

UPGRADATION/MODERNISATION OF DAIRY PLANTS





TOPICS COVERED

- DAIRY PLANT STUDIES – OBSERVATIONS
- UPGRADED TECHNOLOGIES
- CHALLENGES IN PLANT UPGRADATION
- NEW TECHNOLOGIES



PLANTS REQUIRING UPGRADATION/MODERNISATION

- A LARGE NUMBER OF DAIRY PLANTS WERE ESTABLISHED IN '70S AND '80S HAVING CAPACITY RANGING 1 TO 4 LLPD.
- THESE WERE MOSTLY MANUALLY OPERATED PLANTS WITH TECHNOLOGY PREVAILING DURING THE PERIOD.
- THE PRESENT TECHNOLOGY PROVIDES IMPROVED EFFICIENCIES, REDUCED LOSSES AND FOOD SAFETY.
- THE PLANTS WITH OLD TECHNOLOGY RECOMMENDED FOR UPGRADATION FOR IMPROVED OVERALL OPERATING EFFICIENCIES.



DAIRY PLANT STUDIES – OBSERVATIONS

- HIGH PASTEURISATION TEMPERATURE UPTO 84 DEG C

LEADS TO PLATE FOULING, HIGHER DOWNTIME, MORE NUMBER OF CIPS, HIGHER UTILITY CONSUMPTION

- OLD MILK PASTEURISERS HAVING REGENERATION EFFICIENCIES 80-85%

THE OPERATING COST FOR A 10000 LPH PASTEURISER CAN BE HIGHER BY RS 20 LAKH PER YEAR COMPARED TO PASTEURISERS WITH 93% REGENERATION EFF.

- AUTO CONTROLS (STEAM PID, FDV, TEMP. RECORDERS ETC.) OF THE CRITICAL EQUIPMENT AT PROCESSING AND SERVICE/UTILITY SECTIONS ARE GENERALLY NOT IN WORKING CONDITION. MANY A TIMES THESE ARE BYPASSED

INCONSISTENT PRODUCT QUALITY AND COMPROMISED FOOD SAFETY.



DAIRY PLANT STUDIES – OBSERVATIONS

- MANUAL CLEANING IS BEING CARRIED OUT IN MOST OF THE PLANTS. CIP SYSTEM IS EITHER NOT AVAILABLE OR IS BEING OPERATED MANUALLY

PROPER CIP PARAMETERS ARE NOT MAINTAINED AFFECTING PLANT HYGIENE AND HEAT TRANSFER COEFFICIENT IN HEAT EXCHANGERS.

- RINSE RECOVERY SYSTEM IS NOT AVAILABLE

RESULTS IN LOSS OF MILK SOLIDS TO THE TUNE OF 0.25 % AND HIGHER BOD AND COD IN EFFLUENT.

- VARIATIONS IN WEIGHT OF MILK POUCHES ON LOWER SIDE BEYOND PERMISSIBLE LIMITS

VIOLATION OF STATUTORY REQUIREMENT.

DAIRY PLANT STUDIES – OBSERVATIONS

- JAW COOLING WATER OF POUCH FILLING MACHINES IS DRAINED AND NOT RECYCLED

MONETARY LOSS OF RS 1.1 LAKH PER MACHINE (5000 PPH) PER YEAR FOR 16 HRS OPERATION PER DAY.

- STEAM CONDENSATE IS DRAINED, NO RECOVERY SYSTEM IN PLACE
EVERY 6 DEG C RISE IN BOILER FEED WATER TEMPERATURE REDUCES THE FUEL BILL BY 1%.
- FOR RECONSTITUTION GENERALLY AMBIENT WATER/CHILLED MILK IS BEING USED
BY INCREASING WATER/MILK TEMPERATURE TO 40 DEG C, THE MILK SOLID LOSS CAN BE REDUCED BY APPROX. 2%.
- LACK OF RECORD KEEPING OF CRITICAL PROCESS PARAMETERS
IN AUTOMATED PLANT MIS REPORT FOR ALL CRITICAL PARAMETERS IS GENERATED EVERY 15 MINUTES.



