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## MEASURES TO PREVENT EMERGENCY SITUATION AT A DAIRY PLANT

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**Key words:**

*Emergency situation*

*Dairy plants*

*Civil protection*

*Removal*

*Localization*

*Schedule of accident-free  
stopping*

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**ABSTRACT**

Requirements to design and placement of dairy enterprises are specified. The basic stages of development, preconditions and signs of emergency situations in such enterprises are provided. On the example of a dairy plant, a schedule of non-accidental stop of a plant producing condensed milk cans was developed.

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## ЗАХОДИ ЩОДО ЗАПОБІГАННЯ АВАРІЙНІЙ СИТУАЦІЇ НА МОЛОКОПЕРЕРОБНОМУ ПІДПРИЄМСТВІ

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*У статті визначено вимоги до проектування та розміщення молокопереробних підприємств. Наведено основні стадії розвитку, передумови й ознаки виникнення аварійних ситуацій на таких підприємствах. На прикладі молочноконсервного заводу розроблено графік безаварійної зупинки цеху з виробництва згущених молочних консервів.*

**Ключові слова:** аварійна ситуація, молокопереробне підприємство, цивільний захист, ліквідація, локалізація, графік безаварійної зупинки.

Processing enterprise is specified in the law of Ukraine "About Milk and milk products" as an enterprise which buys milk and raw milk, which has manufacturing facilities and conditions for the production of dairy products with guaranteed quality and safety in accordance with the regulating documents.

The design, location, construction, technical re-equipment and reconstruction of milk processing enterprise (plant, shop) is to be carried out in accordance with

acting safety requirements to design of the dairy industry; in accordance with public sanitary rules of planning and building of the human settlements, in accordance with building regulations and standards of technological design. Following of the above mentioned standards at all stages of the process, from the design of enterprise to the production of finished dairy products, is significant compulsory component of a comprehensive system of measures aimed at achieving of stable supply of customers with products of high-quality.

In accordance with its functional use, the territory of milk processing plant is divided into pre-plant zone, industrial zone, utility and storage territories. Administrative buildings, sanitary facilities, checkpoint, parking employees are located in pre-plant zone. The industrial buildings, mechanical repair plants are located in the production zone; the boilers, pump stations, storage of ammonia, oil products, fuel, construction and reserve building materials, packaging are placed in utility and storage zone. It should be mentioned that around borehole sand spare tanks for drinking water controlled zone is located, and protective zone is located round the treatment plant.

The design of the main production shops of the plant includes taking into account their location in accordance with the process flow and at the same time avoiding counter flows of raw materials and finished products [1].

Operating of dairy enterprises in full measure is enabled with plenty of technological equipment, workplace with proper working conditions, safety of vehicles, machinery and other capital goods.

Dairy plants are among the biggest in the food industry in terms of volume of production as well as in terms of the number of workers. Sizes of production facilities, automation of processes, large equipment (vacuum evaporators, dryers of different type, containers for temporary storage of raw materials and finished products) and large scale are the factors showing the necessity for the protection to prevent extreme emergencies. Such protection on dairy enterprises is provided by a system of civil protection.

Civil protection in Ukraine is a system of organizational, technical, sanitary, preventive and other measures that undertaken by the central and local executive bodies, local authorities and subordinated forces and means, enterprises, institutions and organizations regardless of ownership and by voluntary units [2]. They provide the implementation of measures for prevention and liquidation of emergency situations that threaten the lives and health of people and cause material damages in peace time and in times of crisis.

In foreign countries, civil protection, as a system of strategic viability of states, is designed to perform tasks that aimed at protecting of the population and economy from the situations of industrial and natural character.

Today almost all industrialized countries abroad are working to prevent natural and man-made disasters. This work is based on monitoring and forecasting. Each country develops and creates own variants of the national civil protection structures. Despite individuality all these systems are primarily guided by principles taking into account human law of the Geneva Convention of 1949.

Due to the scale of food enterprises, the number of working staff involved in production of consumer goods and due to quantity of technical equipment civil protection is of great importance in the food industry.

Considering the feasibility of the system described above we should mention that dairy industry is no exception from general trends since. Significant part of food industry enterprises can be treated as potentially dangerous objects.

Technical level of enterprises, concentration of production in big industrial cities, weak points of production location, organization of potentially dangerous activities in the zones of possible natural disasters should be treated as main factors affecting scale of the consequences of emergencies. Accidents often have catastrophic consequences accompanied by explosions, fires, radioactive and chemicals contamination of the environment [4].

