ANNEX 18: POLLUTION MANAGEMENT PLAN

PRINOS DEVELOPMENT PROJECT

Pollution Prevention Management Plan P2MP

ENERGEAN OIL & GAS

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INDEX

1. INTRODUCTION & PURPOSE

Energean Oil & Gas has developed a Pollution Prevention Management Plan (P2MP) that focuses on eliminating the use of unnecessary or environmentally unsound materials or processes. The intent of the P2MP is to provide a management system for the Pollution Prevention (P2) Program and to provide an implementation plan for P2 initiatives that will facilitate achievement of Energean's P2 objectives.

This P2MP describes the ongoing P2 efforts at Energean and is a proactive approach to managing the installation's P2 Program. The key personnel, resources, roles, and responsibilities for implementing the Pollution Prevention Management System (P2MS) and maintaining the P2MP are described in Section 2. The procedures required to review and update the P2MP are critical elements of the P2MS are also described in Section 2. P2 initiatives may be integrated into Energean's Environmental Management System (EMS). The EMS addresses management actions that, if carried out, will achieve the performance requirements established by the organization. Those performance requirements are developed by the organization with consideration given to applicable laws, regulations, policies, or interests. This P2MP was developed using these EMS principles. This EMS approach to P2 is consistent with the National and European strategy of Assess, Implement, Manage, and Measure to Achieve Sustained Compliance and Operational Readiness for Environmental Excellence (also known as AIMM to SCORE).

The primary goal of this P2MP is to eliminate, reduce, minimize or maintain the level of pollution at points of compliance in all media areas while maintaining mission readiness and providing support to the installation. It provides a process for Energean to identify and track program objectives and technical initiatives and assign roles and responsibilities. It is the "plan, do, assess, adjust" cycle that ensures the installation's P2 Program is working effectively.

2. SCOPE OF PLAN

P2 initiatives identified in the P2MP are tracked and evaluated.

A review of P2 initiatives should be undertaken annually. This review is typically completed by Energean environmental personnel. Changes to the schedule of P2 initiatives or actions are noted during the annual review. Significant changes in the mission, personnel, or operations of the installation are also noted during the annual review, as well as any changes in priorities of the installation or changes in regulatory compliance requirements. Changes to the P2MP during the annual review may be made as pen and ink markups to the plan, marginal notes, or a short, dated summary report at the end of each affected section of the P2MP.

The primary goal of the P2MP is to eliminate, minimize or maintain the level of pollution at points of compliance in all media areas while maintaining mission readiness and providing support to the installation. The following qualitative programmatic goals were developed:

- Hazardous Materials (HAZMAT) – Minimize the volume of HAZMAT being used;
- Wastewater (including storm water) – Reduce wastewater generation and minimize impacts from storm water;
- Air – Reduce air emissions;
- Solid Waste – Reduce volume of solid waste and recycle as much as economically possible;
- Hazardous Wastes (HW) – Continue to reduce the total amount of HW generated;

- Conservation of Resources – Decrease consumption of finite resources (e.g., fuel, water, etc.) while increasing consumptive efficiency. Evaluate renewable energy sources.

3. ROLES AND RESPONSIBILITIES

This section details actions to be taken by Energean personnel or contractors during each step of the P2MS process.

The HSE Manager, acting as P2 Program Manager, will review site – specific documents on a regular base in order to keep the P2MP up to date. This review will help the P2 Program Manager set annual quantitative goals. These documents include, but are not limited to the following records:

- Monthly atmosphere total sulphation records coming from the 12 station in the region of Thasos island and Kavala, around the facilities;
- Monthly environmental records coming from the main Environmental Station, including Sulfur Dioxide, Hydrogen Sulfide, Total Hydrocarbons, Methane and Non-methane hydrocarbons;
- Annual Green House Gas Emissions report;
- Annual waste management report;
- Monthly process environmental records, e.g. SO2, NOx, CO, combustion O2, temperatures, H2S, smoke, sulfates, BOD5, COD, TSS etc.;
- Safety Data Sheets;
- Daily energy and water consumption reports;

His further responsibilities shall be:

- Request resources as needed to implement the P2MP;
- Serve as strong environmental advocate to other departments;
- Regularly meet with the P2 Coordinator to receive a status update on media-specific objectives;
- Implement an ongoing program to apply P2 solutions to environmental compliance issues.

