of medium size (32cm long); normally blue grey in colour with a white rump and black wing bars.

Problems associated with pest birds:

1. Product damage:
The droppings of sparrows and other birds spoil finished products and packages in loading bays and warehouses.

2. Contamination:
In addition, pigeon droppings, feathers and nesting materials may cross contaminate the food product which is meant for human consumption in production and dispatch area.

3. Spread of disease agents:
The close association of birds with man gives rise to the possibility of disease transmission. Sparrows, pigeons and gulls may carry bacteria causing *Salmonellosis*. Pigeons carry Ornithosis, a disease similar to viral pneumonia that can be transmitted to man through infected droppings or respiratory droplets. Ornithosis is often mistaken for flu in humans and so is possibly far more common than is realised.

4. Sources of insect infestation:

Birds' nests harbour insects and mites which live as scavengers on the nest material or droppings or as external parasites on the birds. Prevention of nest building on premises reduces this damage. The following insects and mites are known to occur in birds' nests. Carpet beetle; fur beetle; case-bearing clothes moth; brown house moth; white shouldered house moth; Dermestid beetles; yellow mealworm beetle; biscuit beetle; Australian spider beetle; cheese mite; flour mite; dust mites; lesser housefly; blowflies and bird mites.

Control: Traditional anti-perching systems consist of sprung wire or spike systems and are designed to prevent birds from alighting on ledges or similar surfaces. UV stable polyethylene or polypropylene netting with an appropriate mesh size for the species concerned:

- 19mm for house sparrows
- 28mm for starlings
- 50mm for pigeons
- 75mm for gulls

RODENTS CONTROL

Commensal rodents can cause considerable damage to dairy products and structures. If rats or mice or squirrels are present in and around such dairy facilities, it is

because they are able to find food, water (in the case of rats), places to hide and places to nest and rear their young. Good sanitation practices, combined with steps to prevent rodent entry into structures and the elimination of rodent harborage, will reduce rodent problems. While sanitation and rodent-proofing may not eliminate rodents, they will limit the size of rat or mice populations the premise can support.

Problems associated with rats and mice:

The main reasons for control are to reduce or eliminate:
- Spread of disease
- Contamination of products
- Damage to food stocks and property

Rodents can cause damage to food intended for humans, by consumption, contamination with faeces and urine, as well as other physical and microbiological contaminants. Rodents have the capability to spread many human pathogens, such as *Salmonella* spp, *Listeria* spp, *Escherichia coli, Cryptosporidium parvum, Leptospira* spp, Hantaviruses, Bubonic plague and Toxoplasmosis.

Rodent Proof Construction:

- **Doors:** Tight-fitting doors with a sill clearance of less than 3/8 inch (1 cm) prevent most rats from entering if doors are kept closed. Self-closing devices may be useful in preventing human carelessness. Doors with

higher clearances should have metal channels or butt plates installed.

- **Windows** left open at night are particularly vulnerable. Mosquito screens will probably prevent entry, but heavier screening with 1/4-inch (6mm) hardware cloth is recommended.
- **Vents and Drainpipes:** Vents that are accessible to rats should be screened in the same manner as windows. Be aware that 1/4-inch mesh hardware cloth reduces ventilation efficiency.

  Drainpipes in particular should be screened and kept in good repair, as this is a favorite entryway. Where rats climb up sewer pipes and into toilet bowls, a rat guard can be installed. A piece of pipe 8 inches (20 cm) in diameter and approximately 30 inches (76 cm) long is placed into a vertical sewer pipe to prevent rats from entering. All utility and service openings into the basement should be inspected and closed.
- **Foundation and Basement:** Holes and cracks in foundation walls and basement floors must be blocked. In rat-infested locations, put hardware cloth, sheet metal or broken glass in large openings before sealing with concrete. This gives the concrete time to harden before rats chew through the uncured concrete.
- **Outside utility lines:** Roof rats travel along utility lines where they can gain entry into structures. Guards with an 18-inch (45 cm) radius are needed to interrupt the free passage of these expert wire walkers.
- **Reception docks:** These areas may offer harborage for rodents, plus provide very easy access to a building.