DAIRY PLANT STUDIES – OBSERVATIONS

- SS LINES NOT BEING CLEANED PROPERLY DUE TO FREQUENT CHANGES IN PIPING TO SUIT IMMEDIATE REQUIREMENT

PLANT HYGIENE COMPROMISED.

- POOR CONDITION OF UTILITY PIPING AND LEAKAGE OF STEAM, WATER, AIR ETC

RESULTS IN UTILITY LOSSES.

- LEAKAGES DUE TO IMPROPER/MAKE SHIFT SS PIPING

MILK SOLID LOSS.



DAIRY PLANT STUDIES – OBSERVATIONS

- MOST REFRIGERATION PLANTS ARE STILL RUNNING WITH LOW SPEED RECIPROCATING COMPRESSORS, FLOODED REFRIGERANT DISTRIBUTION, ATMOSPHERIC CONDENSERS

RESULTING IN MORE POWER AND WATER CONSUMPTION, REFRIGERANT LEAKAGES, OIL CARRY OVER, INCONSISTENT SUCTION PRESSURE, LIQUID CARRY OVER, LOWER HEAT TRANSFER COEFFICIENT, HIGHER DOWNTIME

- IN MOST DAIRIES THE CHILLED WATER PUMPS ARE BEING OPERATED CONTINUOUSLY IRRESPECTIVE OF THE LOAD REQUIREMENT

15 TO 20 % POWER SAVING CAN BE ACHIEVED BY OPERATING THE PUMPS THROUGH VFD.



DAIRY PLANT STUDIES – OBSERVATIONS

- THE QUALITY OF COMPRESSED AIR BEING USED IN PLANTS IS POOR, LADEN WITH OIL AND MOISTURE

FOOD CONTAMINATION AND LONGEVITY OF PNEUMATIC PARTS OF EQUIPMENT IS COMPROMISED.

- WATER CONSUMPTION MONITORING IS TO BE IMPLEMENTED. THE MILK TO WATER RATIO IS HIGH (NORMALLY HIGHER THAN 1:2)

IN A DAIRY OF 1 LLPD REDUCING WATER CONSUMPTION BY 10 % CAN RESULT IN SAVINGS OF RS 4.4 LAKH PER YEAR.

- DEPLETED INSULATION (HOT/COLD)

RESIN BONDED PIPE SECTIONS FOR HOT INSULATION AND CAST-IN-SITU PUF FOR COLD INSULATION ARE RECOMMENDED FOR LOWER THERMAL LOSSES.



DAIRY PLANT STUDIES – OBSERVATIONS

- OIL FIRED BOILERS CAN BE REPLACED WITH SOLID FUEL FIRED (AGRI WASTE BRIQUETTE) BOILERS FOR LOWER STEAM COST

30 % SAVINGS IN COST OF STEAM GENERATION ENVISAGED. THIS ALSO REDUCES DEPENDENCE ON DEPLETING FOSSIL FUELS.

- GENERALLY THE PRS AND STEAM TRAPS FOUND LEAKY IN MOST OF THE PLANTS

ANY MAJOR LEAKAGE OF STEAM (5-6 MM DIA) AT 3.5 BAR PRESSURE RESULTS IN LOSS OF 465 TONNES OF STEAM PER YEAR AMOUNTING TO RS 5.4 LAKH.

- STEAM CONSUMED IN PLANTS IS NOT MONITORED

STEAM FLOW METERS ARE BEING INSTALLED IN NEW/ UPGRADED PLANTS FOR MONITORING THE BOILER PERFORMANCE FOR TAKING NECESSARY CORRECTIVE ACTIONS .



DAIRY PLANT STUDIES – OBSERVATIONS

- POWER FACTOR LESS THAN 0.95 HAS BEEN OBSERVED IN SOME PLANTS

RESULTS IN LESSER AVAILABILITY OF ACTIVE POWER AND PENALTY.

- OLD INEFFICIENT MOTORS /REWOUND MOTORS ARE INSTALLED IN MOST OF THE PLANTS

FOR EVERY REWINDING THE EFFICIENCY OF MOTOR REDUCES BY 8 %. AS PER INTERNATIONAL STANDARDS MOTORS SHOULD BE DISCARDED AFTER 3 REWINDING. IE-3 MOTORS HAVE 2-4 % HIGHER EFFICIENCY THAN IE -1 MOTORS.