The Environmental Engineer, acting as a P2 Coordinator, shall:

- Assess and report the above records;
- Check and maintain the environmental monitoring analyzers;
- Implement effective metrics that are or could be used to identify successes and failures within the media being reviewed;
- Define opportunities for further P2 Initiatives – Any possible opportunities that "stand out" during the review of information and merit consideration as future P2 initiatives;
- Determine the work centers to be evaluated by ensuring that work center processes are documented and management procedures are accurate. This determination is made by considering the following:
    - New operation or processes;
    - Significant changes in operation or process;
    - Mission impact potential;
    - Significant areas for potential release;
    - Significant areas for worker exposure;
    - Areas not reviewed during the last update of the P2MP;
- Investigate and implement priority P2 initiatives;

- Stay current with new P2 technologies;
- Periodically visit the work centers to ensure that the P2 initiatives and equipment are effective and working properly;
- Search for off-site vendors who will recycle or reuse wastes rather than dispose of them;
- Publish the daily, monthly and annual reports;
- Provide technical support for any environmental issue;

The Safety Engineer shall:

- Screen new HAZMAT requests to determine hazard potential;
- Ensure that safety personnel and work center HAZMAT coordinators receive required P2 training;
- Ensure that all contractors register materials;

The Onshore and Offshore Operations Engineers shall:

- Maintain all P2 equipment in good working condition;
- Replace defective P2 equipment under their responsibilities;
- Request resources for keeping the P2 equipment continuously running;
- Provide immediate remedial action in case of P2 failures;
- Define and propose areas of P2 improvement.

4. LEGISLATIVE FRAMEWORK

The ESIA adopted legislative framework is implemented in the P2MP.

5. IMPLEMENTATION

5.1. P2 ON PRINOS COMPLEX PLATFORMS

5.1.1. Flare system

The flare system consists of the following equipment:

- Containment vessel (K.O. drum) in the low pressure grid, V-153
- Containment vessel (K.O. drum) in the high pressure grid, V-151
- Flare chimney, FS-165
- Flare tip, ME-165 A
- Flare molecular seal, ME-165 B
- Flare flame generator, ME-165

For effective relief in case of overpressure there are two relief and released gas collection grids, one of low and one of high pressure so that all the gases can easily end up in the torch.

The ME-165 A is located at a height of 62.4 m from the surface of the sea to achieve a safe dispersal of H2S in case the torch is extinguished.

The flare is designed to provide a total of 53,933 kg/h and to provide smokeless combustion 44,658 kg/h.

The collected liquids in the V-151 and V-153 containers are driven by means of control and level adjustment from the LC-174 and LC-175 respectively in the oily water collection tank V-

133 and then returned to the entrance of the V-101 A and B separators with the P-133 A/B pumps.

The flame at the top of the flare is maintained by a continuous supply of small quantities of sweet gas. If the flame is extinguished, it is relit with a special flare. All shift foremen are trained for this purpose.

5.1.2. Deck washing and rainwater cleaning & disposal system (MARPOL facilities)

Each deck of Delta platform has drainage for the deck washing water and rainwater led to a separator in the lower deck of Delta platform. The water from the outlet of the separator (V-167) is driven in the skim pile while the oil from the separator is collected in the V-168 vessel and then is driven by an air pump in the V-133 oil collector. From V-133, with the P-133 A/B pumps, the oil returns to the entrance of the V-101 A/B separators.