The emergency situations are caused by violation of processes, equipment operation, temporary layoffs as a result of automatic safety locks and other local violations in the work of departments, sections and individual objects falling towers and power lines breaking.

Each industrial enterprise, including dairy plant, develops action plan of accident-free quick stop of production in case of an emergency (disaster). This plan should ensure decrease of risk of secondary damaging factors to the minimum. The feasibility of the plan and the willingness of staff to its execution are identified during civil protection (CP) testing.

Set of required documents for testing should be developed beforehand. Stages of development of the accident, conditions and characteristics of its origin, means of liquidation and localization on the example of ammonia refrigeration unit are shown in Table 1 below.

**Table 1. Stages of emergency development, conditions, signs of its occurrence, location and means of eliminating**

№	Scenario name and stage of accident	Background and signs of accident	Means of emergency protection	Technical means of emergency protection	The sequence of actions
1	Exceed of parameters above critical values	Increasing values	To warn others about the danger, to use personal protection equipment, to do the emergency stop of compressors, to switch on crash ventilation.	Button of compressors emergency stop, pipe line fire, hand trunks RS-50, CMB-50	Use personal protection equipment. Disconnect compressor using the emergency shutdown.
2	Depreciation or material fatigue of equipment	Corrosion, mechanical wear, damage of equipment	Evacuate people from the danger zone, isolate the zone, prevent entering of unauthorized individuals, work only in protection clothing	Filterrespirator C D, insulating respirator IP-4	Inform about emergency via system of alerts communication. Assess the situation. Disable bad block.

*Continuation of tabl. 1*

№	Scenario name and stage of accident	Background and signs of accident	Means of emergency protection	Technical means of emergency protection	The sequence of actions
3	Mistakes of personnel servicing and repairing of equipment	Spill, leak, formation of gas clouds, depressurization of systems during repairs	Provide first aid to victims, direct victims from the zone of lesions for examination. In the case of intense gas leak, give it to evaporate, to apply water spray for its deposition. Isolate zone of emergency situation, notify management.	Protective suits, personal protection equipment	Block ways of getting ammonia in sewers, basements, tunnels. Neutralize gas using water hand barrels IBS-50,.Surround danger zone and evacuate people. Provide assistance to victims. Send people to medical examination

Civil protection involves development of schedule of accident-free stopping of certain production zone or plant as a whole in order to prevent accidents on dairy enterprises system. For plotting of the schedule information about the content of preventive operations, their agents and t duration is required (Table 2).

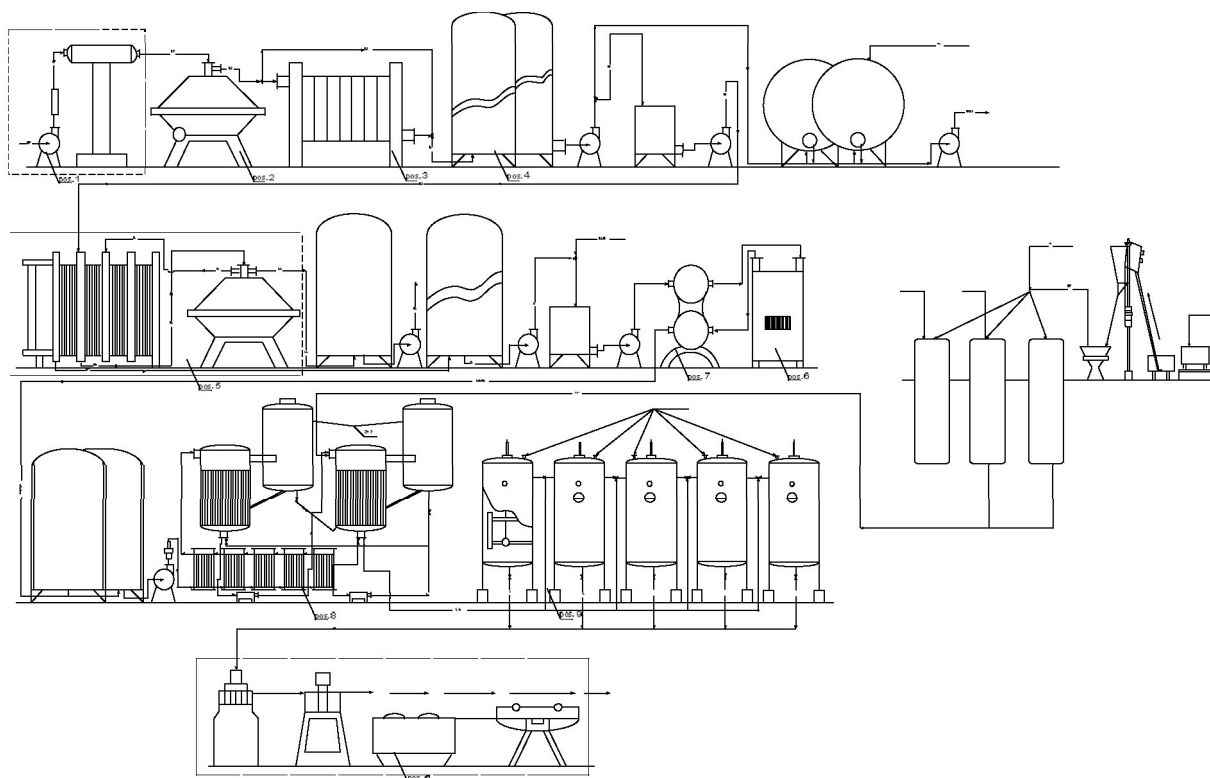
**Table 2. Content warning operation of accident-free stop the plant for the production of condensed canned milk with sugar and their duration**

