CHAPTER TEN

THE CUTTING, BONING AND PACKING PLANT

At this point this title may be taken to include details affecting the wholesale cutting and boning plant, the re-packing plant, retail packing plant, the food services plant, the cold stores and even the basics necessary for the meat preparations and meat products factories.

While this section is referring to what is normally called a ‘cutting room’ or a ‘meat packing plant’, much of the detail discussed can equally apply to any of the meat processing areas used for many of the further processes involving raw meat. This could of course also include re-packing plants, and cold stores. Indeed, some of the requirements can, and do, equally apply to areas that are dealing with meat preparations (a quick description of meat preparations is that it may be a meat plant producing minced meats, sausages, burgers etc where it is a raw meat, perhaps with some added seasoning) or meat products (again a quick description is a meat plant which may be producing cured meats or cooked meats including pies etc. and other further processed meat such as cured meats, bacon, cooked meats and may well be involved at some stage in the ‘High Risk’ type classification). Some of the additional points concerning meat product and meat preparations plants though are discussed later as a separate item after this section where a few additional points will be raised. Other descriptions of cutting rooms may apply to processing rooms which do indeed handle meat but which perhaps also handle other products, bringing two or more items together to create a combination meat item, for examples kebabs, that incorporate meat, peppers and perhaps even mushrooms. In strictly correct terms however, such operations bring the room under the control of ‘meat preparations’. This is particularly noticeable in the case of retail packing plants and food service plants (perhaps more commonly referred to as catering butchers). No apology is given for the generalised, terms,
separations and descriptions used here but where additional requirements are indicated for true ‘High Risk’ foods, mention will be made of them as they occur, mainly in the section dealing with meat products. Although there are some wholesale meat cutting plants that may well produce mince as a part of their business, the process of mincing is again more correctly dealt with in the meat preparations section and is not included here.

There are some differences in the process with beef lamb and pork but the differences are quite minor (excepting for the sizes involved) and so the descriptions given here generally refer to beef. Obviously, with sheep and pigs quartering is not normally required. In general, the processes being carried on in the wholesale meat cutting plant will include;

**Breaking:**

This is the stage where the side (or quarter) of beef, or the carcase of lamb or pork, is broken down into more manageable pieces in order to enable further cutting and boning to be carried out. In the very large plants this may involve the machines that, with some assistance with a knife, do actually ‘pull’ the meat from the skeleton. These pieces of equipment are quite commonly known as *Carna liberators* but the name can vary with different countries and the different manufacturers of the machines. These types of machines can increase the throughput of the boning plant but sometimes, if not used strictly according to the operating methods, they can incur a cost of some muscles receiving some damage in the process and therefore affecting the overall yield of meat obtained.

‘Quartering’ of beef is carried out by means of sawing through the vertebrae between the tenth and the eleventh rib leaving the forequarter with ten ribs. Another way of quartering is that of preparing a ‘Pistola’ cut forequarter (or hindquarter). In this case the separating cut is made between the sixth and seventh rib, leaving a forequarter containing only 6 ribs, the cut commonly known as the ‘beef Forerib’ being left on the hindquarter. Subsequently, the loin of beef cut from a Pistola hindquarter is much larger and all of the ribs (the beef Forerib cut and the parts of the beef sirloin containing the other three ribs) remain as one piece of beef. This method is not ‘commonly’ in use but it does occur and it is better to be aware of it when it is seen.
**Cutting:**

Once the broken down sections of the carcass or side are dealt with they may then, where needed, be cut into the more recognisable pieces of meat, or as they should now more correctly be referred to as ‘Meat Primals’.

**Boning:**

This process may in some cases come before the actual cutting, depending on the process and the plant involved. In order to secure some worker safety it is increasingly demanded that the boning operators must wear chain mail gloves to protect from knife injury. This is basically the removal of bones and connective tissue from the meat. If, as mentioned earlier, a *carna liberator* type of equipment is used the boning will in the main have been done while the beef was in whole quarters.

**Trimming:**

This is the removal of unwanted fat, trimming off of any loose pieces of meat to make the meat more presentable. In the production of P.A.T. beef, this process would follow immediately after boning. P.A.T. BEEF is beef that has been boned and trimmed in the normal way. The actual ‘breaking’ of the carcase may have been amended to enable ‘fuller’ muscles to be achieved, rather than cutting a muscle into two as is sometimes done with traditional butchery. The meat is then virtually separated into individual muscles and all muscle fasciae, fat or any other connective material is removed. The resulting meat is, except for marbling, about 100% visual lean and with absolutely no fat or gristle material in it. It is used to produce sliced or diced meat that is extremely lean but the actual quality of the muscle does of course remain what it was had it not been so trimmed. In other words, the desirability of that muscle is relatively unchanged in respect to tenderness, succulence etc (although some people do question if removal of all fat does impair to some degree the succulence of the meat). Some further brief discussion on P.A.T beef appears later in the section dealing with the equipment (that is needed to help produce it).

**Selection:**
This involves the choosing of the certain pieces of meat for a particular function. If the finished meat is to be ‘rolled’ then it is at this point that it may be tied. Tying may be by hand or by machine or, where appropriate, by the application of netting. If the plant is processing for retail packing then this may also include the preparation of other complex parts, such as the making up of kebabs, etc for example.

**Second Cutting:**

Again this is where the meat is to be used for retail or food service type packing is carried out and includes steaking, dicing, cutting of roasting joints etc and cutting of chops in the case of pork and lamb... Some hand dicing may be carried out but it is much more common nowadays for dicing to be done by machine. Some further details on such processes appear later.

**Curing, Smoking and cooking (a process that is required for Meat Products)**

The curing, smoking and/or cooking of any of the meats being processed would of course take place prior to the packing so a mention must be made at this point of these processes. However, as the various processes are discussed more in a later section it can be taken as the natural progression of the processes that they would in fact be dealt with prior to the packing. One point that must be remembered about these processes though is that from the point of E.U. legislated segregation, Smoking, curing and cooking do all relate to a separate directive from fresh meat and there are certainly a number of aspects that may place some of these products in to the true ‘High Risk’ category requiring rather more special care in handling.