Keep docks clean of all debris and other shelter for rodents.

- **Rodent Stop stainless steel wool** is a non-rusting stainless steel wire wool that seals holes, passages and cracks and prevents mice, rats and other pests from getting in.

Control:

1. **Use of Rodenticides:** Rodenticides usually need to be ingested, that is either eaten in the form of bait or taken into the body via the mouth while grooming. Rodenticides fall into two categories; **acute:** these are quick acting and effective but often painful in their action, and **chronic**: these are slow acting, often multi-feed baits that generally cause minimal pain in their action.

2. **Gassing:** Where burrows outdoors are beyond the minimum distance of three metres from buildings, the use of aluminium phosphide tablets can provide a rapid reduction in rat numbers. This will also reduce the quantity of anticoagulant required to control an infestation.

3. **Tracking Powder:**

   Tracking powder is a toxic dust placed where rodents travel. They pick up the chemical on their feet and fur and ingest the toxicant as they groom themselves or

handle food with their forepaws. Tracking powders have been used for a long time. It is useful when food is plentiful and bait acceptance is difficult to achieve.

But, the disadvantages are:

- They cannot be used where there is a hazard of the toxic powder being blown onto food, tracked on food by rodents or applied in areas with constant human traffic and air currents. Dusty and damp locations and scattered straw or other loose materials interfere with the effectiveness of powders.
- They create a greater hazard than baits because the toxicants in tracking powders are 10 to 40 times the strength found in baits.
- The applicator must accurately locate areas traveled by rodents or the application will be wasted.
- It is almost impossible to remove the tracking powder completely when cleaning up any premises.

Other Alternatives:

a. **Rodent glues** are sticky chemicals that entangle the victim like flypaper. Ready-to-use glue boards are commercially available from various suppliers, or bulk glue can be purchased. The sticky material is spread on heavy craft paper, cardboard, roofing paper, boards, etc. Lengths of it are placed in runways. When an animal steps on the glue he is unable to remove his foot. His struggles will eventually cause him to end up

with more feet and possibly his nose in the material. Glues are nontoxic and hold the animals for disposal.

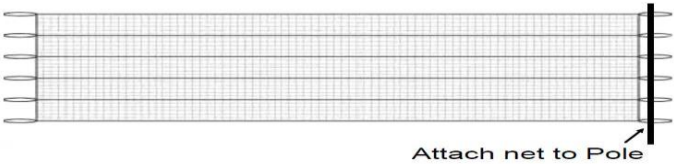
b. Placement of Snap/Spring traps: Spring traps, which are designed to kill the rodent. Bait is set in the centre and the traps left unset for several days to overcome shyness. Traps locations should be marked on a schematic map and inspected daily, traps should be checked weekly and catches for each trap recorded in a log.

c. Live traps: Live catch mouse traps are available in either single or multi catch versions. They can be used as an alternative to toxic baits in high risk/ production areas, although the presence of a bait attractant may pose a contamination risk. Cage traps which catch the target animal live are of limited use as a control measure but may be employed when there is a risk to protected species from other methods. Any animal caught should be despatched humanely. Non-target species must be released unharmed.

PEST BIRD CONTROL

1. **Trapping of birds:** Trapping of birds is a good option for control of house sparrows, starlings and pigeons only. These three species may be live-trapped; but the release of birds, such as pigeons, even miles from the

capture site, is ineffective as the birds are likely to return.



2. **Irritating substances and taste deterrents:** Systems dispersing irritating substances and taste deterrents as a fog or vapour are humane methods to clear or reduce bird populations in large areas. The use of a vaporous grape flavouring product in haze machines is one option, as it repels birds in a wide area without harming or killing them.

