

28th July, 1972.

MEAT RESEARCHERS MEETING - GUELPH, ONTARIO  
THURSDAY, AUGUST 24th, 1972.

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PROCESS ENGINEERING

Dr. A.M. Mullins

Mr. Chairman, gentlemen - Good afternoon.

W. T. FORCE,  
CANADA  
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LIMITED

In times past, and even in the recent past, whenever the word "engineering" was used in relation to the meat industry, there were often a few chuckles in the background.

Engineering in the meat industry was often held up to some mild ridicule, especially when it was compared to the engineering technology that went on with auto-makers. Auto making and meat packing were considered the antithesis of each other, one having developed a tremendous <sup>engineering</sup> technology to mechanize and automate their <sup>assembly</sup> ~~processing~~, the other being considered as backward, with little innovation.

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Well, in spite of our differences, that is in spite of our supposed differences, automotive technologists and meat technologists can continue to exist side-by-side - they apparently enjoy our products - we continue to ~~try~~ <sup>drive</sup> their cars.

I hope, indeed I am sure, that the meat packing industry has out-grown that former connotation that it lacked in engineering innovation or that it did not possess any real technology.

Indeed, in many many operations the meat processor is functioning in a sophisticated, highly technical manner.

When you use the term "process engineering", there is a tendency to think of the engineering that is associated with the process of converting or manufacturing some articles and excluding from that term the engineering aspects that go into the housing for that process and the engineering that goes into the environmental aspects surrounding that process.

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When the subject is "meat packing" I do not believe you can make that differentiation. After all, this industry starts with the slaughter of a live animal, a very perishable quantity. It must process that carcass through many conversions - and at all times maintain it in a sanitary and suitable condition.

The structures that house these operations, the environment <sup>within those structures, these</sup> that is provided ~~surrounding these operations,~~ are not adjuncts to the processing operation, they are really part and parcel of that operation. The engineering content that has to go into those structures and that environment is just as much "process engineering" as the engineering content in process equipment and processing layout.

We still have some of those structures erected just prior to the first world war - multi-storied buildings - often with wood timber framing and exterior brick walls. They used massive amounts of chilled brine solutions circulated through their cold rooms, usually utilizing some form of spray technique to chill the environmental air.



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The theory, of course, was that once you had persuaded someone or something to walk to the top of the structure, gravity allowed you to help it, or the parts thereof, to progress down. That applied equally well to the product as to the brines used in the refrigeration systems.

Post world-war <sup>one</sup>~~two~~, ~~and~~ there was a great deal of building activity at this time, generally made the improvement that timber structures were replaced by reinforced concrete structures. But the basic thinking still remained the same. That is, construct a number of stories, start at the top, and let everything work its way down.

I stand to be corrected here - but I do not believe that throughout the late 1920's, and the 1930's, that the meat packing industry as such changed greatly in its approach to its manufacturing processes, or its approach to the structures and the environment in which it operated. Certainly what new construction there was followed the general patterns of previous decades. Certainly the new constructions were modern in materials and in construction techniques, but their lay-out and configuration adhered to those prior traditions.

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There seemed to be little real innovation.

Meat packing establishments erected in the 30's ~~certainly~~ looked newer than those erected in the early 1920's, but other than looking newer they looked and were very much the same in layout and technique. Maybe it was this period that earned the meat packing industry a reputation for lack of innovation and not too much engineering content.

World War II brought its own priorities, a requirement to produce and only limited possibilities to change or innovate. Post-World War II seems to be the start of a period when the packinghouse industry in total started to change.

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Where does "process engineering talent" exist within the Meat Industry. An industry where the size of operator varies widely:

from the small specialist slaughtering or processing  
operation ..... to

the large integrated meat packing organization.

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Obviously the requirements for the two sizes cannot be met in the same manner. The smaller, specialist operator normally cannot justify "in house" process engineering staff on a day-to-day basis.

The large integrated operator almost in self defence has to employ ~~at least~~ a "core" of engineering talent.

But there is a pool of engineering services available to both size of operators, *that is outside their own immediate organizations.*

These are the services that come from :

- food service consultants,
- equipment suppliers,
- material suppliers,
- specialist contractors

Process engineering input for the meat packer may come from a few specialist consulting firms - who by chance or design - have developed a background in food processing in general and sometimes in meat packing in particular.



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Here I am thinking of the pure consultant - he has no equipment to sell - he provides simply his skill and experience.

There is another kind of consultant available to the meat packer. This is the one whose first concern was to fabricate and supply to the operator pieces of equipment of various kinds. He found it was to his advantage - possibly he found it a necessity - to provide engineering advice as to how his equipment should be used - how it should be integrated with other equipment. He became something of a specialist (usually in selected areas) as to the engineering connotations that applied in setting up these particular operations.

He became a most knowledgeable specialist - to the extent that his prime function shifted from selling individual pieces of equipment - to selling whole systems, complete with all engineering information for installation  
service connections  
etc., etc.