**Packing:**

The completed meat moves from the processing part and will now be presented for packing. The packing may be one of several kinds and may be either for wholesale use or indeed be a retail type of pack. Packaging of meat is covered later and does deal with some of the different types of packing that can be involved.

**Weighing & Labelling:**

Weighing of packs of meat (and bulk containers with bones, fat, meat trim etc) and application of
labels must be carried out and the results recorded. In the case of retail packing this may also include in addition to application of the main label the application of secondary labels (in the case of ‘Special Offers’ this may not occur on all occasions but must be considered in view of pack sizes etc) and this will have to meet demands for both label positioning and presentation. Once again, more will be said about labelling later.

**Metal Detection:**

Packs once labelled move, usually on a conveyor, through a metal detection device that can detect the presence of metal particles up to a given size. The detection of metals can vary between different metals being looked for and will also depend on the sensitivity of the machine that is being used to do the testing. The different metals are usually split into groups to allow a classification, e.g. ferrous; non-ferrous and stainless steel. The sensitivity of any of these machines is also limited by the size of the pack being checked. For small retail type packs the sensitivity can be quite definite with perhaps a level of being capable of detecting a metal sphere of up to 2mm ferrous, 3mm non-ferrous and 4mm stainless steel (or even better for each metal). Although these figures are provided for the sensitivity, it is often found that they are capable of detecting even smaller pieces in practice. Larger, perhaps wholesale packs may only have a sensitivity of being capable of detecting 6mm ferrous, 7mm non ferrous and 8mm stainless steel. Such low levels of detection do little to provide confidence for the buyer but they do at least indicate that some effort has been made and usually with the larger, wholesale size packs, the packs will be broken down for further processing when any foreign material may be isolated.

Detection must be carried out on every single pack processed and tests must also be carried out on the detection equipment itself at specified periods, either half hourly or hourly, with test pieces of known size for each class of metal being used to check that the machine is working and rejecting metal pieces of the particular sizes used. In order to be really effective, the test pieces must be placed inside some pieces of meat, and not just loosely placed on the conveyor belt by themselves. If the machine does detect metal as being present it may either have a ‘swipe’ arm that knocks the detected product into a collection bin or alternatively it may sound an alarm and stop the entire conveyor. At this point it is normal that a supervisor or line manager is called to
deal with the detection for which there should be a written procedure. In practice, while the ‘swipe arm’ can usually prove to be a most effective method, the author did have an occasion once to inspect a plant fitted with such a device but the correlation between the detection and the position of the ‘swipe arm’ had in some way become broken and although the machine did in fact ‘swipe’ a pack off the line, it wasn’t the pack with the metal in it! The problem was identified and corrected but with fast moving conveyors such occurrences must always be considered. The machine that stops the conveyor on detection on the other hand can cause some backup ‘on the line’ when it happens but at least it does stop the line at the time of detection. If the swipe arm method is used, it is necessary that the box that the offending item is ’swiped’ into should be lockable, and locked, to prevent any suspect packs being replaced on the conveyor by unwitting line workers.

Once beyond the check point of the metal detector, particularly for retail type packs, there is little chance of any rectification of the problem of metal being found in the meat so, as records are kept of the actual tests of the device and as every single pack is tested through the machine this point does become a Critical Control Point.

It must of course be remembered that a metal detection device will detect only items containing some element of metal in them. Some detection has been attempted using an ‘X ray’ type device which, it was hoped would detect other materials besides metal but at the time of writing such devices appear to have met with only a limited success in practice. However, as it is possible that other foreign bodies may be found in meat produced from the meat plant it is increasingly common for other ‘foreign body’ detection devices, such as these X-ray machines to be used in order to detect any other items such as glass or wood in addition to metals. All such methods must be considered in order to provide the element of goodwill sought by the purchaser and adequate methods of testing the equipment must be recorded to enable the HACCP process to be

**Quality Assurance (& Quality Control):**

Q.A. functions can be positioned at various points on the production line and obviously it is
preferable that some checks are carried out after the boning and cutting and prior to packing. It is pointless to waste packing materials if the meat being packed doesn’t satisfy the specified requirements. However, although this has been carried out prior to packing it is also necessary that it is carried out at a point where finished product may be checked to see that it visually meets the requirements of the specifications. It is also a point where labelling can be checked in order to obtain assurance that the correct label for that product has been applied, that the correct date of packing has been used and that any bar codes applied are capable of scanning properly. Some packs may be produced and removed at this point for further checks to be carried out, such as the detailed measuring of steaks etc. and for an analysis of fat content to be made in order to ensure that the actual fat content conforms to the specified fat content (and also that it conforms to what it says on the label).

**Equipment:**

Equipment can vary depending on the plant and on the total processing being carried out. Mention has already been made of scales, packing machines, mincing machines, dicing machines, metal detectors etc. but it is impossible to give a fuller breakdown, as the variation can be so great and varied, depending on the needs and type of operation within the plant. In boning / cutting plants mechanical saws including both band saws and smaller hand operated saws may be in use, all of them requiring good training for workers who use them. Some larger plants may use the large and rather complex ‘stripping’ machines known as ’carna liberators that, by attachments to various parts of beef quarters, with a little ‘help’ with a knife, pull the meat from the skeleton. They indeed are specialist items and used correctly are able to increase the rate of throughput of a plant. Used incorrectly they can reduce yields and can be quite a liability. Similarly, such plants may also use ‘membrane skinners’ which enable a far more efficient method of separating some of the residual meat tissues from some of the muscle fasciae material. This is particularly used where the pure muscle is required for the product known as P.A.T. (reportedly meaning ‘prêt a trenche’ or ‘ready to cut’) or alternatively sometimes called P.A.D. (for which there should be a ready translation but it doesn’t appear to be one that is at all well known! The term P.A.D. may have developed due to slight miss-hearing of the name on a telephone; PAT or PAD can quite easily sound similar on the telephone and can equally easily become confused). Membrane skinners in themselves can to some extent involve different types of machinery from some small hand held pieces of equipment with mechanical rotating blades to
rather larger pieces of equipment that remove larger sheets of connective tissue. As these machines can ‘grab’ a piece of tissue and separate the membrane or skin from the meat block it is necessary that detailed training is given in their operation and that great care is taken in their operation since it has been known for some of these machines, used carelessly to start to ‘skin’ the operator’s hands. Usually, it is a mandatory requirement to wear chain mail gloves for the process. In the retail packing plant, or the food service plant, machines for tenderising and more speciality slicing may be used, as may machines to produce diced product, chops and the machines used to produce the fat for use as ‘added fat’ on items such as topside, silverside and thick flank (or knuckle of beef).