3. **Predator features, reflective surfaces and scare eyes:** Visual bird deterrents are used to frighten birds from treated areas, triggering them to flee the area. Common scare triggers such as predator features (decoys of owls, hawks or falcons) reflective surfaces (e.g., aluminum plates, iridescent foil tape and tin foil) and

scare eyes (e.g., scare diverter, scare balloons with predator eye pattern). Where applicable, visual bird deterrents are an economic, low cost solution for some outdoor pest bird problems.

A

B

C

D

However, the success of visual scare devices is highly variable and depends on the type and number of birds, attractiveness of the site and alternate sites, timing (once established at a site, birds become more difficult to scare away), the type of devices used (it is best to use two or more devices in combination) and the skill and persistence of persons using the devices.

A. The scaring effect of predator decoys (e.g., owl decoy) lasts only a short while, until the birds become accustomed to the device.

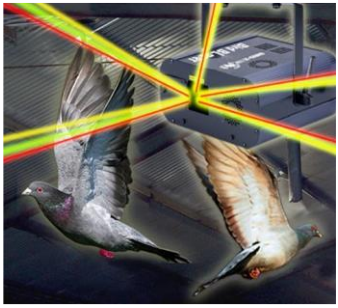
B. A huge balloon with predator eyes on the front and back continuously moves with the air currents in the surroundings. The lenticular 3-D eyes on the balloon produce holographic effects, creating the illusion as if a predator is following the pest birds to attack.

C. The reflective plate reflects direct sunlight by means of its reflective surfaces, hence scattering light beams around in a menacing pattern to harmlessly deter birds from unwanted areas. The reflected light spectrum significantly limits the vision of the birds during their flight. As they become disoriented, the birds deviate in flight and fly to another destination.

D. Bird scare diverters are teardrop-shaped hanging visual bird deterrents that feature predator eyes on a reflective surface. The 'mock' predator eye and shiny reflective surfaces of the diverter confuse and frighten the birds, triggering them to avoid the treated area

4. **Laser bird repelling devices and power strobe lights:** Laser bird repelling devices are an effective and humane way to repel pest birds. They send out bright, fat-beam lasers in multiple colours to scare, confuse and disorient pest birds. The bright lasers are constantly changing position and direction, scaring the birds day and night. They are effective over an area of 1000 m2 in indoor and semi-enclosed areas.

Birds also can be deterred using pulsing strobe light. The flashes of intense light (red, blue and white) at a rate of 60-75 flashes/min and frightening shadows are intolerable and disorienting to birds (pigeons, sparrows, starlings, swallows, crows, blackbirds and more), causing them to fly away from the source of annoyance.



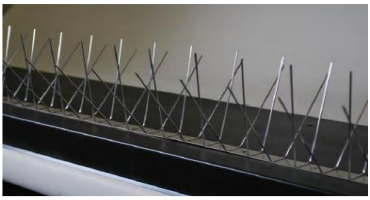
A

B

A. Laser light "hazing" systems-Multi-colored (3 colours) fat-beam lasers constantly change patterns to prevent acclimation, and as such frighten pest birds away.
B. Pulsing strobe light produces flashes of intense light (red, blue and white) at a rate of 60-75 flashes/min and frightening shadows.

5. **Bird spikes:** Bird spikes are used to prevent birds, especially large birds (e.g., pigeons and larger), from landing. Bird spikes are used to deal with light to medium bird pressure. Spikes are available in galvanized steel, durable stainless steel or unbreakable UV-protected polycarbonate. They can be quickly installed by nailing, screwing or gluing down (0.6 -

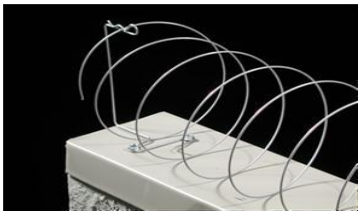
0.9 m/min) onto any surface. Some spikes may bend a full 360° to accommodate any contoured surface.



Stainless steel Bird Spikes

UV-protected polycarbonate Bird spikes

6. **Bird coil (spiral) and bird deterrent wire:** Bird coils (available in high-grade stainless steel) have smooth curves which are completely harmless to both birds and unsuspecting workers needing access to ledges. Bird coils are adaptable to most architectural details.



