ANNAMARIA DEVELOPMENT PROJECT

Annamaria A – Project Description

Appendix A

REV	STATUS	DESCRIPTION	PREPARED	VERIFIED	APPROVED	DATE
00	P	Issued for Annamaria B Envir. Author.	T. Juranic K. Vujec	V. Brkic J. Jelic-Balta	Z. Sikonja L. Ciarrocchi	21/05/2007

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1 INTRODUCTION

This document specifies the design features referring to the integrated development of Annamaria field for the Croatian sector, operated by INAgip.

Purpose of this document is to provide the design conditions characterizing the installation of Annamaria "A" platform (design conditions that are preliminary in the definition of the *Studio di Impatto Ambientale (SIA)* - Environmental Impact Study (EIS) - as key condition for the *Valutazione dell'Impatto Ambientale (VIA*) - Environmental Impact Evaluation (EIV) necessary for the obtainment in Italy of the environmental authorizations as it is foreseen by the Italian Laws and Regulations in force).

Since Eni and INAgip have agreed that the impacts evaluation – for the EIS purpose– on the different environmental conditions shall be analysed either separately for each plant or cumulatively so as to evaluate the project real influence in its entirety, INAgip describes the design features useful to this purpose.

INAgip already owns all the authorisations foreseen by the Croation rules, as it is described in this document.

In particular this appendix is composed of the following sections:

1. Introduction concerning the project organization with particular reference to:

- Project location,
- Description of the Croatian Energy Market,
- Laws and Regulations;

2. Project description subdivided into:

- Chapter 2.1: Description and sequences of project activities,
- Chapter 2.2: Description of drilling activities,
- Chapter 2.3: Description of production activities,
- Chapter 2.4: Description of transport activities.

1.1 PROJECT LOCATION

Annamaria gas field is located in the central-northern area of the Adriatic Sea, ca. 60 km N-E from Fano and ca. 60 km S-W from Pula, on the median line that separates waters under the Italian jurisdiction from the Croatian ones, in a water depth between 55 m and 60 m.

Annamaria A platform, part of the connecting pipeline to the Italian platform Annamaria B and the connecting pipeline to Ika A platform are located in the Croatian contractual area called Ivana (picture1.1).

INA is the owner of the concession for the natural gas exploitation in the “SJEVERNI JADRAN” region (Northern Adriatic) (concession class nr. 310-05/96-01/01, file nr. 5030116-96-3, dated 2 February 1996), governed by a production-sharing contract dated 27 February 1996 between INA and Eni Croatia BV, in the contractual area of IVANA. The activities are operated by INAgip d.o.o., an operating joint venture established by INA 50 % and by Eni Croatia B.V 50 %..

The production share of Annamaria gas field for Croatia is 51,5%.

Picture 1.1 – Croatian Concession Blocks

1.2 GAS MARKET

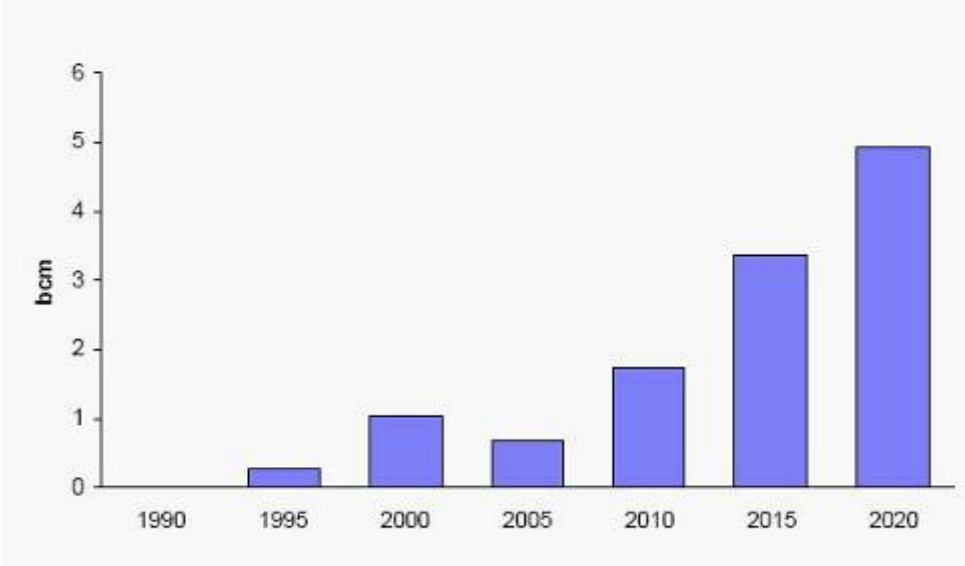
Hereunder the Croatian energy sector will be briefly analyzed with particular reference to the gas market (Wood Mackenzie, document not dated).

The gas sector in Croatia is dominated by the company Industrija Nafte (INA), partly state-controlled and in charge of exploration, production, storage of resources; while export activities are managed by Plinacro, a company formerly controlled by INA. Plinacro split from INA in 2001 and since 2002 it has been completely controlled by the Croatian government. The supply and sale of gas to final users is carried out by ca. 40 local companies (mainly municipality-owned).

Croatia has often taken part in many joint ventures with foreign companies, among them with Eni. In particular Agip and INA have established the company INAgip for hydrocarbons exploration and production in the Northern Adriatic Sea.

Nowadays gas is the main source of energy required at national level in the industrial field. Though the damages to the gas export infrastructure, caused by the Civil War, the demand for energy in this sector has not been affected significantly. For the strategic geographic position of the country and his relative self-sufficiency of energy, it is to be expected that it remains the main energy source to meet the industrial demand.

Croatia imports gas from Russia through Slovenia. Since the national production presently does not seem to increase, the problem is mainly represented by the limited import possibilities from Russia in wintertime that is characterized by an increase of consumptions. The existing contract to import gas from Russia, equivalent to about 1,2 bcm/ per year will expire in 2010. Furthermore import costs are increased by the taxes, that INA has to pay for using pipelines through Slovenia and Austria.



Picture 1.2 – Natural gas import forecast
(Wood Mackenzie, document not dated)

In the future a significant increase of net gas imports is foreseen in order to meet the growing demand of Croatia. Estimates show that the independence of the country will be halved between 2000 and 2020 (Picture 1.2).

In order to meet these forecasts it will be necessary to develop new connection infrastructures with neighboring countries, especially with Hungary (estimated date of works completion is 2011) and with the Italian offshore fields in the Adriatic Sea through submarine gas pipelines.

1.3 LAWS AND REGULATIONS

1.3.1 Main international regulations

Croatia adhered to the following international conventions:

- UNCLOS – United Nations Convention on the Law of the Sea signed in Montego Bay on 10 December 1982, entry into force on 16 November 1994);
- Espoo convention on Environmental Impact Assessment in a transboundary contex signed in ESPOO on 25 February 1991, ratified by Croatia on 8 July 1994, entry into force on 10 September 1997;
- Barcelona Convention for the Environmental Protection of the Mediterranean Sea against Pollution signed on 16 February 1976, entry into force on 12 February 1978;
- London Convention - MARPOL, an International Document for the Prevention of Pollution from ships, signed on 2 November 1973 (and subsequent modifications);
- Kyoto Protocol on Strategies of Progressive Reduction of Gas Release in Atmosphere that moreover promotes Natural Gas Exploitation even for civil and industrial use signed in 1997. This protocol has been signed by Croatia but it is not ratified yet.

As far as the legal system for the area of the study is concerned, the international maritime law is defined by the United Nations Convention on the Law of the Sea (UNCLOS) signed in Montego Bay on 10. December 1982.

According to this convention, as Croatia has not instituted an exclusive economical zone yet, the area which is involved in the installation of Annamaria A platform is in the maritime zone called “continental shelf”. The routes of the future pipeline for the connection with the Italian platform Annamaria B and the Croatian platform IKA A are in international waters as well.

As it is defined in Section VI of the Convention, the continental shelf includes the sea bed and subsurface down to the external edge of the continental border or beyond 200 nautical miles from the base line, if the external edge of continental border does not extend up to that distance.

As it is fixed in the art. 83 of UNCLOS, the delimitation of the continental shelf between states with opposite or adjacent coasts is defined by an agreement between the interested parts, respecting the international laws. Especially, for the Adriatic Sea, is to be considered the agreement between Italy and the x-Jugoslavia entered on 8. January 1968, that fixes the border of continental shelf using the median line between the two country coasts and the consecutive "Agreement for the Technical Modification of the delimitation line of continental shelf" between Italy and Croatia, entered in force on 2. August 2005 (Bollettino ufficiale degli Idrocarburi e della Geotermia - Official Gazette of Hydrocarbons and Geothermal Science dated 30/09/2005 nr. 9, Publication nr. 113).

1.3.2 Main national laws and regulations

This paragraph contains a short close examination of the provisions of current laws and regulations in Croatia to be applied in the various development phases of the project (drilling, production, transport and work over of mining activities) operated by INAgip.

