



**MYRRHA phase 1
implementation**

MINERVA

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PS03 Wastewater Handling and Treatment System Description

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2	Modifications included according to Description CS Rev 1, 092-423-RM-M-14600 (NA.PS03_PDB501)
3	Updated for Basic Design (IIB), according to SCK CEN comments and new input data
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4	8 8.1.2 8	Sump pits and buried pipes final location and routing Fire Extinguishing Systems Location and heights of the lowest points for draining circuits	Preliminary Pending Pending

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1 Introduction

The MINERVA project is embedded in the overall MYRRHA programme. Following the phased MYRRHA implementation strategy, the first facility that will be constructed at SCK CEN, Mol (Belgium) will be the first part of the 600 MeV MYRRHA LINAC that will deliver intense proton beams up to 100 MeV. The 100 MeV accelerator together with the proton target facility (PTF) and full power facility (FPF) is named MINERVA (MYRRHA Isotopes productionN coupling the linEar acceleRator to the Versatile proton target fAcility).

Tractebel together with its Consortium Partner Empresarios Agrupados acts as Design Engineer of all the Structures, Systems and Components (SSC) necessary to operate the MINERVA Accelerator, and covered under the term Nuclear Facilities (NF), except for the accelerator systems themselves, which are excluded from the Design.

The framework and more details about this project can be found in the Project Execution Plan (Ref. [7]).

2 Scope and Purpose

This document describes the functions and physical layout of the PS03 Wastewater Treatment System. It also defines the system's instrumentation and control, its interfaces with other systems and the most important characteristics of its major components, including also Operation and Control and normal functionality.

3 Acronyms

The complete list of acronyms used in the MINERVA project is included in the SCK CEN document "Abbreviations, Glossary and symbols", Ref. [1].

4 Assumptions

The following assumptions have been taken into account:

- [1] It is foreseen that laboratories produce some non-nuclear chemical waste (chemical dilution liquid waste) that shall be collected independently and managed by an external specialized processor according to SCK CEN procedure (Ref. [13]). Laboratories also produce industrial wastewater, when they are located in non-designated areas.
- [2] Continuous drainage of non-nuclear chemicals is not foreseen from the water treatment package plants. These drains can be collected in collection bins.

5 Input Data List

N°	Original Document			Data	Status
	N°	Ed.	Title		
1	=NA.PS03_MEC001	v0 (25-08-2022)	PS03 Waste water – Functional Specifications	System functional specifications and requirements	V
2	092-423-DP-M-14600-B (NA.PS03_PFB501) Comment Sheet	Rev 3	Comment Sheet (CS) to the PFD	SCK CEN comments on the PS03 Wastewater Handling and Treatment System PFD	V
3	SCK CEN/25619566	Rev 2	SUP-radiologische limieten	B02 Activity levels of liquid waste	V
4	CLASS-NGA nl_2020-0826	-	Class-NGA: classificatie van het NGA	Activity levels of liquid waste	V
5	092-423-RM-M-14600 (NA.PS03_PDB501) Comment Sheet	Rev 0, 1, 2 & 3	Comment Sheet (CS) to the Description	Modifications included according to Description CS Rev 0, 1, 2 & 3	V
6	Procedure 52-INS-013 (SCK CEN/4566353ISC)	-	Management of drainage and discharge point of HAW_BAW_rub 3_2 and 3_4	Limits of discharge to the Municipal and Industrial sewer nets	V

Nº	Original Document			Data	Status
	Nº	Ed.	Title		
7	SCK CEN/48331860	Rev 1	=NA.PS-ID1169.docx	Water activation in ACC NF (B02)	V
8	SCK CEN/48333794	Rev 1	=NA.PS-ID1173.docx	Accurate definition of water discharge	V
9	SCK CEN/48336535	1	=NA.PS-ID2288.docx	Municipal, Industrial and Non-contaminated/Non-activated wastewater design and terminal points expected from PTF, FTS and other facilities (such as laboratories)	V
10	SCK CEN/49209729	2	=NA.AA-ID2567.docx	Rainwater pipes shall not be put outside of the façades	V
11	SCK CEN/38700667	-	MINERVA – General ALARA checklist and review	Project ALARA criteria	V

6 System Functions and Configuration

6.1 System Functions

The main function of the Wastewater Treatment System is to collect, monitor, control, condition, store and transfer the liquid wastes to different facilities, an authorized handler, or, in some cases, to reutilize.

The Wastewater Treatment System also classifies the different effluents according to the source, the radioactivity level and the contaminants in order to apply the necessary treatment.

The specific functions related with the different PS03 subsystems are:

- Municipal wastewater subsystem (NA.PS03.GMA10) for the collection, monitoring, handling and transfer of Municipal Wastewater.
- Industrial wastewater subsystems (NA.PS03.GMB_):
 - Industrial Glycol wastewater subsystem (NA.PS03.GMB10) for the collection, monitoring, handling and transfer of Glycol Wastewater.
 - Industrial Laboratories wastewater subsystem (NA.PS03.GMB20) for the collection, monitoring, handling and transfer of industrial wastewater.
 - Industrial Chemical Drainage subsystem (NA.PS03.GMB30) for the collection, monitoring, handling and transfer of chemical wastewater.
 - Industrial Softened wastewater subsystem (NA.PS03.GMB40) for the collection and transfer of softened wastewater.
 - Industrial Adiabatic Coolers Blowdown wastewater subsystem (NA.PS03.GMB50) for the collection, monitoring, handling and transfer of softened wastewater from the adiabatic coolers blowdown.
 - Industrial Demineralized wastewater subsystem (NA.PS03.GMB60) for the collection, monitoring, handling and transfer of demineralized wastewater.
- Potentially Contaminated/Activated B02 wastewater subsystem (NA.PS03.GMD10) for the collection, monitoring, handling and transfer of potentially contaminated/activated wastewater.

According to ID1, rainwater is in the scope of PS03. However, the rainwater system and strategy are designed by the Masterplan and Building Architecture disciplines in their corresponding deliverables.

6.2 System List

Taking into account the different qualities of wastewater to be collected, as referred to in Section 6.1, several subsystems have been considered into the Wastewater Treatment System. Each of these subsystems comprise the specific wastewater drainage, storage and transfer to internal/external handler.

The list of subsystems and equipment that comprise the system will be included in the MINERVA ACC NF SSC List (Ref. [9]).

6.3 Fluid Characterization

The different fluid process media that are considered in the PS03 Wastewater Treatment System, attending to the different wastewater qualities expected, are the following:

- Municipal Wastewater will be sanitary waste from toilets, showers, kitchens and cafeterias.

- Glycol Wastewater will be the softened water/propylene glycol (40 % wt.) mixture used in the PS01 cooling loops and MAC users.
- Industrial Wastewater will be the mixture of non-activated wastewater (potable, softened, demineralized) drained from laboratory sinks and floors and drains from PS01, PS02 and MAC NF glycol-free and chemical-free sources.
- Industrial Chemical Wastewater from laboratories and water treatment plants, where the composition is variable.
- Softened Wastewater will be the softened wastewater from the PS01 and PS02 circuits and MAC NF users.
- Demineralized Wastewater will be the demineralized wastewater from the PS01 and PS02 circuits and MAC NF.
- Activated Wastewater will be the wastewater generated in controlled/supervised areas in the MCB. It will be preliminary classified as B02 based on ID7.

All these process media will be included in the MINERVA ACC NF Fluid List (Ref. [8]).

Stream information of the main process lines of the different subsystems, including the process fluid and their operating conditions, is included in the system Process Flow Diagram (PFD), Ref. [3].

7 System Boundaries and Interfaces

The interfaces of the system with other systems or related equipment are described below. The interfaces are classified into those that are necessary for the system or operation - support systems - and those that are supplied by the system and needed so that other systems can perform their function - dependent systems.

The systems that interface with Wastewater Handling and Treatment System are set out below:

7.1 Support systems

- Low voltage system, necessary for the operation of system equipment, such as the pumps.
- Instrumentation and Control (I&C) system.
- Nuclear HVAC system. It is necessary to manage the vents coming from the Potentially Contaminated/Activated B02 Wastewater Holding Tank.
- PS04 – Solid Waste Treatment. It is necessary for the manage of the glycol and chemical wastewater portable bins.
- PS05 - Industrial gases. It is necessary for the supply of compressed air to the pneumatic valves of the system and nitrogen supply for inert blanketing of the Potentially Contaminated/Activated B02 Wastewater Holding Tank.
- MAC NF.PS03, for further management of the Activated Wastewater.

7.2 Dependent Systems

- PS01 - Cooling Systems: water to be drained by the PS01 will be managed by the PS03. Also, PS03 will work as a water supplier for the PS01 when wastewater can be reused.
- PS02 - Water Preparation and Supply: water to be drained by the PS02 will be managed by the PS03.
- MAC NF: Non-activated wastewater generated in MAC will be transferred to NA.PS03 for further management.
- ACC NF Systems and buildings: Wastewater generated in ACC will be managed by the NA.PS03.
- Plumbing and sewer systems.

7.3 Terminal Point List

The different terminal points of the PS03 Wastewater Handling and Treatment System with the site external facilities, ACC systems and MAC will be included in the MINERVA ACC NF Terminal Point List, Ref. [10].

These terminal points are also identified and numbered in the System Process Flow Diagram, Ref. [3] and P&ID, Ref. [11].

8 System Design Description

8.1 Design Description

The PS03 collects wastewater from the different SSC's for its storage, monitoring, handling and treatment before its dispatch or reutilization.

The PS03 also classifies the different effluents according to the source in municipal wastewater, industrial wastewater, rainwater and potentially contaminated / activated B02 wastewater, in order to apply the necessary handling requirements and discharges to the different terminal points.

According to the Masterplan of MINERVA Ref. [6], and considering the main SSC's that will be served, it has been done a sizing of the system that allows defining an initial location of the equipment in order to foresee the different space reservations in the project Masterplan.

The sizing of the main equipment of PS03 is detailed in the document "Sizing, design and capacity calculations" (Ref. [5]) and it is shown in the PFD (Ref. [3]) and P&ID (Ref. [11]).

8.1.1 Municipal Wastewater Subsystem (NA.PS03.GMA10)

8.1.1.1 Municipal Wastewater Subsystem (NA.PS03.GMA10)

The objective of the Municipal Wastewater Subsystem is to collect, buffer and discharge the wastewater from the sanitary installations to the municipal sewer system.

It collects wastewater from cafeterias, kitchens, toilets and showers from the MCB and MAC. This wastewater can be buffered during a working day in the Municipal Wastewater Sump pit (NA.PS03.GMA10.BB110) located outdoors (as the capacity allows it), and pumped towards the municipal sewer system discharge connection (TP.PS03.0001).

This sump pit is also connected to the industrial sewer system discharge connection (TP.PS03.0015) to allow the temporary discharge of these wastewater towards the industrial wastewater discharge pipe if the discharge to the Municipal Sewer System is not available. (ID8).

This sump pit is inspectable for in-situ sampling, to ensure that the discharge of municipal wastewater into the public sewer complies with the required limits (ID6). Municipal wastewater is not foreseen to exceed the limits to discharge to the TP, so no provisions at this stage of the project are foreseen to connect to a tank trailer.

8.1.1.2 Components description

The municipal wastewater transfer pumps (NA.PS03.GMA10.AP011/012) are (2 x 100%) pumps (one on standby), of 16.5 m³/h design flow capacity that transfer the liquid from the municipal wastewater sump pit to the Municipal Sewer System (TP.PS03.0001), or to the Industrial Sewer System (TP.PS03.0015). They are located outdoors and inside the Municipal Wastewater Sump Pit (NA.PS03.GMA10.BB110).

8.1.1.3 Components arrangement

According to ID8, a connection point to Municipal wastewater sewer is proposed (TP.PS03.0001). The Municipal Wastewater Sump Pit (NA.PS03.GMA10.BB110) and related pumps will optimize the discharge of the municipal wastewater from the sources to the municipal wastewater sewer. Therefore, the sump pit will be located in the south of the MCB, allowing the discharge by gravity from all the sources to the Municipal Wastewater Sump Pit (NA.PS03.GMA10.BB110).

The preliminary location of the sump pit will be somewhere on the surface highlighted in the Figure 1. The definitive location will be studied together with Masterplan discipline.

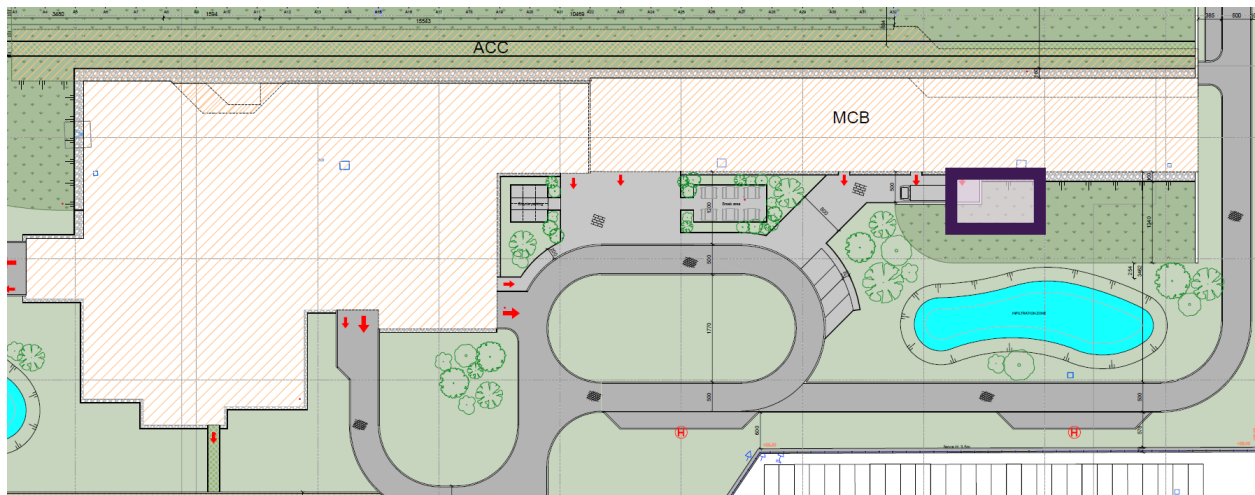


Figure 1. Municipal Wastewater Subsystem (NA.PS03.GMA10) components arrangement

The location of the TP.PS03.0001 to discharge the municipal wastewater from MINERVA is shown in Ref. [4].

8.1.2 Industrial Wastewater (NA.PS03.GMB_)

The main function of these subsystems is to collect, buffer and discharge the Industrial Wastewater from MINERVA into different destinations as detailed below.

8.1.2.1 Industrial Glycol Wastewater Subsystem (NA.PS03.GMB10)

Glycol containing water from the PS01 cooling loops and glycol water users is buffered into:

- Portable bins, when the wastewater can be drained by gravity from the different low points of the circuits to the portable collection bins. This will be analysed and pumped again by means of a portable pump (NA.PS03.GMB10.AP020) to the corresponding circuits if it is reusable. If glycol-water is not reusable, wastewater can be transported to an External Treatment Facility inside the portable bins (TP.PS03.0007), or otherwise, it can be poured into the Glycol-Water Sump Pit to pump the glycol wastewater inside a tank trailer (TP.PS03.0008). MAC glycol-water will be poured into cubitainers, transferred to ACC NF (by TP.PS03.4003). The final destination and handling of the cubitainers will be on the part of PS03, although their transfer and storage in MINERVA will be carried out by PS04.
- Glycol-water Sump Pit (NA.PS03.GMB10.BB110), when wastewater cannot be drained by gravity from the low points of the PS01 cooling loops and glycol water users to the portable collection bins, and for the collection of glycol-water leakages collected by the floor drains of rooms where glycol water systems are located. Glycol-water is buffered inside this sump pit, until it is pumped to a tank trailer (TP.PS03.0008). This sump pit is inspectable for in-situ sampling (if required).

8.1.2.1.1 Components description

The Industrial Glycol Wastewater Subsystem (NA.PS03.GMB10) has the following components:

- Glycol Water Transfer pumps (NA.PS03.GMB10.AP011/012) are (2 x 100%) pumps (one on standby), of 4.95 m³/h design flow capacity that transfer the liquid from the glycol water sump pit to a tank trailer (TP.PS03.0008). They are located outdoors and inside the Glycol Water Sump Pit.
- Portable Transfer Pump (NA.PS03.GMB10.AP020) is (1x100%) pump of 2.2 m³/h design flow capacity that transfers the liquid from the glycol water portable collection bins to the PS01 Cooling Loops to reuse the water, if possible.

8.1.2.1.2 Components arrangement

The Glycol Water Sump Pit will be preliminary located outside, at the north of the AUB, in order to collect by gravity all the glycol-wastewater from the AUB, as it is where the tanks and more amount of glycol are foreseen. However, the precise location of this sump pit is pending until the height of the low points of the different circuits to be drained into this pit is known.

Therefore, it will be to the north of the AUB/CCB that a loading area for glycol water into tank trailers will be foreseen. The preliminary location of the sump pit and the loading area for glycol water into tank trailers will be somewhere on the surface highlighted in the Figure 2. The definitive location will be studied together with Masterplan discipline.