A

B

Somewhat similar, bird deterrent wires also create an unstable landing area, discouraging birds (e.g., pigeons) from attempting to perch on narrow building features such as window sills, stone or brick ledges. They also work by preventing birds from looking over ledges into potential feeding sites.

A. Bird coil prohibits ledges from becoming a stable solid landing platform.

B. Bird deterrent wires, arrayed in two or three parallel rows, create an unstable landing area preventing birds from attempting to perch.

7. **Bird nets and bird wire mesh:** Bird netting is available in different mesh sizes to exclude a wide variety of pest birds. 3 to 5 cm mesh size netting is used as a barrier for pigeons, and a 2 cm mesh size netting for sparrows or starlings. If the netting is to be used near warm equipment, flame-resistant netting should be installed. (Rot, water and UV-proof netting should be used for extended outdoor use)

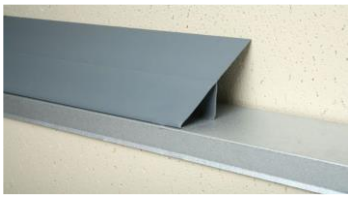
A

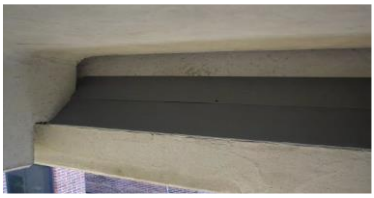
B

A. Bird netting is a well proven control measure to keep pest birds out of certain troublesome areas.
B. Wire mesh systems can keep all birds from getting under solar arrays

8. **Bird slides:** Where netting is visually unacceptable or simply not possible, bird slides should be used. Bird slides protect the ledge, eaves, angle irons, I-beams and most 'L' shaped ledges against roosting and nesting of all bird species. As they slide right off the ledge, they can't get grip. Installation

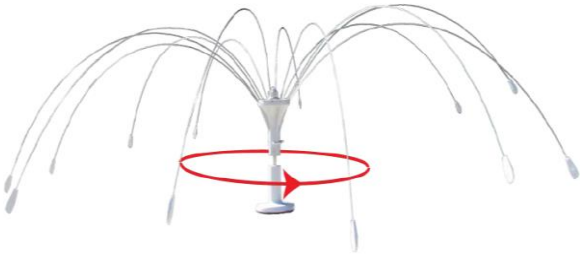
time varies as function of the number of ledges, the installation height and the skills of the installer.





With bird slides, birds slide right off the ledge, preventing them from getting grip

9. **Rotating spiderlike bird deterrents:** A physical bird deterrent rotating and bouncing in the wind successfully deters large birds from landing on unwanted areas such as light fixtures, docks, rooftops, etc.



Rotating spiderlike bird deterrents

The moving parts make it impossible for large birds such as pigeons and to land in concentrated areas. Rotating spiderlike bird deterrents can be glued or screwed down for permanent installation or mounted for temporary use.

10. **Electric bird deterrent systems:** A harmless low level electric pulse (mild electric jolt), emitted by the electrified

tracks on touch and deters birds (pigeons, crows) quite similar like a live electric fence that manages livestock. As such, it is not actually bird- proofing in the physical sense, but is designed to change the behaviour of pest birds by preventing them from perching, loitering, roosting and nesting on ledges, edges, parapet walls, beams and roof peaks.

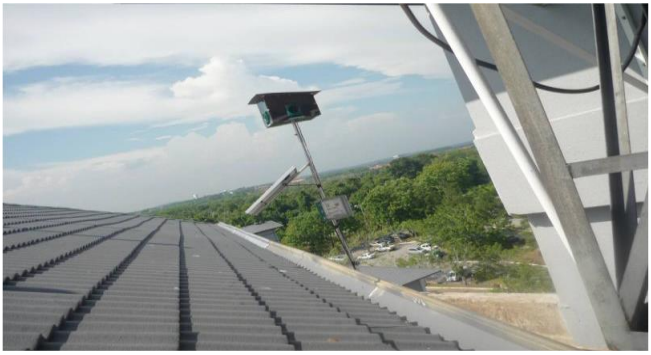
Electric bird deterrent system learns the birds over time to stay away from the protected areas

11. **Anti-collision bird stickers:** There are instances where numerous birds die because they cannot recognize glass panes as an obstacle and fly into them at full speed. This is both tragic for the birds, as well as harmful for the panes in which scratches or small holes are often left behind.