We have this kind of consultant for such things as  
slaughter floors  
rendering operations

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There is a third kind of engineering consultant available to the meat packing industry. He also originates as a supplier, but not as an equipment supplier - rather he is a supplier of a consumable item.

He may supply	-	spices
		casings - artificial or natural
		wrapping films
		cartons
		etc., etc.

Engineering information - together with operating information, is part of the package when dealing with him. Again - as a matter of necessity, the provision of considerable application engineering with his product became a required part of the marketing effort.



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The fourth category "specialist contractor" - somewhat like the first (specialist consultants) have developed either by accident or design - considerable engineering expertise in the meat industry.

They may then function not simply as contractors or erectors, but provide a package of design plus erection.

The availability of process engineering talent from those four sources -

- food service consultants
- equipment suppliers
- material suppliers
- specialist contractors

makes the smaller specialist operator independent of "in house" engineering talent. He has all the "engineering know how", he feels he needs - at his beck and call.

May the larger, integrated operator also rely solely on the process engineering talent available from outside his organization?

Normally no.

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Certainly he makes full use of these outside sources - but he cannot rely on them entirely.

He has a necessity to have a staff of in-house process engineers. He must struggle constantly to be at the forefront of innovative change. This means he must often be the innovator.

Relying solely on "outside" process engineering advice would leave him in the second echelon of change - that of being an "early adopter" rather than being an innovator. A somewhat dangerous position for a larger organization.

The process engineering talent existing in most large meat packing enterprises has to blend a number of inputs into his work.

Possibly more than other industries - a great deal of the practical empirical knowledge in the meat industry exists as "Art". I know groups such as this "The Meat Research Workers" commit more and more of this "Art" into numerical, predictable "Science" every year.

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But just the same - at the moment when attempting to change a mode of operation or to formulate the planning for a new plant, the process engineer must blend together :

- 1) the known "Art" of the process as expounded  
by the Supervision and Management concerned;
- 2) the known "Science" of the process as  
expounded by Research People and Control  
Chemists;
- 3) his own "know how" of the possible mechanics  
inherent in the situation;
- 4) the speculative, innovative changes that may  
be suggested by any of these groups,  
  
the Artist  
  
the Man of Science  
  
the Engineer.

Out of this mélange of knowledge - must come a process or a plant that actually works.

That is the first criterion - it must actually function. There are no credits given for processes or plants that do not work - no matter how brilliant the original conception may have been.



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The second criterion is - it should work better than the previously known process. "Better" could be construed as :

- 1) producing a product of higher quality;
- 2) producing at a higher rate of thruput;
- 3) producing with a higher yield;
- 4) producing with lower labor input.

Any, or all of these generally means - a process or plant that processes product, more economically than its predecessor.

I suppose there are many more criteria that may be nominated - but let us leave this discussion at these two.

The process engineer has the responsibility to :

- first - produce a process or plant that actually works;
- secondly - produce a process or plant that works better than its immediate predecessor.

For those of us who are regularly involved in this distillation of knowledge to working hardware - it often comes as a matter of some surprise that the efforts are crowned with a reasonable record of successes.

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Mr. Chalmers, on Monday, I believe touched on a number of the North American innovations that have become generally accepted throughout the industry :

the beef slaughter system was taken off the floor and placed on a mechanized rail system.

Cooked Meat processes have constantly been streamlined - so that for a number of large volume items - these processes are essentially continuous from raw material to finished product.

One could, I suppose, make an extensive detailed catalogue of the innovative process changes that have been instituted throughout the 1950's and the 1960's. But that is a matter of general record and would not seem to serve much purpose here.

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There is another aspect of the process engineer's function that I should mention. That is his relationship to and his cooperation with the "Federal Inspection Services" that exist in North America.

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The United States and Canada each have very extensive, well qualified "Meat Inspection Services". These bodies, administered by the central governments, provide a continuous inspection service to the meat processor doing inter-provincial (or inter-state) business.

The Inspection's primary function, of course, is to monitor the meat processing operations, as they exist, and as they are on going.

But in addition to the ongoing operation - the inspection service operates an examination and approval section. That is, they are required to examine and approve all proposed process changes, renovations, new plants, etc.

Man, including the public service, possesses those foibles that may allow leniencies for an existing operation - where the "spirit" of the law is being observed, the the "letter" of the law may be missing here and there.

Obviously - when it comes to changes, renovations, new facilities, approval from the Inspection Service requires that the "spirit" and "letter" both, of all regulations must be rigorously observed.



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The intent of "Inspection" regulations could be summed up in one word - "Sanitation". That is to insist that particularly new or modernized facilities adhere to only those arrangements and those materials that may be easily and consistently sanitized.

The "Inspection Service" regulations have been a constant spur to the industry in total and to the process engineer in particular to provide increasingly better facilities, in the sanitary sense.

Sanitation, of course, is a constant parameter in the thinking of the process engineer. Not only in terms of materials that go into the construction of floors, walls, etc., but also the constructional features of operating equipment.

He is expected to produce an assembly that in the first sense - it is possible to sanitize. That is the chief concern of inspection authorities.