**Chilled Storage for Retail Packing and Food Service supply**

When the meat is not to be cut and boned at the slaughter plant, but is to be moved to a separate ‘cutting plant’, retail shop, food service supplier or further processing plant the standards of hygiene and temperature control for handling the meat must continue to be maintained. For ease of description the term cutting plant will be used now but it may include any of the other options previously mentioned. Meat, on the bone, received into the cutting plant must enter it in a similar fashion to how it left the slaughter plant, through a sealed dock-loading bay and into a temperature controlled reception area. In the case of retail shop there will be some slight variations to processes such as the use of a sealed dock being unlikely but once received into such premises, similar care in hygiene control, recording and temperature control can, and must, be maintained. Obviously, the receiving company would need to check various details including any deep muscle temperature, traceability codes and of course the weight of the meat so scales must be available and, as it is dealing here with ‘hanging meat’ it is preferable to have them fixed as a part of the ‘rail’ system. Additional freestanding scales are often kept as a good ‘back up’ and may be found to be useful when intake becomes rather busier. Meats which are received for processing but which are not “hanging” may well be better catered for by having a floor scale but in such cases it is well to remember to allow for drainage of the ‘pit’ beneath the scale at the time of installation. As well as drainage, some thought to the very necessary cleaning of the area and possibly of the area beneath the platform of the scales. Many of the details being recorded may be quite complex and there is usually quite a lot of information to record so, moving with the times it is usually of benefit to have some computer system available to handle this
information. Ideally, where the meat supplied carries a label with a bar code, a bar code scanner can enable far more work to be carried out with less effort and usually with far less risk of error.

Once received the meat must be stored while waiting to be processed. It is of course quite possible that the processing room is waiting for work but more than likely the astute meat trader will ensure that there is adequate stocks of meat held on site with which to keep the processing room working fairly consistently and in an efficient manner. Storage must again be in holding chillers that are capable of holding enough meat to maintain the flow of work for the processing room. Ideally this will be at least one day’s worth of stock, possibly enough for up to three days work. While the meat is being held on stock in the chillers though it is still continuing to mature. The maturation process does of course improve the eating quality of the meat but it must also be remembered that during the holding period while the meat is maturing there will again almost certainly be a possibility of some further weight loss. This is a factor of life and must be accepted by the processor but equally it must affect the overall yield of finished meat obtained from the weight of meat that has been received. This is quite a fine balancing decision for the processor and is one that needs to be judged on both the efficiencies of the chillers and the probable time that the meat is to be held. Once again the efficiency of the chillers in respect to this likely weight loss may be countered to some extent by the level of humidity within the chiller and the importance of the subject of humidity and weight loss has been discussed earlier.

Similarly as mentioned earlier, rails for hanging meat will also be required. A simple rail system does make the storing of the meat much easier for the boning plant and the workers in that plant, plus of course the onward movement of the meat from the goods received area and into the chillers and eventually into the processing area.

Once the meat is to be processed it does need to be recorded into the processing room. This should involve the recording of any traceability codes and it will of course need to be weighed again. If the meat has been held in the chillers, there may have been a weight loss. If it has moved directly from the goods received bay then the ongoing practice of weighing and checking
provides a procedural consistency for everyone. Once again, the use of a bar code scanning system does enable a higher degree of efficiency. If there was no stock in the chillers then the weight should be the same as that which was recorded when it arrived but if it has been held for a day or more in the plants chillers then the weight will no doubt be different (even with the use of humidifying equipment). This final weight is needed in order to calculate the yield of meat achieved from the processing. The meat should at this time be in the acceptable range of temperature for the processing (which according to E.U. legislation is that it must be at 7°C or lower) but the deep muscle temperature should in any event be recorded in order to provide the safeguards that the customer quite rightly expects. As it is acknowledged that meat does not freeze until the temperature falls below –1.5°C and spoilage and discolouration increases with higher temperatures it is sensible that a target temperature of 0°C to 2°C should generally be aimed at for storage. Boners may claim that it is more difficult to bone when the meat is colder but the aim should be to achieve a better product not necessarily provide ‘improved conditions’ for the boners.

The processing room may be close by or may still be some distance away from the holding chillers. Distance in this instance may be counted either as a measurement of length or indeed one of time before the meat reaches its final destination in the processing room. As either one of time or distance it must at all times be subject to good temperature control in order to minimize any adverse effects that may occur due to temperature fluctuation. Corridors that pass by cutting areas (and remember that meat stored in a room through which others need passage to get somewhere is to all intents a corridor) and are used for the carriage of meat are still food areas and should ideally be temperature controlled. This isn’t always the case however in practice and where meat, en route to the cutting area, is left in those corridors it may be subjected to temperature rise (as well as the risk of foreign bodies getting into the meat from other items passing by). Protection of the meat must at all times be paramount and whenever possible corridors should be eliminated in order to minimize the potential for the risks that they offer. There are legislated standards for licensed cutting rooms but the temperatures demanded there are often quite high, considering the care that is being required of the product. If the meat has been well chilled (possibly to as low as 2°C or 3°C) prior to being taken to the cutting area it could be well below the legal maximum permitted temperature before arrival in the cutting room of 7°C, even after standing in a corridor not subjected to temperature control. The cutting rooms
themselves are only required to meet a nominal standard for temperature control of 12°C. Any delays in such temperatures do provide the opportunity for the temperature of the meat to rise. Any temperature rise must be considered to be an adverse temperature fluctuation. If the chilling units fitted in the cutting area are either of the ‘air-sock’ type, or the ‘low velocity’ type, it is probable that a much lower temperature can be achieved and be accepted by the workers in that area. Normal ‘high velocity’ chilling units produce low temperatures by means of large blasts of air. Such large blasting of air causes draughts that can make the workers in the area feel uncomfortable. The ‘air-sock’ type, or the ‘low velocity’ type of chilling unit eliminate to a large extent the effects of draughts and, while the overall temperature of the room may be kept low, the workers in such areas are not made to feel uncomfortable. While the legislated standard may be for 12°C, with an efficient air-sock or low velocity type, temperatures of 5°C or 6°C can often be quite readily achieved and accepted. Such lower temperatures, combined with a sensible working plan where the workers are able to take regular breaks at perhaps about 2 to 3 hour intervals, enabling them to go to a comfortably warm area to rest, does enable the ideal for both the meat being processed to be subjected to minimal adverse temperature fluctuation and for the workers involved in the processing to acknowledge the care needed for the meat.

