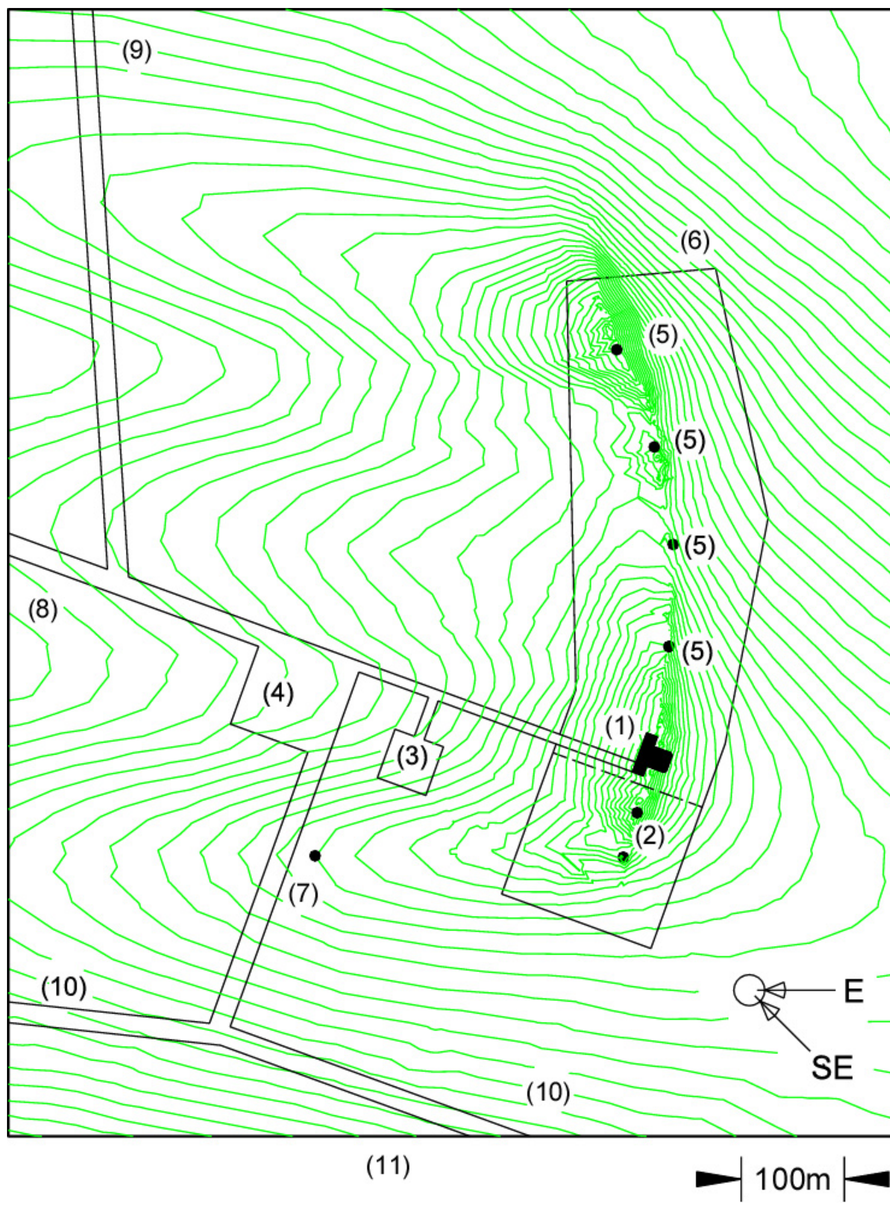

Fig 2.27: Boundaries of construction area, station operation, landing strip:
(1) Station; (2) "Stay-out" zone with stand-alone scientific facilities & AWS; (3) Snow collecting zone;
(4) Parking outside; (5) Wind turbine positions; (6) Access allowed zone; (7) Emergency shelter;
(8) Access to fuel depot (at 1000m) and small Nunatak (2000m); (9) Access to snow runway (2000m N-W);
(10) Access routes to various areas (Gunnestadbreen, coast route, mountains east, mountains west, Utsteinen Nunatak);
(11) Utsteinen Nunatak.