	Content of the operation	Executor	Start of operation, min	End of operation, min
	Getting a signal	Responsible duty	1	2
	Notification of plants	Manager, Service of alerts	2	5
	Stop the raw feeding	Heads of departments, operators of industrial buildings	3	6
	Sequential shut down of batchers	Mechanical-engineer	4	7
	Stop and disabling of equipment on all production lines	Mechanical-engineer	4	20
	Evacuation of the personnel	Responsible duty	5	11
	Disconnection of the voltage from power panels, switching off sources of emergency lighting	Duty electrician, chief of the plant	10	17
	Covering the raw	Responsible staff	7	15
	Blocking water and heating system	Duty mechanic	7	9
	Turning off the power of plants on the main distributing board	Chief Energy	14	20
	Disabling the well, blocking water	Mechanical-engineer	7	10
	Reporting to the chief engineer about shutdown of the production department, or milk processing enterprises in general	Chief Engineer	18	22

Data from Table 2 shows that during emergency stop of an enterprise the most intervals are spent for such operations as evacuation, equipment stop and turn off.

Schedule of trouble-free stop of the milk processing enterprises is shown on the example of prevention of emergency situations during the production of condensed canned milk with sugar.

Total technological scheme of sweetened condensed milk production is shown on Fig. 1.



**Fig. 1. Technological scheme for production of condensed milk with sugar**

Analyzing the data from Figure 1, we can say that the production of condensed milk cans requires the using of plenty of technological equipment and facilities.

Production of canned milk is performed in the following sequence: receiving milk (position 1), cleaning (position 2), cooling (position 3) and the temporary reservation (position 4), normalization (position 5), homogenization (position 6), pasteurization (position 7), condensation (position 8), cooling (item9), packing (position 10) [3]. In general, the production process provided such equipment and facilities as pumps for liquid and condensed products, cleaners, separators, tanks for interim reservation raw, pasteurizer-holder, tubular heat exchangers, homogenizers, vacuum evaporators, crystallizers, packing machines and so on.

Some technical equipment (vacuum evaporators, crystallizers) used in the production of condensed milk cans has large size and requires significant cost of resources, regular and thorough examination of service ability and capacity.

Schedule of trouble-free stop of the plant producing canned milk is shown in Fig. 2.

In the dairy plants according to the Order of the Ministry of Ukraine of Emergencies and Affairs of Population Protection from the Consequences of Catastrophe in Chernobyl No 288 of 15.05.2006 "Regulations setting, operation and maintenance of systems for early detection of emergency situations and notification of people at the moment of their occurrence" system of automatic early detection of emergencies, objective warning system, and on-call dispatcher service were established.

The plant which can threaten people's lives and also can cause damage is equipped by automatic systems for early detection of emergencies. This system includes technical sensors, sirens, etc. They control the dangerous parameters of equipment and environment.