**Room Finishes:**

The processing room is of course still a food room and the wall; floor and ceiling finishes need to be of such a standard to reflect this. Obviously, as it is a chilled area the walls and ceiling will need to be insulated to prevent loss of chill and they should be of a light colour. Quite often they are white but light blue walls have been seen and, provided it is of a lighter shade they are quite acceptable. The surface needs to be impervious to water and this of course includes any joints. Ceramic tiles used to be used for some food processing plants in the past but it was found that the grout between the tiles was not always as impervious (or as easy to clean) as it should have been so ceramic tiling is not nowadays a favoured finish. The angled junction between any two walls, walls to floor and the junction between walls and ceilings all need to be coved to assist in the cleaning process.
As with so many aspects, ideally the material used will be selected because it meets the criteria for hygiene but in the event of damage at some future time it should be of such a type that it will be capable of being replaced in an efficient manner. Many modern walls and ceilings are currently created by using sheet steel which sandwiches an expanded polystyrene or expanded polyurethane filling as an insulation material with the steel sheets having a plastisol coating on the outsides. Where the panel is to be used where one side is ‘against a solid wall’ it is usual for that surface against the wall to be grey in colour while the other side, facing into the food room, is usually of a white colour. If both faces are likely to be in food areas (back to back) then both surfaces are white. These panels are erected using polystyrene ‘strips’ as ‘keys’ to lock them together and are then the seal is completed by using a silicone material. This kind of wall can, in the case of damage, be replaced fairly easily and cause a minimum of ‘downtime’ for the production at the plant. The differing thickness of the expanded polystyrene or polyurethane filling provides an easily calculable figure for the ‘U’ value for insulation properties, whether for chillers, freezers or indeed blast freezers. It must also be remembered that wherever a blast freezer or freezer is to be sited it is simply good sense to ensure that a ‘heating mat’ has been laid below the floor surface in order to prevent major floor damage in the future due to temperature effects on the floor strata. Floors are often coated in red using various polymers but there is no hard and fast rule on the colour demanded for the floor. A good quality power finished granolithic surface that is usually of a light grey colour is often found to be equally acceptable and is usually found to be longer lasting and easier to maintain. Some of the polymer type floors can require a ‘curing’ time of several days in the event of any repairs having to be dealt with while the granolithic type can usually cure enough for normal work within about 1 day. Again, to assist cleaning processes, the angled junction between any two walls and also between walls and floors should be coved to permit a good ‘run off’ of liquids.

Lighting in the processing area needs to be adequate to see the work being done. This of course must include the fact that within any food plant lighting should be adequately protected from breakage. This is usually achieved by means of ‘diffuser’ hoods. The diffusers hoods have two functions; one is to spread a more even light from the source and the second is that they must be capable of holding all of any glass that may come from the lighting source (and equipment)
above it. If the diffusers just remain in place they do collect soiling and eventually some light is prevented from reaching the work surfaces. This is simply a matter of adhering to a good cleaning programme. Some fluorescent tubes are available that are encased by an outer plastic ‘sleeve’, usually with a red line at one end of the sleeve to indicate its presence. Although they do carry out the function of containing glass within the sleeves in the event of breakages, they don’t have the capability to ‘diffuse’ the light from the source.

The legal requirement again quite often demands two standards. One standard for ‘inspection purposes’ and another, far lower standard for other areas of work, often to a lower standard than is ideally the optimum for the work being carried out. Such legally lower standards are not however compulsory and it is in the interests of the good business that the lighting should be adequate for all of the purposes in the area. Good lighting costs only a little more and reflects from light coloured surfaces of walls and ceilings to make any room look much brighter and cleaner. Good lighting enables the workers to adequately see the meat that they are working on (and to detect any untoward items that need removing). In a well lit area where the workers can easily see the item being worked on and in an area that looks clean a much more satisfied working environment is achieved which is far less likely to cause any unrest in the labour force. Quality assurance needs good lighting to be able to examine product to ensure that it is of a colour and type that meets with the specifications of the customer. Here, the standard of lighting needed for ‘inspection purposes’ is really necessary and must always be achieved.

Over a period of time, fluorescent tubes lose their efficiency and when eventually replaced they can even give the impression of having had additional lighting installed in the area. It is therefore of benefit to have a plan to check and replace lighting tubes after definite periods of time, and not just ‘when one of the tubes has ‘gone down’

Personnel access to the room requires some limits. It is an area that will require a demonstrable standard of good food hygiene and must be also be capable of limiting the access to authorised persons only. Obviously, any people who will be working in the area will need to be wearing the appropriate protective clothing, light coloured clothing (again it is usually white but there are no actual limits as long as it is light coloured). This will include coat or boiler suit (noticeably with
a requirement at least that there are no external pockets and no pockets at all above waist level. Loose buttons will be avoided and the use of press-stud or Velcro type fastening is preferred), where coats are worn rather than boiler suits, it would be reasonable to expect that leggings also would be worn. Close mesh hair net and perhaps a hat or helmet. Where workers grow beards or moustaches then it is normally obligatory that they must wear a snood to cover the facial hair. Helmets appear to have become a quite normal requirement but in plants that do not process hanging meat (so there is no likelihood of falling objects) the helmets may not always be obligatory. One of the main advantages of the plastic helmet (apart from protection from falling objects is that different colours may be used to identify specific functions that the wearer may be approved for, e.g. a supervisor or manager, a first aid person or Q.A or Q.C. personnel etc. Due to the noise that may be generated by the processes in the area it is again quite often the norm to have some form of ear defenders. This of course is nowadays also obligatory for slaughter room personnel.