Fuel depot

Storage of fuel and oils in the garage/storage building will be kept to a minimum and will have secondary containment. The fuel depot is located on a safe distance and out of the main wind direction to the lee-side of the ridge (West). The baseline for fuel storage will be the use of 4 sledge-based double skin (bunded) fuel tanks of 12 m³ capacity each. They will store fuel for the back-up generators and transport. These bulk storage tanks are proven technology (used on Concordia) and appear to be safe and reliable. The handling of the fuel will be limited to the displacement of the tanks to avoid too much snow accumulation. When practical the fuel tanks will be equipped with automatic monitoring system. The number of fuel transfers will be reduced. The use of drums on site will be limited but there always will be a minimum quantity on site. At the refuelling points located in designated positions measures will be taken to avoid and eventually retain spills.

Estimated fuel consumption per year (construction):

Jet A1:

- Back-up generators: 8,000 litres => tank capacity 12,000 litres
- Overland transport => 17,000 litres
- Aircraft 8,000 litres

Gasoline (unleaded 95):

- Snowmobiles and other equipment: 2,000 litres

White gas (stoves)

- To be defined

Estimated fuel consumption per year (operational):

Jet A1:

- Back-up generators: 100-2,500 litres => tank capacity 12,000 litres
- Overland transport => 5,000 litres
- Aircraft 4,000 litres

Gasoline (unleaded 95):

- Snowmobiles and other equipment: 2,000 litres

White gas (stoves)

- To be defined

Emergency shelter

The under-snow emergency shelter will be stand-alone (food-power supply-communications) and will be designed for 12 people. The site is out of the wind path versus the station at the lee-side of the ridge.

Stand-alone scientific facilities

Small stand alone facilities are foreseen to the south of the station. The ridge provides good accessibility and anchoring conditions over about 200 m. This is up-wind versus the station and might cause some disturbance. There is an alternative position a small unnamed nunatak 2 km to the west of the ridge.

2.4.7. Water generation and disposal

Water generating

Efficient water housekeeping required water consumption to be kept under control. This will be done by means of using water-efficient end-user equipment (for example toilets).

The water supply for the station will result from a combination of solutions. The initial system will use snow drift and the (resulting) snow accumulation caused by the building and the ridge. The collected snow is automatically dumped into (the lower positioned) snow collector located in the garage/storage building.

Solar thermal panels will be used to melt the snow thereby limiting the use of electrical energy to pumping the water. This system may be very economic but it will only be viable when fresh water is recycled in a secondary network. As a bonus there will be less energy needed to melt snow and less waste water to dispose of. In addition electrical heating, eventually backed-up with waste heat originating from co-generation (multiple sources possible), can be used in the system. A water buffer tank in the main building will accommodate five days supply and the hot water storage will also be inside the main building. Both water storage systems are part of the thermal buffer mass of the building.

Grey and black water

The waste water treatment plant consists of a grey and black water system (black water includes urine and human solid waste). The proposed design minimises water demand by reducing fresh water consumption. Water coming from the snow melting facility, stored in a buffer tank, will be used for all potable functions, including showers and cooking. Other building functions will use recycled water. This has been designed as a modular system that can be extended in future. In an initial configuration there will be:

- An influent buffer collecting all grey and black water produced;
- An anaerobic reactor with ultra-filtration unit;
- A Membrane Aerobic Bioreactor;
- A chlorine unit;
- Active carbon treatment unit;
- UV-treatment unit; and
- Buffer hygienic water.

Future extension could include a reverse osmosis unit (giving up to 90% recycling).

In the current configuration the low quantity of surplus grey water will be released into the 'randkluft', a natural formed gap between rock and snow/ice mass at the west side of the ridge. This backup solution will use an insulated and heated sewage pipe. Note that this can be done north and south of the station and that the water will never be disposed at the snow surface or onto exposed rock. An overview of the expected effluent quality of the grey water is given in **Section 12**, **Table 12.3.**

Air exchange (venting) will use bacterial filters on the outlets adding an additional level of containment to the system. Very low quantities of CO_2 will be produced by the waste water treatment system. The production of methane is avoided in the bioreactor. This will create a higher output of residue but the surplus is very acceptable. The residues will be dried, sealed and stored in sterile containers together with the other waste that will be removed from the site during ship re-supply.

Water consumption

All obvious measures will be taken to keep the water usage as efficient as possible. An important element in this is the selection of low water use equipment. For example the use of latest technology laundry and dishwasher machinery will reduce water demand but also measures such as the use of recycled water for dish washing combined with fresh water for rinsing in the same machine will be beneficial.