At the outlet of water from the separator to the skim pile there is a constantly operating analyzer that counts also the concentration of oil in water. If the concentration exceeds the threshold, the AV-167 valve automatically closes and stops the water supply to the skim pile. If it is necessary, due to constant flow in the V-167 separator, the liquid contents of V-167 can be transferred with the P-133 A/B pump at the entrance of the V-101 A/B separator. This will prevent oil entering the skim pile.

These facilities are in accordance with the provisions of L.1269/1982 (Government Gazette 89/A721.7.82) "International Convention for the Prevention of Pollution from Ships (MARPOL)" and PD 479/84 (GG 169 A71.11.84).

Duly authorized officers of the Port Authority of Kavala conduct annual inspections and issue the relevant certificate of oil pollution prevention as required.

Rainwaters and deck washing waters from Alpha and Beta, are driven through drainage piping at the skim pile of each platform, where they are separated from hydrocarbons (oils). The oils are then driven to the M-165 oi separator on Delta and then onwards to the oily water collector V-133.

5.1.3. Oil separator skim pile and subsea settlement tank

The rainwater and the deck washing water of platforms Alpha and Beta is led through the drainage pipes in each platform's skim pile, where any possible hydrocarbons (oil) are segregated. The oil from the skim pile of Alpha and Beta platforms is led automatically with level control and pumps in the M-165 oil separator of Delta platform and then in the M-164 skim pile of Delta.

The wastewaters of Delta platform after the cleaning processes are led in the skim pile of the platform and then in the subsea settlement tank. Wastewaters are the treated waters of deck drainage and the produced treated water. The principle of operation and advantages of the skim pile separator are already mentioned in the paragraph with the description of Kappa platform equipment. The skim pile separator has an air pump and oil level switches so that the collected oil will be detected and driven in the collection vessel.

The skim pile separator is a vertical cylindrical vessel, immersed in the sea nearly reaching the bottom of the sea. It has a diameter of 1.2 m and a length of 35.8 m, with 28 m below

sea level.

The output of the skim pile separator is connected to the underwater holding tank, which also has level switches, and pneumatic pumps that lead any possibly formed oil in the V-133 collection vessel.

The subsea tank TK-164 is fixed to the seabed. It is a vertical cylindrical vessel with a diameter of 7 m and a height of 8.3 m with open base, two outlets at the bottom side part and a small cylindrical bell on the top (1.53 m diameter x 0.835 m high). Therefore, the tank has a capacity 290 m^3. This bulk is considered more than sufficient to give enough time to identify and correct any potential malfunction. There is a tracking system (oil level gauge) and recovery (pump) of any accumulated oil on the top of the tank.

It should be noted that the TK-164 underwater tank, was placed for the purpose of preventing sea pollution in the summer of 1986 when production was above 20,000 bbl per day which proves it's adequacy for the current and future production.

5.1.4. Washing liquids of wells, vessels and piping

Liquid waste produced during cleaning and maintenance activities of the wells and the cleaning of various vessels and piping on the platforms are transported, through a piping system, to the "LIMIN PRINOS" barge, which is equipped with fifteen tanks. These waste products are transported to shore for treatment and disposal.

5.1.5. Domestic type wastewater

Domestic type wastewater from the complex platforms are transported and stored in special tanks, which are located, on each platform. These are periodically emptied into a tank of the barge or into a portable tank on the support vessel. When the vessel or the barge is parked at the dock land facilities, then the contents of the container is transported to the sewage treatment plant of the land facilities.

5.1.6. Solid waste

Solid waste produced on the offshore facilities is the result mainly of 1) Maintenance and Inspection activities that take place approximately every 30 months and lasts for a period of 15 days and 2) drilling operations, i.e. drilling cuttings.

During maintenance activities waste originates from the cleaning of vessels V-101 A/B, V-107 and V-102 and consist of a small quantity of oily mud (a mixture of heavy hydrocarbons, mainly asphaltenes), which is transported by the barge to the land facilities for further treatment.