    With bird protection stickers, these situations can be effectively prevented. This makes it possible to contribute to the protection of animals in a simple and convenient way and at the same time to protect your own windows and glass surfaces. The outlines on the stickers effectively scare the birds away and keep them away from windowpanes.

NOISE GENERATORS

1. **Ultrasonic bird chase device:** Ultrasonic sound waves are emitted by an ultrasonic bird chase device to efficiently and effectively deter, annoy, and intimidate birds within ranges of 85 m^2 to 335 m^2 depending upon the type of unit installed.



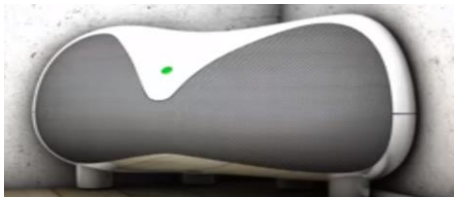
Ultrasonic bird chase devices emit ultrasonic sound waves deterring, irritating and intimidating birds

This is an ideal solution for buildings such as loading bays. Ultrasonic frequencies are virtually silent to humans, so you can get rid of pest birds while maintaining a bird free environment.

2. **Animal repellent with flash light**: The animal repellent is used for the gentle repulsion of dogs, cats, birds etc. As soon as the PIR sensor detects a movement, a loud siren sounds and ultrasound waves (frequency 16 – 27 kHz) are emitted. The unpleasant sounds cause most animals to avoid this area. Birds are repelled by the integrated flash light.

The Repeller has a range of 10m and its powerful ultrasonic wavescover an area of 100 sqm in a 120° arc.Its solar panel powers up rechargeable batteries to enable continuous 24/7 use. Day and night, it detects and repels cats, dogs, squirrels, rats and other nuisance animals over an area of 100 sqm.

3. **Ultrasonic rodent repeller:** Continuously emits high-frequency ultrasound that drives out rats, mice, martens and other rodent pests.



The ultrasound cannot be heard by humans and does not harm people or pets. Unwelcome intruders are not injured; they just find the sound unbearable and they vacate the area to escape it.

4. **Ultrasonic dog repeller:** Drive away dogs using ultrasonic waves Safety for dogs. Strong ultrasonic waves drive away disruptive dogs without harming them. The dog repeller is completely safe for humans, and not audible.

At the push of a button, the dog repeller emits ultrasonic waves that are inaudible to humans. These are very disturbing for dogs, especially at short range (2m to 5m), and cause the animal to move away. The deterrent doesn't trigger any kind of aggression in the dogs and does not hurt them either.

PEST AWARENESS AND STAFF TRAINING

In a dairy industry, as a minimum all section personnel should be aware of the pests that they are likely to encounter in their part of the process and the importance of pest prevention. Particular attention should be given to incoming goods such as raw materials or packaging.

Pests and their habits:

Training on the identification and habits of the more common pests in the dairy industry can be given by the pest control contractor / Agency or through independent consultants. This is best achieved in the form of a brief presentation rather than distribution of literature.

Pest prevention:

The importance of pest prevention through good hygiene, stock management and exclusion practices should be emphasised. Site personnel have the day to day responsibility of ensuring a pest management programme is maintained.