2.4.8. Energy

Reliability

The use of sustainable technology as the primary energy source without compromising functionality, comfort or safety requires a cautious approach in the system engineering. Making best use of co-generation and enhancing energy efficiency implies a high level of integration but this could have a major disadvantage: vulnerability of the whole system for partial break-downs. Therefore in the conceptual design the following approach has been used:

- Reliability: where possible subsystems are composed of modules built up from proven technology extended to (relatively) new technology for highest efficiency. The minimum functionality of the subsystem is assured by the core system.
- Independency: the interaction (e.g. co-generation) of subsystems does not compromise the functioning of the individual subsystems.
- Redundancy: detailed Failure Mode Effect Analysis (FMEA) of the whole building is used as an input to the design process. Safety measures, maintenance and other applicable strategies are tailored according to this.

Prior to the concept phase of the project an extensive technology survey was conducted looking at potential solutions for energy generation, distribution, storage and sustainable energy system in general. Such a survey was also applied for most aspects of the building physics such as Heating, Ventilation, Air Conditioning (HVAC)... Brainstorms for possible solutions were backed-up by preliminary energy simulations taking into account the on-site weather data (wind/sun/temperature), user (consumer) profiles, user scenarios, materials used, the building geometry and orientation.

User profiles

Base energy "modes" identified for energy consumption, basic overview:

	Profiles	**Days**	
1	Winter	215	Remote sensing & monitoring
2	Unmanned start-up	30	Remote waste water system start-up + gradual heating of building
3	Manned start-up	5	Staff arrives (+ visitors) - air transport available
4	Summer high 1	25	Science activities (nominal use) - air transport available
5	Summer low	60	Science activities (nominal use) - air transport NOT available
6	Summer high 2	25	Science activities (nominal use) - air transport available
7	Manned close down	5	Preparing for over wintering - air transport available

Table 2.4: Base energy "modes" identified for energy consumption

The number of people on the base will vary depending on the time of the season and the scientific activities planned. There will be a minimum support staff of 4 people. This number may increase depending on the support required for the scientific work. In a season with a high level of activity the average number of people stationed at the base is estimated to be approximately 50% of the total number because many of them will be performing field research. In November and February when most air transport is available the occupation is highest. In these periods most people will stay for a maximum of 1 month at the base. Also during summer the weather conditions can force the crew to stay inside the buildings. In the energy budgets these "events" have been taken into account.

Energy generation system overview

The energy generation side of the system consists of different elements that function separately or combined depending on the demands and circumstances. The station site has a sheltered nature (see **Section 4.4** for weather data) but the site still provides sufficient wind to use wind energy as a major electrical energy source.

The concept currently studied consists of a number of relatively small wind turbines positioned on the ridge in (N-S direction) with an interval of 100 m. All the wind turbines are located north of the station (the first at 100 m) and are supported by a guy wire system for robustness and minimal-impact anchoring. These turbines can be lowered without the assistance of heavy equipment. From a technical point of view this is not obligatory but this option can be envisaged to minimize the risk of damage during winter. Furthermore this will facilitate maintenance and repairs. The mechanical modifications are limited to few reinforcements and better sealing to counter snow drift intrusion. Additional to these turbines a small "winter turbine" will be installed at a natural lower point of the ridge (speed-up). This turbine will provide extra power to the station during the winter thereby reducing the required battery capacity needed for monitoring (building & science) and to maintain the buildings inside temperature under control.

On the building different solar power systems are used. They are solar thermal and photovoltaic panels. For solar passive energy there are, apart from the strategically positioned glazing, also "solar transparent" insulation panels on the roof used for pre-heating ventilation air and to warm up the thermal masses situated in the building roof buffer zones. The distribution of the different panel types is defined by the user profiles (energy needs) and the position of the sun during the day. The photovoltaic system will be capable to provide up to 10 % of the electrical load and mainly will reduce the storage capacity in batteries as much as possible.

Although power supply at the station is based on renewable energy, wind and solar radiation studies show that both are reliable energy sources; it may happen that occasionally the power supply can be insufficient. Therefore a number of measures are taken:

The station is equipped with two back-up generators. Jet A-1 consumption is estimated at 50-100 litres fuel per day depending on the load. A double-walled fuel tank can store 12000 litres which will provide sufficient autonomy for a full season at 100 % use. Excess heat from the generators will be reused into the hot water system which itself supplies the passive snow melting circuit, the building active heating system or preheating for appliances which use hot water. In nominal conditions the generators are expected to be used at a very low rate as the systems mentioned do not rely on the generators to be operational. The use of redundancy in the generator park adds another safety level and allows maintenance to be done during operations; also it provides flexibility to cope with energy use variations.