All the exploitation activities carried out in the territory of The Croatian Republic have to proceed in accordance with the current regulations on safety at work, fire prevention and environment protection. In particular, hereunder a list of main rules:

- Mining Act (Official Gazette 190/03; 100/04);
- Occupational Safety Act ("Official Gazette" 59/96, 94/96, 114/03, 100/04);
- Law on Construction of Facilities ("Official Gazette" 175/03, 100/04);
- Physical Planning Act ("Official Gazette" br.30/94, 68/98, 32/00, 61/00, 100/04);
- Fire Prevention Act ("Official Gazette" 58/93, 100/04, 33/05);
- Nature Protection Act ("Official Gazette" 70/05);
- Rule Book on Preparation of Environmental Impact Studies ("Official Gazette" 14/90);
- Marine Act (("Official Gazette" 181/04)
- Clean Water Act ("Official Gazette" 107/95, 150/05);
- Instruction for Keeping of Records on Frequency of Discharge of Dangerous and Toxic Substances into Waters, on Quantity and Composition of those Substances, and Manner of Submitting the Data to Public Water Management Companies ("Official Gazette" 9/90);
- State Plan for Protection of Waters against Pollution ("Official Gazette" 8/99);
- Decree on Classification of Waters ("Official Gazette" 77/98);
- Decree on Hazardous Sustances in Waters ("Official Gazette" 78/98);

- Regulation of limit values of dangerous and other matter in wastewater (“Official Gazette” 40/99, 6/01);
- Waste Management Act (“Official Gazette” 178/04, 153/05, 111/06);
- Law on Storage and Marketing of Flammable Liquids and Gases (“Official Gazette” 24/76);
- Decree on categories, types and classification of waste with a catalogue of waste and list of dangerous waste (“Official Gazette” 50/05);
- Environmental Protection Act (“Official Gazette” 82/94, 128/99);
- Rule Book on Construction of Facilities for Flammable Liquids and on Storage and Decanting of Flammable Liquids; (“Official Gazette” 108/95);
- Emergency Response Plan for Unexpected Pollution of the Sea in the Republic of Croatia (“Official Gazette” 8/98);
- Law on Ratification of the International Convention on Preparation, Action and Co-operation in Case of Oil Pollution (“Official Gazette” 7/98);
- Regulations on main technical requirements, safety and protection during exploration and production of liquid and gaseous hydrocarbons from Croatian Offshore (“ Official Gazette “ 03/04).
- Rule Book on Handling of Chemicals (INAgip d.o.o., 12/98);

1.3.3 Reference Standards

Eni E&P Division has defined the standards and specific procedures to manage the different operations applicable also for Partner and/or Participate companies in Italy and abroad, thus in Croatia as well. Especially referring to the activities to be carried out within the Annamaria project, hereunder are mentioned the following documents of the Unità Geografica Italia, responsible for the operations in Italy and applicable by service contracts with INAgip:

- Piano di Emergenza Unità Geografica Italia (UGIT) - (SGI-UGIT Doc. No. SGI-UGIT-C-PRO-1-015 dated 31/12/2005);
- UGIT - Sistema di Gestione Integrato, Procedura Integrata. Procedura per la valutazione del rischio (Doc. SGI-UGIT-C-PRO-1-002 dated 16/12/05);
- UGIT - Sistema di Gestione Integrato, Procedura Integrata. Identificazione degli Aspetti Ambientali e Valutazione della Loro Significatività (Doc. SGI-UGIT-C-PRO-4-001 dated 27/06/06);
- UGIT - Sistema di Gestione Integrato, Procedura Integrata. Procedura operativa antinquinamento marino (Doc. 1.3.4.54 del 17/12/03)

- UGIT - Sistema di Gestione Integrato, Istruzione di Lavoro Integrata. Comportamento da Tenere alla Guida di Carrelli Elevatori a Forche ed Istruzioni durante l'imbracatura dei Carichi (Doc. SGI-UGIT-D-IDL-3-001 dated 13/09/05);
- UGIT - Sistema di Gestione Integrato, Istruzione di Lavoro Integrata. Norme di Sicurezza Catene e Funi per Sollevamento Carichi (Doc. SGI-UGIT-D-IDL-3-002 dated 15/07/2004);
- UGIT - Sistema di Gestione Integrato, Istruzione di Lavoro Integrata. Utilizzo di Gru e Mezzi di Sollevamento (Doc. SGI-UGIT-D-IDL-3-003 dated 15/07/04);
- UGIT - Sistema di Gestione Integrato, Istruzione di Lavoro Integrata. Movimentazione Manuale (Doc. SGI-UGIT-D-IDL-3-004 dated 15/07/04);
- UGIT - Sistema di Gestione Integrato, Istruzione di Lavoro Integrata. Gestione delle attività di imbarco del gasolio sulle navi e della consegna alle piattaforme (Doc. SGI-UGIT-D-IDL-1-003 dated 16/12/05);
- UGIT - Sistema di Gestione Integrato, Istruzione di Lavoro Integrata. Norme di Comportamento per Attività con Utilizzo di Mezzi Navali (Doc. SGI-UGIT-D-IDL-3-012 dated 15/07/04);
- UGIT - Sistema di Gestione Integrato, Istruzione di Lavoro Integrata. Gestione Rapporti Interni Infortuni Incidenti Near Miss Occorsi nei Luoghi di Lavoro UGIT (Doc. SGI-UGIT-D-IDL-3-021 dated 15/07/04);
- UGIT - Sistema di Gestione Integrato, Istruzione di Lavoro Integrata. Riunioni di Sensibilizzazione su Near Miss in Luoghi Tecm/Peit. (Doc. SGI-UGIT-D-IDL-3-022 dated 15/07/04);
- UGIT - Sistema di Gestione Integrato, Istruzione di Lavoro Integrata. Uso del Metanolo in Piattaforma (Doc. SGI-UGIT-D-IDL-3-026 dated 15/07/04);
- UGIT - Sistema di Gestione Integrato, Istruzione di lavoro integrato. Permesso di lavoro (Doc. 1.3.3.67 dated 30/01/01);
- UGIT - Sistema di Gestione Integrato, Istruzione di lavoro di sicurezza. Gestione delle macchine e dei registri di manutenzione (Doc. SGI-UGIT-D-IDL-3-006 dated 15/07/04);
- UGIT - Sistema di Gestione Integrato, Istruzione di lavoro ambientale. Istruzione per l'effettuazione dei campionamenti e dei monitoraggi (Doc. SGI-UGIT-D-IDL-4-002 dated 15/07/04);
- UGIT - Sistema di Gestione Integrato, Istruzione di lavoro ambientale. Carico/scarico di gasolio, glicole e liquidi oleosi e semioleosi da/verso le piattaforme (Doc. SGI –UGIT-D-IDL-4-009 dated 15/07/04);
- UGIT - Sistema di Gestione Integrato, Istruzione di lavoro di sicurezza. Abbandono piattaforma (Doc. SGI-UGIT-D-IDL-3-032 dated 15/07/04);

- UGIT - Sistema di Gestione Integrato, Istruzione di lavoro di sicurezza. Invio del personale su impianti off-shore (Doc. SGI—UGIT-D-IDL-3-033 dated 15/07/04);
- UGIT - Sistema di Gestione Integrato, Relazione ambiente. Quadro di sintesi dei requisiti normativi nazionali (Doc. SGI-UGIT-E-REL-4-010 dated 02/05/06);
- UGIT - Sistema di Gestione Integrato, Relazione ambiente. Quadro di sintesi dei requisiti normativi locali (Doc. SGI-UGIT-E-REL-4-011 dated 02/05/06).

For the correct management of drilling and associated operations, the following documents will be issued:

- "Programma geologico e di perforazione del pozzo" (*Geological and well drilling plan)*;
- "Programma di completamento e prova di produzione" (*Completion and production test programme)* or "Programma di chiusura mineraria" (*Well plugging and abandoning programme)* according to the results obtained from production tests.

Furthermore, the following procedures are listed, already effective for current activities in the area; further procedures will be fixed once that the Croatian authority will request proper specifications regarding Annamaria A:

- "Well Control Manual" (Eni, STAP P-1-M-6150);
- "Directional control and surveying procedures" (Eni, STAP-P-1-M-6120);
- Applicable documents list for development projects activities (Eni, STAP-G-1-E-14089);
- Oil Spill Emergency Procedure (INAgip, Rev. 4, November 2000);
- Installation and Pipeline Assembly Emergency Response Plan (INAgip, Rev. 2, January 2006);
- Drilling Emergency Response Plan (INAgip, Rev. 5, January 2006);
- Waste Management Procedure (INAgip, January 2001).

1.3.4 INAgip's EIS

List: Studies, Elaborates and EIS –
Environmental Impact Studies for Croatian Adriatic Offshore Projects

1986, Northern Adriatic zero condition environmental study – the Ivana gas field, Institute for Oceanography and Fishery, Split, Institute Jože Štefan, Ljubljana, Institute Ruđer Bošković, Sea Research Centre, Zagreb, State Hydrographic Institute, Split,

1996, Ecological study of gas fields in the northern Adriatic, Institute of oceanography and fisheries, Acta Adriatica, Vol.37(No.1/2)3-216 A1-A6, Split

1996, The study of the environmental impacts of the exploaitation field “Sjeverni Jadran” and the gas pipeline connecting to the mainland, WET d.o.o., Zagreb

1998, Supplement, “Environmental baseline survey Ivana A – Garibaldi K”, State Hydrographic Institute, Split

1998, Environmental impact study for the exploitation field “North Adriatic” and gas pipeline to shore, WET d.o.o.(Water and Environmental Technology), Zagreb

1998, Supplement, Environmental impact study for the exploitation field “North Adriatic” and gas pipeline to shore, WET d.o.o.(Water and Environmental Technology), Zagreb

1999, EIS, Croatian part of international gas pipeline Casal Borsetti – Pula, WET d.o.o.(Water and Environmental Technology), Zagreb

2002, Environmental impact study for Marica and Katarina gas field, WET d.o.o.(Water and Environmental Technology), Zagreb

2003, Supplement to the EIS of field “North Adriatic and the gas pipeline connecting to the mainland”, Environmental Elaborate – Supplement platform Ivana K and gas pipeline route change to shore, of North Adriatic gas fields, WET d.o.o.(Water and Environmental Technology), Zagreb

2003, Environmental impact study for main gas pipeline Pula – Karlovac DN 500/75, EKONERG HOLDING d.o.o.