- OFFLOAD TAP CHANGING TRANSFORMERS HAVE LIMITED VOLTAGE REGULATION

ONLOAD TAP CHANGING TRANSFORMERS HAVE LOW FLUCTUATION IN VOLTAGE OUTPUT ($\pm 1.25\%$) THEREBY INCREASING THE LIFE OF MOTORS.



UPGRADED TECHNOLOGIES

1. PROCESS AUTOMATION
2. AUTOMATED REFRIGERATION PLANT (ENERGY SAVINGS)
3. IMPROVED THERMAL EFFICIENCIES (BOILER)
4. USE RENEWABLE / NON-CONVENTIONAL SOURCES OF ENERGY
 - BOILERS WITH AGRI WASTE BRIQUETTES
 - SOLAR ENERGY FOR THERMAL APPLICATION



PROCESS AUTOMATION

1. CONTROL MILK/PRODUCT LOSSES. (AUTOMATED LMP SOLID LOSSES 0.6 TO 0.8%)

- PRODUCT STANDARDIZATION WITH AUTOMATED & ACCURATE CONTROL OF FAT AND SNF
- ACCURATE (TIMER / VOLUMETRIC BASED) WATER FLUSHING/ PURGING OPERATION
- RECOVERY OF MILK SOLIDS THROUGH RINSE MILK RECOVERY SYSTEM

2. ENSURE FOOD SAFETY & CONSISTENT QUALITY

- FINER MONITORING & CONTROL OF PROCESS PARAMETERS
- AUTOMATIC CIP SYSTEM TO ENSURE CLEANING EFFICACY WITH CHOICE OF RECIPES
- CLOSED LOOP CIRCUIT CONTROL WITHOUT HUMAN INTERVENTION
- MAINTAIN HYGIENE WITH MINIMAL CONTAMINATION E.G. PRODUCT STREAM MAINTAINED AT HIGHER PRESSURE THAN UTILITY IN PHE



PROCESS AUTOMATION

3. HIGHER PLANT EFFICIENCIES

- IMPROVED PLANT CAPACITY UTILISATION
- LOW UTILITY CONSUMPTION - (IN AUTOMATED LMP WATER CONSUMPTION IS 0.6 TO 0.7 LITRE PER LITRE OF MILK PROCESSED)
- LOWER ETP REQUIREMENT DUE TO CONTROLLED PRODUCT LOSSES – (PARTIAL TREATMENT OF SLUDGE FROM SELF CLEANING SEPARATOR)

4. DAILY MIS REPORTS

- RELIABLE/ACCURATE DAILY REPORTS
- QUICK DECISION ENABLING FAST ACTION
- HISTORICAL ANALYSIS

5. LESS MANPOWER REQUIREMENT – (FOR THREE SHIFT OPERATION OF A 5 LLPD AUTOMATED LMP, MANPOWER REQUIREMENT WOULD BE 21 INCLUDING RELIEVRS)