Installed power overview

1. Wind energy:

- 3 positions used for 15kW wind turbines (summer)
- 1 spare position for upgrade (upgrade)
- 1 position for the integration of the "winter" wind turbine of 7kW

2. Solar electric energy:

- 100m² in photovoltaic panels (10kW)

3. Solar thermal collectors:

- Water melting: 20m²
- Sanitary hot water production: 20m²

- Building heating: 40m²

4. Solar passive energy:

- 30% of building vertical and roof surfaces

5. Emergency power supply:

- Uninterrupted Power Supply (UPS) by means of fly-wheel and 1 conventional system (5kW for 10 minutes)
- 2 generators 20kW running on Jet A1

6. Not taken into consideration here:

- Power facilities for stand-alone scientific facilities.

Heating, ventilation and air conditioning

Most of the heating and ventilation as well as the snow melting and water heating are done with passive solar energy and waste heat recovery. Solar thermal collectors supply almost all the necessary heat for snow melting and sanitary hot water production.

The HVAC is composed of a balanced ventilation system and a central heating via floor and wall heating. The ventilation group is provided with a high efficiency heat and moisture recovery in the form of a hygroscopic wheel or accumulation block.

Buffer zones optimised for passive solar thermal gains will reduce to a large extent the need of additional heating in the comfort zones. This small amount of additional heat will be provided partly by solar thermal collectors, the rest will be recovered from the electricity generation (co-generation) or by fuel boilers. The heat will be distributed at low water temperatures using floor and wall heating.

Energy storage

Electricity storage

A (typical) problem with renewable energy is its intermittent character. The energy stored in the buffer battery pack will be reduced as much as is reasonably feasible by the following measures:

- It has been decided to rely on photovoltaic as well as wind energy production as primary electricity sources.
- A fly-wheel will be installed that will buffer fast variations in the consumption and electricity production of the wind turbines. This will also help to level out energy input variations and it can be used as an Uninterrupted Power Supply (UPS) providing an emergency back-up system.
- Electricity consumption will be matched to electricity production by demand side management.

Heat storage

It is essential to enhance the heat-storage capacity of the building since by nature the thermal mass of the building will be very small. One possibility studied is to use the rock (granite) found on site. Special care will be taken to assure that the stones will not collect lasting contamination so that after the decommissioning of the building they can be left on site.

Furthermore, heat storage tanks will be placed in the inner core of the building, guaranteeing the recuperation of the convection losses of the storage tanks for space heating. Depending on the impact on the building volume, phase change materials will be introduced to reduce the volume of the storage tanks within the building volume.

Demand side management

An intelligent and robust control system (industrial type) will monitor the building and, according to demand, will steer the different processes in the building. The system will keep energy use coordinated as much as possible with energy supply. One of the measures the system will be able to take to anticipate power peaks will be to use short 15 minute 'switch-off or power-on' sequences for non-critical items e.g. battery chargers, freezers, heating equipment.

Reducing energy usage

All building elements are studied with energy efficiency in mind. Equipment selection and the use of passive systems will be maximised. Some examples:

- External light will be captured using photon collectors or "solatubes" to provide light in technical rooms and other building spaces.
- The selection of low energy-use equipment.
- The use of water-efficient spray water taps.
- "Presence detector" systems for unoccupied rooms.
- Self closing doors in the entrance area.
- Aerodynamic studies to identify high thermal losses on building skin (more insulation required).

Alternative systems under evaluation

- Propane for water heating (as a backup-system) and the kitchen stove.
- Hydrogen production and storage plant linked to the wind turbines (excess wind power used to generate hydrogen by electrolysis and storage for later use instead of higher buffer battery capacity).

2.4.9. Emissions

In normal operation the station will generate very low emissions. Even in the exceptional case when the emergency generators are used for powering the whole station the emission will be relatively low thanks to the very energy efficient nature of the building.

Very low quantities of CO_2 will be produced by the waste water treatment system. The aerobic bioreactor is tuned to avoid production of methane.