Municipal type of solid waste from the offshore facilities are collected and transported to the land facilities for receipt, transport and disposal by the Municipality of Kavala.

During drilling operations the produced cuttings are transferred to the surface through drilling mud. These cuttings are removed from the mud in the shale shakers that form part of the 'Energean Force' DES installed on either Prinos A or Prinos B platforms. These wet cuttings are transferred by an air blower system to the 'Energean Force' barge where they are dried. After drying they are transported to shore where they are permanently disposed by a licensed contractor. Because of all drilling activities on Prinos complex will be sidetracks from existing wells, the produced cuttings weight will be smaller compared to the planned

drilling activities of the new Epsilon field .

Each drilled well generates on average 150 tons of drill cuttings.

5.1.7. Fire, Hydrogen sulfide and explosive gases detection system

The platforms are covered by a large network of detectors of various types depending on the requirements of the areas they protect.

In the central control room of Delta platform there is a mimic panel that displays visual signals (lights with coded color) and acoustic signals (beepers) that reveal the area and the cause of activation of the detectors. The fire detection installation comprises of:

a. Smoke detectors (ionization)
b. Thermal Detectors
c. Flammable gas detectors
d. H2S detectors
e. UV detectors
f. UV/IR detectors
g. Building pressure loss detectors
h. Risk announcement/instruction manual switches
i. Hydrogen Sulfide/gas leak announcement manual switches
j. Manual emergency stop switches
k. Strobe lights
l. Fire/risk announcement local beepers
m. Portable flammable gasses and hydrogen sulfide detectors

The thermal detectors, smoke detectors and area pressure loss detectors are located in building areas such as the control room and substation.

The flammable gasses and hydrogen sulfide detectors are installed in the production units, the control room and substation. Finally, the UV detectors are installed in the open spaces of production units.

5.1.8. Functional P2 measures

The proper operation of the equipment and the smooth possessing course is ensured by continuous measurement and variables check such as pressure, flow, level, etc. while setting the desired limits with the help of devices such as automatic valves, pressure level controllers, etc.

In order for the supervision of the processes to be more comprehensive and effective in the control room (CR) there is first of all continuous indication and recording of the major variables, but also automation and controls that allow setting either automatically or with the proper handling.

The control room has special boards with illuminated warning signs that inform of non-desired conditions or if any variable has reached its upper or lower acceptable limits. These optical signals (alarms) are accompanied by an audible signal so as to warn the operator in the control room (controlman) to take the corrective actions imposed.

Apart from the surveillance systems and equipment and process control systems, emergency support systems are activated in hazardous cases for the protection of the personnel and the equipment.

These systems are:

- emergency shutdown systems
- fire detection systems
- H_2S detection
- flammable gas detection
- fire water systems

The above systems can be activated either automatically (automatic), with sensing of predetermined conditions by specific organs, either through direct intervention and handling by the staff (manual).

5.2. P2 ON KAPPA PLATFORM

5.2.1. Condensate separator skim pile

Produced liquids enter a three-phase separator V-171 A/B and are separated into gaseous hydrocarbons and small quantities of liquid hydrocarbons and water. The gas is compressed at 12 barg by compressor C-666 B and passes through a glycol dehydration unit (TEG dehydration unit) before led to the pipeline. The condensate (liquid hydrocarbons) is added to the gas pipeline while the separated water (about 150 – 250 lt/d) passes through a cleaning system and flows into the sea through the skim pile.

Water from V-171 A/B is drained to V-174 where hydrocarbons are separated from water. The water is drained in the skim pile with level control and level adjustment. The hydrocarbons are pumped, with level control and level adjustment, with pump P-172 A/B to the tree phase separator V-171 A/B.