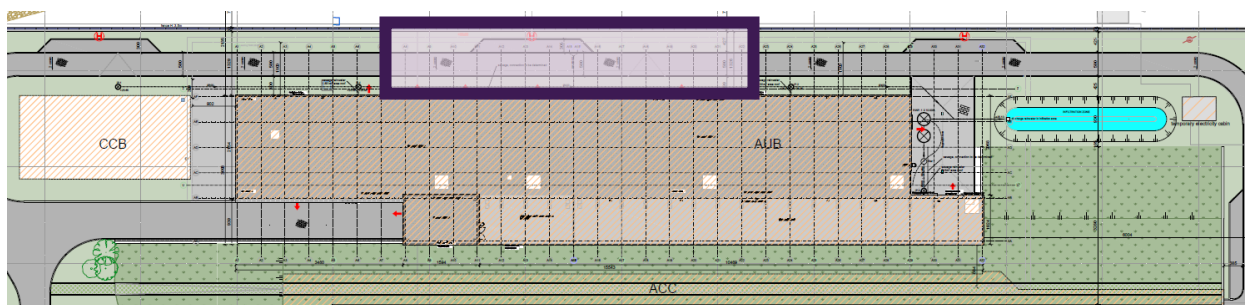


Figure 2. Industrial Glycol Wastewater Subsystem (NA.PS03.GMB10) AP011/012 components arrangement

8.1.2.2 Industrial Laboratories Wastewater Subsystem (NA.PS03.GMB20)

Water from labs sinks, floor drains and drains from water circuits (non-activated, glycol-free and chemicals-free) along with MAC Industrial wastewater is collected in several pits and guided to the industrial sewer system (TP.PS03.0015):

- One leaktight pit to collect and pump the drains from the basement of the AUB.
- One sump pit to collect and pump the drains from the AUB/CCB. This will collect also the fire extinguishing wastewater in the AUB (if exists).
- One sump pit to collect and pump the drains from the MAC and MCB. Is in this sump pit where water analysis systems (pH and conductivity) are foreseen, by a recirculation pipeline. If the measures taken show that wastewater is out of the limits for discharge to the TP.PS03.0015 (ID6), a branch line is foreseen to connect to a tank trailer (TP.PS03.0009). Also this sump pit is inspectable for in-situ sampling.

8.1.2.2.1 Components description

The Industrial Laboratories Wastewater Subsystem (NA.PS03.GMB20) has the following components:

- Industrial Wastewater Collection Pumps (NA.PS03.GMB20.AP031/032) are (2 x 100%) pumps (one on standby), located in the Drainage and Transfer Room Leaktight Pit, of 2.75 m³/h design flow capacity that transfer the industrial wastewater from the Drainage and Transfer Room Sump Pit (AUB) to the Industrial Wastewater North Sump Pit (outdoors).

- Industrial Wastewater North Transfer Pumps (NA.PS03.GMB20.AP021/022) are (2 x 100%) pumps (one on standby), located in the Industrial Wastewater North Sump Pit (NA.PS03.GMB20.BB120), of 6 m³/h design flow capacity that transfer the industrial wastewater generated in the AUB and collected in the Industrial Wastewater North Sump Pit (NA.PS03.GMB20.BB120) (outdoors) to the Industrial Wastewater South Sump Pit (NA.PS03.GMB20.BB110) (outdoors).
- Industrial Wastewater South Transfer Pumps (NA.PS03.GMB20.AP011/012) are (2 x 100%) pumps (one on standby), located in the Industrial Wastewater South Sump Pit (NA.PS03.GMB20.BB110), of 16 m³/h design flow capacity that transfer the industrial wastewater from the Industrial Wastewater South Sump Pit (NA.PS03.GMB20.BB110) (outdoors) to the TP.PS03.0015.

8.1.2.2.2 Components arrangement

The Drainage and Transfer Room Leaktight Pit will be located in the Drainage and Transfer Room (AUB L-1), in order to collect the drains from the Industrial Demineralized Wastewater Subsystem (NA.PS03.GMB60), which are located in this room.

The Industrial Wastewater North Sump Pit (NA.PS03.GMB20.BB120) will be located outside, at the north of the AUB, to collect by gravity all the industrial wastewater generated in the AUB. The precise location of this sump pit remains pending the freezing of the general layout of the AUB and the Masterplan.

The Industrial Wastewater South Sump Pit (NA.PS03.GMB20.BB110) will be located outside, at the south of the MCB, to collect the wastewater generated in MAC and MCB. The precise location of this sump pit remains pending the freezing of the general layout of the MCB and MAC and the Masterplan, so it facilitates the drainage by gravity from both buildings (from the MCB point of view, it is possible, as far as the industrial wastewater comes from upper floors).

The preliminary location of the pits will be somewhere on the surfaces highlighted in the Figure 3. The definitive locations will be studied together with Masterplan and BA disciplines.

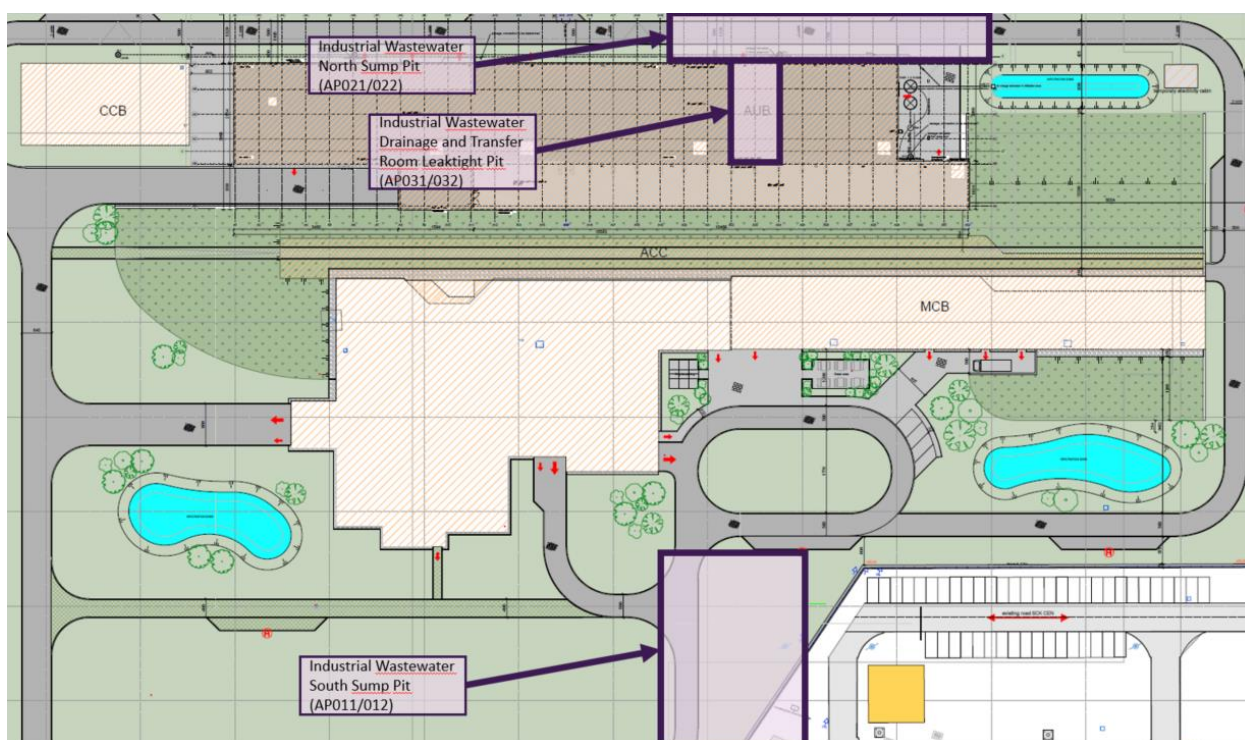


Figure 3. Industrial Laboratories Wastewater Subsystem (NA.PS03.GMB20) components arrangement

The location of the TP.PS03.0015 to discharge the industrial wastewater from MINERVA is shown in Ref. [4].

8.1.2.3 Industrial Chemical Drainage Subsystem (NA.PS03.GMB30)

Industrial Chemical Drainage Subsystem (NA.PS03.GMB30): Chemical liquids from laboratory and water treatment plants are collected separately and by gravity in portable chemical collection bins for its disposal by an authorized handler (TP.PS03.0005) (assumption [1]).

This wastewater will be mainly generated in the different laboratories, where workers will pour the chemical wastewater into the corresponding bins; and in the Water Treatment Room, where the water treatment package systems of PS02 will pour the chemical wastewater into different bins according to the nature of the chemicals (assumption [2]).

When the portable collection bins are filled, these are replaced by empty ones. The filled portable collection bins will be handled by the PS04 as conventional solid waste and stored in the Conventional Storage Room (MCB) until it is packed up by an Authorized Handler.

8.1.2.4 Industrial Softened Wastewater Subsystem (NA.PS03.GMB40)

Softened wastewater from PS01 and PS02 circuits is collected and transferred by gravity to the closest industrial wastewater sump pit, to be managed as industrial wastewater (NA.PS03.GMB20, Section 8.1.2.2).

8.1.2.5 Industrial Adiabatic Coolers Blowdown Wastewater Subsystem (NA.PS03.GMB50)

Softened wastewater from the blowdown of the adiabatic coolers, as well as the drains from the Softened Water Storage Tank (NA.PS02.GKC10.BB010) are collected into the Adiabatic Coolers Blowdown Sump Pit (NA.PS03.GMB50.BB110) and pumped to the lagoon during normal operation.

If the header to the lagoon is not available due to maintenance operations in the pipeline, this wastewater will be discharged to the industrial sewers system (TP.PS03.0015).

8.1.2.5.1 Components description

The municipal wastewater transfer pumps (NA.PS03.GMB50.AP011/012) are (2 x 100%) pumps (one on standby), of 16.87 m³/h design flow capacity that transfer the liquid from the adiabatic coolers blowdown sump pit (NA.PS03.GMB50.BB110) to the lagoon.

8.1.2.5.2 Components arrangement

The Adiabatic Coolers Blowdown Sump Pit (NA.PS03.GMB50.BB110) will be located outdoors, in a place where gravity drainage is possible from the PS02 Softened Water Tank and from the PS01 adiabatic coolers. Preliminary, it is foreseen to be located at the east of the AUB, although this will be precisely defined when Masterplan and buried pipes and the height and location of the previous mentioned tank and adiabatic coolers drainage points are fixed.

The preliminary location of the sump pit will be somewhere on the surface highlighted in the Figure 4. The definitive location will be studied together with Masterplan.

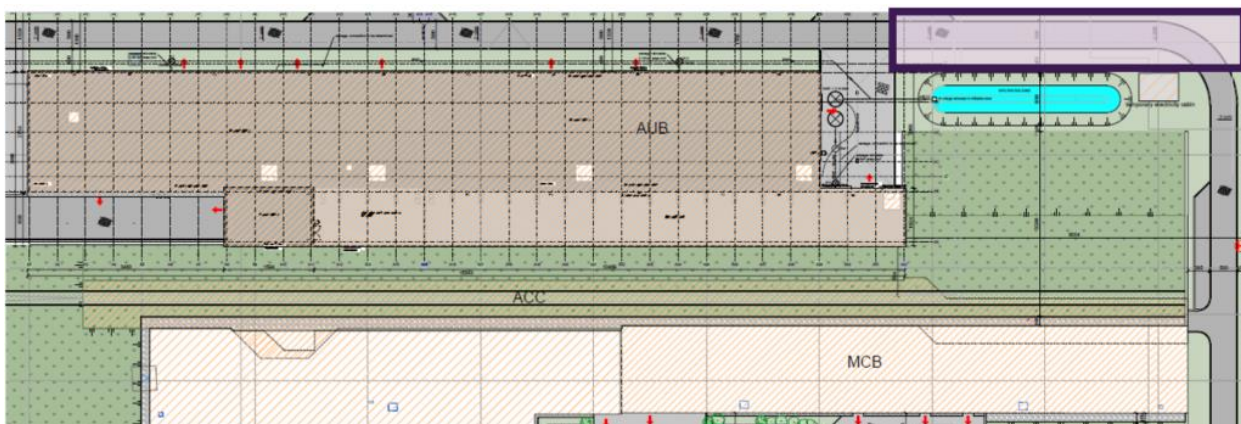


Figure 4. Industrial Adiabatic Coolers Blowdown Wastewater Subsystem (NA.PS03.GMB50) components arrangement

The location of the discharge to the lagoon is shown in Ref. [4].

8.1.2.6 Industrial Demineralized Wastewater Subsystem (NA.PS03.GMB60)

Demineralized wastewater from PS01 cooling loops and PS02 system, will be drained by gravity to the PS03 Industrial Demineralized Wastewater Tanks (NA.PS03.GMB60.AP011/012), located at the drainage and transfer room of the AUB (level -1), where it will be stored and analysed (pH and specific conductivity) during the maintenance operations of the circuits. Also in-situ sampling will be available if more measures to be taken from the wastewater are needed. As wastewater coming from different circuits (PS01 and PS02), a recirculation loop is included to homogenise the liquid inside the tanks, and in order to take a representative sample and measurement of the characteristics of the liquid.

Once the wastewater have been measured, if reuse in the PS01 cooling loops is considered, NA.PS03.GMB60.AP011/012 will pump the water to the corresponding PS01 cooling loop. If its characteristics are not good enough to reuse the water, it is considered as wastewater and is pumped to the Industrial Wastewater North Sump Pit (NA.PS03.GMB20.BB120), to be subsequently evacuated via the TP.PS03.0015.

Demineralized wastewater that cannot be drained to this tanks by gravity, will be directly discharged to the Industrial Laboratories Wastewater Subsystem (NA.PS03.GMB20). This will be further analysed when the buildings layout and the location of the PS01 and PS02 draining points are available.

8.1.2.6.1 Components description

The Industrial Demineralized Wastewater Subsystem (NA.PS03.GMB60) has the following components:

- The Industrial Demineralized Wastewater Tanks (NA.PS03.GMB60.BB011/012) are (2 x 50%) atmospheric tanks, of 5 m³ design capacity that hold the demineralized wastewater from the PS01 and PS02 drains.
- The Industrial Demineralized Wastewater Transfer pumps (NA.PS03.GMB60.AP011/012) are (2 x 100%) pumps (one on standby), of 2.73 m³/h design flow capacity that transfer the liquid from the Demineralized Wastewater Tanks (NA.PS03.GMB60.BB011/012) tanks to the PS01 cooling loops if the wastewater is reusable, or to the Industrial Wastewater North Sump Pit (NA.PS03.GMB20.BB120) if it is not reusable.

8.1.2.6.2 Components arrangement

All the components defined in 8.1.2.6.1 are located in the Drainage and Transfer Room (AUB L-1), in order to facilitate the collection by gravity-driven pipes of all the drains generated by the PS01 and PS02 systems. The preliminary location of the components will be somewhere on the surface highlighted in the Figure 5. The definitive locations will be studied together with BA discipline.

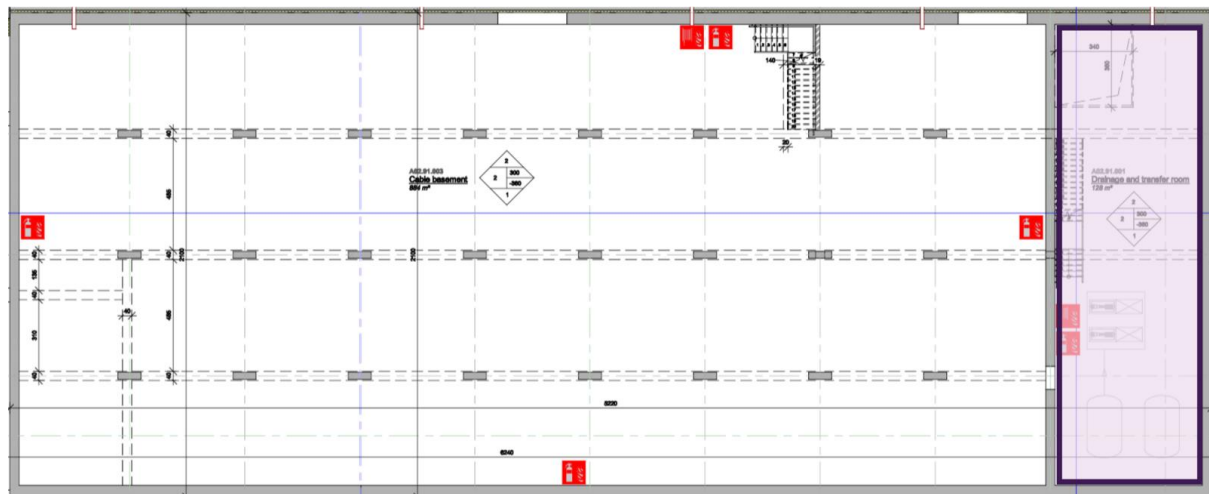


Figure 5. Industrial Demineralized Wastewater Subsystem (NA.PS03.GMB60) components arrangement in AUB basement

The location of the discharge to the Industrial Wastewater North Sump Pit (NA.PS03.GMB20.BB120) is shown in Figure 3.

8.1.3 Potentially Contaminated/Activated B02 Wastewater Subsystem (NA.PS03.GMD10)

8.1.3.1 Potentially Contaminated/Activated B02 Wastewater Subsystem (NA.PS03.GMD10)

The potentially contaminated/activated wastewater is preliminary classified as B02, according to ID7. This subsystem is in charge of collecting and handling safely the wastewater from controlled and supervised areas from the MCB.

All water that is collected in ACC controlled and supervised areas is assumed to be B02 and it is guided to the different Potentially Contaminated/Activated Wastewater sump pits via gutters and pipes. From this sump pit/pump well, the liquid is pumped to the MAC through the TP.PS03.4005 (unique pipeline driving B02 wastewater from ACC NF to MAC NF) or to the Potentially Contaminated/Activated B02 Wastewater Holding Tank, depending on the location and source of the wastewater:

- Controlled drains led directly from the emptying of the loops to the sump pits that are located in the Injector Room and in the Cooling Systems Room, are directed to different sump pits (NA.PS03.GMD10.BB130 and NA.PS03.GMD10.BB150), which will pump the water into the Potentially Contaminated/Activated B02 Wastewater Holding Tank (NA.PS03.GMD10.BB010).
- Controlled drains led directly from the emptying of the loops to the sump pits that are located in the SC Linac Tunnel, as well as the floor drains, sinks, emergency showers and eyewash and drains from the PS03 holding tank are collected in different sump pits (NA.PS03.GMD10.BB120, NA.PS03.GMD10.BB110 and NA.PS03.GMD10.BB160), which will pump the water directly through the TP.PS03.4005 to MAC, to be further analysed and managed.