Most emissions will originate from vehicles. Thanks to the very compact layout of the station's different buildings and the direct connection between the main building and the garage/storage vehicle movements are limited and mainly needed for logistic supply and science related tasks.

The vehicle park will be diverse and focussed on over-snow scientific missions. In the operational phase the number of heavy vehicles dimensioned for transporting heavy loads will be limited. Currently a number of vehicle types are being evaluated. An economical-to-run vehicle to be used for scientific missions is sought-after since this will be used intensively. The programme foresees in the relative near future snowmobiles with 4-stroke engines. These machines consume significantly less than 2-stroke machines and are getting more common on the market. Most field missions to the mountain area will probably use this equipment.

2.4.10. Communications

Today's standard communications will be used including satellite telephone, satellite data-link and radio (VHF) for small distances. Field parties will get individual satellite phones (Iridium).

2.4.11. Testing and validation

The main building will be pre-assembled in Belgium where a comprehensive testing programme will be conducted to validate the station's performance and robustness. The fact that the main building will be erected in an almost identical manner as on site will allow running a test programme that not only looks at the mechanical aspects but also tests the functionality of all active subsystems. Furthermore break-down scenario's identified in the FMEA of the building and its subsystems will be validated, by simulating as realistic as possible, the emergency response and damage control scenarios identified. By doing this the project team intends to limit the time needed for debugging on site (where not all specialised staff will be present). Another aspect judged to be important is that most of the delicate assembly and construction tasks will be possible in best conditions rather than on site where weather conditions and human factors are more critical.

2.4.12. Transport

After the testing in Belgium, the building will be disassembled and packed for shipment. The units remain partially assembled and will be dimensioned for easy handling and to meet transport requirements. The pre-assembled building units will be mounted in the ISO-norm containers in such a way that transport damage caused by shocks and vibrations of the over-land transport over the ice-shelf will be avoided.

2.4.13. Construction on site

As a baseline, the assembly on site will be done using mechanical (bolted) interfaces only, thereby avoiding on-site welding or the use of adhesives as much as possible. This will also facilitate the decommissioning and recycling of the different components in a later phase. Pre-assembled building units dimensions and weight will favour easy and safe handling rather than size. Construction techniques will be rationalised using a minimum of different tools. The construction method will be studied to cope with the extremely short time period available for on site assembly.

2.4.14. Materials

Material selection will be done according to environmental and safety parameters established along ecological building guidelines. In the material selection process the following parameters will get priority:

- maximum durability (station lifetime)
- materials suitable for recycling

Exceptions to this baseline will only be allowed after thorough analysis has demonstrated that the material has major technical advantages enhancing the overall efficiency of the building.

No environmentally harmful substances will be used. Special attention will be paid to the off-gassing characteristics of the materials used in the building in order to create a clean and healthy environment. Also in the context of fire protection the building materials will not emit toxic fumes. The station has a light-weight construction that will facilitate transport and construction. The light structure however has also a low thermal mass and thus the built-in heat buffering capacity is limited. A solution to this is the use of on site material such as small granite stones that can be found in plenty on the construction site. No contamination of the stones will be allowed to make sure they can be returned to the ridge during decommissioning.

2.4.15. Upgradeability

Studying different Antarctic stations and the way they evolved in time has helped in the design and to set up upgrade strategies for the building and its facilities. In the retained philosophy there's no extension in floor space of the main building foreseen. The building is not only designed for a specific integrated energy concept but also it is not the intention of the Belgian government to enlarge the station. The building design allows an easy upgrade to a full-year station (this will have hardly have an effect on the hardware) and the flexible design allows to accommodate more people inside the building if required. An essential part of the upgrade capability are measures to update the equipment and the facilities with minimal impact on the required construction and resources (reference industrial facilities). This is applicable for example to the cable management concept, the modular architecture of active systems and the thorough standardization of mechanical interfaces throughout the building. In a nutshell: improving the existing building without enlarging it.

2.4.16. Best practice strategies

The different systems in the building will be designed according to best practice guidelines. These will, for example, include measures to assure that no disturbance is caused for communication and for scientific equipment in and near the building. There will be down-time management plans; a maintenance and a spare part strategy will be in place.