REFRIGERATION PLANT UP-GRADATION

1. AUTOMATION OF REFRIGERATION PLANT OPERATION

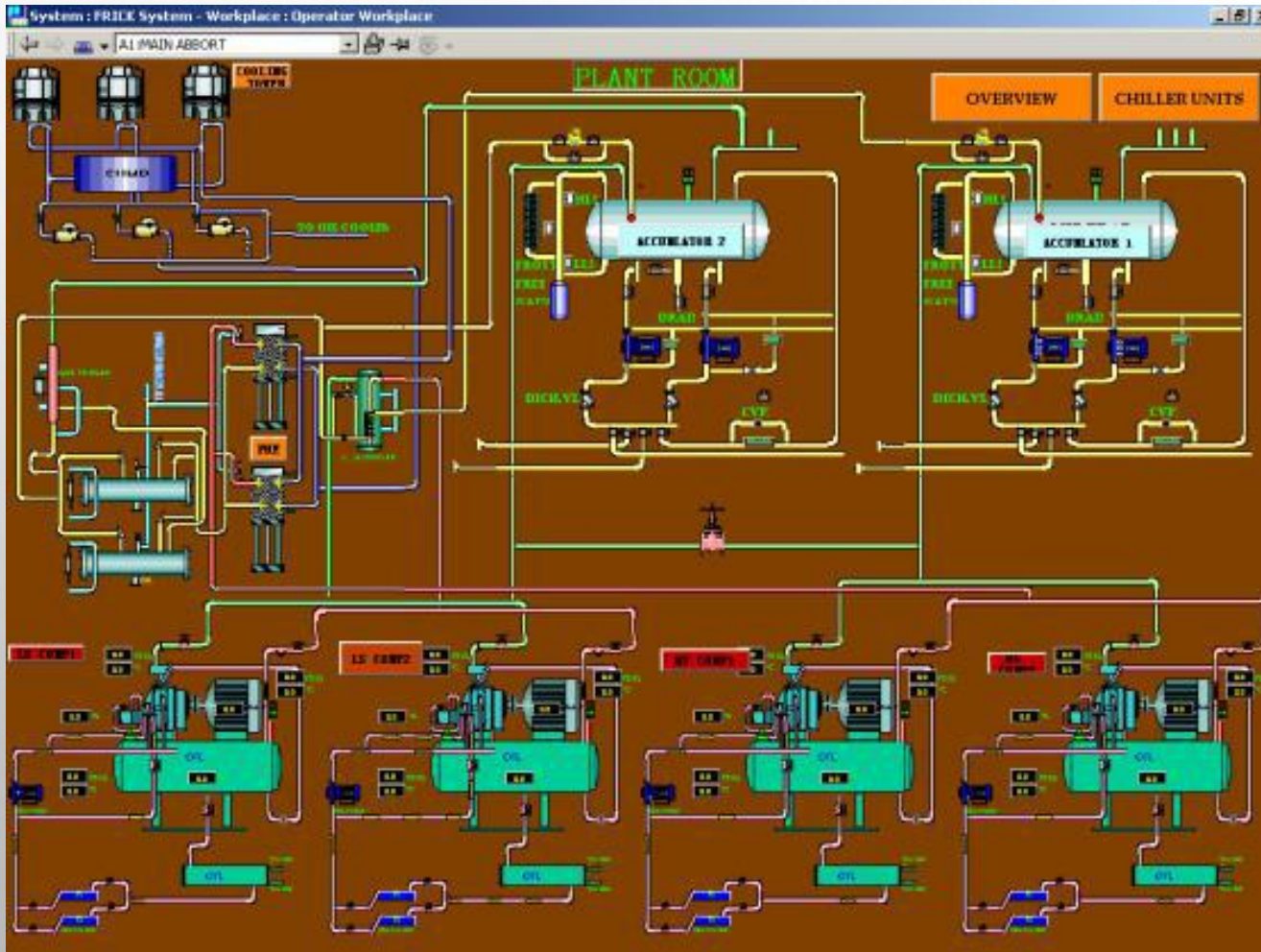
- CONTROL OF ACCURATE SUCTION PRESSURE
- CENTRALISED PLANT CONTROL WITH DATA LOGGING AND SAFETY INTERLOCKS
- STEPLESS CAPACITY CONTROL (SCREW COMPRESSORS)
- RELIABILITY & OPTIMIZED PLANT OPERATION

2. USE OF ENERGY EFFICIENT/SCREW COMPRESSORS WITH ECONOMISER

- MINIMUM MAINTENANCE REDUCED DOWN TIME
- VFD FOR COMPRESSOR MOTORS LEADS TO ENERGY SAVING
- REDUCED OIL CARRYOVER
- USE OF ECONOMIZER TO IMPROVE THE COP BY 5 -10 %
- REFRIGERANT BASED THERMO SYPHON OIL COOLER ELIMINATES WATER CIRCULATION PUMP AND IS MAINTENANCE FREE. (SAVINGS OF RS 1.65 LAKH PER YEAR FOR 150 TR COMPRESSOR).