This has covered the requirement for all workers employed in the room but of course there are occasions when other people may require entry. Customers or their representatives, officials for various government agencies who need to examine any operations and sometimes a proud owner of the plant would wish to invite other outsiders to see the standards that are in place. All of the people entering the room MUST conform to the same standards that are required for workers employed in the area in respect to clothing and general food hygiene. This must be a mandatory requirement.

The access point to the processing room will need to have facilities for boot wash, hand wash and hand drying and probably hand sanitisation. One of the points mentioned in legislation about hand washing is at best, vague. That is the point of hand wash water temperature. Legislation usually requires ‘...a supply of hot and cold running water or warm water at a suitably controlled temperature...’ Such phrasing does in fact cover what is required but rarely do any texts give guidance to what is ‘a suitably controlled temperature’. It has been enlightening when, acting as an examiner of potential meat inspectors in the U.K. and I have asked that question, “What do you consider to be a suitable temperature for hand washing?” Answers have been very
varied. Some took a guess and were either correct or very close to being correct. Some just gave up and said that they ‘hadn’t been told’ or, ‘didn’t know’. Others, no doubt in an attempt to impress, suggested temperatures of 60°C and 82°C or even higher! No doubt without any skin left after exposure to such high temperatures, the flesh remaining beneath would have been clean, but as the temperature that they were suggesting was either that for pasteurisation or that required for knife and equipment sterilizers it is probable that not many people would take the trouble to wash their hands at all in that water. The answer of course is quite simple in that it should be near the human body temperature say, from about 35°C to 40°C. If the water is too cold, people won’t bother to wash their hands because of the low temperature. They are after all going to work in a room with a controlled temperature that is quite low in itself. If it is too high, perhaps not even as high as those answers given by the meat inspection students of 60°C or 82°C or more, people will take the option that they will ‘not bother’ to wash their hands. If the temperature is at or about body temperature they will find it comfortable and, when working in a colder atmosphere, quite comforting and they will want to wash their hands. This attitude will also continue into the work area where it is necessary that hand washing becomes quite a regular feature. No hand wash station should have the facility of a plug for the waste outlet. The hands should be washed under running water. This statement may appear to be quite superfluous but if, as said earlier, the water temperature is incorrect it is not unknown for some workers to try and create a ‘reservoir’ of water which can maintain a more ‘comfortable temperature. Unfortunately, this can also create a ‘soup’ of quite disgusting nature after a number of people have ‘dipped their hands’ in. Such things are perhaps less common nowadays, but the writer has in the past seen many instances of such practices (on one occasion it was seen being done by a meat inspector) and it can unfortunately, on occasion, still be seen in some less desirable plants. It isn’t always a ‘plug’ that is used either. Wads of disposable paper towel have been seen in the past being used to make a ‘plug’ and such instances must be watched for and dealt with. Liquid soap must be available in a suitable dispenser and disposable towels to dry their hands with. Many plants now also have a food grade alcohol hand rinse solution available for use after having washed the hands. Such a food grade sanitising solution regularly used can only be further evidence to the customer of the care that is being taken in an attempt to ensure the highest of hygiene standards. Also, within any part of a meat plant, the use of hot air hand dryers is prohibited; it is claimed that this is due to the possibility of undesirable aerosol effects that
they can create within the area.

Boot washes are necessary, particularly for the underside of the soles of the boots in order to remove any foreign bodies that may have lodged there prior to entering the food processing area. Indeed, there are a number of plants that are adopting the ‘High Risk’ strategy of removing boots on leaving the processing area at a bench where the boots are removed at one side, then, by swinging round, footwear for wearing outside the processing area may be put on.

The standard of the hand washing facilities continues into the working area where there should be adequate numbers of hand wash stations within easy reach of any worker. It is pointless to provide a single hand wash station virtually at the opposite end of the room from where the people are working. In order to encourage hand washing, hand wash stations should be within a short distance from any worker. Once it has been established that the hand wash stations are close to the worker it becomes logical that a knife and equipment sterilizer should be sited with them. They do after all both require a water supply and they both require a drain for waste and the need for them to be in close proximity to the workers becomes more logical. Yet other instances in the past seen by the author have been an excess of zeal in getting such items close to the worker where they have been sited with one hand-wash unit & sterilizer at each workstation immediately next to the actual cutting boards. In such cases also due to the close proximity of the heat source of the knife sterilizer, meat has been seen to be in the process of slowly being ‘cooked’. The position, and indeed quantity, of these stations then needs to be rationalised and ideally they will be sited behind the worker and perhaps with one station serving three or four workers in order to both achieve the close proximity needed and yet keep a safe distance between them and the meat being processed.

The processing will of course take place on a cutting board; they may perhaps be a part of a fixed table or alternatively be slotted onto a rack that adjoins onto a moving conveyor. The cutting board must be impervious in nature (other than in butchers shops, the use of wood for cutting boards and chopping blocks has been prohibited for a number of years) to prevent the absorption of any contaminant into its surface. No matter what material they are made from they must be thoroughly cleaned as a part of a regular cleaning programme. It is perhaps somewhat ironic that
while wood is prohibited, a well cleaned hardwood cutting board or chopping block can be proved to be equally as safe for cutting food as the more common plastic types. Similarly, a plastic type cutting board that has been cleaned, but not cleaned properly, may indeed place far more food at risk than would a good, properly cleaned wooden cutting board. Ideally once again the cutting board will be white, or of a distinctive colour (which will be necessary if other items than meat may be cut in that area). Where such ‘colour coding’ of cutting boards is in use it must be a rigidly adopted procedure in which the same colours are used at all times for the same products. ‘Obviously they should be clean prior to use and where it is possible to do so, particularly in a larger plant handling high volumes, they should be changed at break times to provide another clean surface. One option for this is where the board may be ‘reversed’ so that both sides may, at different times, be used as the cutting surface. This kind of option does also help to maintain a more even wear on both surfaces. Most of the plastic type of cutting boards will exhibit some wear after a time. This is only to be expected but most of them can be re-surfaced by means of an automatic wood-planing machine. In the case of a large processing room it can prove to be quite cost effective to have such a machine in the care of the site engineer where the boards can be re-surfaced as needed but before buying a machine it is better to take one to a woodworking establishment in order to get conformation that it is of a type which will resurface.