Wastewater collected and stored in the Potentially Contaminated/Activated B02 Wastewater Holding Tank (NA.PS03.GMD10.BB010), due to the emptying of the PS01 cooling loops, will be homogenised by the recirculation loop, where it will be sampled and measured (pH, specific conductivity and radioactivity), once

the section of the PS01 loop has been emptied. Also manual samples can be taken from the recirculation loop, keeping certain distances from the tank, and providing radiological protection for workers under ALARA criteria.

Once the water is measured, it is declared as reusable or not, depending on its characteristics (Ref. [14]). If reusable, water is pumped again to the PS01 cooling loops when maintenance work on the loops has been completed. If not reusable, water is declared as wastewater and pumped directly to the MAC through TP.PS03.4005, and the PS01 cooling loop is filled with demineralized water produced by the PS02.

The Potentially Contaminated/Activated B02 Wastewater Holding Tank (NA.PS03.GMD10.BB010) is located inside a leaktight containment pit, in order to avoid the spreading of activated wastewater through the Cooling Systems Room in case of tank collapse. Wastewater will be retained inside the leaktight containment pit, until its discharge by gravity to the Potentially Contaminated/Activated B02 Wastewater Sump Pit (Buffer Room) (NA.PS03.GMD10.BB120) is possible, in order to pump the wastewater to MAC.

8.1.3.2 Components description

Several sump pits are located inside the MCB to collect the potentially contaminated/activated B02 wastewater:

- Two sump pits to collect the PS01 cooling loop drains in the Cooling Systems Room (NA.PS03.GMD10.BB130) and in the Injector Room (NA.PS03.GMD10.BB150), to pump the wastewater to the Potentially Contaminated/Activated B02 Wastewater Holding Tank (NA.PS03.GMD10.BB010). These sump pits are sealed to prevent water entering from the floor of the room (e.g. with a waterproof cover).
- Two sump pits (NA.PS03.GMD10.BB110 and NA.PS03.GMD10.BB160) to collect the PS01 cooling loop and floor drains from the SC LINAC Tunnel and pump it to the TP.PS03.4005.
- One sump pit (NA.PS03.GMD10.BB120) to collect the floor drains from different rooms, leakages from cooling circuits, leaktight containment pits, safety showers and eyewashes and lab sinks in controlled areas and pump it to the TP.PS03.4005.

As this subsystem handles potentially radioactive water, the water inside the different sump pits that lie stagnant shall be minimized as much as possible.

The Potentially Contaminated/Activated B02 Wastewater Subsystem (NA.PS03.GMD10) has the following components:

- The Potentially Contaminated/Activated B02 Wastewater Holding Tank (NA.PS03.GMD10.BB010) is a pressurized tank, of 5 m³ design capacity that hold the demineralized activated wastewater from the PS01 drains, to be analysed and reused if subsequently possible.
- The Potentially Contaminated/Activated B02 Wastewater Transfer Pumps (NA.PS03.GMD10.AP011/012) are (2 x 100%) pumps (one on standby), of 4.29 m³/h design flow capacity that transfer the liquid from the Potentially Contaminated/Activated B02 Wastewater Sump Pit (SC Linac Tunnel – East) (NA.PS03.GMD10.BB110) to the MAC through the TP.PS03.4005.
- The Potentially Contaminated/Activated B02 Wastewater Transfer Pumps (NA.PS03.GMD10.AP021/022) are (2 x 100%) pumps (one on standby), of 5.5 m³/h design flow capacity that transfer the liquid from the Potentially Contaminated/Activated B02 Wastewater Sump Pit (Buffer Room) (NA.PS03.GMD10.BB120) to the MAC through the TP.PS03.4005.
- The Potentially Contaminated/Activated B02 Wastewater Collection Pumps (NA.PS03.GMD10.AP031/032) are (2 x 100%) pumps (one on standby), of 3.3 m³/h design flow capacity that transfer the liquid from the Potentially Contaminated/Activated B02 Wastewater

Sump Pit (Cooling Systems Room) (NA.PS03.GMD10.BB130) to the Potentially Contaminated/Activated B02 Wastewater Holding Tank (NA.PS03.GMD10.BB010).

- The Potentially Contaminated/Activated B02 Wastewater Transfer Pumps (NA.PS03.GMD10.AP041/042) are (2 x 100%) pumps (one on standby), of 4.95 m³/h design flow capacity that recirculates the water to the tank itself to homogenise the liquid, transfer the liquid from the Potentially Contaminated/Activated B02 Wastewater Holding Tank (NA.PS03.GMD10.BB010) to the PS01 cooling loops or to the MAC through the TP.PS03.4005.
- The Potentially Contaminated/Activated B02 Wastewater Collection Pumps (NA.PS03.GMD10.AP051/052) are (2 x 100%) pumps (one on standby), of 3.3 m³/h design flow capacity that transfer the liquid from the Potentially Contaminated/Activated B02 Wastewater Sump Pit (Injector Room) (NA.PS03.GMD10.BB150) to the Potentially Contaminated/Activated B02 Wastewater Holding Tank (NA.PS03.GMD10.BB010).
- The Potentially Contaminated/Activated B02 Wastewater Transfer Pumps (NA.PS03.GMD10.AP061/062) are (2 x 100%) pumps (one on standby), of 4.29 m³/h design flow capacity that transfer the liquid from the Potentially Contaminated/Activated B02 Wastewater Sump Pit (SC Linac Tunnel – West) (NA.PS03.GMD10.BB160) to the MAC through the TP.PS03.4005.

All the embedded pipes and penetrations of this subsystem will be jacketed, as wastewater is potentially contaminated/activated. Water collected in the jackets due to leakages in the main pipe, will be driven to low points where the leakage can be identified.

8.1.3.3 Components arrangement

All the components described in 8.1.3.2 are located in the supervised/controlled areas of the MCB, as shown in Figure 6.

The PS03 Potentially Contaminated/Activated B02 Wastewater Holding Tank (NA.PS03.GMD10.BB010) will be located inside the Cooling Systems Room, avoiding unauthorised personnel coming in close proximity to the tanks. This tank will be located inside a leaktight containment pit.

The sump pits are located strategically to allow the collection of drains all around the building by gravity pipelines. The preliminary location of the sump pits will be somewhere on the surfaces highlighted in the Figure 6. The definitive locations will be studied together with BA discipline.

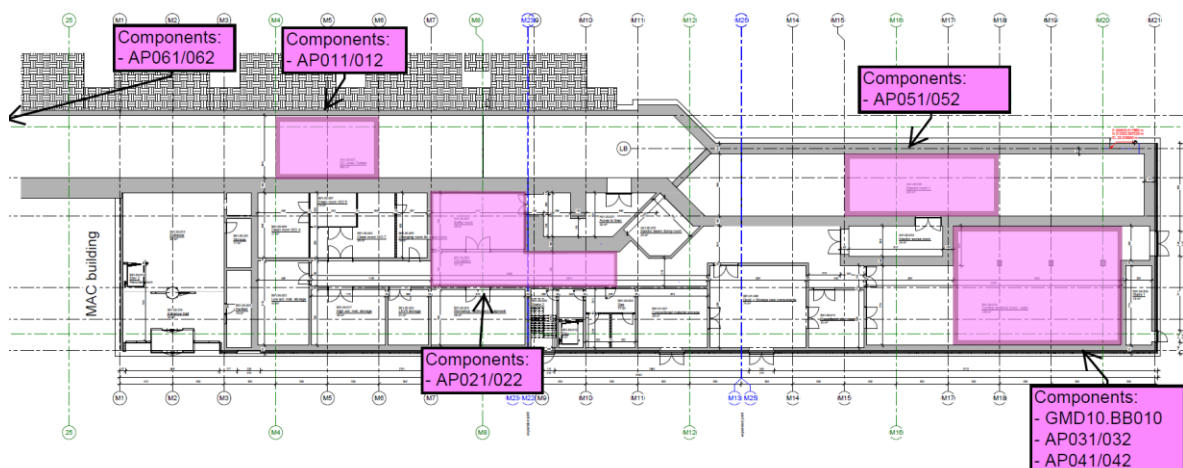


Figure 6. Potentially Contaminated/Activated B02 Wastewater Subsystem (NA.PS03.GMD10) components arrangement

9 Instrumentation and Control

The instruments and mechanical equipments are identified in the P&IDs (Ref. [11]) and the signals associated to the devices are listed in Ref. [12].

The PS03 Wastewater Handling and Treatment System Control Diagram (Ref. [15]) will provide with all detail about control, protections, alarms and graphical representation of the system.

9.1 Control General Criteria

9.1.1 Drivers Control Modes

All system drivers are monitored and controlled from the Conventional Control System HMI of the operator station located in the Control Room.

All drivers have two modes of operation: AUTOMATIC and MANUAL. The operator could press the AUTOMATIC/MANUAL buttons in the devices' faceplate. When the individual driver is in manual mode, it is operated and monitored by the operator from the Conventional Control System HMI, pressing the START/STOP or OPEN/CLOSE pushbuttons.

START/STOP or OPEN/CLOSE commands during operation in automatic mode come from immediately superior automatic control level. The automatic mode will be the normal mode for the normal operation.

The devices will be operated remotely or locally by the operator by the previous selection in the LOCAL/REMOTE faceplate selector:

- REMOTE mode means that all the orders come from the control system from the Control Room by means of the Conventional Control System HMI by acting on the devices' faceplate OPEN/CLOSE pushbuttons located in the corresponding valve's faceplate.
- LOCAL means that all orders come acting on the OPEN/CLOSE or START/STOP pushbuttons located on field at the device control box.

9.1.2 Functional Group and Selector

The control system has a hierarchical control level structure based on functional groups (FG). The system can also be controlled from the lower hierarchical levels, either from functional subgroups (FSG) or from actuating directly on the different equipment as it is indicated in Section 9.1.1.

In order to control and supervise the groups, the system includes AUTOMATIC/MANUAL buttons in the groups' faceplates, used by the operator to select the control mode (automatic or manual), modify the setpoints and actuate manually on the demand to the final control element. In order to actuate upon the different parameters.

When a functional group or equipment is in automatic mode, it is not possible to control it from their faceplate located on the graphic display of each system, and it will only follow the automatic orders from a higher hierarchical levels.

When a functional group or equipment is in manual mode, the operator has responsibility for control, since it will be only possible to control it from the control faceplate located on the graphic display of each system, and it ignores any automatic orders it receives from higher hierarchical levels.

Whenever there are redundant functional subgroups or equipment, a dedicated selector shall decide (following the operator previous selection) which equipment shall be started and which shall be in standby. If the system is started through the functional group and during operation the main equipment has a

problem that prevents it from operating properly, the selector will automatically start up the standby equipment, stop the equipment in problems and change the selection, turning the standby equipment into main equipment, and vice versa. Once the problem is solved, and the equipment that suffered the problem is transferred to automatic mode, this equipment becomes the standby one, ready for any problem in the main equipment.

When a system is started from its functional group, all the actuators controlled by it shall be transferred to AUTO to ensure they all will follow the higher level commands.

Regardless of the control mode, the necessary startup permissives, protections and interlocks shall be programmed into the control system to prevent any type of actuation that could cause damage to the system equipment or dependent systems.

The functional group start permissive has to be defined in such a way that prevents the group to be started if due to their equipment status, it shall not be able to perform its main task properly.

9.1.3 HMI

All system drivers are monitored and controlled from the Conventional Control System HMI of the operator station located in the Control Room.

The user name will be included in the status bar of the Main Display Area – Mimic.

For more details about HMI see SCADA HMI Guideline NA.CN_EDB503.

9.1.4 On maintenance status

The Operator will set maintenance status in the faceplate of the devices in the Conventional Control System HMI. The representation of the maintenance status will be by the letter L in WHITE on a RED background on the graphic display of the equipment meaning that the equipment is not controllable by the Operator (equipment out of order).

The use of a password shall be required for operators to be able to configure out the system during the maintenance period.

Other maintenance activities will be described in the corresponding supplier maintenance procedures.

The maintainability has been taken into account in the design of the system.

9.1.5 PID Controller

A PID controller continuously calculates an error value as the difference between a desired setpoint (SP) and a measured process variable (PV) and applies a correction based on proportional, integral, and derivative terms (denoted P, I, and D respectively). A direct PID output tends to increase as the PV signal increases. A reverse PID output tends to decrease as the PV signal increases.

9.1.6 Anomaly

When an equipment has any problem that makes it unable to be controlled by the control system, its state switches to ANOMALY. An alarm is then generated to warn the operator to solve the problem.

An equipment in ANOMALY is rejected to manual and does not have permissives to be actuated until the cause is solved. Some causes to set an equipment in ANOMALY would be: electrical cabinet (or MOV actuator) not available, feedback anomaly, command failure, any kind of trip, etc.

An equipment in ANOMALY has to be acknowledge prior to be restored to AUTO control mode. The equipment cannot be acknowledged until the cause that generates the anomaly state has disappeared.

9.1.7 Forced Commands

When any equipment is set in manual control mode and the operator does not take care of its control, the necessary forced actuations shall be programmed in order to avoid any system equipment or dependent system equipment damage.

The forced commands shall actuate even if the corresponding actuation permissives are not met. When a forced command it shall be signalled through an alarm to warn operator about the anomaly situation. For any equipment forced to any state, the commands to override this state, either AUTO or MANUAL, are not permitted.

9.2 System Control

The hierarchical control structure is described in the following block diagram:

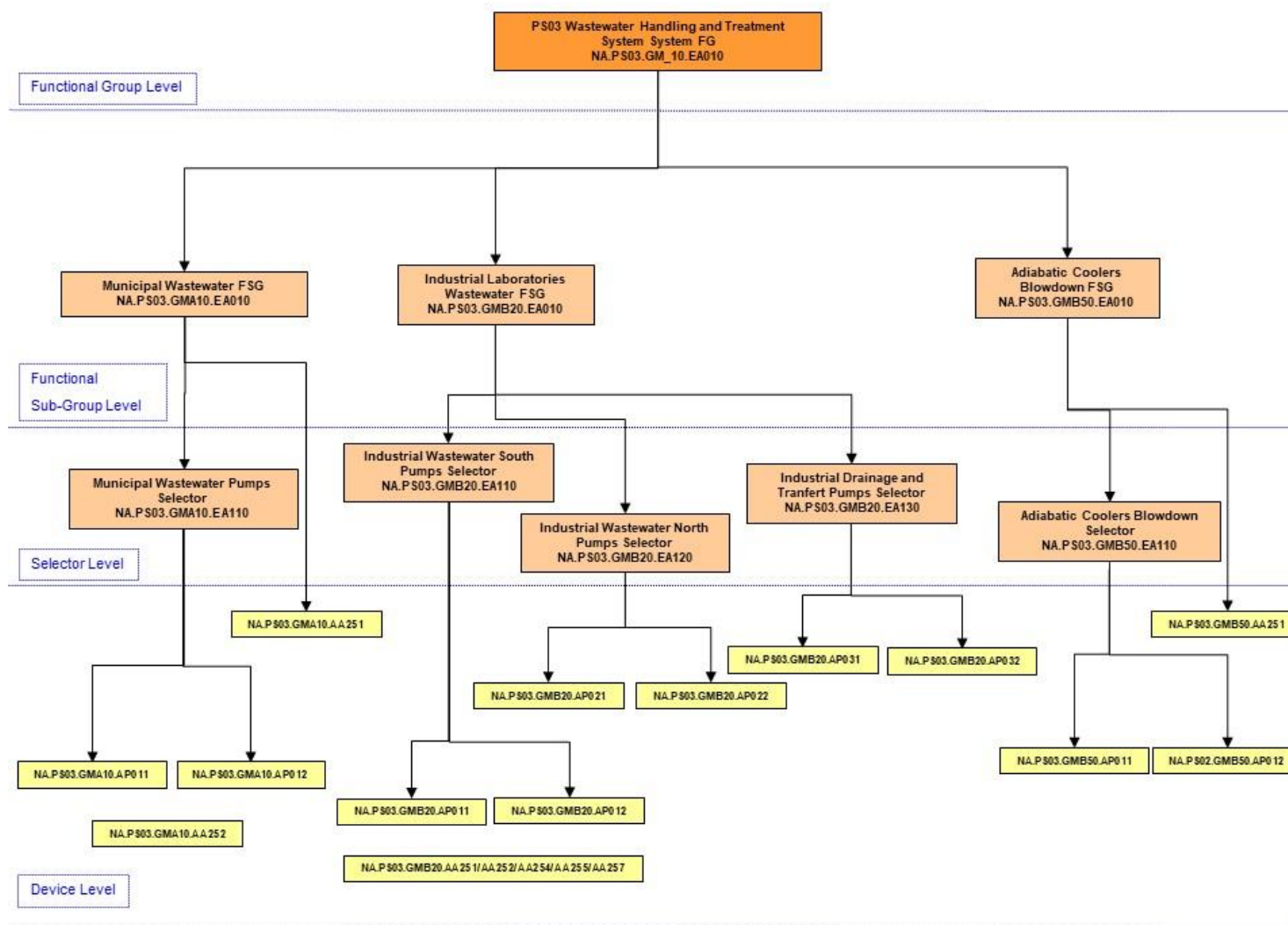


Figure 7. PS03 Wastewater Handling and Treatment System Hierarchy

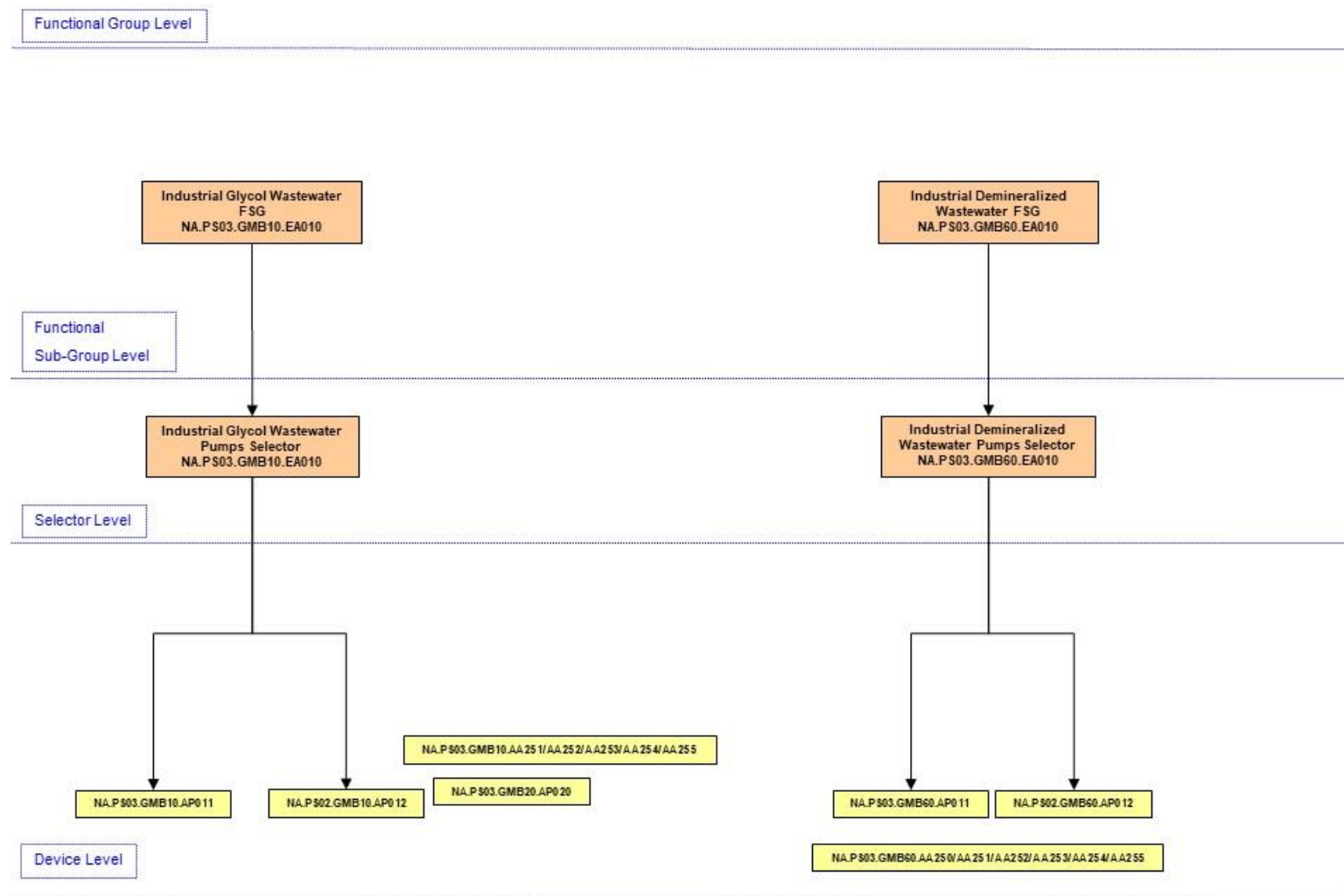


Figure 8. PS03 Wastewater Handling and Treatment System Hierarchy

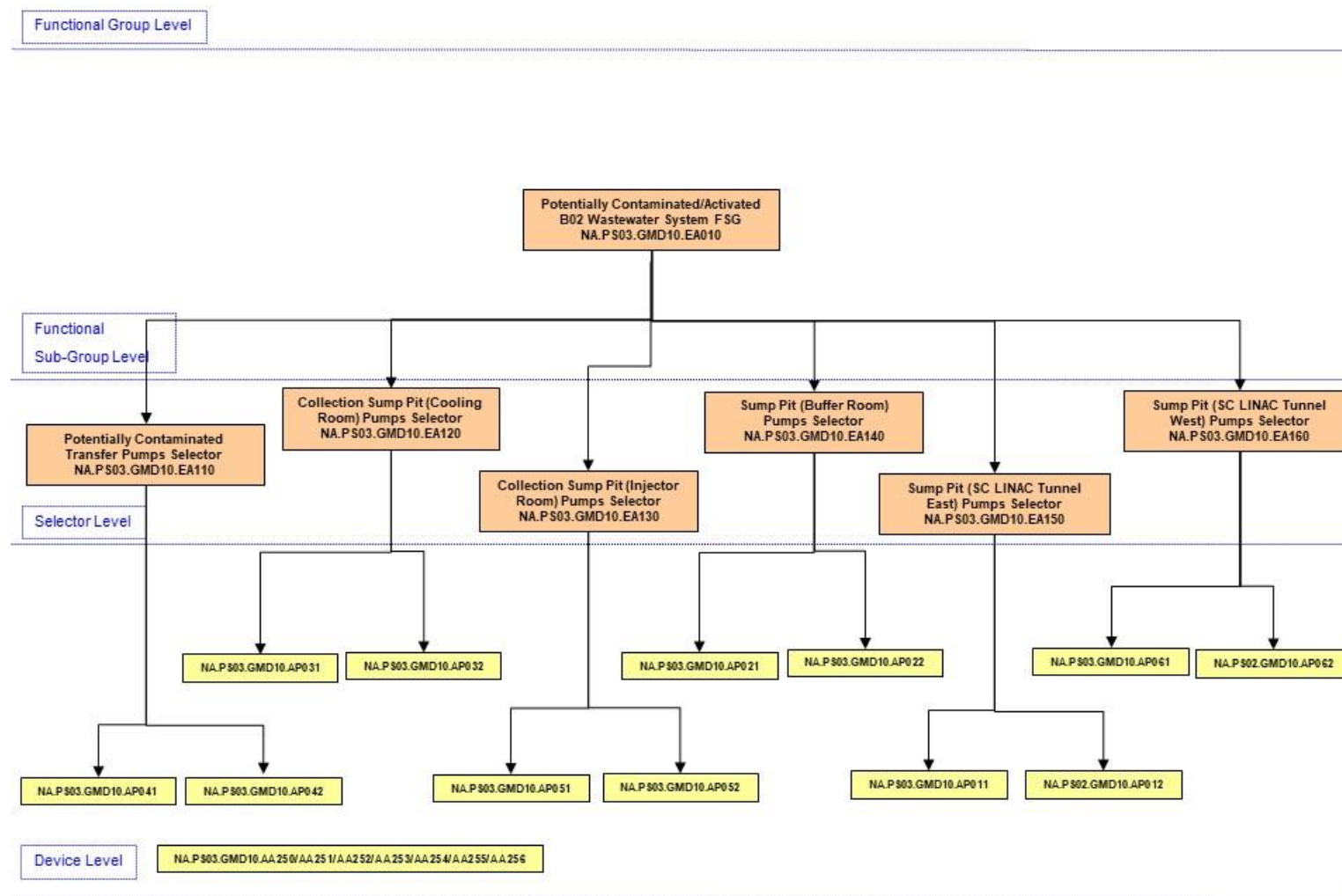


Figure 9. PS03 Wastewater Handling and Treatment System Hierarchy

9.3 Operation Modes

9.3.1 Normal operation

9.3.1.1 Municipal Wastewater Subsystem NA.PS03.GMA10

The Municipal Wastewater Sump Pit (NA.PS03.GMA10.BB110) contains two pumps (NA.PS03.GMA10.AP011/AP012) controlled by multi-level switch (NA.PS03.GMA10.LS010). Both pumps will be in AUTO mode and one will be selected as main pump in the selector.

In normal operation the pump selected as the main pump will start-up when sump pit level increase above a high level, while the other shall remain on standby, awaiting actuation in the event any problem is detected in the main pump. A pump operating hours counter will be programmed in the software in order that the operator can equally distribute the Municipal Wastewater Pumps operating hours.

The flow of Municipal Wastewater shall be measured by the totalizer flow transmitter NA.PS03.GMA10.FQT010.

The discharge of the Municipal Wastewater will be to the Municipal Sewer System (TP.PS03.0001), therefore, the on-off valve NA.PS03.GMA10.AA251 will open when the pump starts. Whether there is a problem in the Municipal Sewer System (TP.PS03.0001), or in the pipeline connecting to it, the operator will have the option to close manually the on-off valve NA.PS03.GMA10.AA251 and to open manually the on-off valve NA.PS03.GMA10.AA252.

9.3.1.2 Industrial Glycol Wastewater Subsystem NA.PS03.GMB10

The Industrial Glycol Wastewater Sump Pit (NA.PS03.GMB10.BB110) contains two pumps (NA.PS03.GMB10.AP011/AP012) controlled by multi-level switch (NA.PS03.GMB10.LS010). Both pumps will be in AUTO mode and one will be selected as main pump in the selector. The whole operation with these pumps is considered MANUAL and the operator will select the AUTO mode for these pumps once that the tank trailer is connected to the pipe (TP.PS03.0008). Once that the operation to pump the Industrial Glycol Wastewater, the pumps will be stopped and set in the MANUAL mode and the tank trailer disconnected from the pipe.

In normal operation the pump selected as the main pump will start-up when sump pit level increase above a high level, while the other shall remain on standby, awaiting actuation in the event any problem is detected in the main pump. A pump operating hours counter will be programmed in the software in order that the operator can equally distribute the Industrial Glycol Wastewater Pumps operating hours.

The consumption of Industrial Glycol Wastewater shall be measured by the totalizer flow transmitter NA.PS03.GMB10.FQT010.

All the valves (NA.PS03.GMB10.AA252/AA253/AA254/AA255) that allow the drainage to discharge the Industrial Glycol in the Industrial Glycol Wastewater Sump Pit (NA.PS03.GMB10.BB110) will be actuated manually by the operator.

The Portable Transfer Pump (NA.PS03.GMB10.AP020) will be actuated manually by the operator.

9.3.1.3 Industrial Laboratories Wastewater Subsystem NA.PS03.GMB20

- Drainage and Transfer Room Leaktight Pit

The Drainage and Transfer Room Leaktight Pit contains two pumps (NA.PS03.GMB20.AP031/AP032) controlled by multi-level switch (NA.PS03.GMB20.LS010). Both pumps will be in AUTO mode and one will be selected as main pump in the selector.

In normal operation the pump selected as the main pump will start-up when the pit level increase above a high level, while the other shall remain on standby, awaiting actuation in the event any problem is detected in the main pump. A pump operating hours counter will be programmed in the software in order that the operator can equally distribute the Drainage and Transfer Room Pumps operating hours.

The discharge of the Drainage and Transfer Room Pit will be to the Industrial Wastewater North Sump Pit, however, if the level is high in the Industrial Wastewater North Sump Pit the Drainage and Transfer Wastewater pumps could not discharge into it.

➤ Industrial Wastewater North Sump Pit (NA.PS03.GMB20.BB120)

The Industrial Wastewater North Sump Pit contains two pumps (NA.PS03.GMB20.AP021/AP022) controlled by multi-level switch (NA.PS03.GMB20.LS020). Both pumps will be in AUTO mode and one will be selected as main pump in the selector.

In normal operation the pump selected as the main pump will start-up when sump pit level increase above a high level, while the other shall remain on standby, awaiting actuation in the event any problem is detected in the main pump. A pump operating hours counter will be programmed in the software in order that the operator can equally distribute the Industrial Wastewater North Pumps operating hours.

All the valves (NA.PS03.GMB20.AA251/AA252/AA254/AA255) that allow the drainage of floor drains to be discharged to the Industrial Wastewater North Sump Pit will be actuated manually by the operator.

The discharge of the Industrial Wastewater North Sump Pit will be to the Industrial Wastewater South Sump Pit, however, if the level is high in the Industrial Wastewater South Sump Pit the Wastewater North Sump Pit pumps could not discharge into it.

➤ Industrial Wastewater South Sump Pit (NA.PS03.GMB20.BB110)

The Industrial Wastewater South Sump Pit contains two pumps (NA.PS03.GMB20.AP011/AP012) controlled by multi-level switch (NA.PS03.GMB30.LS010). Both pumps will be in AUTO mode and one will be selected as main pump in the selector.

In normal operation the pump selected as the main pump will start-up when sump pit level increase above a high level, while the other shall remain on standby, awaiting actuation in the event any problem is detected in the main pump. A pump operating hours counter will be programmed in the software in order that the operator can equally distribute the Industrial Wastewater South Pumps operating hours.

The valve NA.PS03.GMB20.AA257 will allow to have a line for sampling of the wastewater in the Industrial Wastewater South Sump Pit. It will be open automatically when one of the Industrial Wastewater South Sump Pit pumps starts.

In the Industrial Wastewater South Sump Pit will be analysed PH and Specific Conductivity (SC) by the NA.PS03.GMB20.AT010/AT020 respectively.

The discharge of the Industrial Wastewater South Sump Pit will be to the Industrial Sewer System (TP.PS03.0015).

The flow of the Industrial Laboratories Wastewater Subsystem discharged to the Industrial Sewer System (TP.PS03.0015) will be measured by the totalizer flow transmitter NA.PS03.GMB20.FQT010.

In case that a truck needs to collect the drainage the flow will be measured by the totalizer flow transmitter NA.PS03.GMB20.FQT020.

9.3.1.4 Industrial Adiabatic Coolers Blowdown Wastewater Subsystem NA.PS03.GMB50

The Adiabatic Coolers Blowdown Sump Pit (NA.PS03.GMB50.BB110) contains two pumps (NA.PS03.GMB50.AP011/AP012) controlled by multi-level switch (NA.PS03.GMB50.LS010). Both pumps will be in AUTO mode and one will be selected as main pump in the selector.

In normal operation the pump selected as the main pump will start-up when sump pit level increase above a high level, while the other shall remain on standby, awaiting actuation in the event any problem is detected in the main pump. A pump operating hours counter will be programmed in the software in order that the operator can equally distribute the Industrial Wastewater North Pumps operating hours.

The discharge of the Adiabatic Coolers Blowdown Wastewater will be to the Lagoon, therefore, the on-off valve NA.PS03.GMB50.AA251 will open when the pump starts. Whether there is a problem in the header to the Lagoon, the operator will have the option to close manually the on-off valve NA.PS03.GMB50.AA251 and to open manually the on-off valve NA.PS03.GMB50.AA252.

The discharge flow of Industrial Adiabatic Coolers Blowdown Wastewater shall be measured by the totalizer flow transmitter NA.PS03.GMB50.FQT010.

9.3.1.5 Industrial Demineralized Wastewater Subsystem NA.PS03.GMB60

The Industrial Demineralized Wastewater is collected in two tanks NA.PS03.GMB60.BB011/BB012. One of the valves NA.PS03.GMB60.AA250/252 will be opened and when the level in the tank is high will close and the other valve will be opened. The valves cannot be opened at the same time.

The CO2 filters pressure will be measured by NA.PS03.GMB60.PT010 and NA.PS03.GMB60.PT020.

Once that one or both tanks are filled the operator will recirculate the demineralized water of each tank each time, opening manually the valves NA.PS03.GMB60.AA251 and NA.PS03.GMB60.AA257 for the tank NA.PS03.GMB60.BB011 or NA.PS03.GMB60.253 and NA.PS03.GMB60.AA257 for the tank NA.PS03.GMB60.BB012 depending on the water that it is going to be recirculated and will start one of the Industrial Demineralized Wastewater pumps. The operator will open manually the NA.PS03.GMB60.AA256 too in order to have the data from the PH and Specific Conductivity (SC) analyzers measured by NA.PS03.GMB60.AT010 and NA.PS03.GMB60.AT020 respectively.

Once that the parameters are measured the operator will close the recirculation valve that is open NA.PS03.GMB60.AA251 or NA.PS03.GMB60.253, close the NA.PS03.GMB60.AA256 and will open the valve NA.PS03.GMB60.AA254 or NA.PS03.GMB60.AA255 depending on where the demineralized wastewater is going to be pumped.

The operator will chose the tank that it is going to empty before and will open manually it is isolation and recirculation valves (NA.PS03.GMB60.AA251 and NA.PS03.GMB60.AA257 for the tank NA.PS03.GMB60.BB011 and NA.PS03.GMB60.253 and NA.PS03.GMB60.AA258 for the tank NA.PS03.GMB60.BB012). After the opening of the valves the operator will select the pump in the selector to start it. Once that the tank it is emptied the pumps will be stopped and the operator will do the same operation with the other tank.

The pressure at the discharge of the Industrial Demineralized Wastewater pums is measured by NA.PS03.GMB60.PT030.

9.3.1.6 Potentially Contaminated/Activated B02 Wastewater Subsystem NA.PS03.GMD10

The Potentially Contaminated/Activated B02 Wastewater System consists of two Collection Sump Pits where only activated water from the PS01 cooling loops is collected to be pumped to the Potentially

Contaminated/Activated B02 Wastewater Holding Tank (NA.PS03.GMD10.BB010) and three Transfer Sump Pits to pump the wastewater to MAC (TP.PS03.4005).