2005, Technical Study, Gas pipeline Ivana K – Terminal Pula DN 450/85 (MAINLAND PART), Inženjering za naftu d.o.o. Zagreb

2006, Location Permit for project Gas pipeline Ivana K – Terminal Pula DN 450/85 (MAINLAND PART) with special conditions, Republic of Croatia, Ministry of Environmental Protection, Physical Planning and Construction, Zagreb

2007, Technical Study for obtaining of Location Permit for Platforms Annamaria A, Ana, Vesna, Irina, Božica 1 and Božica 2 with intrafield pipelines, INA, SD – Istraživanje i proizvodnja nafte i plina, Zagreb

Study on Muds Technology of Preparation, Processing and Handling of Drilling Cuttings and Well Completion Fluids (Plan for Use of Chemicals in Well Drilling), (INAgip d.o.o., 3/98);

Supplement to the Study on Technology of Preparation, Treatment and Handling of Drilling Cuttings and Well Completion Fluids, (INAgip d.o.o., 5/98);

2007, Location Permit for Annamaria A project, Doc. No. 531-06-2-1/07 23

1.3.5 HSE Reference and HSE Technical documentation

INAGIP INTERNAL RULE-BOOKS, REGULATIONS AND INSTRUCTION IN THE SPHERE OF SAFETY RULE-BOOKS:
HSE Policy
HSE Strategic Objectives
Occupational Safety Regulations
Emergency Response Plan
Operative Instructions in Case of Emergency
Decision on Work Posts With Special Conditions of Work
Decision on the Protection of Non-Smokers
Decision on Use of Personal Protective Devices
Hazard and Risk Register – HQ and Pula Base
Hazard and Risk Register – Production Fields
Company Car Policy

- Rules I on General Safety Measures (regulations of INA-Naftaplin, Zagreb);
- Rules V on Well Location, Taking Over Control of the Well and Well Site, and Well Abandonment (regulations of INA-Naftaplin, Zagreb);
- Rules VII on Waste (regulations of INA-Naftaplin, Zagreb);
- Rules XI on Well Site Work Areas (regulations of INA-Naftaplin, Zagreb);

2 PROJECT DESCRIPTION

2.1 DESCRIPTION AND SEQUENCES OF PROJECT ACTIVITIES

2.1.1 General Data

Annamaria field is mainly characterized by the location on the median line, partly under the limits of Italian waters jurisdiction and partly in Croatian waters.

The exploitation program foresees an integrated development between Italian and Croatian concession Operators and Owners. This integration will be fulfilled in the installation of two platforms and relevant submarine pipelines designed to maximize the entire exploitation respecting either the laws in force in both countries or the gas shares fixed originally (GOIP) which allot – as specified before – 48,5% for Italy and 51,5% for Croatia. However the project will be developed and managed separately by both operators, and in particular:

- For the Italian part belonging to the Italian concession:

  Eni S.p.A. is the concession owner and field operator. The Italian part of project includes Annamaria B platform and relevant wells, the connecting sealine to Brenda platform and all the necessary revamping activities of existing treatment plants. The connecting sealine between A and B will be realized jointly with INAgip;

- For the Croatian part belonging to the contractual field of Ivana in Croatia:

  INAgip is the field operator. The Croatian part of the project includes Annamaria A platform and relevant wells, the connecting sealine to Ika A platform and all the necessary revamping activities of the existing treatment plants. The connecting sealine between A e B will be realized jointly with Eni.

In order to monitor the production from the reservoir thin layers, the development plan for both concessions will be specified in the following two phases, called Phase 1 and Phase 2. In particular, the field development program foresees for the Croatian part:

1. Installation of Annamaria A platform, whose coordinates (reference system WGS84) are given in the following table:

Table 2.1 – Platforms location with reference system WGS84

Platform	Longitude E	Latitude N
Annamaria A	13° 22’ 30.105”	44° 21’ 48.558”

2. Laying of two new sealines:

- Annamaria A - Ika A (export to the existing Croatian pipeline network);
- Annamaria A - Annamaria B (pipeline for gas production balance);

3. Upgrading of the existing platforms in Croatia to allow the installation of the connecting pipelines between Annamaria field and the existing onshore network:

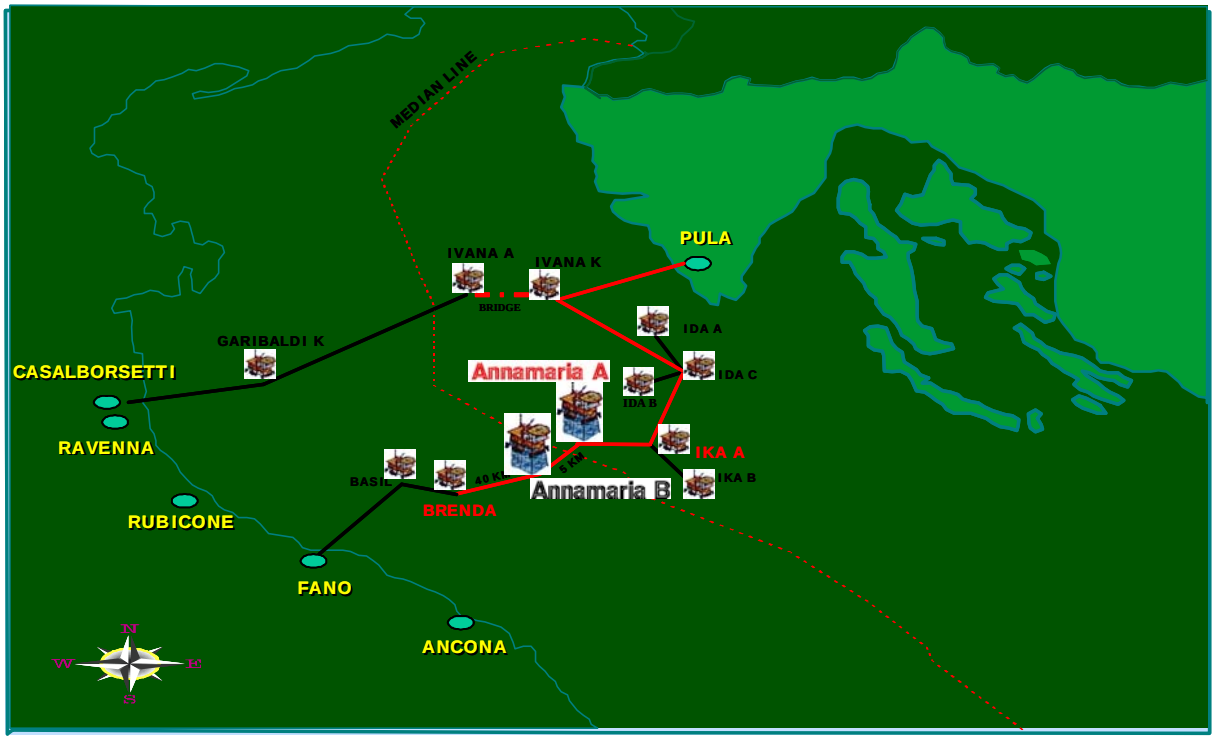
- The existing Croatian platform Ika A, where the pipeline coming from Annamaria A has to arrive;

In particular, Phase 1 of development program foresees:

- The construction of Annamaria A platform, complete of production units, main separation units, auxiliary systems, safety systems, gas collection and export systems. The platform will be temporarily manned thanks to the installation of a living quarter to allow the accommodation up to 19 persons;
- Drilling of 6 production wells that will be drilled in operating sequence;
- Laying of a sealine between Annamaria A and IKA A to export the extracted gas. From IKA A the production will be sent to IVANA platform to be later sent onshore.
- Laying of a production balancing pipeline between Annamaria B and Annamaria A to allow the transport of the gas shares fixed originally, 48,5% for Italy and 51,5% , independently from which platform the gas is produced;
- Upgrading of the existing Brenda platform to allow the transport of the gas produced from Annamaria B to the existing network.

On the basis of the results obtained from wells connected to reservoir thin layers (where the main part of reserves are located) a possible Phase 2, foreseeing the drilling of further 2 wells, will be evaluated.

The operating sequence to realize the two phases foresees the return of the drilling jack-up rig to the platform within the first 2 years, allowing a series of simultaneous operations (simultaneous production and drilling).



Picture 2.1 - Annamaria field Development layout

2.1.2 Scheduled periods for operations

The schedule for the project realization is:

- Start of Engineering Activities 2006;
- Start of Platform Construction 2°Q 2007;
- Platform Installation 1°Q 2008;
- Drilling and Completion 2008;
- Pipeline Installation 2008;
- Start-up January 2009.

The production life of the platform will be approx. 30 years.

2.2 DESCRIPTION OF DRILLING ACTIVITIES

2.2.1 Drilling Program - ANNAMARIA A Platform

The scenario for the development of Annamaria A platform foresees a first phase with the drilling of 6 wells. Only later, in case of positive results of the first well production tests in the reservoir thin layer, a second phase will be started with the drilling of two additional wells simultaneously to the production activity (always with the aim of localizing reservoir thin layer levels).

Planned drilling program.

Wells will have the following casing shape:

- conductor pipe dia 26";
- surface column of dia. 13 ⅜";
- intermediate column dia 9 ⅝";
- production column dia 7".

Wells shape can be "S" and "SLANT" type. The "S" shape identifies wells that are deviated and then return in vertical to the field reservoir while the "SLANT" shape refers to wells where the maximum reached inclination is maintained even in the reservoir section.

The well characteristics are summarized in the following table.