In the second sense, that assembly must be arranged so that the sanitizing procedure may be quickly and easily done - so the cost of sanitation is not too onerous. That is the chief concern of management.

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In a third sense - that assembly must be arranged and protected so that it is reasonably "Resistant" to the sanitizing procedure.

This is a major concern of the process engineer himself.

I do not think there is any doubt that one of the major economic crosses the Meat Industry must bear is this cost of sanitation.

It is not solely the cost of the daily clean up in terms of cleaners, water and labor. It is also the toll that this cleanup takes in terms of buildings and equipment.

This daily clean up, using vast quantities of water, cleaners that in one way or another are corrosive, demands unusual protective measures for operating equipment. In spite of protective measures, operating equipment incurs a high repetitive maintenance cost - at least 50% of which may be attributed to the abusive (in the mechanical sense) sanitation procedure. It also leads to replacement of operating equipment before its otherwise useful life has been served, and before obsolescence has required its replacement.

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The major enemy of electrical apparatus and lubricated surfaces is - water. We provide gobs of water every day, in the name of sanitation. This takes its toll of our equipment.

This water use has one other limiting aspect. It limits our choice of equipment. Devices that would be suitable and advantageous to use, things that are used in other industries with success, cannot often be installed in the packinghouse. They simply will not stand up to our watery environment.

The effect of daily, severe sanitation procedures on operating equipment is quite visible, to those daily involved in the industry.

What is not so visible is the effect of this sanitation requirement on buildings. Here the sequence is more insidious.

Vast quantities of water daily applied in any structure - find the minute fractures that exist. The corrosive process starts and progresses steadily in the hidden portions of the structures. By the time the most visible evidence is available - the structure is usually well advanced in deterioration - and in need of renovation.



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This periodic renovation is a cost the Meat Industry must bear, one that would not be near so severe if another style of occupancy (other than meat packing) had used the premises.

The process engineer must constantly keep in mind the abusive nature of the environment he deals with. His structures must resist their attack. His structural and architectural considerations - are as much a part of his process design considerations as is his layout of the processing line, and his choice of equipment.

This brings us back to a theme that we started with. The process engineer in the Meat Industry cannot be related simply to the processing equipment itself, with the structures housing that process being someone else's incidental concern.

The process engineer in this industry has to be concerned with the housing of his processes to the same degree as the process itself. The housing is not an incidental item, it is a vital, pertinent item.

New plants under construction today for the Meat Industry are going to some extraordinary lengths in this structural aspect.

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Some plants are utilizing only "hollow-square" structural sections to minimize the flat surfaces available, and these sections are entirely galvanized prior to erection. A costly procedure.

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There is a subject related to sanitation that requires an increasingly larger share of the engineering input that must go into the Meat Industry.

That subject is Waste Treatment and Odor Control. Sanitation requires the removal and discharge of all types of soil.

That soil plus other materials ends up in our waste system. It requires treatment. The Meat Industry from its outset always operated an elementary form of treatment - that is, it has always used simple settling basins to essentially separate waste fats that could be recovered for inedible use. This was always an economic consideration.

Settling basins are still the first item in any treatment system, but they have ceased to be simple. Today requires a much more sophisticated basin, utilizing mechanical system to skim and discharge fats, to collect sludge.

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In the Waste Treatment field the Meat Industry does possess the advantage that its waste materials are degradable, by the same methods that have traditionally served municipalities to treat normal municipal wastes.

Increasingly then, Meat Industry installations must construct more sophisticated treatment systems, incorporating secondary aeration, sludge dewatering systems, final filtering systems, etc., etc. The degree of treatment depending on the general economics of the situation - if he is able to treat his waste more economically than the municipality - he will do so. If not, he will pay the municipality to perform that treatment.

Some plants today operate complete treatment systems - the equivalent in every way to the most modern municipal systems. The day is not far distant when the Meat Plant will treat his waste waters to the potable water standard and recycle water at least for certain restricted uses.

Waste treatment is an increasingly important consideration of the process engineer.



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One other increasingly vital consideration - without as long a history as waste treatment - is odor control.

The meat industry possesses the possibility from a number of sources to emit noxious odors. From the point of view of being a good corporate citizen, this should not be allowed. If that is not sufficient incentive, today, in most areas of the country, the law requires - no noxious emissions.

The process engineer then has this odor control consideration. He must match the most appropriate control system to the process. That may be :

simple air dilution;

water washing of the air discharge;

washing with chlorine solutions;

dry chlorine injection with subsequent water washing;

incineration;

or a combination of these methods.

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Gentlemen - it seems to me that I have rambled around this subject somewhat, exploring partly for my own edification really what "Process Engineering" in the Meat Industry actually consists of.

For the Meat Industry, Process Engineering is a most comprehensive term - it has to involve itself with all aspects of the industry - the structures that house it;  
the environment within which it operates,  
the treatment of its waste,  
in addition to the actual process function.

Gentlemen, it has been a pleasant day for me - thank you for the opportunity.

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