Each Potentially Contaminated/Activated B02 Wastewater Collection Sump Pit contains two pumps (NA.PS03.GMD10.AP031/AP032) and (NA.PS03.GMD10.AP051/AP052) controlled by multi-level switch (NA.PS03.GMD10.LS040) and (NA.PS03.GMD10.LS050) respectively. Both pumps will be in AUTO mode and one will be selected as main pump in the selector. Only one pump from one pit can start at the same time.

Each Potentially Contaminated/Activated B02 Wastewater Transfer Sump Pit contains two pumps (NA.PS03.GMD10.AP021/AP022), (NA.PS03.GMD10.AP011/AP12) and (NA.PS03.GMD10.AP061/AP062) controlled by multi-level switch (NA.PS03.GMD10.LS060), (NA.PS03.GMD10.LS070) and (NA.PS03.GMD10.LS080) respectively. Both pumps will be in AUTO mode and one will be selected as main pump in the selector. Only one pump from one pit can start at the same time.

In normal operation the pump selected as the main pump in each sump pit will start-up when sump pit level increase above a high level, while the other shall remain on standby, awaiting actuation in the event any problem is detected in the main pump. A pump operating hours counter will be programmed in the software in order that the operator can equally distribute the Potentially Contaminated/Activated B02 Wastewater Pumps operating hours.

The discharge of the Potentially Contaminated/Activated B02 Wastewater from the Potentially Contaminated/Activated B02 Wastewater Collection Sump Pits (BB130 & BB150) will be to the Potentially Contaminated/Activated B02 Wastewater Holding Tank (NA.PS03.GMD10.BB010) and the level will be measured by the level transmitter NA.PS03.GMD10.LT010.

The tank is located inside a leaktight containment pit where a multi-level switch (NA.PS03.GMD10.LS030) will advise about a leak if any occurs.

The Nitrogen make-up valve NA.PS03.GMD10.AA601 will make-up Nitrogen when the pressure in the tank measured by (NA.PS03.GMD10.PT010) is under a low level. Once that the pressure is above a high pressure the valve will close it.

Once that the tank is filled, or all the activated water to be drained from the PS01 cooling loops is already in the holding tank, the operator will recirculate the activated water to the tank, opening manually the valve NA.PS03.GMD10.AA250, keeping all discharge valves closed (NA.PS03.GMD10.AA251, NA.PS03.GMD10.AA252, NA.PS03.GMD10.AA253, NA.PS03.GMD10.AA254 and NA.PS03.GMD10.AA255).

The operator will open manually the NA.PS03.GMD10.AA256 too in order to have the data from the PH and Specific Conductivity (SC) analyzers measured by NA.PS03.GMD10.AT010 and NA.PS03.GMD10.AT020 respectively. The radiation will be measured by NA.PS03.GMD10.RT010.

Once that the parameters are measured, the operator will close the recirculation valve that is open. NA.PS03.GMD10.AA250, close the NA.PS03.GMD10.AA256 and will open the valve NA.PS03.GMD10.AA251 or NA.PS03.GMD10.AA252 or NA.PS03.GMD10.AA253 or NA.PS03.GMD10.AA254 if the parameters are under the expected values and the corresponding PS01 cooling loop is ready to be filled again. If the parameters are not under the expected values, the wastewater will be sent to MAC through the valve NA.PS03.GMD10.AA255 (TP.PS03.4005).

The potentially contaminated/activated B02 Wastewater will be pumped by the pumps NA.PS03.GMD10.AP041/AP042.

The valves NA.PS03.GMD10.AA251 or NA.PS03.GMD10.AA252 or NA.PS03.GMD10.AA253 or NA.PS03.GMD10.AA254 will discharge in the PS01 Surge Tanks when the level in those tanks is not high

measured by NA.PS01.PJB31.LT010, NA.PS01.PJB32.LT010, NA.PS01.PJB33.LT010 and, NA.PS01.PJB34.LT010 respectively. The condition to open the NA.PS03.GMD10.AA255 is pending on MAC.

The valve NA.PS03.GMD10.AA257 will open manually by the operator to discharge in the Potentially Contaminated/Activated B02 Wastewater Transfer Sump Pit (Buffer Room) (NA.PS03.GMD10.BB120) only if the level measured by NA.PS03.GMD10.LS060 is not high .

The flow of the activated wastewater sent to MAC is measured by flow totalizer transmitter NA.PS03.GMD10.FQT020.

The radiation of the activated wastewater sent to MAC is measured by NA.PS03.GMD10.RT020.

9.3.2 Abnormal operation

- High high level in the Municipal Wastewater Sump Pit (NA.PS03.GMA10.LS010) (HH).
- Low low level in the Municipal Wastewater Sump Pit (NA.PS03.GMA10.LS010) (LL).
- High high level in the Glycol Wastewater Sump Pit (NA.PS03.GMB10.LS010) (HH).
- Low low level in the Glycol Wastewater Sump Pit (NA.PS03.GMB10.LS010) (LL).
- High high level in the Drainage and Transfer Room Sump Pit (NA.PS03.GMB20.LS010) (HH).
- Low low level in the Drainage and Transfer Room Sump Pit (NA.PS03.GMB20.LS010) (LL).
- High high level in the Industrial Wastewater North Sump Pit (NA.PS03.GMB20.LS020) (HH).
- Low low level in the Industrial Wastewater North Sump Pit (NA.PS03.GMB20.LS020) (LL).
- High high level in the Industrial Wastewater South Sump Pit (NA.PS03.GMB20.LS030) (HH).
- Low low level in the Industrial Wastewater South Sump Pit (NA.PS03.GMB20.LS030) (LL).
- High PH Industrial Wastewater NA.PS03.GMB20.AT010 (H).
- High Specific Conductivity (SC) Industrial Wastewater NA.PS03.GMB20.AT020 (H).
- High high level in the Adiabatic Coolers Blowdown Sump Pit (NA.PS03.GMB50.LS010) (HH).
- Low low level in the Adiabatic Coolers Blowdown Sump Pit (NA.PS03.GMB50.LS010) (LL).
- High high differential pressure in the CO2 filter (NA.PS03.GMB60.PT010) (HH).
- High high differential pressure in the CO2 filter (NA.PS03.GMB60.P020) (HH).
- High high level in the Industrial Demineralized Wastewater Tank (NA.PS03.GMB60.LT010), (HH).
- High high level in the Industrial Demineralized Wastewater Tank (NA.PS03.GMB60.LT020), (HH).
- High high level in the Potentially Contaminated/Activated B02 Wastewater Collection Sump Pit (Cooling Systems Room) (NA.PS03.GMD10.LS040) (HH).
- Low low level in the Potentially Contaminated/Activated B02 Wastewater Collection Sump Pit (Cooling Systems Room) (NA.PS03.GMD10.LS040) (LL).
- High high level in the Potentially Contaminated/Activated B02 Wastewater Collection Sump Pit (Injector Room) (NA.PS03.GMD10.LS050) (HH).
- Low low level in the Potentially Contaminated/Activated B02 Wastewater Collection Sump Pit (Injector Room) (NA.PS03.GMD10.LS050) (LL).
- High high level in the Cooling System Room Leaktight Containment Pit (NA.PS03.GMD10.LS030) (HH).
- Low low level in the Potentially Contaminated/Activated B02 Wastewater Holding Tank (NA.PS03.GMD10.LT010), (LL).
- High high level in the Potentially Contaminated/Activated B02 Wastewater Transfer Sump Pit (Buffer Room) (NA.PS03.GMD10.LS060) (HH).
- Low low level in the Potentially Contaminated/Activated B02 Wastewater Transfer Sump Pit (Buffer Room) (NA.PS03.GMD10.LS060) (LL).
- High high level in the Potentially Contaminated/Activated B02 Wastewater Transfer Sump Pit (SC LINAC Tunnel – East) (NA.PS03.GMD10.LS070) (HH).
- Low low level in the Potentially Contaminated/Activated B02 Wastewater Transfer Sump Pit (SC LINAC Tunnel – East) (NA.PS03.GMD10.LS070) (LL).

- High high level in the Potentially Contaminated/Activated B02 Wastewater Transfer Sump Pit (SC LINAC Tunnel – West) (NA.PS03.GMD10.LS080) (HH).
- Low low level in the Potentially Contaminated/Activated B02 Wastewater Transfer Sump Pit (SC LINAC Tunnel – West) (NA.PS03.GMD10.LS080) (LL).

9.4 System Control

The different controls developed for the system are described in more detail below, however, all details about system control, protections, interlocks, alarms and automatic actions will be depicted in the corresponding system control diagram.

9.4.1 Analogue Control and Regulation

9.4.1.1 *Municipal Wastewater Subsystem NA.PS03.GMA10*

Not applicable. There is no analogue control and regulation loop.

9.4.1.2 *Industrial Glycol Wastewater Subsystem NA.PS03.GMB10*

Not applicable. There is no analogue control and regulation loop.

9.4.1.3 *Industrial Laboratories Wastewater Subsystem NA.PS03.GMB20*

Not applicable. There is no analogue control and regulation loop.

9.4.1.4 *Industrial Adiabatic Coolers Blowdown Wastewater Subsystem NA.PS03.GMB50*

Not applicable. There is no analogue control and regulation loop.

9.4.1.5 *Industrial Demineralized Wastewater Subsystem NA.PS03.GMB60*

Not applicable. There is no analogue control and regulation loop.

9.4.1.6 *Potentially Contaminated/Activated B02 Wastewater Subsystem NA.PS03.GMD10*

Not applicable. There is no analogue control and regulation loop.

9.4.2 Logic Control and Protections

When the PS03 Wastewater Handling and Treatment System is started up via its Functional Group (NA.PS03.GM_10.EA010) by the operator acting on the Conventional Control System HMI, the following actions will be carried out automatically:

- All drivers controlled by the functional group will be switched to automatic control mode.

In order to ensure that the functional group starts-up/stops only when it is able to fulfill their purpose, and to do it in a safe way for the equipment and for their dependent systems, the following start-up/stop permissives will be programmed:

- Start Permissives
 - Municipal Wastewater Functional Subgroup (NA.PS03.GMA10.EA010) is available.
 - Industrial Laboratories Wastewater Functional Subgroup (NA.PS03.GMB20.EA010) is available.
 - Industrial Adiabatic Coolers Blowdown Functional Subgroup (NA.PS03.GMB50.EA010) is available.
- Stop Permissive

- Not applicable, the functional group shall always have the stop permissive.

The shutdown of the system through the functional group, by the operator acting on the Conventional Control System HMI, shall stop automatically all the pumps in operation.

All the drivers of the PS03 Wastewater Handling and Treatment System will remain in automatic control mode unless express action by the operator.

9.4.2.1 *Municipal Wastewater Subsystem NA.PS03.GMA10*

9.4.2.1.1 *Municipal Wastewater Subsystem FSG NA.PS03.GMA10.EA010*

When the Municipal Wastewater Subsystem is started up via its Functional Subgroup (NA.PS03.GMA10.EA010) by the operator acting on the Conventional Control System HMI or from a command coming from a higher hierarchical level (PS03 Wastewater Handling and Treatment System FG (NA.PS03.GM_10.EA010)), the following actions will be carried out automatically:

- All drivers controlled by the Functional Subgroup (NA.PS03.GMA10.EA010) will be switched to automatic control mode.
- It will command the operation of the associated Municipal Wastewater transfer pumps (NA.PS03.GMA10.AP011/AP012) through a selector (NA.PS03.GMA10.EA110), so that it can manage the start-up and the stop of these pumps depending on the state of the system at any time.
- The Municipal Wastewater Transfer Pumps Selector shall start-up the pump selected as main by operator on the Conventional Control System HMI. Once the Municipal Wastewater Sump Pit (NA.PS03.GMA10.BB110) is above a high level, the Selector shall start the pump previously selected as main.
- The Municipal Wastewater Transfer Pumps Selector shall stop the pump running once the Municipal Wastewater Sump Pit (NA.PS03.GMA10.BB110) is under a low level.

In order to ensure that the Functional Subgroup starts-up only when it is able to fulfill their purpose, and to do it in a safe way for the equipment and for their dependent systems, the following start-up permissives will be programmed:

- Start Permissives
 - At least one Municipal Wastewater Transfer Pump (NA.PS03.GMA10.AP011/AP012) is available.
 - The valve NA.PS03.GMA10.AA251 is available.
 - Not low level in the Municipal Wastewater Sump Pit (NA.PS03.GMA10.BB110) with NA.PS03.GMA10.LS010, (L).
- Stop Permissive
 - Not applicable. The Functional Subgroup shall always have the stop permissive.

The shutdown of the system through the Functional Subgroup, either by operator acting on the Conventional Control System HMI or from a command coming from a higher hierarchical level (PS03 Wastewater Handling and Treatment System FG (NA.PS03.GM_10.EA010)), shall stop automatically the Municipal Wastewater Transfer Pump in operation.

All the drivers of the Functional Subgroup will remain in automatic control mode unless express action by the operator.

9.4.2.1.2 *Municipal Wastewater Transfer Pumps (NA.PS03.GMA10.AP011/AP012)*

The function of these pumps is to pump the wastewater from the Municipal Wastewater Sump Pit (NA.PS03.GMA10.BB110) to the Municipal Sewer System (TP.PS03.0001) in normal operation or the Industrial Laboratories Subsystem if there is a problem with the Municipal Sewer System or the pipeline connecting to it.

- Automatic Start
 - The pump starts automatically if the level in the Municipal Wastewater Sump Pit is high, measured with NA.PS03.GMA10.LS010, (H).
- Automatic Stop
 - The pump stops automatically if the level in the Municipal Wastewater Sump Pit is low, measured with NA.PS03.GMA10.LS010, (L).
- Start Permissives
 - Not low level in the Municipal Wastewater Sump Pit, measured with NA.PS03.GMA10.LS010, (L).
- Stop Permissives
 - The pumps are always permitted to stop.
- Trip conditions. The pump will be tripped when any of the following conditions are reached:
 - Low low level in the Municipal Wastewater Sump Pit, measured with NA.PS03.GMA10.LS010, (LL).
- Forced stop
 - Not applicable.

9.4.2.1.3 On-Off valve NA.PS03.GMA10.AA251

The function of this valve is to discharge the Municipal Wastewater Sump Pit to the Municipal Sewer System (TP.PS03.0001).

- Automatic Open
 - The valve opens automatically when one of the Municipal Wastewater Transfer Pumps (NA.PS03.GMA10.AP011/AP012) starts.
- Automatic Close
 - The valve closes automatically when both Municipal Wastewater Transfer Pumps (NA.PS03.GMA10.AP011/AP012) are stopped.
- Opening Permissives
 - When the on-off valve is NA.PS03.GMA10.AA252 is closed.
- Closing Permissives
 - The valve is always permitted to close.
- Forced Open
 - Not applicable.

9.4.2.1.4 On-Off valve NA.PS03.GMA10.AA252

The function of this valve is to discharge the Municipal Wastewater Sump Pit to Industrial Laboratories Subsystem if there is a problem with the Municipal Sewer System or the pipeline connecting to it.

- Automatic Open
 - The valve does not open automatically, its opening is only manual with the operator supervision.
- Automatic Close
 - The valve does not close automatically, its closing is only manual with the operator supervision.
- Opening Permissives
 - When the on-off valve is NA.PS03.GMA10.AA251 is closed.
- Closing Permissives
 - The valve is always permitted to close.
- Forced Open
 - Not applicable.

9.4.2.2 Industrial Glycol Wastewater Subsystem NA.PS03.GMB10

9.4.2.2.1 Industrial Glycol Wastewater FSG NA.PS03.GMB10.EA010

The operation of the Industrial Glycol Wastewater Transfer pumps (NA.PS03.GMB10.AP011/AP012) will be purely manual since implies the connection to the tank trailer to discharge, therefore the Industrial Glycol Wastewater FSG NA.PS03.GMB10.EA010 is not part of a the higher hierarchical level level (PS03 Wastewater Handling and Treatment System FG (NA.PS03.GM_10.EA010)).

When the Industrial Glycol Wastewater Subsystem is started up via its Functional Subgroup (NA.PS03.GMB10.EA010) by the operator acting on the Conventional Control System HMI the following actions will be carried out automatically:

- All drivers controlled by the Functional Subgroup (NA.PS03.GMB10.EA010) will be switched to automatic control mode once that the tank trailer is connected to the pipe.
- It will command the operation of the associated Industrial Glycol Wastewater Transfer pumps (NA.PS03.GMB10.AP011/AP012) through a selector (NA.PS03.GMB10.EA110), so that it can manage the start-up and the stop of these pumps depending on the state of the system at any time.
- The Industrial Glycol Wastewater Pumps Selector shall start-up the pump selected as main by operator on the Conventional Control System HMI. Once the sump pit level increase above a high level, the Selector shall start the pump previously selected as main.
- The Industrial Glycol Wastewater Pumps Selector shall stop the pump running once the sump pit level is under a low level.

In order to ensure that the Functional Subgroup starts-up only when it is able to fulfill their purpose, and to do it in a safe way for the equipment and for their dependent systems, the following start-up permissives will be programmed:

- Start Permissives
 - At least one Industrial Glycol Wastewater Transfer pumps (NA.PS03.GMB10.AP011/AP012) is available.
 - Not low level in the Industrial Glycol Wastewater Sump Pit (NA.PS03.GMB10.BB110) measured by multi-level switch (NA.PS03.GMB10.LS010), (L).
- Stop Permissive
 - Not applicable. The Functional Subgroup shall always have the stop permissive.

The shutdown of the system through the Functional Subgroup, either by operator acting on the Conventional Control System HMI, shall stop automatically the Industrial Glycol Wastewater transfer pump (NA.PS03.GMB10.AP011/AP012) in operation.

All the drivers of the Functional Subgroup will remain in automatic control mode unless express action by the operator.