SCADA CONTROL –AUTOMATED REFRIGERATION





OTHER UPGRADATIONS IN REFRIGERATION PLANT

1. USE OF PRE CHILLER FOR PROCESS RETURN WATER (@-2 DEG C EVAP TEMP)
IMPROVES COP BY ABOUT 25 %.
2. USE OF LARGER SIZE EVAPORATIVE CONDENSERS FOR CONDENSING TEMPERATURE OF 36 DEG C IN PLACE OF 40 DEG C
IMPROVES COP BY ABOUT 12 %.
3. EVAPORATIVE CONDENSER INSTEAD OF ATMOSPHERIC CONDENSERS
RESULTS IN LOWER POWER & WATER CONSUMPTION.
4. LIQUID OVER FEED SYSTEM WITH CENTRALIZED LP ACCUMULATOR
IMPROVES THE OVERALL HEAT TRANSFER COEFFICIENT AND ELIMINATES LIQUID CARRYOVER ISSUES. ALSO FACILITATES UNIFORM ICE THICKNESS IN IBT COILS
5. VFD CONTROLLED CHILLED WATER PUMPS TO SAVE ENERGY
ENERGY SAVING OF 15-20%
6. INTRODUCTION OF ICE SILOS FOR ICE STORAGES
LESSER FOOTPRINT & NO CIVIL BUILDING REQUIREMENT
7. USE OF PACKAGE CHILLER UNITS
REDUCES STORAGE VOLUME OF REFRIGERANT, THERMAL STORAGE & IMPROVED COP



IMPROVED THERMAL EFFICIENCY

1. AUTO RECOVERY OF MAXIMUM STEAM CONDENSATE FROM PLANT AND PUMP IT TO BOILER FEED WATER TANK USING MOTIVE STEAM.
2. AUTOMATIC BLOWDOWN SYSTEM TO REDUCE BLOWDOWN LOSSES AND BETTER TDS CONTROL OF BOILER WATER.

TO MAINTAIN BOILER WATER TDS CONSTANT AT 3500 PPM (FIRE TUBE)

3. CONTINUOUS FLUE GAS ANALYSER AND CONTROL OF AIR TO REDUCE HEAT LOSSES THROUGH FLUE GASES.

INCREASE IN FUEL COST BY RS 4.5 LAKH/YEAR FOR EVERY 5% INCREASE IN EXCESS AIR IN 8TPH FO FIRED BOILER OPERATING 20 HRS/DAY

4. INTRODUCTION OF AGRI WASTE BRIQUETTE BASED BOILER

PAYBACK IN 24 – 30 MONTHS.



CHALLENGES IN PLANT UPGRADATION

- UPGRADATION REQUIREMENT IS UNIQUE FOR EACH PLANT AND NEEDS COMPREHENSIVE STUDY AND INTEGRATED PLAN FOR IMPLEMENTATION
- IMPLEMENTATION IN PIECE MEAL BASIS MAY NOT YIELD DESIRED RESULT
- SPACE CONSTRAINTS IN EXISTING PLANTS
- PLANT SHUT DOWN ISSUES FOR IMPLEMENTATION
- DEFINITE TIME SCHEDULE FOR UPGRADATION MAY BE DIFFICULT TO PREDICT DUE TO UNFORESEEN
- NEW TECHNOLOGY ADOPTION BY EXISTING OPERATORS/STAFF
- NON-AVAILABILITY OF COMPETENT MANPOWER
- THE NEW STATE OF THE ART MACHINES ARE SENSITIVE TO POWER FLUCTUATIONS AND NEEDS STABILISED POWER SOURCE WITH CONTROLLED HARMONICS