The skim pile is a separation patent with the aid of gravity. It is more efficient due to the use of multiple baffles, which facilitate the removal of oil droplets and reduce the distance the oil must traverse. The hydrocarbon concentration decreases during the passage of the liquid since hydrocarbons are separated from the water when passing through the various stages of the skim pile.

The skim pile satisfies the following conditions:

- Meets international and regional standards of wastewater disposal for the operation of offshore installations and the produced water. International standards call for a level of 15ppm whilst regional regulations require discharges at a maximum of 10ppm. Water flowing to the skim pile is monitored and the flow shut down automatically at a level of 12pmm. Sampling shows that levels are routinely below 10ppm.
- Clean and efficient disposal of sand.
- Collects and removes all free hydrocarbons (oil) from the water stream.

- It can process large amounts of liquids with long residence times and therefore prevent any sea pollution in case of an anomaly.

The skim pile dimensions are, 762 mm outer diameter and length of 30,480 mm. It goes into the sea at a depth of about 25 m.

All drainage from the platform areas flow to the skim pile, where liquid hydrocarbons float, forming a layer. The oil phase of the skim pile is automatically pumped into the oily water separator, V-174, when the float switch is activated. The blow case operates on gas pressure for transporting the liquid hydrocarbon.

The small amount of produced water occupies 6-10% of the skim pile and in combination with the extensive residence time; full separation of the condensates is achieved.

5.2.2. Fire and gas detection system

The Kappa platform is covered by a network of detectors for protection in case of hydrocarbons leak or fire.

- Explosive gas detectors (5):
  They protect the production units, sampling is continuous and the limit is set at the 25% of the lower explosive limit.
- Ultraviolet Radiation Detectors (UV) (6):
  They protect open spaces; they operate constantly and are checked every three months.

In case two gas or fire detectors are activated, the platform's general shutdown system is automatically activated.

5.3. P2 AT SUBMARINE PIPELINES

The submarine pipelines transporting crude oil and gas are protected in case of rupture, and thus preventing large leakage of oil or gas in the sea, with Low Pressure Self Operated valves which close automatically if the line pressure falls below a set value. In addition, there are independent low pressure switches that automatically shut off the pipelines. Regarding the sour gas pipeline, the isolation of the pipeline in case of low pressure is accompanied with simultaneous channeling and controlled burning of the contents of the pipeline in the flare (blow down).

5.4. P2 ON PLATFORMS LAMDA AND OMICRON

5.4.1. Vent and flare system

The hydrocarbon piping on the platform will be depressurized and drained only in rare occasions. The vent and flare system is connected to the production facilities through the closed drain system and not through a dedicated flare header system.

When production facilities are (all or partly) lined up through the closed drain system to the flare, they have been already partly depressurized to Delta Production separator through

the pipeline. Expected residual pressure will typically be 15 – 20 barg. From that point onwards they would need to depressurize to the flare.

As inventories are very low, a simple LP maintenance flare is envisaged suitable. This will also dispose of any annulus bleed should that be necessary.

Depressurization of the subsea pipeline(s) will be done from Prinos Delta. This operation does not require to be accommodated by the SIP design.

Lift gas is used to purge and light the flare prior to maintenance operations taking place. Gas bottles are used when/if lift gas is not available and the fuel system makes allowance for that requirement.

The maintenance flare is also used to collect gas returns from the production barge when wells are being cleaned up via this facility typically after a work over campaign.

It is expected that the well clean-up job is set the sizing case for the flare design. Operating experience in Prinos shows that assisting clean-up with typical gas lift flows is not uncommon. Hence the flare system should be designed to handle up to 1200Sm3/h of gas lift gas and up to 600Sm3/hr of associated gas from the well which is assumed to be controlled through choke at rates of up to 1000bpd for effective cleaning.