9.4.2.2.2 Industrial Glycol Wastewater Transfer pumps (NA.PS03.GMB10.AP011/AP012)

The function of these pumps is to pump the water from the Industrial Glycol Wastewater Sump Pit (NA.PS03.GMB10.BB110) to the tank trailer (TP.PS03.0008) considering the operation totally manual.

- Automatic Start
 - The pump starts automatically if the level in the Industrial Glycol Wastewater Sump Pit (NA.PS03.GMB10.BB110) is high, measured with NA.PS03.GMB10.LS010, (H).
- Automatic Stop
 - The pump stops automatically if the level in the Industrial Glycol Wastewater Sump Pit (NA.PS03.GMB10.BB110) is low, measured with NA.PS03.GMB10.LS010, (L).
- Start Permissives
 - Not low level in the Industrial Glycol Wastewater Sump Pit (NA.PS03.GMB10.BB110), measured with NA.PS03.GMA10.LS010, (L).
- Stop Permissives

- The pumps are always permitted to stop.
- Trip conditions. The pump will be tripped when any of the following conditions are reached:
 - Low low level in the Industrial Glycol Wastewater Sump Pit (NA.PS03.GMB10.BB110), measured with NA.PS03.GMB10.LS010, (LL).
- Forced stop
 - Not applicable.

9.4.2.2.3 On-Off valves (NA.PS03.GMB10.AA252/AA253/AA254/AA255)

The function of this valve is to discharge to the Industrial Glycol Wastewater Sump Pit (NA.PS03.GMB10.BB110).

- Automatic Open
 - The valve does not open automatically, its opening is only manual with the operator supervision.
- Automatic Close
 - The valve does not close automatically, its closing is only manual with the operator supervision.
- Opening Permissives
 - The valve is always permitted to open.
- Closing Permissives
 - The valve is always permitted to close.
- Forced Open
 - Not applicable.

9.4.2.2.4 Portable Transfer Pump (NA.PS03.GMB10.AP020)

The function of this pump is to drain the water from the Portable Collection Bins considering the operation totally manual.

- Automatic Start
 - The pump does not start automatically, its start is only manual with the operator supervision.
- Automatic Stop
 - The pump does not stop automatically, its stop is only manual with the operator supervision.
- Start Permissives
 - The pumps is always permitted to start.
- Stop Permissives
 - The pumps is always permitted to stop.
- Trip conditions. The pump will be tripped when any of the following conditions are reached:
 - Not applicable.
- Forced stop
 - Not applicable.

9.4.2.3 Industrial Laboratories Wastewater Subsystem NA.PS03.GMB20

9.4.2.3.1 Industrial Laboratories Wastewater Subsystem FSG NA.PS03.GMB20.EA010

When the Industrial Laboratories Wastewater Subsystem is started up via its Functional Subgroup (NA.PS03.GMB20.EA010) by the operator acting on the Conventional Control System HMI or from a command coming from a higher hierarchical level (PS03 Wastewater Handling and Treatment System FG (NA.PS03.GM_10.EA010), the following actions will be carried out automatically:

- All drivers controlled by the Functional Subgroup (NA.PS03.GMB20.EA010) will be switched to automatic control mode.
- It will command the operation of the associated Industrial Wastewater South Transfer pumps (NA.PS03.GMB20.AP011/AP012) through a selector (NA.PS03.GMB20.EA110), Industrial Wastewater North Transfer pumps (NA.PS03.GMB20.AP021/AP022) through a selector (NA.PS03.GMB20.EA120) and Drainage and Transfer Wastewater pumps (NA.PS03.GMB20.AP031/AP032) through a selector (NA.PS03.GMB20.EA130), so that it can manage the start-up and the stop of these pumps depending on the state of the system at any time.
- The three Pumps Selector (NA.PS03.GMB20.EA110, NA.PS03.GMB20.EA120 and NA.PS03.GMB20.EA130) shall start-up the pump selected as main by operator on the Conventional Control System HMI. Once the Sump Pit is above a high level, the Selector shall start the pump previously selected as main.
- The three Pumps Selector (NA.PS03.GMB20.EA110, NA.PS03.GMB20.EA120 and NA.PS03.GMB20.EA130) shall stop the pump running once the Sump Pit is under a low level.

In order to ensure that the Functional Subgroup starts-up only when it is able to fulfill their purpose, and to do it in a safe way for the equipment and for their dependent systems, the following start-up permissives will be programmed:

- Start Permissives
 - At least one Industrial Wastewater Transfer South pump (NA.PS03.GMB20.AP011/AP012) is available.
 - At least one Industrial Wastewater North Transfer pump (NA.PS03.GMB20.AP021/AP022) is available.
 - At least one Drainage and Transfer Wastewater pump (NA.PS03.GMB20.AP031/AP032) is available.
 - Not low level in the Industrial Wastewater South Sump Pit (NA.PS03.GMB20.BB110) with NA.PS03.GMB20.LS030, (L).
 - Not low level in the Industrial Wastewater North Sump Pit (NA.PS03.GMB20.BB120) with NA.PS03.GMB20.LS020, (L).
 - Not low level in the Drainage and Transfer Room Leaktight Pit with NA.PS03.GMB20.LS010, (L).
 - On-Off valve NA.PS03.GMB20.AA257 is available.
- Stop Permissive
 - Not applicable. The Functional Subgroup shall always have the stop permissive.

The shutdown of the system through the Functional Subgroup, either by operator acting on the Conventional Control System HMI or from a command coming from a higher hierarchical level (PS03 Wastewater Handling and Treatment System FG (NA.PS03.GM_10.EA010), shall stop automatically the Industrial Wastewater Pump in operation.

All the drivers of the Functional Subgroup will remain in automatic control mode unless express action by the operator.

9.4.2.3.2 *Drainage and Transfer Wastewater Pumps (NA.PS03.GMB20.AP031/AP032)*

The function of these pumps is to pump the water from the Drainage and Transfer Room Leaktight Pit to the Industrial Wastewater North Sump Pit.

- Automatic Start
 - The pump starts automatically if the level in the Drainage and Transfer Room Wastewater Leaktight Pit is high, measured with NA.PS03.GMB20.LS010, (H) and the level in the Industrial Wastewater North Sump Pit (NA.PS03.GMB20.BB120) is not high, measured with NA.PS03.GMB20.LS020, (H).
- Automatic Stop

- The pump stops automatically if the level in the Drainage and Transfer Room Leaktight Pit is low, measured with NA.PS03.GMB20.LS010, (L) or if the level in the Industrial Wastewater North Sump Pit (NA.PS03.GMB20.BB120) is high, measured with NA.PS03.GMB20.LS020, (H).
- Start Permissives
 - Not low level in the Drainage and Transfer Room Leaktight Pit, measured with NA.PS03.GMB20.LS010, (L).
- Stop Permissives
 - The pumps are always permitted to stop.
- Trip conditions. The pump will be tripped when any of the following conditions are reached:
 - Low low level in the Drainage and Transfer Room Leaktight Pit, measured with NA.PS03.GMB20.LS010, (LL).
- Forced stop
 - Not applicable.

9.4.2.3.3 *Industrial Wastewater North Transfer Pumps (NA.PS03.GMB20.AP021/AP022)*

The function of these pumps is to pump the water from the Industrial Wastewater North Sump Pit to the Industrial Wastewater South Sump Pit.

- Automatic Start
 - The pump starts automatically if the level in the Industrial Wastewater North Sump Pit (NA.PS03.GMB20.BB120) is high, measured with NA.PS03.GMB20.LS020, (H) and if the level in the Industrial Wastewater South Sump Pit (NA.PS03.GMB20.BB110) is not high, measured with NA.PS03.GMB20.LS030, (H).
- Automatic Stop
 - The pump stops automatically if the level in the Industrial Wastewater North Wastewater Sump Pit (NA.PS03.GMB20.BB120) is low, measured with NA.PS03.GMB20.LS020, (L) or if the level in the Industrial Wastewater South Wastewater Sump Pit (NA.PS03.GMB20.BB110) is high, measured with NA.PS03.GMB20.LT030, (H).
- Start Permissives
 - Not low level in the Industrial Wastewater North Sump Pit (NA.PS03.GMB20.BB120), measured with NA.PS03.GMB20.LS020, (L).
- Stop Permissives
 - The pumps are always permitted to stop.
- Trip conditions. The pump will be tripped when any of the following conditions are reached:
 - Low low level in the Industrial Wastewater North Sump Pit (NA.PS03.GMB20.BB120), measured with NA.PS03.GMB20.LS020, (LL).
- Forced stop
 - Not applicable.

9.4.2.3.4 *Industrial Wastewater South Transfer Pumps (NA.PS03.GMB20.AP011/AP012)*

The function of these pumps is to pump the water from the Industrial Wastewater South Sump Pit (NA.PS03.GMB20.BB110) to the Industrial Sewer System (TP.PS03.0015).

- Automatic Start
 - The pump starts automatically if the level in the Industrial Wastewater South Sump Pit (NA.PS03.GMB20.BB110) is high, measured with NA.PS03.GMB20.LS030, (H).
- Automatic Stop
 - The pump stops automatically if the level in the Industrial Wastewater South Wastewater Sump Pit (NA.PS03.GMB20.BB110) is low, measured with NA.PS03.GMB20.LS030, (L).
- Start Permissives

- Not low level in the Industrial Wastewater South Wastewater Sump Pit (NA.PS03.GMB20.BB110), measured with NA.PS03.GMB20.LS030, (L).
- Stop Permissives
 - The pumps are always permitted to stop.
- Trip conditions. The pump will be tripped when any of the following conditions are reached:
 - Low low level in the Industrial Wastewater South Wastewater Sump Pit (NA.PS03.GMB20.BB110), measured with NA.PS03.GMB20.LS030, (LL).
- Forced stop
 - Not applicable.

9.4.2.3.5 On-Off valve NA.PS03.GMB20.AA257

The function of this valve is to recirculate the Industrial Wastewater South Sump Pit.

- Automatic Open
 - The valve will open automatically when one of the Industrial Wastewater South pumps is running.
- Automatic Close
 - The valve will close automatically when both Industrial Wastewater South pumps is stopped.
- Opening Permissives
 - The valve is always permitted to open.
- Closing Permissives
 - The valve is always permitted to close.
- Forced Open
 - Not applicable.

9.4.2.3.6 On-Off valves (NA.PS03.GMB20.AA251/AA252/AA254/AA255)

The function of this valve is to to discharge to the Industrial Wastewater North Sump Pit.

- Automatic Open
 - The valve does not open automatically, its opening is only manual with the operator supervision.
- Automatic Close
 - The valve does not close automatically, its closing is only manual with the operator supervision.
- Opening Permissives
 - The valve is always permitted to open.
- Closing Permissives
 - The valve is always permitted to close.
- Forced Open
 - Not applicable.

9.4.2.4 Industrial Adiabatic Coolers Blowdown Subsystem NA.PS03.GMB50

9.4.2.4.1 Industrial Adiabatic Coolers Blowdown Subsystem FSG NA.PS03.GMB50.EA010

When the Industrial Adiabatic Coolers Blowdown Subsystem is started up via its Functional Subgroup (NA.PS03.GMB50.EA010) by the operator acting on the Conventional Control System HMI or from a command coming from a higher hierarchical level (PS03 Wastewater Handling and Treatment System FG (NA.PS03.GM_10.EA010), the following actions will be carried out automatically:

- All drivers controlled by the Functional Subgroup (NA.PS03.GMB50.EA010) will be switched to automatic control mode.

- It will command the operation of the associated Adiabatic Coolers Blowdown Transfer Pumps (NA.PS03.GMB50.AP011/AP012) through a selector (NA.PS03.GMB50.EA110), so that it can manage the start-up and the stop of these pumps depending on the state of the system at any time.
- The Adiabatic Coolers Blowdown Transfer Pumps Selector shall start-up the pump selected as main by operator on the Conventional Control System HMI. Once the Adiabatic Coolers Blowdown Sump Pit (NA.PS03.GMB50.BB110) is above a high level, the Selector shall start the pump previously selected as main.
- The Adiabatic Coolers Blowdown Transfer Pumps Selector shall stop the pump running once the Adiabatic Coolers Blowdown Sump Pit (NA.PS03.GMB50.BB110) is under a low level.

In order to ensure that the Functional Subgroup starts-up only when it is able to fulfill their purpose, and to do it in a safe way for the equipment and for their dependent systems, the following start-up permissives will be programmed:

- Start Permissives
 - At least one Adiabatic Coolers Blowdown Transfer Pump (NA.PS03.GMB50.AP011/AP012) is available.
 - The valve NA.PS03.GMB50.AA251 is available.
 - Not low level in the Adiabatic Coolers Blowdown Sump Pit (NA.PS03.GMB50.BB110) with NA.PS03.GMB50.LS010, (L).
- Stop Permissive
 - Not applicable. The Functional Subgroup shall always have the stop permissive.

The shutdown of the system through the Functional Subgroup, either by operator acting on the Conventional Control System HMI or from a command coming from a higher hierarchical level (PS03 Wastewater Handling and Treatment System FG (NA.PS03.GM_10.EA010), shall stop automatically the Adiabatic Coolers Blowdown Pump in operation.

All the drivers of the Functional Subgroup will remain in automatic control mode unless express action by the operator.

9.4.2.4.2 *Adiabatic Coolers Blowdown Transfer Pumps (NA.PS03.GMB50.AP011/AP012)*

The function of these pumps is to drain the water from the Adiabatic Coolers Blowdown Sump Pit (NA.PS03.GMB50.BB110) to the Lagoon during normal operation or the Industrial Laboratories Subsystem if there is a problem with the Lagoon pipe.

- Automatic Start
 - The pump starts automatically if the level in the Adiabatic Coolers Blowdown Sump Pit (NA.PS03.GMB50.BB110) is high, measured with NA.PS03.GMB50.LS010, (H).
- Automatic Stop
 - The pump stops automatically if the level in the Adiabatic Coolers Blowdown Sump Pit (NA.PS03.GMB50.BB110) is low, measured with NA.PS03.GMB50.LS010, (L).
- Start Permissives
 - Not low level in the Adiabatic Coolers Blowdown Sump Pit (NA.PS03.GMB50.BB110), measured with NA.PS03.GMB50.LS010, (L).
- Stop Permissives
 - The pumps are always permitted to stop.
- Trip conditions. The pump will be tripped when any of the following conditions are reached:
 - Low low level in the Adiabatic Coolers Blowdown Sump Pit (NA.PS03.GMB50.BB110), measured with NA.PS03.GMB50.LS010, (LL).
- Forced stop
 - Not applicable.

9.4.2.4.3 *On-Off valve NA.PS03.GMB50.AA251*

The function of this valve is to discharge the Adiabatic Coolers Blowdown Sump Pit to the Lagoon.

- Automatic Open
 - The valve opens automatically when one of the Adiabatic Coolers Blowdown Transfer Pumps (NA.PS03.GMB50.AP011/AP012) starts.
- Automatic Close
 - The valve closes automatically when both Adiabatic Coolers Blowdown Transfer Pumps (NA.PS03.GMB50.AP011/AP012) are stopped.
- Opening Permissives
 - When the on-off valve is NA.PS03.GMB50.AA252 is closed.
- Closing Permissives
 - The valve is always permitted to close.
- Forced Open
 - Not applicable.

9.4.2.4.4 On-Off valve NA.PS03.GMB50.AA252

The function of this valve is to discharge the Adiabatic Coolers Blowdown Sump Pit to the Industrial Laboratories Subsystem if there is a problem with the Lagoon pipe.

- Automatic Open
 - The valve does not open automatically, its opening is only manual with the operator supervision.
- Automatic Close
 - The valve does not close automatically, its closing is only manual with the operator supervision.
- Opening Permissives
 - When the on-off valve is NA.PS03.GMB50.AA251 is closed.
- Closing Permissives
 - The valve is always permitted to close.
- Forced Open
 - Not applicable.

9.4.2.5 Industrial Demineralized Wastewater Subsystem NA.PS03.GMB60

9.4.2.5.1 Industrial Demineralized Wastewater FSG NA.PS03.GMB60.EA010

The operation of the Industrial Demineralized Wastewater (NA.PS03.GMB60.AP011/AP012) will be purely manual, therefore the Industrial Demineralized Wastewater FSG NA.PS03.GMB60.EA010 is not part of the higher hierarchical level (PS03 Wastewater Handling and Treatment System FG (NA.PS03.GM_10.EA010)).

When the Industrial Demineralized Wastewater Subsystem is started up via its Functional Subgroup (NA.PS03.GMB60.EA010) by the operator acting on the Conventional Control System HMI the following actions will be carried out automatically:

- All drivers controlled by the Functional Subgroup (NA.PS03.GMB60.EA010) will be switched to automatic control mode.
- It will command the operation of the associated Industrial Demineralized Wastewater Transfer pumps (NA.PS03.GMB60.AP011/AP012) through a selector (NA.PS03.GMB60.EA110), so that it can manage the start-up and the stop of these pumps depending on the state of the system at any time.
- The Industrial Demineralized Wastewater Selector shall start-up the pump selected as main by operator on the Conventional Control System HMI. Once the operator starts the pump.
- The Industrial Demineralized Wastewater Selector shall stop the pump running once the tank level is under a low level.

In order to ensure that the Functional Subgroup starts-up only when it is able to fulfill their purpose, and to do it in a safe way for the equipment and for their dependent systems, the following start-up permissives will be programmed:

- Start Permissives
 - At least one Industrial Demineralized Wastewater Transfer pump (NA.PS03.GMB60.AP011/AP012) is available.
 - Not low level in the Industrial Demineralized Wastewater tanks measured by NA.PS03.GMB60.LT010 and NA.PS03.GMB60.LT020.
- Stop Permissive
 - Not applicable. The Functional Subgroup shall always have the stop permissive.