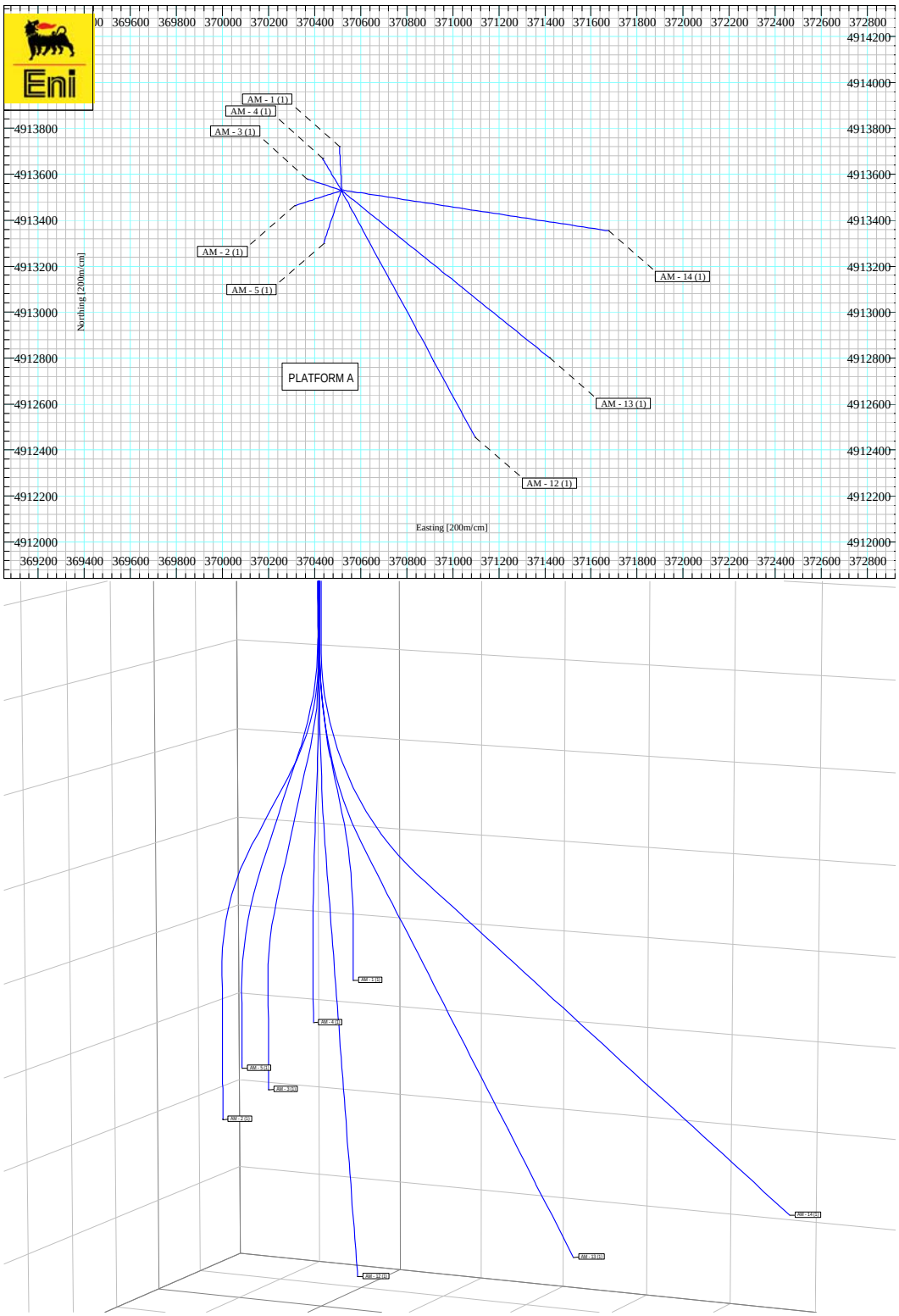
Table 2.2 - Wells identification and shapes - Annamaria A platform

ANNAMARIA A						
FIRST PHASE						
WELLS	**TVD (m)**	**TMD (m)**	**TYPE**	**MAX INCL (°)**	**DISPLACEMENT (m)**	**AZIMUTH (°)**
AM-A01D	1108,4	1143,44	S-SHAPE	27	189,31	256,03
AM-A02D	1388,3	1430,17	S-SHAPE	28	213,88	250,82
AM-A03D	1388,3	1358,77	S-SHAPE	16,41	154,18	287,54
AM-A04D	1198,99	1221,85	S-SHAPE	19,02	157,55	328,32
AM-A05D	1235,3	1282,92	S-SHAPE	26,44	241,92	197,25
AM-A12D	1459,2	2053,64	SLANT	54,99	1218,69	150,43

SECOND PHASE						
AM-A13D	1460,4	2005,65	SLANT	53,29	1158,61	127,74
AM-A14D	1460,9	2026,47	SLANT	55,28	1170,25	97,59

Remarks:

- S-shape: well characterized by an "S" shape;
- Slant: well that at a certain depth takes a particular bending and maintains the angle down to the well bottom.



Picture 2.2 – Wells Shape of Annamaria A (top and 3D view)

2.2.1.1 Mud Program

The mud program foresees the use of water-base mud and specific additives, different for the different drilling phases.

Table 2.3 – Typology of drilling muds

Phase	Drilling interval (measured depth-md)	Description	Mud code
Surface hole 16" for casing 13" 3/8	from sea bed to m 300 (MD)	Bentonite slurry - fresh water base type	FW - GE
Intermediate hole 12"1/4 for casing 9"5/8	from m 300 to m 1200 (MD)	Ligneous sulphonated mud - fresh water base type	FW-LS-LU
Final hole 8"1/2 for casing 7"	from m 1200 to m 2100 (MD)	Polymeric mud with lubricant	FW-PO-LU

The following table 2.4 lists the chemicals, subdivided according to their properties, mainly used for the packaging of water base mud. Table 2.5 lists the estimated quantities of mud obtained from the drilling of a typical well. The composition for each phase is given in Table 2.6.

Table 2.4 – Chemicals Characteristics for packaging of drilling fluid

Product	**Action**
Bentonite – sodium clay	Main viscous agent
Barites – BaSO4	Weight regulators
CMC LVS (low viscosity)	Viscosity regulators
Ligneous sulphonates – sulphonated lignin (paper manufacturing residues)	Fluidifying and dispersant agents
CMC HVS (high viscosity) – Carboxyl-methyl cellulose (modified cellulose) XC Polymer– bio-polymer (product with polysaccharides modified by "xantomonas" bacteriums) Mica Cellulosic Plugging Agent (Perflow/Brandexx)	Filtrate reducers
Presantil	Pipe freeing agent
Caustic soda – NaOH Sodium carbonate and bicarbonate – NA2CO3, NAHCO3	PH controllers
Drilling Water	

Table 2.5 – Estimated quantities of mud produced by a typical well

Phase	Mud Code	Produced mud (m3)
Surface hole	FW-GE	120
Intermediate hole	FW-LS-LU	300
Final hole	FW-PO-LU	100
TOTAL		520

Remark:
Above mentioned quantities are those necessary for drilling of each single phase without taking into account surface volumes (about 160 m^3).

Table 2.6 – Mean Composition of mud for single drilling phase

MUD CHEMICALS	PHASE 16" (kg/m3)	PHASE 12"1/4 (kg/m3)	PHASE 8"1/2 (kg/m3)
BARITES	100	100	100
BENTONITE	40	20	15
NaOH	1	1	1
CMC HVs	2	2	2
CMC LVs		4	4
Sodium bicarbonate		1	1
Dispersant		5	3
Presantil		2	2
XC-Polymer		2	2
Cellulosic plugging agent	143		
Drilling water	714	864	871

The above listed estimated quantities are purely indicative. Since the mud program to be adopted has not been defined yet in detail, reference is made to data referring to the drilling of a field located in the Adriatic sea, having similar characteristics with Annamaria, as regards the typology of crossed formations and relevant environmental issues.

2.2.1.1.1 Estimate of Products used for packaging of drilling mud

At present, the proposed development scenario considers the drilling of 6 wells, 5 of them “S” shape type and 1 “SLANT” shape type. Furthermore the drilling of 2 additional wells “SLANT” shape type is foreseen, to be confirmed after the first

production test. To evaluate the quantity of chemicals to be used, the drilling in batch of all wells has to be assumed.

Table 2.7 – Total estimated quantities of product (First phase: 6 wells)

TOTAL CHEMICALS CROATIA (tons)				
PHASES	16”	12 ¼”	8 ½”	TOTAL
BARITE	90	270	800	1160
BENTONITE	84	12	0	96
NaOH	3	6	3	12
CMC HVs	3	7	2	12
PAC LV	0	13	11	24
Sodium bicarbonate	0	1	5	6
Dispersant	1	22	18	41
XC-Polymer	0	4	2	6
Lubricant	0	0	36	36
Drilling water	900	1800	1000	3700

Table 2.8 - Total estimated quantities of product (Second phase: 2 additional wells)

TOTAL CHEMICALS CROATIA (tons)				
BARYTE	30	90	270	390
BENTONITE	28	4		32
NaOH	1	2	1	4
CMC HVs	1	2	1	4
PAC LV	0	4	3	7
Sodium bicarbonate	0	0.3	1.5	1.8
Dispersant	0.3	7	6	13.3
XC-Polymer	0	1.5	.5	2
Lubricant	55	0	12	12
Drilling water	300	600	300	1200

2.2.2 Well completion

At the end of drilling activities, the wells of Annamaria field will be completed, purged and connected to production facilities.

2.2.2.1 Wells completion operations

All wells will be completed in double with 2 ⅜" tubings, with Sand Control (Frack Pack or High Rate Water Pack).

For Annamaria case, characterised by several production levels, a "double" completion string will be used, composed of two 2 ⅜" tubings and able to produce independently of one another, on different levels.