Tables and/or conveyors need to be constructed of stainless steel (or similar material) in order to assist in the maintenance of high standards of food hygiene. Their construction must be done with their potential function in mind and to enable easy cleaning on all surfaces with few ‘lips’ or ‘crevices’ where dirt may lodge. Conveyors may be constructed for many industries and it can be found that some ‘segmented’ types of conveyors, although made from stainless steel (or hard wearing plastics) have so many crevices and lips that they are almost impossible to clean effectively. Tables also can have been constructed initially for some other industries and be less suitable for the meat plant so again it is important to select the correct table for the kind of work to be done. The height at which the tables and cutting surfaces are at must be evaluated to the height of the workers. Surfaces that are too high or too low may well cause adverse working conditions and lead to increases in lost time from workers through ‘bad backs’ or even worse, claims that they infringe on ‘Health & Safety at Work legislation’.
Knives & equipment used in the processing area must again be made of materials that are impervious to absorption of any contaminants. It is quite normal now for the knives to be constructed of stainless steel with a plastic type of handle. Butchers steels (when used) have a similar requirement and this would of course apply to any other types of working knife edge maintaining tools that are used. Separate facilities, away from the processing room should be available for the workers to sharpen their knives and it is important that they do indeed keep their tools sharp. In most cases it is a mark of respect of the quality of the worker that they take a pride in keeping their equipment in good order. It used to be said that the butchers knife was either his best friend or his worst enemy and this can still hold true today. A good sharp knife helps to make the workload easy while a blunt knife, in addition to making the work harder to do also increases the risks of cuts as more pressure needs to be placed on the knife when it isn’t sharp. Handsaws, when used do again require care in selection and should where possible have quick release catches to enable both efficient cleaning of blades and a fairly rapid change of blade when required. Mechanical saws need to be fit for the purpose that they are to be used for. In particular, when mechanical saws are being used, the workers should receive quite formal training in their operation (and cleaning). Many meat plants now operate the system where workers must wear a ‘chain mail’ glove to minimise the risk of injury when handling knives and saws. When these items are used, they can be found to be extremely difficult to clean properly (prior to sterilization) and it is worth putting some effort in testing the various types of protective gloves (and particularly the recommended cleaning processes). This type of glove, constructed of many small stainless steel links can, when placed into a sterilizer before cleaning will result in meat being ‘cooked’ into the fine links and may prove to be extremely difficult, if not impossible, to clean later.

The processed meat itself then must be handled with care and put aside for packing and processing. Bones, fat, meat trim and other material not considered to be a part of the final meat must also be weighed (as individual items) and moved. Labels from the weighing process must be applied to the outside of all of the holding containers of these materials. At this point all of these items are still effectively suitable for human food. Some of them may not be aesthetically desirable as food in their present state but, following some further process, they may well be
utilised in some way either in other products that are to be used for human food or alternatively for animal food. Bones may be used to make stocks, fats may be rendered. Meat trim, while not usually being large pieces of meat in themselves they may later be utilised into burgers or sausages. Each of these items must be separated into their particular group and then be moved into appropriate chilled storage for utilisation later. The meat trim may have to be vacuum packed in bags or alternatively it may be being placed into larger containers for bulk usage later. That would equally of course require chilled storage. Each of the items needs to have either separate chilled areas or an identified place within the main chillers to enable good storage until it is moved on.

The meat itself, once processed, must be moved to the packing area. Packing should not be done in the area where the meat is being processed since many forms of packaging material do in fact bring with them elements of potential contamination. It is impossible to describe ‘packing’ in general terms here since each type of meat will require different ways of packing. Some may be packed using vacuum packing in a bag; some may be gas flushed; some may be placed onto a continuous thermoformed plastic base which then proceeds into a ‘sealing area’ of the machine where an addition of gasses may be introduced; some may be placed into pre-formed plastic trays that are then deposited into ‘slots’ on a moving belt in a machine that will seal them into a ‘pack’, again with perhaps the addition of some gasses while some meat plants still use the ‘overwrap’ methods of obtaining presentation. The processed meat may indeed be required to be frozen prior to packing and could need to be passed onto a conveyor to feed into a liquid nitrogen tunnel or gyro freezer for initial freezing prior to packing.

PACKING:

The most common type of packing of larger pieces of meat, such as those for wholesale sales is by vacuum packing. Vacuum packing involves the meat being placed into bags or pouches that are normally constructed of two or more types of plastic laminated (or co-extruded) together to provide very low gas permeability. The pouch is then placed into a machine with the open edges of the pouch over the top of a sealing bar. As the lid of the machine closes a vacuum is drawn in
the chamber (there are many types of vacuum packing machines and, in one way or another, in order to operate at all at some point they have to have a ‘closed chamber. The one being described as an example and fitted with hinged lids is quite common). Once the vacuum has been drawn, the sealing bars come together and heat-seal the pouch closed and at this point normal atmosphere enters the chamber and the lid of the machine will then open. In the earlier days of vacuum packing, the pouches were sealed with a metal tag that clipped around the neck of the pouch but with the ever-present problem of the risks of metal getting into the meat this was superseded by the heat-sealing of the bags. Some processes may include one further stage, that of ‘heat shrinking’ the bag after it has been sealed. The heat shrinking can either be through a tunnel where it is sprayed with hot water or through a tunnel where it is subjected to an appreciable force of hot air. This process (whether hot air or water) tends to ‘thicken’ the plastic material from which the bag is constructed and in so doing ‘tightens’ the bag more to the meat. Those opposed to this system continue to be opposed to it while those who prefer it insist that a much longer shelf life is achieved. In the case of ‘preferences’ it is up to the individual and not for decision in this book.