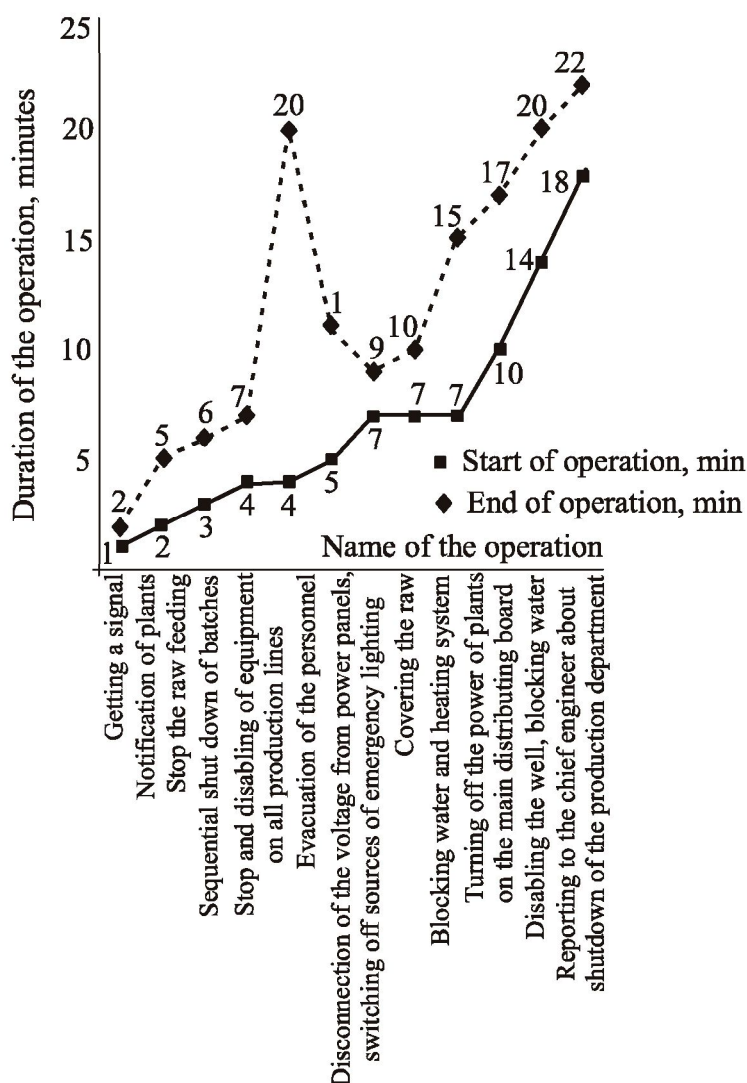


Fig. 2. Schedule of trouble-free stop of plant producing condensed milk cans

Object warning system provides alert of management and staff working in dairy plants employees on duty and responsible for shift in the rescue service of civil protection units, which are involved in joint action to eliminate and locate the accident. Such system includes an electric siren to send an "All attention" warning signal, street speaker, illuminated signs (information board), subscriber radio

receiving of the network public broad casting, centralized calling system, direct dial telephone between on duty manager and on duty employee of MIA.

The responsibility for timely notification of people who are on the territory of an enterprise and attracting of the necessary capabilities of civil protection services to control and eliminate an emergency (accident) relies on manager. The results of the above mentioned notification and arrival capabilities CP on duty service manager reports to the authorized supervisor of liquidation (localization) of emergency.

After receiving the notification about the accident manager should immediately perform the following steps via using the object warning system: enable a remote sirens start to transmit sound electric siren which means "All attention", transmit the appeal text to people who are on the territory of the enterprise, via the hotline with another MIA must report about the occurrence of the situation at the plant to attract the necessary capabilities of CP services (Deadline for notification is 3 minutes).

The time scheduled for collection capabilities of civil protection depends on the time of their gathering and the distance to the accident), to inform the company's management about emergency situation, to inform safety Inspector about the situation at the enterprise.

### **Conclusions**

The proposed engineering measures reduce the risk of accidents, fires, explosions, reduce material loss of plants, protect employees from entering into possible defer at zone of. A set of preventive measures ensures the security of all employees and, thereby, contribute to ensuring the necessary conditions of work of milk processing plant.

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## **МЕРЫ ПО ПРЕДУПРЕЖДЕНИЮ АВАРИЙНОЙ СИТУАЦИИ НА МОЛОКОПЕРЕРАБАТЫВАЮЩЕМ ПРЕДПРИЯТИИ**

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*В статье определены требования к проектированию и размещению молокоперерабатывающих предприятий. Приведены основные стадии развития,*

*предпосылки и признаки возникновения аварийных ситуаций на таких предприятиях. На примере молочноконсервного завода разработан график безаварийной остановки цеха по производству сгущенных молочных консервов.*

**Ключевые слова:** *аварийная ситуация, молокоперерабатывающее предприятие, гражданская защита, ликвидация, локализация, график безаварийной остановки.*