During well completion operations, also the completion with "Sand Control" is carried out using one of the several available methods, either with open hole or inside casing. This type of completion prevents sand from entering into the well and reduces or limits erosion phenomena on the bottom-hole equipment and on surface facilities. For the particular case of Annamaria field, the foreseen Sand Control technique is the Inside Casing Gravel Pack and, in particular the High Rate Water Pack and the Frac Pack.

2.2.2.2 Well plugging and abandoning operations

At the end of the field production life, all the platform wells will be completely closed.

This operation will be done using a series of cement plugs to ensure the complete isolation of production levels, recovering in the subsoil the hydraulic conditions present before the well drilling and operation. These activities will consider the reached depth, the type and depth of column, the mining and geological results obtained from the survey and shall comply with Eni/INAgip procedures and the international best practices.

If, for technical reasons, it is impossible to close the well down to the sea bed, mining closure shall foresee to cut and recover at least a part of the not-cemented columns.

2.2.2.3 Measures to mitigate the impact

The following paragraphs explain the main pollution preventing measures that are normally used during drilling phase and the main methods for monitoring the environmental aspects.

2.2.2.4 Treatment of cuttings and drilling mud

The Croatian regulations, in line with the Barcelona Convention, ratified by Croatia on 27/11/1998 (Official Gazette n° 17/1998), entry into force on 09/07/2004 (Official Gazette n° 11/2004), allow, upon authorisation request to competent authorities, to discharge at sea the cuttings and the water-base drilling mud; Inagip requested and obtained the authorisation to discharge at sea this type of cuttings. This authorisation was given on 05/02/1999 with the resolution by the DRŽAVNE UPRAVE ZA ZAŠTITU PRIRODE I OKOLIŠA (Government Environmental Agency).
The given authorisation, based on the "Environmental Impact Study for the development of the North Adriatic field and the gas pipeline onshore" (WET - Water and Environmental Tecnology - d.o.o, 1998) and the "Addendum to the Environmental Impact Study for the development of the North Adriatic field and the gas pipeline onshore" (WET - Water and Environmental Tecnology - d.o.o, 1998) foresees the following:

i) Drilling mud shall be water-base type;

ii) Cuttings and drilling mud residues can be directly disposed at sea;

iii) Cuttings and mud shall be sampled and analysed so as to verify their compatibility with the limits imposed by the received authorisation;

iv) Mud and/or cuttings contaminated by agents different from those that have been authorised for the packaging of the mud (acid sludge, lubricants) shall be recovered and transferred onshore to be treated by an appropriate centre authorised for their treatment and disposal

2.2.2.5 Civil Sewage and Oily waters Treatment

Civil sewages (w.c. discharge, sinks, shower-bath, storeroom) are treated by systems certified by a Regulatory Body before being discharged at sea. In the engine room, the pumps and motors area are located below the main deck and are completely coated with bilge to collect oily waters including all those coming from the areas where oil spill and leakage could happen. The fluids collected by sump pumps are transferred to an oil-water separation plant. The separated water is then sent to the liquid sewage tank, while the oil is stored in the relevant barrel, before being transported onshore to be disposed.

2.2.2.6 Measures to be taken in case of accidental oil spill

The drilling plant is assisted 24 hours a day by a supply vessel, that besides being a temporary storage for those materials necessary for drilling operations and relevant sewage, is equipped with 3 barrels, 200 litres each, containing dispersant and equipped with apposite booms to be used offshore in case of accidental leakage of pollutants at sea.

Besides INAgip can benefit from the services offered by Eni UGIT and use the resources stored at the operating District of Ravenna that in compliance with what established by the "Piano Emergenza Inquinamento Marino" by Eni S.p.A, Division E&P (Emergency Response Plan for Unexpected Pollution of the Sea) has the necessary equipment to be used in case of accidental spill of pollutants at sea.

In particular, the available equipment consist in:

- 500 m pollution preventing floating booms;
- Nr. 2 skimmers to recover the floating oil on the water surface;
- Nr. 200 barrels of chemical dispersant
- Oil-absorbing material (sorbent booms, sorbent blanket, etc).

Furthermore INAgip, as Eni associated company, can avail of the international agreements reached with the leading companies specialized in fighting against pollution of the sea caused by hydrocarbon leakages, like OSRL (UK) - world leader in this sector and to whom Eni is one of the shareholders - and in the Mediterranean area, Castalia Ecolmar, having with Eni a service agreement.

2.2.3 Drilling phase – Evaluation of Waste Production, Exhausts into Atmosphere, Sound Output and Vibrations Production

The wastes produced on platform, indifferently from their type or method of disposal, even if temporarily, are stored in suitable structures to be recycled, as in case of drilling mud, or suitably disposed in an appropriate final structural. Regarding the exhausts into atmosphere and the sound output, these are mainly caused by the generators operations and the mechanical parts in movement.

2.2.3.1 Typology and Quantity of produced Wastes

The produced wastes are composed of:

- Urban solid wastes (tins, cardboards, wood, rags etc.);
- Wastes coming from drilling/completion activities (mud in excess, mud-soaked cuttings);
- Sewage (plant scavenging waters, meteoric waters, sink waters);
- Civil Sewage (w.c. discharge, sinks, shower-bath).

On the basis of similar projects, the following table 2.9 shows an estimated quantity of wastes produced by a single drilled well.

Table 2.9 – Type and Evaluation of Produced Wastes

Wastes comparable to urban type (tons)	Mud and water Liquid Wastes (m3)	Cuttings from drilling (tons)	Civil Sewage (m3)
20	1000	350	300

2.2.3.2 Exhausts into atmosphere

The main source of exhausts into atmosphere is caused by the release of polluting gas by the engines operating the generators.

An electric power production system with diesel generators is installed on platform for a total installed power of approx. 5000 – 5500 KW. All installed generators are used for the production of electric power necessary for the platform operation, except for one to be used in emergency conditions (i.e. black-out). The used fuel is diesel oil, with a sulphur content lower than 0,2 %.

Hereunder are given the characteristics of power generators installed on the Jack-up Rig, Labin type, similar to those relevant to other plant types that could be used for the drilling of Annamaria A and B wells:

- Main engines: 4 CATERPILLAR, model 3516 DITA, power 1200kW each;
- Emergency diesel engine: CATERPILLAR, model 3508 TA, power 590kW.

Table 2.10 – Power generators exhausts characteristics

Source of release	Height of release	NO_2 (mg/m^3)	CO g/m^3)	Particulate (mg/m^3)	Gas T (°C)	Flowrate (Nm^3/h)
Diesel engine CAT 3516	6,70m (from main deck) 33,20m (from sea level)	3810	373	86	287	1295
Diesel engine CAT 3516		3789	404	90	323	1331
Diesel engine CAT 3516	7,70m (from main deck) 34,20m (from sea level)	3761	510	79	333	1210
Diesel engine CAT 3516		3815	573	82	360	1235
Emergency diesel engine CAT 3508 TA		3659	610	62	160	825

2.2.3.3 Noise generation

Generally on the drilling plant noises can be ascribed to the diesel engines used for electric power generation, to the rotary table, the winch, the pumps and the cementing machine. The noise is low-frequency type; the noisiest sector is where the motors are installed.

Bibliography shows that most of the marine vertebrates (except for most of Mammals) use low frequencies to communicate either with individuals of the same species or to receive and send signals between different species. Sensible low-frequency noises are the potential cause of the fish fauna departure and moreover can cause an interference with the normal physiological and behavioural functions of some species.

Drilling of wells could cause an increase of low-frequency noise compared to the normal environmental noise in the area.

The drilling activity can produce a disturbance of:

- a medium low-frequency noise (average noise level at a frequency of 240 Hz present in the environment) equivalent to 96 dB during drilling phase with an increase of about 20 dB compared to the natural level of 76 dB; this value is based on bibliographic data, in any case it is much lower than the maximum limit of 150 dB;
- a disturbed area (submarine area where the noise - emitted by sound source - exceeds the environmental noises of 76 dB) corresponding to a radius of approx. 2,5 km from the platform.

2.2.4 Wastes treatment and disposal methods

For Annamaria project, mud and/or cuttings contaminated, wash water, oils and urban solid wastes and/or similar are collected and transferred onshore to be disposed. On platform only garbage, civil sewage (w.c. discharge, sinks, shower-bath, storeroom) are treated by a dedicated system and bilge waters.

2.2.4.1 Drilling Fluids and Cuttings

Old drilling mud and cuttings are discharged to the sea.

According to the authorization received the water based mud used on Annamaria A Platform will be sampled and analysed as shown in the following table:

WATER BASED MUD					
Parameters to be analysed	Measurement frequency	Measurement sampling performed by	Measurement results/reporting	Submission of reports	Opinion/Approval
Hydrocarbon content, heavy metals, toxicity, genotoxicity, fish, algae, bacteria	*During 1st use of same kind of mud*	*Ruder Boskovic Institute*	*Ruder Boskovic institute*	*Istrian County, MZO, DI*	*Istrian County*

2.2.4.2 Waste Treatment on platform [Gr2]

The only treatments performed on board are limited to the following:

- Food garbage is pulverized and discharged into the sea by a sifter with 25 mm mesh, as it is fixed by the international rule “MARPOL (Marine Pollution)”;
- Civil Sewage (w.c. discharge, sinks, shower-bath, storeroom) is treated by a depuration plant (biological homologated type) before discharging into the sea offshore. They are discharged in compliance with the Croatian laws on the basis of the provisions of the international regulation “MARPOL”;
- Bilge waters are composed of a mixture of oil and water and are treated in a dedicated separator. In case of presence of oily substances in the water on the Rig they are collected in a special tank and then transported to Pula by a Supply Vessel, to be later treated.

2.2.5 Supply Vessels for Operations

During drilling phase a series of ships, vessels and aircrafts will support the activities for plant components transport, raw material supply, waste disposal, personnel transportation, and control activity as well.