If the meat is in fact going to be packed for retail sale then it is quite likely that it may involve two, and perhaps three of the methods mentioned earlier. Obviously, the longest established is that of ‘overwrap’ which usually nowadays involves the use of a machine which ‘stretches’ the film as it wraps it around the tray and, in some cases, may ‘heat shrink’ the film after wrapping (in this case it is normally hot air that is used and not water). Overwrap though is a process which although now comparatively in decline is still in use and may well carry on being used for some time yet.

Vacuum Packing for retail sale of fresh meat is, in general, held back by the change in colour of the meat, particularly beef, in vacuum pack when the deprivation of oxygen causes the colour to revert from the bright red colour of oxymyoglobin to the ‘purple/blue’ colour of myoglobin. Some unconfirmed reports did circulate in the 1980’s of a butchery manager in a supermarket chain in Kentucky, U.S.A. who, on having some freshly cut steaks left at the end of the day vacuum packed them and left them in the display chiller, intending to open the packs again the following day. The story continued that a customer saw the vacuum packs of steaks in the
cabinet and asked why they were that colour. The quick thinking butcher, loyal to his own State replied that they were from beef obtained from cattle fed on Kentucky Blue Grass! The response to that was reported to be a huge ongoing demand for Steaks from Blue Grass fed Beef that caused the supermarket to vacuum pack even more beef for retail sale. As said, it was an unconfirmed report, but it did highlight the fact that some butchers who are quick thinkers can often increase business! Retail packing of beef using vacuum pack is still not reported to be a major method of packing elsewhere though.

The other two methods are ‘thermoforming’ modified atmosphere packing and ‘pre-formed tray’ modified atmosphere packing, the latter being largely distributed by the Reiser Corporation of the USA (there is also a U.K. Division of this company, for the web site for this company go to http://www.reiser.com/about/about_ross.shtml ). Both of these methods involve quite large and complex machines. A further method, which is in some ways similar to the thermoforming machine is also used but will be discussed separately, this process is a patent of W R Grace and is called ‘Darfresh’ packaging. The process of Darfresh packaging and indeed the registered name of Cryovac (and multivac) were both originated by the W.R. Grace Corporation in the U.S.A. (and again a U.K. Branch does exist) but in recent years both the registered name of Cryovac and the process of Darfresh have been sold onto other manufacturers. Both Reiser and W R Grace do have operational centres in the U.K. and throughout Europe. For the web site go to www.reiser.com and www.multivac.co.uk.

The thermoforming process commences with a large roll of reasonably thick film (a film which is laminated from two or more different materials to create an appropriate ‘barrier’ material to air) being fed under a ‘forming head’ that, with the use of moulds, heat and pressure, forms the film into trays across the width of the film base. Examples of some of the types of materials used for the make up of the tray are unplasticised polyvinyl chloride (UPVC), linear low-density polyethylene (LDPE) and High-density polyethylene (HDPE). It may be a single tray width, two trays wide or even in some cases three trays wide. The author has never seen them being used for more than three trays wide across the base of the film. However, as it is understood that these machines were initially created to produce a sterile sac to hold surgical instruments for hospitals it is quite possible that multi trays across the film are possible and could well be in use. The size
of the trays can be changed by a replacement of the moulds under the sealing head. The meat to be packed is placed into the formed trays (into each of which a ‘drip pad’ has been placed); usually depending upon the size of the tray, about eight to ten trays are in view at any one time for filling. The filled trays are moved on as the machine pulls more film forward for forming and the filled trays then pass under a sealing head. Another roll of film, once again a ‘barrier’ film but usually considerably thinner than the base film also passes under the sealing head and is positioned immediately above the filled tray. The films here may include Polythene terephthalate (otherwise known as polyester) (PET), Polyvinylidine chloride (PVdC), LDPE, Polyamide (PA), PVdC, Ethylene vinyl alcohol copolymer (EVOH). The types of films can of course go on further and as mentioned, it is advisable to use the resources of IAPRI for the various packaging material information. The sealing process involves a vacuum being drawn on the trays beneath the sealing head (which has sealing edges which match the shapes of the forming heads) and then the space created by the vacuum is filled with replacement gasses. The gasses used may well change with the kind of product being packed but, as was mentioned earlier, this then creates a pack where the atmosphere has been modified. ‘Modified atmosphere packs’ (M.A.P.) once filled and sealed may well continue to change the atmosphere within the pack due to the ‘respiration’ of the contents within the pack (aided by some of the chemical changes that continue to take place in the meat and the activity of any organisms (aerobic and/or anaerobic) which may be present on the meat). Once the gasses are in place, the top film is sealed onto the lower film (tray) and the entire film moves forward another station. As the filled, sealed trays exit from the sealing head they pass through a cutter stage that separates the trays into individual units that may then be weighed, labelled, metal detected and moved into the chilled storage.

The pre-formed tray method of modified atmosphere packing is a similar system but instead of forming a tray from a plastic sheet, pre-formed trays made from an expanded polystyrene type base with a food grade film being a material that is impervious to the passage of air, being laminated onto the inside surface of the polystyrene tray. Here a normal pairing may be a tray of expanded polystyrene lined with something like EVOH and/or LDPE. Using this method the trays may be filled (again with a drip pad in the base and product on top) and a stock of filled trays may be built up in order to achieve a continuous flow through the sealing machine. This it
is claimed enables, through the benefits of a little more time in tray filling for greater care to be
exercised in the presentation of the product in the tray before it is presented to the sealing head.
The filled trays in this case are placed into readymade ‘slots’ on a moving conveyor which then
passes under the sealing head for air evacuation and gas filling, at this point the ‘trays’ being fed
with an appropriate ‘barrier’ film over them prior to sealing. Obviously there is no need to have
cutters’ for the base as the trays are already individual items but a cutter will trim excess film
from the top sealing film.