The flare header collects:

- Annulus bleed lines from wells (temporary connection)
- Closed drain pot vent
- Gas returns during clean-up job of one well (temporary connection with vent of barge's separator)

A vent and blowdown study is completed as part of the detailed design in which the following parameters are determined:

- Blowdown flowrates
- Back pressure calculations
- Blowdown temperatures
- Radiation levels
- Dispersion levels and Lower Flammable Limit

The flare is ignited using flare guns.

5.4.2. Open and closed drains

Closed drains:

A closed drains header is routed to a closed drains vessel. The closed drain is mechanically isolated from the production system and used in the following scenarios:

- In preparation of maintenance turnaround, once facilities have been depressurized to Delta Production separator through the pipeline. Expected residual pressure 15 – 20 barg.
- When kick starting an individual well after work over. All mechanical isolation are in place. Barge separator outlet connects to the closed drain drum.
- When performing pigging operation. Purge/drain of pig launcher connected to drain header.

- When collecting any annulus bleed lines should they be necessary

The vessel is sufficiently sized to contain full platform pipework/flowline liquid inventory up to 50% level. This allows a full maintenance cycle with no need to drain the closed drain vessel to the pipeline who is in shut in conditions during maintenance campaigns.

Upon restart of the platform, all hydrocarbons contained in the closed drain drum are routed off platform via the export line or to specialized barge storage suitable for sour fluids. A pump is used with no required redundancy.

Typical drain points are:

- Test and production manifolds and headers
- Gas lift manifold and header
- Gas lift and production flowlines
- The MultiPhase Flow Meter assembly (including sample point)
- (Temporary) pig launcher

Open drains:

The topsides is designed so that no hydrocarbon contaminated water is discharged overboard. The open drains system is able to handle the highest demand of rainwater. To this end minimal hard deck plates are used by privileging when adequate cratted deck. Drip pans area located at all possible leak area are provided.

A small drains oil recovery system, including an oily water separator and skim pile equipped with an oil-in-water analyzer and automatic shut-off valve is also included to prevent the unintentional discharge of untreated fluids directly to sea.

The recovered oil will be pumped into the closed drain vessel or alternatively to the maintenance barge. Pump is provided with 2*100% arrangement. The skim pile oily water pump is locally started and discharges to the Oily water treatment tank.

Energean's maintenance barge is used to transfer all waste fluids from the Lamda and Omicron platforms.

5.4.3. Fire & Gas and H2S detection system

An extensive grid of fire, hydrocarbon gas and H2S detectors, together with ESD pushbuttons are strategically located.

Topsides F&G detection automatically shuts-in wellhead valves and gas lift and production riser topsides Emergency Shut-Down Valves (ESDVs).

5.5. P2 AT NEW SUBMARINE PIPELINES

5.5.1. Installations method

The pipelines and umbilicals will be buried to protect them against mechanical impact by falling objects and by trawl boards and chains or other fishing gear and thus preventing oil and gas leakages. Trenching will be done by means of a PMT-supplied post-trenching plough.

The pipelines (and umbilicals) will be installed individually, separated by a distance of about 20m to allow minor deviations in the plough runs. They will be buried to a depth of about 0.5m top of pipe, that is, one pass with the plough.

5.5.2. Corrosion protection

The primary anti-corrosion coating for the offshore pipelines is Fusion Bonded Epoxy (FBE). External coating will be made of 3-layer polypropylene, bonded to the line pipe at the manufacturer's plant.

A fusion bonded epoxy (FBE) system will be paired with half shell bracelet type sacrificial anodes at designated intervals to mitigate external corrosion of the offshore pipelines.

The corrosion management philosophy is to be selected consistent with a design life of 20 years for the pipelines.

All coatings shall be applied in accordance with internationally recognized specifications.

5.6. P2 ON CONSTRUCTION SITES

Measures are implemented to accomplish the following objectives:

- To prevent loss of soil during construction by storm water runoff and/or wind erosion, including protecting topsoil by stockpiling for reuse.
- To prevent sedimentation of storm sewers or receiving streams.
- To prevent pollution of the air with dust and particulate matter.