2.4.17. Documentation

A key-factor in safe and efficient operations is documentation. To manage the station, a technical data-package, following standard industrial procedures, will be applied. The data-package will consist among other things of user and maintenance manuals, assembly drawings and instructions, spare part lists and emergency procedures. Two identical sets, both on paper and electronic, of this data-package will be kept on the station as well as in Brussels to assure easy communication on technical issues.

2.4.18. Decommissioning

The station will be designed as 'state of the art' with respect to sustainable development, energy consumption and waste disposal, with a foreseen lifetime of minimum 25 years. The station is also designed so that it can be easily decommissioned, disassembled and removed. If dismantling of the station is required, no significant remnants of the occupation will be left, in order to meet the requirements of the Environmental Protocol and relevant Belgian domestic law. The eventual clean-up of the removed station will be subject to an EIA.

2.4.19. Minimum Impact Objectives

Design Criteria

The station design has a maximum target energy load of 40 kW, excluding research equipment and support vehicles. The station is designed to be constructed, operated and decommissioned using:

- fossil fuels for transport and construction only
- solar / wind for building functions and scientific equipment (operational)
- other (under evaluation)

The facilities are designed to minimise use of fossil fuels and to maximise the use of renewable energy where practical. The station has been designed to have a minimum environmental impact during construction, operation and decommissioning.

Construction and Operation

The method of construction, operation and decommissioning have been planned to meet the requirements of the Environmental Protocol and relevant Belgian domestic law.

A waste management regime that includes the treatment of human waste will be implemented.

Construction, operation and decommissioning will be managed under the framework of an Environmental Management Plan.

The station construction, operation and decommissioning has been planned to minimise health and safety risks during all stages. Belspo, IPF staff and contractors will have relevant training and will be provided with the necessary equipment and personal protection to reduce the likelihood of major health or safety incidents.

The construction team and any contractors will be managed by the IPF Project Leader. The key-construction team will already be involved in the pre-construction in Brussels in order to become acquainted with the construction itself. Staff and contractors will be briefed prior to departing for Antarctica to ensure that they understand and fully comply with the relevant provisions of the Environmental Protocol, its Annexes and Belgian law that might affect them or their work.

2.5. Area of disturbance

2.5.1. Area of operations

The area of operations around the new station will include the buildings, (research) facilities and cargo depot within the station perimeter. This area will be about 0.5 km^2 excluding the 600 m x 50 m snow runway and access routes (see also **Fig. 2.27**: boundaries of construction area, station operation, landing strip)

The scientific field activities during the period November-February are in a range of maximum 200 km from the station, up to the polar plateau and down to coastal Breid Bay.

There will be an additional disturbance by the yearly movement of station personnel and small amounts of cargo to and from the station using the DROMLAN air-network and the annual re-provisioning of and waste removal from the station using ship transport to Breid Bay, (un)loading at the ice shelf and the transport of cargo via tracked vehicles. See also **Fig. 2.7**: scheme of different transport routes for the proposed activity (cargo discharge at coast, construction, operation and science).

2.5.2. Duration & Intensity

The construction of the new station is likely to take 4 months, depending on weather conditions and transport availability. It will include the main building, a garage/storage building, an emergency building and the huts for geophysical observations.

The construction will then be handed over to Belspo, who will supply other necessary scientific equipment as of 2008-2009, the first planned scientific and logistic operations season. Scientific equipment will be installed at the station as required by the scientific demand and evolution of the research programme.

A minimum lifetime of the station of 25 years is foreseen.

2.5.3. Standard Procedures

A number of policies and standard procedures are being developed to manage operations in Antarctica. The policies and procedures are integral to safe and efficient operations and include minimum standards for staff, equipment and working conditions.

Policies will be designed to lessen inherent risks of working in Antarctica and to minimize environmental effects.

The Station leader in Antarctica, in close cooperation with Belspo, will oversee Search and Rescue (SAR), medical response and other emergencies in accordance with an Emergency Response and Contingency Plan. The plan includes among other things:

- responsibilities and chain-of-command;
- Health and Safety issues;
- medical support and evacuation procedures;
- emergency communications procedures; and
- route marking and navigation.

2.5.4. Fuel Caches and Fuelling

A fuel depot consisting of 12 m³ sledge-based fuel tanks is located near the station. See also **Section 2.4.6:** Station surroundings.

For the construction of the station emergency fuel depots along the access route to the coast will be installed near Seal (Selungen) nunatak at approximately 53 km from the station as well as on the coastal depot area (BEL-L0 or BEL-L0 NEW) at approximately 165 km from the station.