Both systems it is claimed have some advantages. With thermoforming, the cost of new moulds
or replacement moulds is very costly. The down time for changing moulds is somewhat longer
than it is for changes with the pre-formed tray type machine. The actual cost of the formed tray
from the thermoforming machine is considerably less than that of the pre-formed trays. There is
a wastage of film though if the machine has to ‘run empty’ to get product out from under the
head (formed trays that are sealed while empty will remain under the head). The exposed time of
trays to enable a good presentation on the thermoforming machine is limited by the speed of the
machine as it creates new trays and ‘moves on’. With the pre-formed trays a better presentation
and display of the meat in the tray may be achieved and a stock of filled trays built up to ensure
that the machine is kept running (when doing this though, some limit must be placed on the time
that meat can be left ‘unpacked’ before passing under the sealing head).

Both methods use gas. For retail type presentations the gasses usually used in packing red meat
are Oxygen and Carbon Di-Oxide at levels of 70 to 75% Oxygen to 25 to 30% Carbon Di-Oxide.
Game in the form of Venison and Wild Boar though is found to benefit from an increase in the
Oxygen to 80% with Carbon Di-Oxide at 20%. Poultry meat though may either use a mixture of
Carbon Di-Oxide and Nitrogen with a mixture of 30% Carbon Di-Oxide and 70% Nitrogen for
retail type packs and even 100% Carbon Di-Oxide for bulk or wholesale packs. Once again, the
benefits of using the vast information source at IAPRI cannot be overstated.
‘Darfresh’ (a patented system of the W.R. Grace Corporation) utilises a similar method to that of the thermoforming but instead of forming a ‘tray’ as such creates a ‘dimple’ into the film to permit product to be placed on or about that spot. The process then seals under the sealing head and creates a pack where the top film (which in this case is slightly thicker than the top films mentioned so far) seals to the lower film, without the use of gas and leaves, for example, a group of 4 or 5 steaks sealed into a pack where a single steak could be taken out of the packaging and leave the remaining steaks still sealed in the pack. Usually, the sealing films have little or no air permeability so the ‘blue’ colour of the meat is evident as with vacuum packing. For food service supply of course this is quite satisfactory but it does place some restrictions on retail displays as the ‘blue’ beef of vacuum pack is evident rather than the oxygenated bright red of modified atmosphere packing.

The various processes all claim that they have the ultimate in shelf life for the product being packed but while they may each of them certainly achieve some kind of environment that may produce an extended life, the ultimate shelf life of the product depends on;

a) The general food hygiene that has been observed prior to packing.
b) The quality of the meat prior to packing
c) The temperature and storage of the meat up to the time of packing.
d) The storage temperature and handling of the meat after packing.

In other words, the meat won’t have an extended shelf life if it was at the end of its life before being packed and it won’t have an extended life if it isn’t treated with respect after it has been packed. Respect can also mean several things with packed meat. Temperature abuse is an obvious area where respect is needed but another area where respect is required is in handling. An analogy given to a customer by a marketing colleague of mine a number of years ago were to ask the customer,

“Would you throw a bottle of whisky across the table to a colleague who was putting the bottles in to cartons”? 

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The answer of course was “no”.

“In that case” my colleague replied, “why throw this vacuum packed beef fillet when it is worth far more money than the bottle of whisky”!

There didn’t appear to be a reply to that!

Vacuum packed meat is protected but it is not impregnable and it does deserve to be handled with care.

The packing process, whichever process is being used, should be done quickly in order that the packed meat may be labelled, metal detected and then moved back under chill as soon as it is possible to do so. Obviously once processed and packed, the meat will once again need to be weighed. At the weighing point labels should be generated which may be affixed to the packs of meat weighed. This has a dual purpose, it enables a weight of saleable product to be given (with the scales being ‘tared’ to take account of the packaging material) and the resulting ‘finished’ weight enables a yield of finished product to be obtained. The final yield of course is necessary for an evaluation of:

a) The value of the finished meat and
b) The effectiveness of the work of the processors or cutters.

The answer to a) would of course involve the weight of both the finished meat and the meat trim and the subsequent price of finished meat. Bones and fat now quite often have a low or even negative value but the total calculation to arrive at the final value may be obtained from all of these weights.

The answer to b) is that both the meat plant operator and the customer are able to evaluate the quality and quantity of the work being produced. In the case of the meat plant operator by the cutter or processor, in order to enable efficient staff selection within the plant for particular work and in the case of the customer, to be able to assess the quality of service being offered by the plant operator as a whole.
As has been mentioned earlier, the labelling can contain much information and it is necessary that at the time of application of the labels that some checking is carried out to provide some assurance that the information is indeed correct and that it is clear to read.

Wrapping and packing materials that appear on the scene following the processing of the meat may indeed produce a large bulk for storage but that storage must be well separated from the meat. It is of course necessary to hold stocks of packing materials, quite often this will involve considerable quantities and it must be held quite separate from where the open food is being held. Separated it may be but it must also be in a place which is quite easily accessible from the packing area in order to maintain continuity of supplies to the production line. If it is cardboard cartons then a ‘cardboard store’ may be sited above the processing area with a ‘feed’ of cartons being delivered by chute or conveyor to make its first appearance at a point close to where the carton is needed following the initial packing process.

If the meat plant is in fact carrying out distribution of packaged meat in plastic distribution trays then it will also be necessary to have the facilities of an effective tray wash system. Clean trays should exit from there into a clean tray storage area. The reason for this is to minimise any steam or heat being generated from the washing process being passed from the tray wash area directly into the meat processing and packing area. This clean tray storage area then must have an access into the packing area in order that the finished packed product may be ‘trayed’ prior to moving into the chillers. In general this needs to be a one-way route to prevent any misuse of the system. Soiled trays, those that have been used and are returning, would require access to the tray wash from a point close to where the trays are returned to the plant. The cleaned trays need a separated room from the cleaning room in order that adequate vents or fans can remove any unwanted steam and heat in a direction away from the packing area. Ideally there may even be a small passageway or ‘air lock’ between the tray storage area and the packing room itself.