The above will be accomplished by doing the following:

- Preserve vegetation and mark clearing limits;
- Establish and delineate construction access;
- Install sediment controls;
- Stabilize soils;
- Prevent soil loss during construction;
- Stockpile topsoil for reuse;
- Protect slopes;
- Protect drain inlets, all rainwater conveyance systems, and receiving water bodies;
- Stabilize channels and outlets;
- Control pollutants including dust and particulate matter;
- Control dewatering;
- Housekeeping.

Moreover the following activities and conditions shall be monitored:

- Deliveries and vehicles on site
- Silty water
- Plant, wheel and boot washing
- Drainage

- Material storage, stockpiles and exposed ground
- Excavations
- Oil storage, use & refueling
- Nuisance
- Land contamination and invasive species
- Chemical and hazardous substances
- Waste management

6. MITIGATION MEASURES

6.1. PRINOS complex emergency shutdown system

This system is intended to isolate the sources of flammable substances and toxic hydrogen sulfide to protect the workers first of all, the facilities and the environment as well.

There is the option of emergency shutdown of only one well platform (Alpha or Beta) while continuing the operation of the other platform and the Delta production platform. However, Delta platform's emergency shutdown will also mean shutdown of the two well platforms.

Emergency shutdown of the well platforms means that the side safety valve (wing valve) of all the wells of the platform automatically closes.

Delta's emergency shutdown means:

- Automatic shutdown of all wells on platforms Alpha and Beta. Depending on the condition that triggered the shutdown, the automatic shutdown can concern only the wing valve or even the three safety valves of each well, namely the wing, master and downhole safety valves.
- Automatic shutdown of all emergency valves of Delta platform (SD valves) that isolate various key points in the production process equipment.
- Automatic power cut to all electrical equipment of the installation except of the instrument air compressor, the cooling water pumps, the fire pumps and the safety systems.
- Blowdown valves of the flare open automatically
- Activation of proper visual and auditory signals in the control room.
- Acoustic signal to all facilities in the event of activation due to the presence of flammable gas or fire.

Emergency shutdown of Alpha or Beta platform can be done:

- Automatically by simultaneous activation on two flame detectors in the area.
- Automatically by activating specific pairs of flammable gas detectors.
- Automatically if fusible plugs that are over the wells and production pipelines of each platform melt.
- Automatically in the event of detention of the Delta platform for any reason.
- Manually from the control room by activating the corresponding detention switch.
- Manually from emergency detention switches (manual ESD) present in various parts of each platform.

Emergency shutdown of Delta platform can be done:

- Automatically by activating its equipment safety switch (very low or high pressure switch, level switch, etc.).
- Automatically by the simultaneous activation of two fire detectors of an area on the platform.
- Automatically by activating a specific pair of flammable gas detectors.
- Manually from the emergency detention switch in the control room.
- Manually by activating one of the detention switches present in various selected spots of the platform.

6.2. Kappa platform emergency shutdown system

This system is intended to isolate the sources of flammable substances and toxic hydrogen sulfide to protect the workers first of all, the facilities and the environment as well. Emergency shutdown of Kappa wells means that the side safety valves (wing valves) of the two wells of the platform automatically close.

Kappa's emergency shutdown means:

- Automatic shutdown of all wells. Depending on the condition that triggered the shutdown, the automatic shutdown can concern only the wing valve or even the three safety valves of each well, namely the wing, master and downhole safety valves.
- Automatic shutdown of all shutdown valves of the pipeline to Delta platform.
- Automatic power cut to all electrical equipment except of the safety systems equipment.
- Blowdown valves of the flare open automatically.
- Activation of proper visual and auditory signals in Delta control room.
- Acoustic signal on Kappa in the event of activation due to the presence of flammable gas or fire.