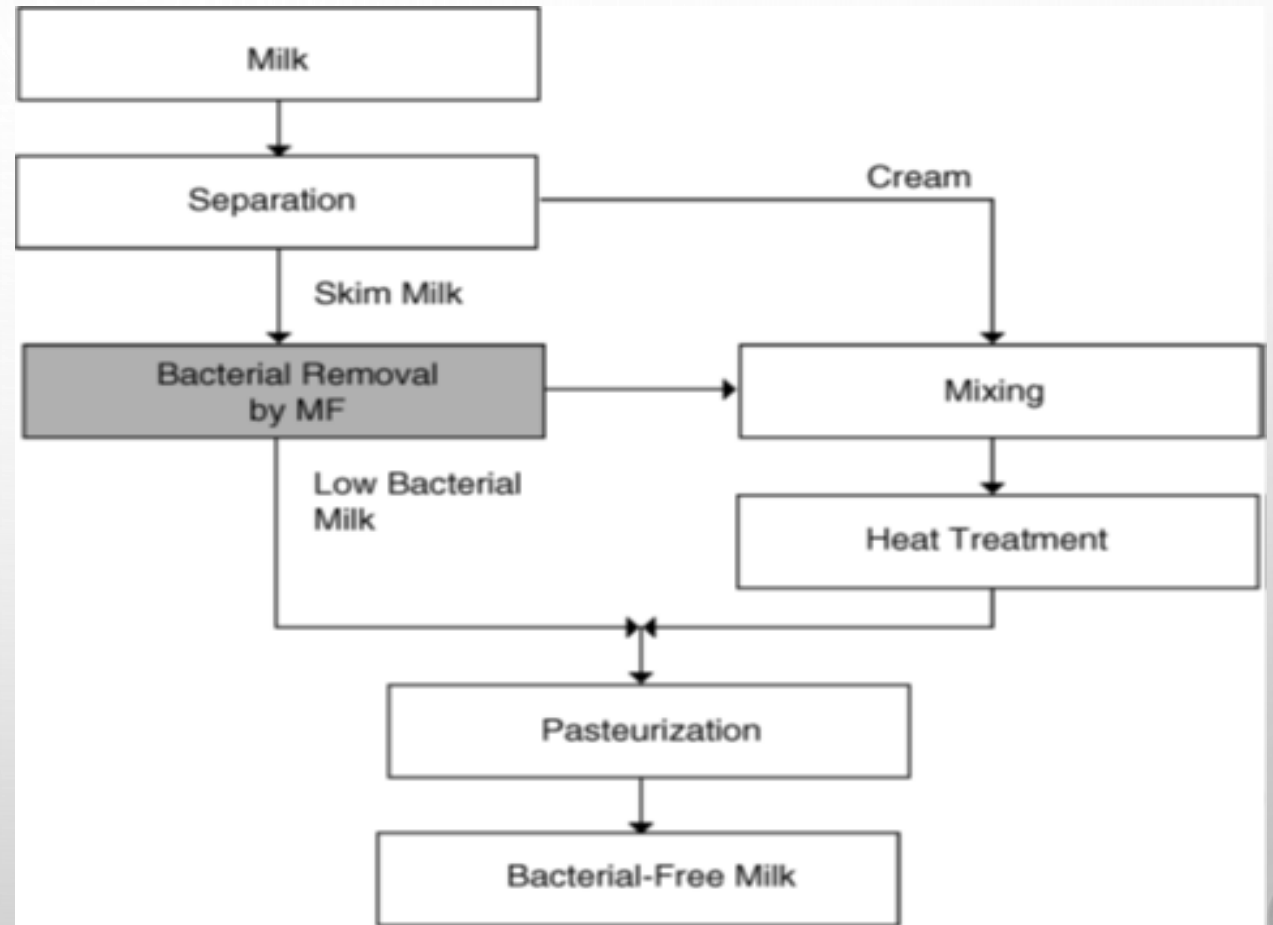


NEW TECHNOLOGIES

MEMBRANE TECHNOLOGY IN MILK PROCESSING

1. BACTERIA REMOVAL FROM MILK

THE REMOVAL OF BACTERIA AND SPORES FROM MILK TO EXTEND ITS SHELF-LIFE BY MICRO FILTRATION. IN THIS APPROACH, THE ORGANOLEPTIC AND CHEMICAL PROPERTIES OF THE MILK ARE UNALTERED.





NEW TECHNOLOGIES

MEMBRANE TECHNOLOGY IN MILK PROCESSING

2. CONCENTRATION OF MILK

CONCENTRATION OF MILK, WHICH CONVENTIONALLY IS DONE BY EVAPORATION TECHNIQUE, CAN ALSO BE ACHIEVED BY REVERSE OSMOSIS. THE CONCENTRATED MILK HAS ITS GREATEST POTENTIAL IN ICE-CREAM MANUFACTURING, SINCE ALL THE SOLIDS ARE RETAINED IN THE CONCENTRATE AND 70% OF THE WATER IS REMOVED. THIS IS ALSO BENEFICIAL IN REDUCTION OF TRANSPORTATION COST OF MILK, INCREASING CAPACITY OF EXISTING EVAPORATOR.