The shutdown of the system through the Functional Subgroup, either by operator acting on the Conventional Control System HMI, shall stop automatically the Industrial Demineralized Wastewater Transfer pump (NA.PS03.GMB60.AP011/AP012) in operation.

All the drivers of the Functional Subgroup will remain in automatic control mode unless express action by the operator.

9.4.2.5.2 Industrial Demineralized Wastewater Transfer pumps (NA.PS03.GMB60.AP011/AP012)

The function of these pumps is to pump the water from the Industrial Demineralized Wastewater tanks (NA.PS03.GMB60.BB011/012) to be reused in the PS01 or to the Industrial Wastewater North Sump Pit (NA.PS03.GMB20.BB120). The whole operation is considered manual.

- Automatic Start
 - The pump does not start automatically .
- Automatic Stop
 - The pump does not stop automatically..
- Start Permissives
 - Not low level in both Demineralized Wastewater tanks, and
 - One On-Off Isolation valve is opened (NA.PS03.GMB60.AA257/AA258)
- Stop Permissives
 - The pumps are always permitted to stop.
- Trip conditions. The pump will be tripped when any of the following conditions are reached:
 - Low level in in both Demineralized Wastewater tanks.
- Forced stop
 - Not applicable.

9.4.2.5.3 On-Off valves (NA.PS03.GMB60.AA250/AA252)

The function of this valve is to to fill each Industrial Demineralized Wastewater Tank.

- Automatic Open
 - The valve does not open automatically, its opening is only manual with the operator supervision.
- Automatic Close
 - The valve closes automatically when the level in the tank is high.
- Opening Permissives
 - The valve NA.PS03.GMB60.AA250 will open only when NA.PS03.GMB60.AA252 is closed and the valve NA.PS03.GMB60.AA252 will open only when NA.PS03.GMB60.AA250 is closed.
- Closing Permissives
 - The valve is always permitted to close.
- Forced Open

- Not applicable.

9.4.2.5.4 On-Off Recirculation valves (NA.PS03.GMB60.AA251/AA253)

The function of this valve is to recirculate the Industrial Demineralized Wastewater in each tank.

- Automatic Open
 - The valve does not open automatically, its opening is only manual with the operator supervision.
- Automatic Close
 - The valve does not close automatically, its closing is only manual with the operator supervision.
- Opening Permissives
 - The valve is always permitted to open when its corresponding recirculation valve is open (NA.PS03.GMB60.AA257/AA258).
- Closing Permissives
 - The valve is always permitted to close.
- Forced Open
 - Not applicable.

9.4.2.5.5 On-Off Isolation valves (NA.PS03.GMB60.AA257/AA258)

The function of this valve is to recirculate the Industrial Demineralized Wastewater in each tank.

- Automatic Open
 - The valve does not open automatically, its opening is only manual with the operator supervision.
- Automatic Close
 - The valve does not close automatically, its closing is only manual with the operator supervision.
- Opening Permissives
 - The valve NA.PS03.GMB60.AA257 will open only when NA.PS03.GMB60.AA258 is closed and the valve NA.PS03.GMB60.AA258 will open only when NA.PS03.GMB60.AA257 is closed.
- Closing Permissives
 - The valve is always permitted to close.
- Forced Open
 - Not applicable.

9.4.2.5.6 On-Off valve NA.PS03.GMB60.AA254

The function of this valve is to discharge the Industrial Demineralized Water into the PS01 System.

- Automatic Open
 - The valve does not open automatically, its opening is only manual with the operator supervision.
- Automatic Close
 - The valve closes automatically when both Industrial Demineralized Wastewater tanks are under a low low level.
- Opening Permissives
 - The valve is always permitted to open.
- Closing Permissives
 - The valve is always permitted to close.
- Forced Open
 - Not applicable.

9.4.2.5.7 On-Off valve NA.PS03.GMB60.AA255

The function of this valve is to discharge the Industrial Demineralized Wastewater into the Industrial Wastewater North Sump Pit.

- Automatic Open
 - The valve does not open automatically, its opening is only manual with the operator supervision.
- Automatic Close
 - The valve closes automatically when both Industrial Demineralized Wastewater tanks are under a low low level.
- Opening Permissives
 - When the level in the Industrial Wastewater North Sump Pit is not high measured by NA.PS03.GMB20.LS020.
- Closing Permissives
 - The valve is always permitted to close.
- Forced Open
 - Not applicable.

9.4.2.6 Potentially Contaminated/Activated B02 Wastewater Subsystem NA.PS03.GMD10

The operation of the Potentially Contaminated/Activated B02 Wastewater System will be purely manual, therefore the Potentially Contaminated/Activated B02 Wastewater FSG NA.PS03.GMD10.EA010 is not part of the higher hierarchical level (PS03 Wastewater Handling and Treatment System FG (NA.PS03.GM_10.EA010)).

When the Potentially Contaminated/Activated B02 Wastewater is started up via its Functional Subgroup (NA.PS03.GMD10.EA010) by the operator acting on the Conventional Control System HMI the following actions will be carried out automatically:

- All drivers controlled by the Functional Subgroup (NA.PS03.GMD10.EA010) will be switched to automatic control mode.
- It will command the operation of the associated to the pumps (NA.PS03.GMB60.AP041/AP042), (NA.PS03.GMB60.AP031/AP032), (NA.PS03.GMB60.AP051/AP052), (NA.PS03.GMB60.AP021/AP022), (NA.PS03.GMB60.AP011/AP012) and (NA.PS03.GMB60.AP061/AP062) through their respective selectors (NA.PS03.GMD10.EA110), (NA.PS03.GMD10.EA120), (NA.PS03.GMD10.EA130), (NA.PS03.GMD10.EA140), (NA.PS03.GMD10.EA150) and (NA.PS03.GMD10.EA160) so that it can manage the start-up and the stop of these pumps depending on the state of the system at any time.
- The Selector shall start-up the pump selected as main by operator on the Conventional Control System HMI. Once the sump pit level increase above a high level, the Selector shall start the pump previously selected as main.
- The Industrial Selector shall stop the pump running once the sump pit level is under a low level.

In order to ensure that the Functional Subgroup starts-up only when it is able to fulfill their purpose, and to do it in a safe way for the equipment and for their dependent systems, the following start-up permissives will be programmed:

- Start Permissives
 - At least one of the pumps (NA.PS03.GMD10.AP041/AP042) is available.
 - At least one of the pumps (NA.PS03.GMD10.AP031/AP032) is available.
 - At least one of the pumps (NA.PS03.GMD10.AP051/AP052) is available.
 - At least one of the pumps (NA.PS03.GMD10.AP021/AP022) is available.
 - At least one of the pumps (NA.PS03.GMD10.AP011/AP012) is available.
 - At least one of the pumps (NA.PS03.GMD10.AP061/AP062) is available.

- Not low level in any of the sump pits measured by NA.PS03.GMD10.LS040, NA.PS03.GMD10.LS050, NA.PS03.GMD10.LS060, NA.PS03.GMD10.LS070 and NA.PS03.GMD10.LS080.
- Not low level in the tank NA.PS03.GMD10.LT010.
- Stop Permissive
 - Not applicable. The Functional Subgroup shall always have the stop permissive.

The shutdown of the system through the Functional Subgroup, either by operator acting on the Conventional Control System HMI, shall stop automatically the pumps in operation.

All the drivers of the Functional Subgroup will remain in automatic control mode unless express action by the operator.

9.4.2.6.1 *Potentially Contaminated/Activated B02 Wastewater Transfer pumps* (NA.PS03.GMD10.AP041/AP042)

The function of these pumps is to pump the water from the Potentially Contaminated/Activated B02 Wastewater Holding tank (NA.PS03.GMD10.BB010) to be reused in the PS01 or to send it to MAC. The whole operation is considered manual.

- Automatic Start
 - The pump does not start automatically.
- Automatic Stop
 - The pump does not stop automatically.
- Start Permissives
 - Not low level in tank.
- Stop Permissives
 - The pumps are always permitted to stop.
- Trip conditions. The pump will be tripped when any of the following conditions are reached:
 - Low low level in the tank.
- Forced stop
 - Not applicable.

9.4.2.6.2 *Potentially Contaminated/Activated B02 Wastewater Collection Pumps* (NA.PS03.GMD10.AP031/AP032)

The function of these pumps is to drain the water from the Potentially Contaminated/Activated B02 Wastewater Collection Sump Pit (Cooling Systems Room) to the tank.

- Automatic Start
 - The pump starts automatically if the level in the Potentially Contaminated/Activated B02 Wastewater Collection Sump Pit (Cooling Systems Room) (NA.PS03.GMD10.BB130) is high, measured with NA.PS03.GMD10.LS040, (H).
- Automatic Stop
 - The pump stops automatically if the level in the Potentially Contaminated/Activated B02 Wastewater Collection Sump Pit (Cooling Systems Room) (NA.PS03.GMD10.BB130) is low, measured with NA.PS03.GMD10.LS040, (L).
- Start Permissives
 - Not low level in the Potentially Contaminated/Activated B02 Wastewater Collection Sump Pit (Cooling Systems Room) (NA.PS03.GMD10.BB130), measured with NA.PS03.GMD10.LS040, (L), and
 - Both pumps (NA.PS03.GMD10.AP051/AP052) are stopped and
 - The level in the Potentially Contaminated/Activated B02 Wastewater Holding Tank is not high measured by (NA.PS03.GMD10.LT010).
- Stop Permissives

- The pumps are always permitted to stop.
- Trip conditions. The pump will be tripped when any of the following conditions are reached:
 - Low low level in the Potentially Contaminated/Activated B02 Wastewater Collection Sump Pit (Cooling Systems Room) (NA.PS03.GMD10.BB130), measured with NA.PS03.GMD10.LS040, (LL).
- Forced stop
 - Not applicable.

9.4.2.6.3 Potentially Contaminated/Activated B02 Wastewater Pumps (NA.PS03.GMD10.AP051/AP052)

The function of these pumps is to drain the water from the Potentially Contaminated/Activated B02 Wastewater Collection Sump Pit (Injector Room) (NA.PS03.GMD10.BB150) to the tank.

- Automatic Start
 - The pump starts automatically if the level in the Potentially Contaminated/Activated B02 Wastewater Collection Sump Pit (Injector Room) (NA.PS03.GMD10.BB150) is high, measured with NA.PS03.GMD10.LS050, (H).
- Automatic Stop
 - The pump stops automatically if the level in the Potentially Contaminated/Activated B02 Wastewater Collection Sump Pit (Injector Room) (NA.PS03.GMD10.BB150) is low, measured with NA.PS03.GMD10.LS050, (L).
- Start Permissives
 - Not low level in the Potentially Contaminated/Activated B02 Wastewater Collection Sump Pit (Injector Room) (NA.PS03.GMD10.BB150), measured with NA.PS03.GMD10.LS050, (L), and
 - Both pumps (NA.PS03.GMD10.AP031/AP032) are stopped, and
 - The level in the Potentially Contaminated/Activated B02 Wastewater Holding Tank is not high measured by (NA.PS03.GMD10.LT010).
- Stop Permissives
 - The pumps are always permitted to stop.
- Trip conditions. The pump will be tripped when any of the following conditions are reached:
 - Low low level in the Potentially Contaminated/Activated B02 Wastewater Collection Sump Pit (Injector Room) (NA.PS03.GMD10.BB150), measured with NA.PS03.GMD10.LS050, (LL).
- Forced stop
 - Not applicable.

9.4.2.6.4 Potentially Contaminated/Activated B02 Wastewater Transfer Pumps (NA.PS03.GMD10.AP021/AP022)

The function of these pumps is to pump the water from the Potentially Contaminated/Activated B02 Wastewater Sump Pit (Buffer Room) (NA.PS03.GMD10.BB120) to the tank.

- Automatic Start
 - The pump starts automatically if the level in the Potentially Contaminated/Activated B02 Wastewater Sump Pit (Buffer Room) (NA.PS03.GMD10.BB120) is high, measured with NA.PS03.GMD10.LS060, (H).
- Automatic Stop
 - The pump stops automatically if the level in the Potentially Contaminated/Activated B02 Wastewater Sump Pit (Buffer Room) (NA.PS03.GMD10.BB120) is low, measured with NA.PS03.GMD10.LS060, (L).
- Start Permissives
 - Not low level in the Potentially Contaminated/Activated B02 Wastewater Sump Pit (Buffer Room) (NA.PS03.GMD10.BB120), measured with NA.PS03.GMD10.LS060, (L).

- Both pumps (NA.PS03.GMD10.AP011/AP012) and (NA.PS03.GMD10.AP061/AP062) are stopped.
- Stop Permissives
 - The pumps are always permitted to stop.
- Trip conditions. The pump will be tripped when any of the following conditions are reached:
 - Low low level in the Potentially Contaminated/Activated B02 Wastewater Sump Pit (Buffer Room) (NA.PS03.GMD10.BB120), measured with NA.PS03.GMD10.LS060, (LL).
- Forced stop
 - Not applicable.

9.4.2.6.5 *Potentially Contaminated/Activated B02 Wastewater Transfer Pumps (NA.PS03.GMD10.AP011/AP012)*

The function of these pumps is to pump the water from the Potentially Contaminated/Activated B02 Wastewater Sump Pit (SC LINAC Tunnel - East) (NA.PS03.GMD10.BB110) to the MAC NF.

- Automatic Start
 - The pump starts automatically if the level in the Potentially Contaminated/Activated B02 Wastewater Sump Pit (SC LINAC Tunnel - East) (NA.PS03.GMD10.BB110) is high, measured with NA.PS03.GMD10.LS070, (H).
- Automatic Stop
 - The pump stops automatically if the level in the Potentially Contaminated/Activated B02 Wastewater Sump Pit (SC LINAC Tunnel - East) (NA.PS03.GMD10.BB110) is low, measured with NA.PS03.GMD10.LS070, (L).
- Start Permissives
 - Not low level in the Potentially Contaminated/Activated B02 Wastewater Sump Pit (SC LINAC Tunnel - East) (NA.PS03.GMD10.BB110), measured with NA.PS03.GMD10.LS070, (L).
 - Both pumps (NA.PS03.GMD10.AP021/AP022) and (NA.PS03.GMD10.AP061/AP062) are stopped.
- Stop Permissives
 - The pumps are always permitted to stop.
- Trip conditions. The pump will be tripped when any of the following conditions are reached:
 - Low low level in the Potentially Contaminated/Activated B02 Wastewater Sump Pit (SC LINAC Tunnel - East) (NA.PS03.GMD10.BB110), measured with NA.PS03.GMD10.LS070, (LL).
- Forced stop
 - Not applicable.

9.4.2.6.6 *Potentially Contaminated/Activated B02 Wastewater Transfer Pumps (NA.PS03.GMD10.AP061/AP062)*

The function of these pumps is to pump the water from the Potentially Contaminated/Activated B02 Wastewater Sump Pit (SC LINAC Tunnel – West) (NA.PS03.GMD10.BB160) to the MAC.

- Automatic Start
 - The pump starts automatically if the level in the Potentially Contaminated/Activated B02 Wastewater Sump Pit (SC LINAC Tunnel - West) (NA.PS03.GMD10.BB160) is high, measured with NA.PS03.GMD10.LS080, (H).
- Automatic Stop
 - The pump stops automatically if the level in the Potentially Contaminated/Activated B02 Wastewater Sump Pit (SC LINAC Tunnel - West) (NA.PS03.GMD10.BB160) is low, measured with NA.PS03.GMD10.LS080, (L).
- Start Permissives
 - Not low level in the Potentially Contaminated/Activated B02 Wastewater Sump Pit (SC LINAC Tunnel - West) (NA.PS03.GMD10.BB160), measured with NA.PS03.GMD10.LS080, (L).

- Both pumps (NA.PS03.GMD10.AP021/AP022) and (NA.PS03.GMD10.AP011/AP012) are stopped.
- Stop Permissives
 - The pumps are always permitted to stop.
- Trip conditions. The pump will be tripped when any of the following conditions are reached:
 - Low low level in the Potentially Contaminated/Activated B02 Wastewater Sump Pit (SC LINAC Tunnel - West) (NA.PS03.GMD10.BB160), measured with NA.PS03.GMD10.LS080, (LL).
- Forced stop
 - Not applicable.

9.4.2.6.7 On-Off valve NA.PS03.GMD10.AA250/AA256

The valve NA.PS03.GMD10.AA250 will allow the recirculation and the NA.PS03.GMD10.AA256 to measure the water parameters. Both valves will be operated manually by the operator acting on the valves faceplate on the Conventional Control System HMI.

- Automatic Open
 - The valve does not open automatically, its opening is only manual with the operator supervision.
- Automatic Close
 - The valve closes automatically when the Potentially Contaminated/Activated B02 Wastewater Holding Tank is under a low low level.
- Opening Permissives
 - The valve is always permitted to open.
- Closing Permissives
 - The valve is always permitted to close.
- Forced Open
 - Not applicable.

9.4.2.6.8 On-Off valve NA.PS03.GMD10.AA251/AA252/AA253/AA254/AA255

All these valves will be operated manually by the operator acting on the valves faceplate on the Conventional Control System HMI.

- Automatic Open
 - The valve does not open automatically, its opening is only manual with the operator supervision.
- Automatic Close
 - The valve closes automatically when the Potentially Contaminated/Activated B02 Wastewater Holding Tank is under a low low level.
- Opening Permissives
 - The valves NA.PS03.GMD10.AA251/AA252/AA253/AA254 will be allowed to open if the level in their corresponding discharge PS01 surge tanks is not high measured by NA.PS01.PJB31.LT010, NA.PS01.PJB32.LT010, NA.PS01.PJB33.LT010 and, NA.PS01.PJB34.LT010 respectively.
 - The valve NA.PS03.GMD10.AA255 will be allowed to open with a signal from MAC that it is pending.
- Closing Permissives
 - The valve is always permitted to close.
- Forced Open
 - Not applicable.