To this purpose, during the development of activities, in waters closed to the areas of operation and along the navigation corridor to reach the respective Italian and Croatian coasts, a series of ships and aircrafts will be present, as follows:

- **Supply Vessels**:
  - Weight: 1200 tons,
  - Engine characteristics: diesel engine of 6000 BHP,
  - Number: 2 vessels operating 24 hours a day for the material transport (there) and wastes (back),
  - Nr. of Transport per month from/to Ravenna: 8,
  - No. of Transport per month from/to Pula: 4.
- **Crew Boat**:
  - Weight: 150 tons,
  - Engine characteristics: diesel engine of 2200 BHP,
  - Nr. of Transport per month from/to Ravenna: 30,
  - Nr. of Transport per month from/to Pula: 3.

- **Helicopters**:
  - Nr. of Transport per month from/to Ravenna: 15.

Crew boats and helicopters will be used exclusively to transport personnel and materials of small dimensions and not for transporting wastes.

2.2.6 Realization Period

The following table 2.14 indicates the overall period, subdivided into phases for drilling and completion of all the eight wells, foreseen for Annamaria B platform.

Table 2.11 – Estimate of Drilling and Completion Period - Annamaria A

WELLS	Drilling (days)	Completion (days)	Total (days)
First phase			
AM-A01D	12	24	36
AM-A02D	11	22	33
AM-A03D	14	34	48
AM-A04D	12	30	42
AM-A05D	13	24	37
AM-A12D	17	20	37
		Phase total	233
Second phase (probable)			
AM-A13D	16	23	39
AM-A14D	18	20	38
		Phase total	77

2.3 DESCRIPTION OF PRODUCTION ACTIVITIES

Afterwards it will be described the field exploitation activity for Annamaria A platform.

2.3.1 Description of Annamaria A Platform

Annamaria A will be a temporarily manned platform, equipped with an integrated living quarter to allow the accommodation up to 19 persons for maintenance operations. In any case all the necessary safety devices will be installed to guarantee the safety onboard. Access to platform is guaranteed by an helideck and a fix boat landing.

Final treatment plant will be sized for the following flowrates:

- gas: approx. 1.400.000 Sm3/day;
- water: approx. 24,50 m3/day.

The jacket is composed of a braced frame structure, constituted by steel tubular pylons welded one to another with network structure, anchored to the bottom by four legs, two verticals and two oblique to allow the jack up to get closed from one side.

The deck is developed on four levels, on the highest one will be installed the living-quarter (two levels) and the helideck. The following table 2.12 shows the height and main dimensions of various platform decks.

Table 2.12 – Deck layout

	Elevation Top Of Steel (T.O.S.) (m)	Dimensions (m)
Boat landing	2	-
Lower deck	13,2	30 x 22
Cellar deck	17,2	30 x 30
Mezzanine deck	23,2	30 x 30
Weather deck	29,2	30 x 30
Helideck deck	40,3	20 x 20

On the Lower, Cellar and Mezzanine Deck the process and utilities systems are located.

The Weather deck will be used to carry out drilling and work over operations, where the equipment and/or valves that can release hydrocarbons cannot be installed.

The different levels are connected by stairs suitably installed, so as to facilitate in every condition the descent from higher to lower decks, down to the mooring dock (escape routes).

The following Table 2.13 shows the weights of the main sections composing the platform.

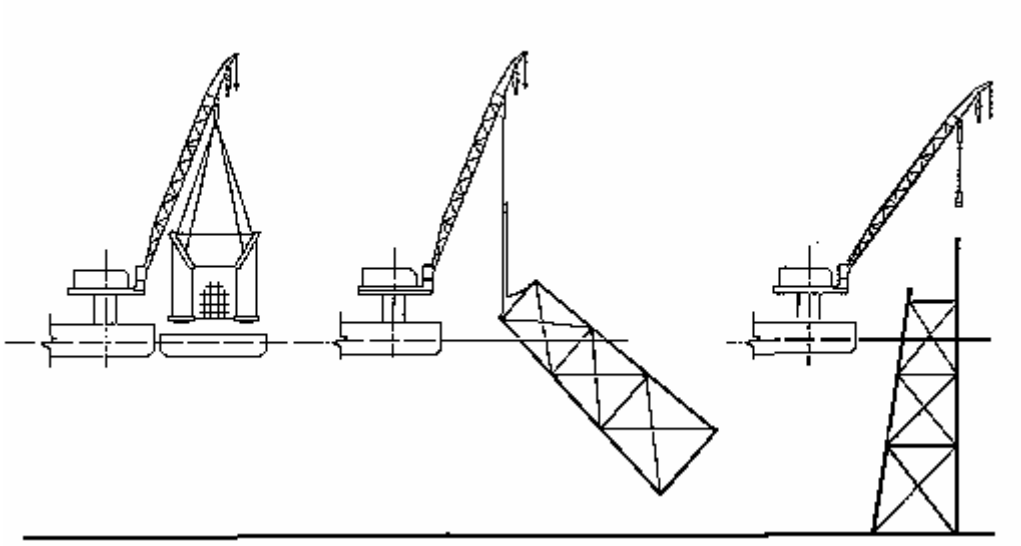
Table 2.13 – Weight of Platform Single Sections

Element	Weight (Tons)
Jacket	1160
Piles	1070
Conductors	683
Wellhead Structures	88
Topside	1810
PLATFORM TOTAL	4811

The platform orientation was defined so that prevailing winds maximize the natural ventilation of the platform in order to avoid the accidental gas releases from wells in areas where equipment are installed.

2.3.2 Platform installation

The jacket is entirely prefabricated at yard on horizontal position and then transported to installation site on a barge. Once reached the selected area for positioning, by a special lifting naval mean (“crane-barge” RAMBIZ type), the jacket is rotated to vertical position and installed on the sea bed. Afterwards the four foundation piles are fixed (one for each leg) by a pile driver to anchor the structure to the sea-bed. The pile driver is constituted by a driving component that beats the pile head repeatedly and allows the progressive subsoil penetration.



Picture 2.3 – Jacket Installation Layout

As for the jacket, also the topside (deck) is totally prefabricated onshore and then transported to the installation site complete of all equipment in order to reduce as much as possible the offshore installation operations. Once positioned, the deck is lifted by a special naval mean (“crane-barge” Rambiz type), and installed on the jacket legs. Consequently the two structures (deck and jacket) will be anchored by welded joints.

Picture 2.4 – Images of lifting crane barge
(Web site Saipem: http://intermaresarda.it)

During the various installation phases, in compliance with the art. 28 of DPR 886/79, a safety area around the platforms is foreseen, whose extension is established by an injunction of the competent harbour office or on the basis of agreements reached with the frontager State if this area is close to the borderline of this State. In this area are forbidden anchorage operations and deep-sea fishing.

During the platform installation, a series of naval means will support the activities for transportation and for jacket and deck positioning, for laying of pipelines and for logistic operations.

In particular, during the development of the activities, vessels present in the operations areas and along the navigation corridors to reach the respective Italian and Croatian coasts, will be the following:

- Barge: naval lifting mean type Crane-Barge Rambiz
- 3 Supply Vessels 1200 tons each, equipped with diesel engine 6000 BHP, working 24 hours a day.

2.3.3 Plants Description

The gas production of Croatian competence in Annamaria field will be firstly treated on platform by water separation and heating to inhibit hydrate formation. The gas will be totally transferred to land except for a part used as fuel gas. A new sealine will transport the produced gas to the existing Ika A platform, from there it will be sent to Ivana K compression platform through Ida C platform. The main process and utilities systems are briefly described in the following.

2.3.3.1 Process Units

2.3.3.1.1 Wellhead areas

The platform is designed for eight double completion wells (two production strings for each well). 6 out of them will be drilled in the initial phase while the other 2 in a second phase. In particular, Annamaria A wells area will be composed of a wellhead module with twelve slots and six wells. The platform will be equipped with the necessary instrumentation and valves in order to manage the wells in safe conditions. The opening and closure of wells and the main production parameters will be managed by Ivana A control room by a remote control and telemetering system.

2.3.3.1.2 Gas Treatment

Sixteen separators are planned (one for each string) in order to optimise the production and simplify the operation. The associated reservoir water will be sent to the treatment system onboard.

Each string will be directly connected to a production separator through a flowline, operated at the relevant wellhead dynamic pressure so as to assure the separation of raw gas from the associated reservoir water. The separated gas will be sent to the gas manifold operated at the minimum dynamic pressure among all the strings. The variation between operating pressure of each separator and the gas manifold operating pressure will be controlled by a choke valve installed downstream each gas separator.

Due to the temperature and pressure operating condition of each string, the pressure variation through the choke valve could cause the hydrates formation in the gas stream.

In order to avoid it, upstream the choke valve, it is foreseen to heat gas by means of 16 heat exchangers (one for each string) and connected to a hot water circuit.

2.3.3.1.3 Gas Export

Once treated in the separators, the gas will be brought to the necessary export pressure, collected in a production manifold, measured by a fiscal measuring system and finally sent to the receiving platform through a new dedicated sealine (dia.16" to Ika A). On the platform the installation of a new launching trap is foreseen for pigging of the new line, if necessary.

In order to meet the production quotes to be expected by the two concession owners, part of the gas produced by Annamaria A could be transported to Annamaria B and viceversa.

The interconnecting sealine between the two platforms is designed to work in both directions and is equipped with a special control device to allow bi-directional transport of the produced gas. Furthermore the installation of a bi-directional trap is foreseen for the pigging of the interconnecting line.