Emergency shutdown of Kappa platform can be done:

- Automatically by simultaneous activation on two flame detectors in the area.
- Automatically by activating specific pairs of flammable gas detectors.
- Automatically if fusible plugs that are over the wells melt.
- Manually from Delta control room by activating the corresponding shutdown switch.
- Manually from emergency shutdown switches (manual ESD) present in various parts of the platform.

6.3. Submarine pipelines emergency shutdown system

Low Pressure Self Operated valves close automatically if the line pressure falls below a set value. In addition, there are independent low pressure switches that automatically shut off the pipelines.

6.4. Lamda and Omicron platforms emergency shutdown system

In line with Prinos philosophy:

- Production wells are equipped with DHSV, UMV and WV, all hydraulically actuated
- As per API RP14C, a PSHL device sensing flowline pressure of each well downstream of choke, shuts down the well when actuated
- Well ESD: 2 levels of well shut down:
  - Partial well ESD: only wing valve and gas lift ESD valve close. Typical for process –related ESD
  - Total well ESD: all 4 ESD valves (DHSV, MV, WV, gas lift ESDV) close. Typical for fire-related ESD
- Total Platform ESD: defined as wells' total ESD plus pipelines' ESDVs closure. Actuation is similar to DELTA Total Platform ESD e.g. "confirmed" H2S or F&G detectors as well as process reasons. Process reasons results in total Platform ESD due to high production and/or gas-lift manifold pressure.

An operating philosophy is developed, to minimize interventions; a remote ESD/F&G reset is available. However, high ESD levels can only be locally reset.

6.5. Construction sites

In case of pollution incidents all works will stop and remedial activities shall be commenced immediately.

In case the incident extends beyond the site boundaries the local authorities shall be immediately informed for remedial actions to be taken.

7. MONITORING

Energean measures, records and monitors air pollution and meteorological data on an ongoing basis with the following equipment and methods:

- An environmental control station north of the onshore facilities that records and collects the concentrations of waste gases (SO_2 and H_2S) and meteorological data (wind speed and direction, temperature and humidity).
- Twelve stations measuring total sulphation are established in the surrounding area (from the city of Kavala to Thasos) recording on a monthly basis all sulfur compounds (sulfur dioxide, hydrogen sulfide and mercaptans) as a whole.
- All environmental process parameters are regularly recorded and analyzed on a daily base.
- Soil sampling from different spots of the wider region every fall by the Environmental Expert and analysis in the company's laboratory to control the soil pH.
- The quality of waste waters with pH measurements on a daily basis and regular analysis of suspended solids, TDS, turbidity, hydrocarbons, sulfates, chlorides, iron and COD. The results are collected and evaluated.

8. TRAINING

All personnel participate in annual induction programs that include the following relevant to pollution prevention topics:

- Environmental awareness
- Waste segregation principles
- Control of substances hazardous to health
- Material Safety Data Sheets
- Firefighting basics and practice

9. AUDITING AND REPORTING

The Kavala Port Authority inspects and renews the offshore pollution prevention certificate once per year.

A third party organization is certifying the Green House Emission Gases report once per year.

The DNV-GL is certifying the safe operation of the offshore platforms, the subsea settlement tank and the submarine pipelines every 5 years and the safety systems every two years.

Internal audits are executed on a regular and an ad-hoc base including all company's installations.

An environmental report including data from the twelve total sulphasion stations and data from the environmental station is issued on a monthly base and included in the Technical monthly report.

A weekly report is issued including data (HC, sulphates, Fe total) from the output of the produced water deoilers , the skim pile and the subsea settlement tank.

A monthly report is issued including data (TSS, BOD5, COD, HC, Fe total, sulphates) from the output of the subsea settlement tank.

A test report for the fixed H2S detection systems is issued every month.

A test report for the fixed combustible gas and fire detection systems is issued every two months.

A test report for the shutdown systems is issued once per year.

A weekly environmental report shall be issued for each construction site providing the status of the measures outlined in paragraph 5.6.