9.4.2.6.9 On-Off valve NA.PS03.GMD10.AA257

The valve NA.PS03.GMD10.AA257 will open manually by the operator to discharge the wastewater contained in the leaktight pits to the Potentially Contaminated/Activated B02 Wastewater Sump Pit (Buffer Room).

- Automatic Open
 - The valve does not open automatically, its opening is only manual with the operator supervision.
- Automatic Close
 - The valve closes automatically when the Potentially Contaminated/Activated B02 Wastewater Sump Pit (Buffer Room) is over a high level.
- Opening Permissives
 - If the level measured by NA.PS03.GMD10.LS060 is not high
- Closing Permissives
 - The valve is always permitted to close.
- Forced Open
 - Not applicable.

9.5 Sequence

The higher hierarchical level for the PS03 PS03 Wastewater Handling and Treatment System FG (NA.PS03.GM_10.EA010).

9.5.1 Start-up sequence

The operator will select the main pump to start on the Selector's faceplates (NA.PS03.GMA10.EA110, NA.PS03.GMB20.EA110, NA.PS03.GMB20.EA120, NA.PS03.GMB20.EA130 and NA.PS03.GMB50.EA110).

The Functional Group (NA.PS03.GM_10.EA010) will be switched to automatic control mode by operator acting on the FG faceplate on the Conventional Control System HMI and all the FSG (NA.PS03.GMA10.EA010, NA.PS03.GMB20.EA010 and NA.PS03.GMB50.EA010) along with their dependent equipment will be in auto mode too.

The PS03 Wastewater Handling and Treatment System will be ready to regulate itself in automatic mode. The pumps start when their control loops required to them to start.

In order to start the Industrial Glycol Wastewater Subsystem, once that the tank trailer is connected, the operator will select the main pump on the Selector NA.PS03.GMB10.EA110 faceplate and after will switched to automatic mode on the FSG NA.PS03.GMB10.EA010 faceplate and all its dependent equipment will be in auto mode.

Regarding the Industrial Desmineralized Wastewater Subsystem, the operator will select the main pump on the Selector NA.PS03.GMB60.EA110 faceplate and after will switched to automatic mode on the FSG NA.PS03.GMB60.EA010 faceplate and all its dependent equipment will be in auto mode.

The operator will select the main pump to start on the Selector's faceplates (NA.PS03.GMD10.EA110, NA.PS03.GMD10.EA120, NA.PS03.GMD10.EA130, NA.PS03.GMD10.EA140, NA.PS03.GMD10.EA150 and NA.PS03.GMD10.EA160).

The Functional SubGroup FSG (NA.PS03.GMD10.EA010) will be switched to automatic control mode by operator acting on the FG faceplate on the Conventional Control System HMI and all its equipment will be in auto mode too.

9.5.2 Shutdown sequence

The operator by acting on the Functional Group (NA.PS03.GM_10.EA010) faceplate' stop button on the Conventional Control System HMI, will stop automatically all the pumps in operation.

All the drivers of the PS03 Wastewater Handling and Treatment System will remain in automatic control mode unless express action by the operator.

In order to stop the Industrial Glycol Wastewater Subsystem, the operator will act on FSG NA.PS03.GMB10.EA010 faceplate to stop automatically the pumps and he will act on the pumps faceplates to by switching the pumps to manual mode.

Regarding the Industrial Desmineralized Wastewater Subsystem, the operator will act on FSG NA.PS03.GMB60.EA010 faceplate to stop automatically the pumps and he will act on the pumps faceplates to by switching the pumps to manual mode.

The operator will stop the Functional SubGroup FSG (NA.PS03.GMD10.EA010) all its equipment.

9.6 Alarms

Hereafter are listed the PS03 Wastewater Handling and Treatment System alarms due to the proces, however, the whole alarm's list with all details related to the alarms as tag-name, description, priority will be presented in the Alarm List [16] document. . A few of the below alarms will be pre-alarms of the abnormal operation indicated in section 9.3.2.

- High high Municipal Wastewater Sump Pit (NA.PS03.GMA10.LS010), (HH).
- High Municipal Wastewater Sump Pit (NA.PS03.GMA10.LS010), (H).
- Low Municipal Wastewater Sump Pit (NA.PS03.GMA10.LS010), (L).
- Low low Municipal Wastewater Sump Pit (NA.PS03.GMA10.LS010), (LL).
- Municipal Wastewater TransferPumps (NA.PS03.GMA10.AP011/AP012) tripped.
- Municipal Wastewater Transfer Pumps (NA.PS03.GMA10.AP011/AP012) not available.
- Bad quality Municipal Wastewater totalizer Flow (NA.PS03.GMA10.FQT010).
- High high level in the Industrial Glycol Wastewater Sump Pit (NA.PS03.GMB10.LS010) (HH).
- High level in the Industrial Glycol Wastewater Sump Pit (NA.PS03.GMB10.LS010) (H).
- Low level in the Industrial Glycol Wastewater Sump Pit (NA.PS03.GMB10.LS010) (L).
- Low low level in the Industrial Glycol Wastewater Sump Pit (NA.PS03.GMB10.LS010) (LL).
- Industrial Glycol Wastewater Transfer Pumps (NA.PS03.GMB10.AP011/AP012) tripped.
- Industrial Glycol Wastewater Transfer Pumps (NA.PS03.GMB10.AP011/AP012) not available.
- Bad quality in the Industrial Glycol Wastewater totalizer flow (NA.PS03.GMB10.FQT010).
- Portable Transfer Pump (NA.PS03.GMB10.AP020) tripped.
- Portable Transfer Pump (NA.PS03.GMB10.AP020) not available.
- High high level in the Drainage and Transfer Room Sump Pit (NA.PS03.GMB20.LS010) (HH).
- High level in the Drainage and Transfer Room Sump Pit (NA.PS03.GMB20.LS010) (H).
- Low level in the Drainage and Transfer Room Sump Pit (NA.PS03.GMB20.LS010) (L).
- Low low level in the Drainage and Transfer Room Sump Pit (NA.PS03.GMB20.LS010) (LL).
- Drainage and Transfer Wastewater Pumps (NA.PS03.GMB20.AP031/AP032) tripped.
- Drainage and Transfer Wastewater Pumps (NA.PS03.GMB20.AP031/AP032) not available.
- High high level in the Industrial Wastewater North Sump Pit (NA.PS03.GMB20.LS020) (HH).
- High level in the Industrial Wastewater North Sump Pit (NA.PS03.GMB20.LS020) (H).
- Low level in the Industrial Wastewater North Sump Pit (NA.PS03.GMB20.LS020) (L).
- Low low level in the Industrial Wastewater North Sump Pit (NA.PS03.GMB20.LS020) (LL).
- Industrial Wastewater North Transfer Pumps (NA.PS03.GMB20.AP021/AP022) tripped.
- Industrial Wastewater North Transfer Pumps (NA.PS03.GMB20.AP021/AP022) not available.
- High high level in the Industrial Wastewater South Sump Pit (NA.PS03.GMB20.LS030) (HH).
- High level in the Industrial Wastewater South Sump Pit (NA.PS03.GMB20.LS030) (H).
- Low level in the Industrial Wastewater South Sump Pit (NA.PS03.GMB20.LS030) (L).

- Low low level in the Industrial Wastewater South Sump Pit (NA.PS03.GMB20.LS030) (LL).
- Industrial Wastewater South Transfer Pumps (NA.PS03.GMB20.AP011/AP012) tripped.
- Industrial Wastewater South Transfer Pumps (NA.PS03.GMB20.AP011/AP012) not available.
- High PH Industrial Wastewater NA.PS03.GMB20.AT010 (H).
- Bad quality PH Industrial Wastewater NA.PS03.GMB20.AT010.
- High Specific Conductivity Industrial Wastewater NA.PS03.GMB20.AT020 (H).
- Bad quality Specific Conductivity Industrial Wastewater NA.PS03.GMB20.AT020.
- Bad quality totalizer Flow Industrial Wastewater NA.PS03.GMB20.FQT010.
- Bad quality totalizer Flow Industrial Wastewater NA.PS03.GMB20.FQT020.
- High high level in the Adiabatic Coolers Blowdown Sump Pit (NA.PS03.GMB50.LS010) (HH).
- High level in the Industrial Adiabatic Coolers Blowdown Sump Pit (NA.PS03.GMB50.LS010) (H).
- Low level in the Industrial Adiabatic Coolers Blowdown Sump Pit (NA.PS03.GMB50.LS010) (L).
- Low low level in the Adiabatic Coolers Blowdown Sump Pit (NA.PS03.GMB50.LS010) (LL).
- Adiabatic Coolers Blowdown Transfer Pumps (NA.PS03.GMB50.AP011/AP012) tripped.
- Adiabatic Coolers Blowdown Transfer Pumps (NA.PS03.GMB50.AP011/AP012) not available.
- High high differential pressure in the CO2 filter (NA.PS03.GMB60.PT010) (HH).
- High differential pressure in the CO2 filter (NA.PS03.GMB60.PT010) (H).
- Bad quality differential pressure in the CO2 filter (NA.PS03.GMB60.PT010).
- High high differential pressure in the CO2 filter (NA.PS03.GMB60.PT020) (HH).
- High differential pressure in the CO2 filter (NA.PS03.GMB60.PT020) (H).
- Bad quality differential pressure in the CO2 filter (NA.PS03.GMB60.PT020).
- High high level in the Industrial Demineralized Wastewater Tank (NA.PS03.GMB60.LT010), (HH).
- High level in the Industrial Demineralized Wastewater Tank (NA.PS03.GMB60.LT010), (H).
- Low level in the Industrial Demineralized Wastewater Tank (NA.PS03.GMB60.LT010), (L).
- Bad quality in the Industrial Demineralized Wastewater Tank (NA.PS03.GMB60.LT010).
- High high level in the Industrial Demineralized Wastewater Tank (NA.PS03.GMB60.LT020), (HH).
- High level in the Industrial Demineralized Wastewater Tank (NA.PS03.GMB60.LT020), (H).
- Low level in the Industrial Demineralized Wastewater Tank (NA.PS03.GMB60.LT020), (L).
- Bad quality in the Industrial Demineralized Wastewater Tank (NA.PS03.GMB60.LT020).
- High pressure at the discharge of the Industrial Demineralized Wastewater Pumps (NA.PS03.GMB60.PT030), (H).
- Low pressure at the discharge of the Industrial Demineralized Wastewater Pumps (NA.PS03.GMB60.PT030), (L).
- Bad quality pressure at the discharge of the Industrial Demineralized Wastewater Pumps (NA.PS03.GMB60.PT030).
- High PH of the Industrial Demineralized Wastewater (NA.PS03.GMB60.AT010), (L).
- Bad quality PH of the Industrial Demineralized Wastewater (NA.PS03.GMB60.AT010).
- High Specific Conductivity Industrial Wastewater NA.PS03.GMB60.AT020 (H).
- Bad quality Specific Conductivity Industrial Wastewater NA.PS03.GMB60.AT020.
- High level in the Potentially Contaminated/Activated B02 Wastewater Tank (NA.PS03.GMD10.LT010), (H).
- Low level in the Potentially Contaminated/Activated B02 Wastewater Tank (NA.PS03.GMD10.LT010), (L).
- Low low level in the Potentially Contaminated/Activated B02 Wastewater Tank (NA.PS03.GMD10.LT010), (LL).
- Bad quality in the Potentially Contaminated/Activated B02 Wastewater Tank (NA.PS03.GMD10.LT010).

- High pressure in the Potentially Contaminated/Activated B02 Wastewater Tank (NA.PS03.GMD10.PT010), (H).
- Low pressure in the Potentially Contaminated/Activated B02 Wastewater Tank (NA.PS03.GMD10.PT010), (L).
- Bad quality in the Potentially Contaminated/Activated B02 Wastewater Tank (NA.PS03.GMD10.PT010).
- High pressure at the discharge of the Potentially Contaminated/Activated B02 Wastewater pumps (NA.PS03.GMD10.PT020), (H).
- Low pressure at the discharge of the Potentially Contaminated/Activated B02 Wastewater pumps (NA.PS03.GMD10.PT020), (L).
- Bad quality at the discharge of the Potentially Contaminated/Activated B02 Wastewater pumps (NA.PS03.GMD10.PT020).
- High PH of the Potentially Contaminated/Activated B02 Wastewater (NA.PS03.GMD10.AT010), (L).
- Bad quality PH of the Potentially Contaminated/Activated B02 Wastewater (NA.PS03.GMD10.AT010).
- High Specific Conductivity Potentially Contaminated/Activated B02 Wastewater NA.PS03.GMD10.AT020 (H).
- Bad quality of the Specific Conductivity Potentially Contaminated/Activated B02 Wastewater NA.PS03.GMD10.AT020.
- High Radioactivity of the Potentially Contaminated/Activated B02 Wastewater NA.PS03.GMD10.RT030 (H).
- Bad quality Radioactivity of the Specific Conductivity Potentially Contaminated/Activated B02 Wastewater NA.PS03.GMD10.RT030.
- High high level in the leaktight containment pit (Cooling System Room) (NA.PS03.GMD10.LS030) (HH).
- High level in the leaktight containment pit (Cooling System Room) (NA.PS03.GMD10.LS030) (H).
- High high level in the Potentially Contaminated/Activated B02 Wastewater Cooling System Room (NA.PS03.GMD10.LS040), (HH).
- High level in the Potentially Contaminated/Activated B02 Wastewater Cooling System Room (NA.PS03.GMD10.LS040), (H).
- Low level in the Potentially Contaminated/Activated B02 Wastewater Cooling System Room (NA.PS03.GMD10.LS040), (L).
- Low low level in the Potentially Contaminated/Activated B02 Wastewater Cooling System Room (NA.PS03.GMD10.LS040), (LL).
- High high level in the Potentially Contaminated/Activated B02 Wastewater Injector Room (NA.PS03.GMD10.LS050), (HH).
- High level in the Potentially Contaminated/Activated B02 Wastewater Injector Room (NA.PS03.GMD10.LS050), (H).
- Low level in the Potentially Contaminated/Activated B02 Wastewater Injector Room (NA.PS03.GMD10.LS050), (L).
- Low low level in the Potentially Contaminated/Activated B02 Wastewater Injector Room (NA.PS03.GMD10.LS050), (LL).
- High high level in the Potentially Contaminated/Activated B02 Wastewater Buffer Room (NA.PS03.GMD10.LS060), (HH).
- High level in the Potentially Contaminated/Activated B02 Wastewater Buffer Room (NA.PS03.GMD10.LS060), (H).
- Low level in the Potentially Contaminated/Activated B02 Wastewater Buffer Room (NA.PS03.GMD10.LS060), (L).
- Low low level in the Potentially Contaminated/Activated B02 Wastewater Buffer Room (NA.PS03.GMD10.LS060), (LL).

- High high level in the Potentially Contaminated/Activated B02 Wastewater Linac Tunnel East (NA.PS03.GMD10.LS070), (HH).
- High level in the Potentially Contaminated/Activated B02 Wastewater Linac Tunnel East (NA.PS03.GMD10.LS070), (H).
- Low level in the Potentially Contaminated/Activated B02 Wastewater Linac Tunnel East (NA.PS03.GMD10.LS070), (L).
- Low low level in the Potentially Contaminated/Activated B02 Wastewater Linac Tunnel East (NA.PS03.GMD10.LS070), (LL).
- High high level in the Potentially Contaminated/Activated B02 Wastewater Linac Tunnel West (NA.PS03.GMD10.LS080), (HH).
- High level in the Potentially Contaminated/Activated B02 Wastewater Linac Tunnel West (NA.PS03.GMD10.LS080), (H).
- Low level in the Potentially Contaminated/Activated B02 Wastewater Linac Tunnel West (NA.PS03.GMD10.LS080), (L).
- Low low level in the Potentially Contaminated/Activated B02 Wastewater Linac Tunnel West (NA.PS03.GMD10.LS080), (LL).
- High Radioactivity of the Potentially Contaminated/Activated B02 Wastewater NA.PS03.GMD10.RT020 (H).
- Bad quality Radioactivity of the Specific Conductivity Potentially Contaminated/Activated B02 Wastewater NA.PS03.GMD10.RT020.
- Bad quality totalizer flow of the Potentially Contaminated/Activated B02 Wastewater pumps (NA.PS03.GMD10.FQT020).

10 References

- [1] Abbreviations, Glossary and Symbols - SCK CEN\8905079 (=MNRV_BDB001).
- [2] Applicable Codes and Standards - MINERVA/4NT/0691961/000/00.
- [3] PS03 Wastewater Handling and Treatment System PFD (=NA.PS03_PFB501).
- [4] Process Systems, Equipment and Piping Design Criteria (=NA.PS_PDB501).
- [5] PS03 Sizing, Design and Capacity Calculations Wastewater Treatment System (=NA.PS03_PDD501).
- [6] Masterplan Layout (=NA.PM_CTA501)
- [7] Project Execution Plan (=NA.AC_ABZ501).
- [8] MINERVA ACC NF Fluid List (=NA.AA_BPB503).
- [9] MINERVA ACC NF SCC List (=NA.AA_BPB502)
- [10] MINERVA ACC NF Terminal Points List (=NA.AA.BPB501)
- [11] PS03 Wastewater Treatment System P&ID (=NA.PS03_PFB503).
- [12] UBMS Control Interface Principle (=NA.CN_EDB502)
- [13] SCK CEN/4107788 (128-INS-06) – Sorteerinstructie Afval van labochemicaliën
- [14] PS01 Cooling Systems Description (=NA.PS01_PDB501)
- [15] PS03 Wastewater Handling and Treatment System Control Diagram
- [16] Alarm List (=NA.CN_EPB502)