2.3.3.2 Utilities

2.3.3.2.1 Gas heating system

In order to prevent hydrates formation, gas heating is foreseen upstream the choke valve. For gas heating, a heat exchanger (one for each string) gas-hot water is foreseen; hot water in closed circuit, that functions as heating "medium", releases heat to the gas and absorbs heat in a single exchanger, that is fed by a further "medium" (water in closed circuit), heated by flue gas. These flue gases are produced in a boiler fed by fuel gas. Re-circulation pumps for the two "mediums" complete the plant.

2.3.3.2.2 Fuel Gas System

The system is designed to treat the produced gas to be used as fuel gas by electric power generators or purge gas and/or blanketing gas by other users. The gas to be treated taken from the production header, before being choked is treated in a glycol scrubber and then heated by an electric heater in order to avoid hydrates formation. Afterwards the gas is choked to the operating pressure, filtered in cartridge filters to remove the impurities and the possible condensates and then sent to the users.

2.3.3.2.3 Diesel System

The system has to provide the required diesel for the emergency generator, if needed to the platform crane. The system is mainly constituted of a storage tank manually filled by barrels, a discharge pump and two coalescence filters (one in stand-by).

2.3.3.2.4 Instrument Air System

The system is mainly consisting of two compressors screw type, filters, dryers, a dry air accumulator and a wet air accumulator. The system has to guarantee the instrument and service air for all users on the platform.

2.3.3.2.5 Main Generation System

The main power generation system mainly consists of two electrical generators fed by the extracted gas, normally working in 1+1 configuration. The engine-generator units are suitably sized (2 x 100%, each for the platform total load), to meet the electrical requirement of the platform in the different operating conditions (except for emergency condition, initial start-up and start-up after emergency shutdown, etc.) of the plant.

2.3.3.2.6 Emergency Generation System

Main loads, where middle / long terms shutdowns cannot be accepted, have to be supplied by an emergency diesel generation system (generator driven by a diesel engine). In case of failure of the main electric power supply, the diesel generator is designed for the automatic start-up by an automatic switchover device, installed on emergency distribution board, guaranteeing in that way the electric power supply to the main users. The electrical equipment of emergency system is separated from the main electrical system.

2.3.3.2.7 Safety Power System

To guarantee the continuous power supply, main loads have to be supplied by a safety power source provided by uninterruptible power supplies units (UPS). UPS, besides guaranteeing the continuity in power supply, will ensure the constant sinusoidal wave factors and a high quality of power. The UPS automatically change over from the normal electrical line to the safety power system having “no break” effect to the essential loads. The feed of users or electric safety systems, besides being supplied by UPS having appropriate autonomy, shall be connected to the power generator system.

2.3.3.2.8 Drains System

The drain system collects all the oily or semi-oily drains by two separated collector headers: one dedicated to closed drain, while the other is for open drains.

Both collectors convey fluids to a section of the storage tank that will be periodically emptied by the supply vessel. The closed and open drains of diesel system and wellheads hydraulic system will be sent to a separated section to recover diesel or oil in case of leakage. Even this tank will be periodically emptied by the supply vessel.

The drains (mainly rainy waters) of the helideck are collected in a dedicated vessel. The vessel is sized so as to collect the helicopter fuel, in case of the tank accidental damage. The separated water is sent to the sea-sump while separated hydrocarbons are sent to the platform drains recovery tank.

All non-polluting drains (mainly rainy waters) are directly discharged to the sea sump[1] caisson by a draw-off tube that separates, because of gravitation, the water from the hydrocarbons that accumulate on the surface. The separated fraction is gathered and periodically sent to a supply vessel by a portable pump to be later disposed onshore. The capacity of the sump caisson is calculated to ensure that rainy water discharge to sea has hydrocarbon contents within the limits imposed by the law.

In particular the sea-sump is calculated for a hydrocarbon separation speed of 4 mm/sec and therefore with a minimum diameter of 500 mm. The minimum depth of sea sump has to be 26 m.

2.3.3.2.9 Oily Water Treatment System

Associated reservoir waters, separated in the wellhead separators, will be sent to the oily water treatment unit. The system is composed of a de-gazer tank where all gases dissolved in water will be separated and of a coalescence separator where the two liquid phases (water and hydrocarbons) will be separated by gravitation. Hydrocarbons will be collected and transported to the on-shore gas treatment plant through the gas export sealine. The water is firstly treated by a mechanical filtration system and then by active carbon filters to be later sent to a closed drain system. The system is able to ensure the discharge of a content of hydrocarbon particles equivalent to 40 ppm.

2.3.3.2.10 Atmospheric Vents

The installation of two atmospheric vents is foreseen to collect and exhaust into atmosphere and in safe areas the gas released from the process and utilities systems during the continuous and emergency operations.

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[1] Draw off tube to separate hydrocarbons, if any

A high-pressure vent will treat only discontinuous discharges released by high-pressure operating equipment during emergency phases, while a low-pressure vent will treat continuous and discontinuous discharges released by low pressure operating equipment both during operation as well as emergency phases.

In particular, the low pressure vent tip will be equipped with flame arrestors in order to avoid any back flame propagation and with automatic CO_2 fire fighting system to prevent the accidental ignition of the vent.

2.3.3.2.11 Purge Burner

Two purge burner systems will be installed to collect and burn all fluids coming from the wells during start-up or work over operation.

2.3.3.2.12 Air Conditioning System

Two different air conditioning systems will be installed: one for the living quarter while the other is for auxiliary cabins.

2.3.3.2.13 Fire Fighting System

In case of fire the following protections are foreseen for the platform safety:

- a water-foam and a dry powder system for the helideck, activated simultaneously in emergency situations. In case of fire, water and foam to hoses are fed by the pressurisation caused by the use of nitrogen bottles, while powder is supplied by two skids located on the opposite sides of the helideck.
- a water system, to protect personnel, composed of a water distribution network fed by two fire water pumps (one operating and one in stand-by) which suck water from the sea. The water distribution network supplies the monitor hose reels located in the living quarter and in the strategic places of platform deck. The water distribution network is always pressurised by two jockey pumps (one operating and one in stand-by).
- a Inergen system, for technical rooms, composed of Inergen bottles. This gas can extinguish the fire without damaging the equipment and can be used in manned rooms.
- a CO_2 system for engine rooms, composed of CO_2 bottles. This gas can extinguish the fire without damaging equipment and is also suitable for use in manned rooms.

2.3.3.2.14 Lifting Facilities

The weather deck is equipped with a diesel engine driven crane. The characteristics of the crane are listed below:

- 18 tons at 6 m;
- 5 tons at 18 m;
- 4 tons at 20 m;
- 3 tons at 22 m;
- minimum operating radius of 4,5 m.

2.3.3.2.15 Rescue and safety, fire fighting and first aid equipment

The platform is equipped with 2 lifeboats, each with 32 seats, as a mean of evacuation. Furthermore, a life raft with 8 seats will be installed in the process area. Special boxes with life jackets to wear during the evacuation will be installed next to the lifeboats and life raft. A first aid kit and stretchers will be provided on the platform. All the board staff must have personal protection equipment (helmet, safety glasses, accident-prevention shoes, portable gas detectors, etc).

The platform will be fitted with portable powder and CO_2 extinguishers and life belts to throw to sea in case of man overboard.

2.3.3.2.16 Control System

As mentioned above, Annamaria A is a temporary manned platform to be used as a temporary maintenance centre. During normal activities, it is controlled and managed by the control station: the process and safety data are sent to the SCADA system on Ivana A platform, enabling the operators to monitor in the control room the platform operating parameters.

Moreover, the platform is always controlled and protected by local control and safety systems (PCS and ESD/F&G) able to manage the platform during the start-up, normal operation and emergency shut-down phases.

During manned phase, it is possible to control the platform locally from the control room, always under the supervision of the operators working in Ivana A control room.

The platform main Control Systems are:

Control System (PCS) to control and manage process data, alarms, display video pages, etc.

Safety System (ESD and F&G), for personnel, environment and equipments protection. In particular, there are several levels of emergency shut-down according to the gravity of detected causes:

- Emergency Shut-down ESD (I0, I1, I2, I3), to be activated remotely by a telecommunication system or locally by platform operator by pushing buttons.
- Process Shut-down PSD (I4), to be activated remotely via telemetering system or locally by platform operator.
- Local Shut-down LSD (I5).

The F&G system is designed to detect and carry out automatic actions for protection against fire and gas. In particular, the platform is monitored by gas, flame and smoke detectors.

Moreover, a fusible plug network will be installed along the platform to detect Fire. The fusible plug network is pressurized by instrument air, it controls the well and process areas and activates the Process Shut-down (PSD) and the Emergency Shut-down (ESD). In case of gas, fire or smoke detection, the Emergency System (ESD and F&G) will bring the platform automatically to safe conditions and will activate the PAGA System which provides four levels of emergency signals.

The Remote Control Unit has to take over mainly the process, auxiliaries and safety data and transmit them to Ivana A control room by a telemetering system. The unit allows to activate the shut-down commands of the single flowlines, process shut-down (PSD) and Emergency Shut-down (ESD).

Local instruments pneumatic and/or electrical type. Besides, the platform valves will be pneumatically activated except for the subsurface valves (SSSV) that are hydraulic type.

2.3.3.2.17 Wellhead Control Panel

The Wellhead Control Panel mainly consists of a pneumatic and a hydraulic unit, able to control wellhead valves. The pneumatic unit has to manage the panel internal logics and provide for the pneumatic activation of wing valves (WV) and master valves (SSV). The hydraulic unit has to activate subsurface valves (SSSV), and is mainly consisting of two electrical hydraulic pumps (one operating and one in stand-by) and an emergency manual pump. The system will be provided with an oil accumulator tank to allow an adequate autonomy.