Information posters:

In addition to training sessions the posting of information at individual workstations or sensitive locations such as rest areas and goods-inwards doorways can act as a reminder of the requirements of the Pest Management

Programme. These can remind staff of pest related risks and preventive measures such as:

- Door and window disciplines
- Hygiene and housekeeping
- Stock storage and rotation

REPORTING AND RECORD KEEPING

The organisation of a reporting system and maintenance of records is essential if Good Manufacturing Practice (GMP) status is to be achieved. Records must be kept for the following reasons:

- To highlight any recommendations
- To demonstrate compliance with legislation
- To monitor pest management processes
- As evidence of compliance to third party auditors

Pest sightings log:

A record should be kept of any pest sightings, including those made by personnel other than those involved in pest management. This can be in the form of a book or a folder where the following information can be logged:

- Name of person making report
- Date and time
- Location

- Pest seen
- Any other relevant information

In addition to entering the sighting in the book, the sighting must be reported to the appointed manager in charge of pest management who will decide on further action. Where a pest control contractor is employed the sighting will normally result in a request for service. In the case of an on-going riddance programme the reports will provide information on the success of the treatment.

The pest sightings record should be checked and signed on each contractor visit to the site and daily where an in-house programme is in place. The contents of the pest sightings record should be part of the management review process.

Pest control report:

Inspection reports must be concise and legible and stored in an easily accessible binder. A typical pest control report will contain as a minimum:

- Treatment date
- Details of the pest control contractor and name of technician servicing the site
- Details of the customer and name of the contact person on site
- Type of visit: scheduled, follow-up, callout, etc
- Pests found

- Action taken
- Pesticide used
- Location of baits and monitors (this may be in the form of a checklist or plan)
- Quantities used
- Risk assessment
- Post treatment precautions
- Recommendations on proofing, hygiene and storage
- Details of follow-up inspections

Individual specifications may include additional reports such as analyses and trends for each bait or monitor. The report must be signed by the pest control technician and the customer.

Where anticoagulant rodenticides are used outdoors the following additional records should be kept:

- A site plan identifying areas where bait has been laid
- Details of the active ingredient, formulation and quantities used
- Inspection reports, which demonstrate the treatment frequency to check and replace baits and to search for and remove dead rodent bodies where appropriate
- Reports of any effect on non-target species and action taken to reduce risk
- Reports of any interference or removal of baits
- Reports on conditions, which may adversely affect treatment and remedial actions

- Evidence that control has been achieved within the prescribed timescales

Other records:

- Safety Data Sheets (SDS) for pesticides used on site
- Site Risk Assessments
- Environmental Risk Assessments
- Qualifications, insurance membership and accreditation documents

References

1. Moerman, F. & Wouters, P. (2015), 'Hygiene concepts in food factory design', Ch. 4, in Leadley, C. and Sykes, R. (eds.), *Innovation and future trends in food manufacturing and supply chain technologies*, N° 293, 1st ed., Cambridge, United Kingdom, Woodhead Publishing,pp. 81-83.

2. Tvedten, S.L. (2003), 'The best control for Birds', Ch. 35, An Intelligent Pest Management Manual, The Best Control 2, pp. 1333-1356.

3. Prevention and control of pest birds *Frank Moerman, Catholic University of Leuven - KU Leuven & EHEDG Belgium*

4. Food Manufacturing, Processing and Storage Pest control, classification 7, University of Arkansas, U.S. Department of Agriculture, and County Governments Cooperating

5. Dairy plant design and layout- e course of ICAR by Sunil M Patel & A G Bhadania AAU, Anand

6. Guidance document-Food Safety Management System by FSSAI

7. Sanitation, Exclusion and Facility Design By: Jerry W. Heaps, General Mills, Minneapolis

8. Pest control procedures in Food Industry –Chartered Institute of Environmental Health, Jan 2009

9. A pest control program-Purdue University by Kevin Keener, P.hD., P.E Food process engineer, Extension specialist and associate professor of food science

10. Pest management standards for food plants, 2013 by The National Pest Management Association, US

11. Swiss inno solutions: http://www.swissinno.com/en/mammals/dog/ultrasonic-dog-repeller/description/

INTEGRATED PEST MANAGEMENT PROGRAMME

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