2.6. Description of Construction Camp

Belare 2007 Expedition

- By air in November: a team of 12 people in
- By ship in December/January: cargo + 2 people in
- By air in January: A team of 20 people in + 8 people out
- By air in February: 26 people out

The construction camp will be installed on the same spot as the base camps of the Belare 2004 and 2005 expeditions. During these expeditions a covered trench was made to store the equipment used by the survey expeditions in winter. A Weatherhaven tent is currently available on site. The camp will be extended with additional Weatherhaven shelters. All procedures will be in place as described elsewhere in this document. The early team that flies in beginning of November will install the base camp. A weather protected work shop will be installed using the equipment on site from the Belare 2006 expedition. Note that this is only equipment and no construction material. The team will prepare the site and start to install the mechanical anchoring points on the ridge as well as the validation of the traverse route to the coast route and organize the coast camp and emergency fuel depots.

Sea-ice conditions allow ship arrival and unloading in the first week of January. At this moment a new construction team will fly in (although a group may come with the ship depending on the possibilities) and 8 early team members will be evacuated by airplane. The construction team will be responsible for the logistics (unloading and over-land transport) and the construction of the building. The construction camp will be extended to accommodate the larger group using the emergency building unit that will come in by ship and will be pre-assembled. An additional Weatherhaven shelter will provide sufficient sleeping accommodations.

Kitchen/eating room	Weatherhaven shelter
Office/briefing/meeting room	Emergency building
Sleeping accommodations	Weatherhaven shelter
	Weatherhaven shelter
Sanitary facilities	ISO-norm container 20'
Food storage (construction)	ISO-norm container 20'
Weather protected workshop	ISO-norm container 20'
	ISO-norm container 20'
	ISO-norm container 20'
Waste collecting	ISO-norm container 20'
	ISO-norm container 20'

Table 2.5: Overview of the construction camp facilities

2.7. Waste collection and disposal

A Waste Management Plan (WMP) will be prepared that will comply with all the requirements of Annex III of the Environmental Protocol. The plan will comprise aspects of the reduction of waste generated, handling and storage of waste in Antarctica, disposal of waste removed from Antarctica, and education and training of staff.

There will be two parts to the WMP. The first part will cover the construction of the station and associated activities. The second part will be the plan for the ongoing operation of the station and will be regularly reviewed and updated.

The following elements will form part of the Waste Management Plan:

- Management and Responsibilities
- Minimisation of Waste
- Waste Storage and Handling
- Waste Equipment
- Waste Disposal
- Prohibited Products

Waste

On the station all wastes will handled and stored according to Belgian law safety, environment and health guidelines. All waste will be removed from the station for appropriate reuse, recycling, treatment or disposal in Cape Town South Africa.

In both main building and garage/storage buildings the wastes will be collected in designated areas. There will be different types of rubbish bins (or other appropriate receptacle) to separate the wastes at the source. Successively the bins will be emptied in larger transport boxes located in a 20' ISO-norm container located in the garage/storage building. This container will be removed from the building when a ship re-supply is organized. The full container can be exchanged for an empty one when unloading on the sea-ice or the ice shelf. Also the transport boxes are designed to be taken out of the container in order to transport them by cargo-sling (helicopter unloading at the ice shelf will always be an option). In the logistic preparation of the station's supply a first logical step is to get rid of packing material as much as possible. The incoming goods will be stored in the transport boxes mentioned above. The empty boxes already on site will be reused. A garbage compactor can be used to compact the solid waste if required.

Fuel drums

The quantity of fuel drums on site will be limited. The empty drums will be reused on site or taken out of Antarctica but they will not be compacted so that they can be recycled in Cape Town. It is not the intention to use fuel drums for storing solid waste. This would contaminate the waste with fuel/oil (processing issue), furthermore it would require more time and effort from the crew on site.

Hazardous products

Procurement guidelines will be used to make sure that the most appropriate products are selected, limiting the quantity of hazardous products to the strict minimum. The products and their empty packaging will be stored in specific areas according to best practice standards. This storage will also be monitored by the building safety system.

Mitigation measures

The recovery of energy by burning waste is not considered in order to keep emissions low (adequate process control).

Also during the construction the amount of waste will be minimised (see **Section 2.6**: Description of Construction Camp).