IS REMOVED.



NEW TECHNOLOGIES

ONLINE U V SYSTEM – CONTAMINATION OF DAIRY PROCESS WATER CAN RESULT IN LOSS OF PRODUCT (NOT ONLY RESULTING IN PRODUCTION LOSSES, BUT ALSO HIGHER WASTE EFFLUENT SURCHARGE COSTS), PRODUCT RECALLS, AND LOST CONSUMER CONFIDENCE. UV WATER DISINFECTION USING OFFERS A VIABLE ALTERNATIVE TO CONVENTIONAL DISINFECTION TECHNIQUES FOR ENSURING SAFE, MICROBE-FREE WATER AND PROCESSING FLUIDS IN THE DAIRY INDUSTRY.





NEW TECHNOLOGIES EFFLUENT TREATMENT PLANT

1. DISSOLVED AIR FLOATATION SYSTEMS - FOR EFFICIENT REMOVAL OF FAT, OIL & GREASE , SCUM FROM DAIRY EFFLUENT

ABOUT 80-90 % REDUCTION IN OIL & GREASE LEVELS OBTAINED COMPARED TO CONVENTIONAL OIL SKIMMER.

2. MEMBRANE BIO- REACTOR (MBR) TREATMENT SYSTEM FOLLOWED BY AERATION SYSTEM – TO OBTAIN CONSISTENT AND VERY GOOD TREATED EFFLUENT QUALITY PARAMETERS .

Sl.no	Parameter	As per PCB Norms	MBR system
1	COD	< 250	10-15
2	BOD	< 30	< 5
3	TSS	< 100	NIL
4	OIL & GREASE	< 10	NIL



NEW TECHNOLOGIES

EFFLUENT TREATMENT PLANT

3. FINE BUBBLE DIFFUSED AERATION SYSTEMS WITH RETRACTABLE GRIDS AND SILICON MEMBRANES INSTEAD OF FIXED SURFACE AERATORS AND EPDM MEMBRANES.

THE RETRACTABLE GRID ENABLES EASY MAINTENANCE OF DIFFUSERS.

THE SILICON DIFFUSERS SHOW BETTER RESISTANCE TO FOULING THAN EPDM MEMBRANES.

4. DISSOLVED OXYGEN (DO) METER INTEGRATING WITH AIR BLOWERS WITH VFD DRIVE IN AERATION TANKS FOR ENERGY EFFICIENT OPERATIONS.

IF THE DESIRED LEVEL OF DO IS ATTAINED IN THE AERATION TANKS THEN THE RPM OF THE AIR BLOWERS IS REDUCED BY VFD DRIVE RESULTING IN ENERGY SAVINGS.

5. MECHANISED SLUDGE DE-WATERING SYSTEMS INSTEAD OF SLUDGE DRYING BEDS FOR EFFICIENT HANDLING OF THE SLUDGE ALL THROUGHOUT THE YEAR.

THE SLUDGE DRYING ON SLUDGE DRYING BEDS IS A MESSY THING AND IS NOT POSSIBLE DURING RAINY SEASON.

MECHANISED SLUDGE DE-WATERING SYSTEMS PRODUCE A SLUDGE CAKE WITH 20 % SOLIDS WHICH CAN BE EASILY HANDLED AND IS OF BAG ABLE CONSISTENCY.



NEW TECHNOLOGIES EFFLUENT TREATMENT PLANT

6. ONLINE COD, BOD, TSS, PH ANALYSER HOOKED UP TO CPCB SERVERS.

THIS IS AN ONLINE INSTRUMENT USED FOR MEASUREMENT OF VARIOUS EFFLUENT PARAMETERS LIKE, COD, BOD, TSS, PH, FLOW, IN TREATED EFFLUENT 24X7 AND IS HOOKED UPTO CPCB /LOCAL PCB SERVERS (TO BE MADE MANDATORY SHORTLY).

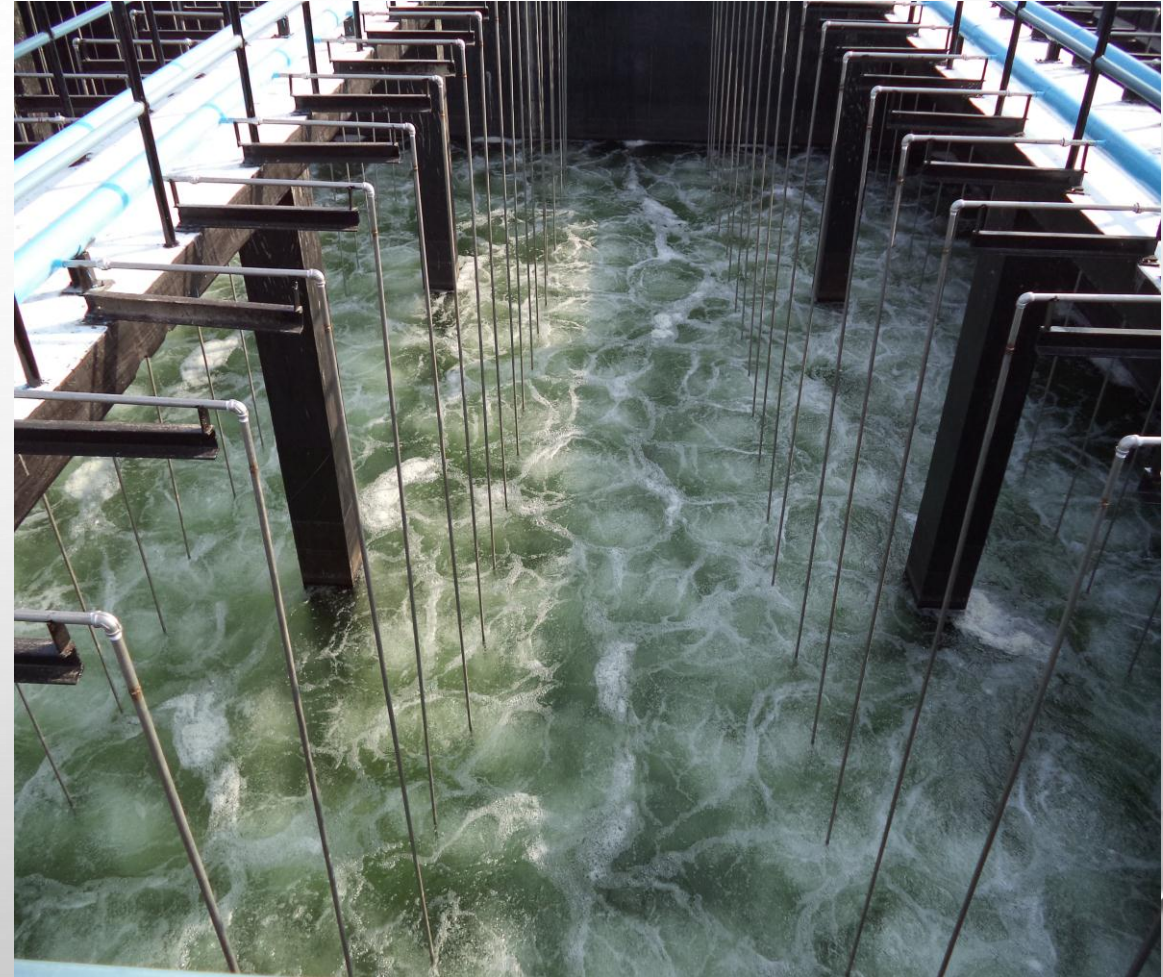
7. TERTIARY TREATMENT OF EFFLUENT TO MEET POTABLE WATER STANDARDS USING MBR, ACF (ACTIVATED CARBON FILTER), RO, MEE (MULTIPLE EFFECT EVAPORATOR)

THE OPERATING COST (UTILITIES, MEMBRANE REPLACEMENT EVERY THREE YEARS, CHEMICALS) WOULD BE ABOUT RS 150/KL OF TREATED WATER

MBR & FINE BUBBLE DIFFUSED AERATION



BANAS ETP-MBR SYSTEM





MECHANISED SLUDGE DEWATERING





THANKS !