2.3.3.2.18 Platform lighting system

Platform lighting is subdivided in three separated systems:

- Normal lighting (fed by main gas generator);
- Emergency lighting (fed by emergency diesel generator);
- Safety lighting (fed by batteries through UPS system)

Minimum lighting levels (Emin/E. minSICUR), to be guaranteed respectively by Normal/Emergency lighting provided by generators and by Safety Lighting provided by UPS batteries, together with the maximum uniformity factors (Ug) to be met for each of the above mentioned systems, and for each platform area typology (indoor and outdoor as well), comply with the Company standards specifications.

In particular, hereunder are given indicative values for the required lighting and distribution uniformity:

Off-shore outdoor area (“Boat Landing” – “Lower Deck” – “Cellar Deck” – “Mezzanine Deck” – “Weather Deck”):	E min. = 60 lux E minSICUR. = 5 lux g = 3
Single instruments (at the point):	E min. = 100 lux
Electrical boards:	E min. = 70 lux Ug = 1,5
Electrical room – General area:	E min. = 240 lux E minSICUR. = 50 lux Ug = 2
Control room – Stations:	E min. = 600 lux E minSICUR. = 50 lux Ug = 1,5
Control room – General area:	E min. = 360 lux E minSICUR. = 50 lux Ug = 2

The platform is equipped with a navigation aid system, signalling obstacles both for air and marine navigation as well. Navigation aid system consists of four white lights blinking in “Morse” code, located at the platform corners, with a minimum visibility of

10 nautical miles from each direction. Air navigation signalling system consists of red fixed lights located on the platform highest points (i.e. roof and crane boom and vent tip).

The helideck is complete of a perimetric identification system consisting of green lights and floodlights that shall evenly light with a white light the helicopter landing and take-off surface. The wind sleeve is lit and two green lights shall signal the platform status respectively for fire and/or explosive mixture presence.

2.3.3.2.19 Platform cathode protection system

The jacket is complete of a cathode protection system composed of aluminium-zinc-indium sacrificial anodes. The total quantity of anodes is equivalent to 60 tons; this value is estimated for the platform overall operating life: 30 years.

2.3.4 Production phase – Estimate of water discharge, Waste production, Release of pollutants into atmosphere, Sound output and Vibration production

The main discharges during Annamaria A platform exploitation phase are described in the following.

2.3.4.1 Exhausts into atmosphere

Exhausts into atmosphere, that shall be specifically authorised, are the following:

Natural gas produced by the equipment and wells manual depressurisation during maintenance and/or emergency operations. They shall be considered as extraordinary operations, not programmable and sporadic, considering the extreme simplicity of the systems installed onboard.

Flue gases originated by wells drain during the production start-up phases.

Air containing lube oil vapours originated from the generators lube oil tank vent due to temperature ranges. This release is discontinuous. The release period is 12 hours/day and the relevant flowrate can be considered as negligible.

Continuous release of flues originated by the gas heater burner for hydrates inhibition.

- Flues Flowrate = 1300 Sm3/h = 1540 kg/h (according to stoichiometric reaction calculation);
- O_2 excess = 5%;

Type of pollutants:

- NOx = 24,21 kg/h (17,8 g/hp-h indicated for gas engines Caterpillar type);
- CO = 1,5 kg/h (1,1 g/hp- h);
- HC = 5,3 kg/h (3,9 g/hp-h).

Flue gases originated by generators discharge. The release is continuous and is originated by a machine operating 365 days per year.

- Discharge flowrate: max. 1284 Sm^3/h (flues originated by a generator operating at 100%)
- Type of pollutant: COx, NOx;
- Concentration: CO < 650mg/Nm^3;
  NOx < 500mg/Nm^3;
  H_2S absent;
- Release area: at the top of the Cellar Deck.

Gas originated by the low pressure vent after the degassing of production water continuously discharged by the 16 separators:

- Discharge flowrate: max. 1,7 Sm^3/h;
- Pollutant type: CH_4;
- Concentration: 99% molar;

2.3.4.2 Liquid discharges

Liquid discharges are the following:
Production water, collected and sent to a dedicated treatment system where water is separated from hydrocarbons. Once reached the limits imposed by the law, the water is discharged to sea through the sea-sump.

- Discharge flowrate: max. 1,042 Sm^3/h
- Pollutant type: liquid hydrocarbons
- Concentration: < 40ppm oily in treated water

Outlet concentration for BOD, COD, TOC and Suspeded particles in accordance with design data and Croatian Official Gazette NN 40/99 and NN 6/01 as max. alowable values:

- BOD_5: 25 mgO_2/L
- COD: 125 mg/L
- TOC 15 mg/L
- Suspeneded matter: 35 mg/L

Sanitary fittings discharges from the living quarter module (max. 19 people): this discharge shall be considered as continuous assuming that Annamaria A platform is continuously manned, and it is treated by a dedicated treatment system and then sent to the sea-sump.

- Discharge flowrate: max. 0,119 Sm^3/h;
- Pollutant type: biological discharges

Outlet concentration for BOD, COD, TOC and Suspeded particles in accordance with design data and Croatian Official Gazette NN 40/99 and NN 6/01, as max. alowable values:

- BOD_5: 40 mgO_2/L
- COD: 150 mg/L
- TOC 15 mg/L
- Suspeneded matter: 60 mg/L
- Free Chlorine: 0,2 mg/L

Oily or potentially oily drains: these drains, limited to equipment maintenance operations, are separately collected by two dedicated networks and conveyed to a closed vessel, to be periodically sent onshore by vessel to be suitably treated later.

Drains from the helideck: they are collected and treated in a dedicated tank. Separated hydrocarbons are then sent to the drain tank and from here transported onshore, while meteoric waters are sent to the sea-sump.

Non-polluting drains (mainly meteoric waters): they are collected and conveyed to the sea-sump to be later transported onshore by vessel.

2.3.4.3 Wastes production

Wastes produced on Annamaria A platform are estimated as follows:

- Solid wastes: 4000 kg/year;
- Mixed packaging: 5200 kg/year;
- Exhaust oil: 1300 l/year;
- Carbon filters: 850 kg/year.

These wastes will be transported twice per year and will be disposed or recovered (oils) onshore in an authorised structure.

2.3.4.4 Sound output

Sound output produced during the production phase do not exceed the limits imposed by national and international laws for personnel health and safety at work.

It is not foreseen that vibrations and sound output in the surrounding environment can damage marine life that is used to the noise level generated by the sea transportation traffic.

The type of noise produced by the equipment installed onboard Annamaria A platform is in the range of 3000 - 8000 Hz.

2.3.5 Realisation time scheduled for operations

As anticipated at Paragraph 2.1.2, the scheduled time for the realisation of both platforms is:

- Start of engineering activities 2006;
- Start of platform construction activities 2° Q 2007;
- Platform installation 1° Q 2008 (jacket); 4°Q 2008 (deck);
- Drilling and completion 2008;
- Installation of sealines 2008;
- Start-up 1° Q 2009.

The platform estimated production life would be approx. 30 years.

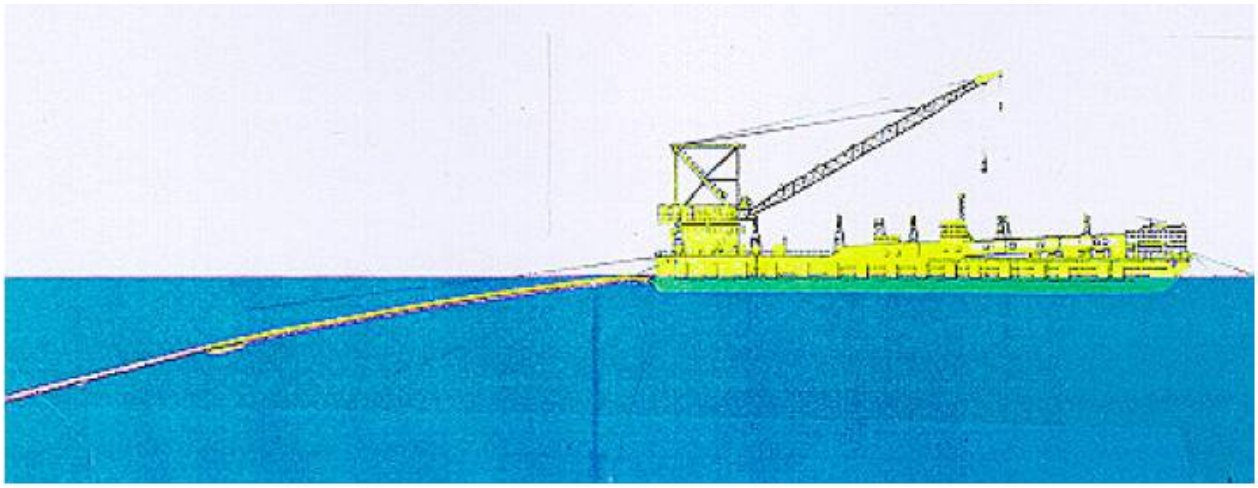
2.4 DESCRIPTION OF EXPORT SYSTEMS

2.4.1 Sealines

The gas produced from Annamaria A platform will be exported to the existing platform IKA A through a sealine dia 16", approx. 10 km long. This gas will be conveyed to the existing sealines system towards Croatia, place of the final destination for the gas pertaining to Croatia.

As already previously described, Annamaria A and Annamaria B platforms will be connected by a sealine, approx. 5 km long and with dia 16". This sealine will enable to transport quantities of gas, so as to balance the production between the Croatian and the Italian platforms according to the GOIP (Tract Participation), produced by the Italian platform Annamaria B.

All sealines will be installed by using apposite lay-barges by using piggy back system (Picture 2.5).



Picture 2.5 – Sealine lay barge

After the non-destructive tests on all welds, the recovery of the continuity of the corrosion protection coating and the concrete weighting, the sealine will be launched sliding it on the skidways, and the lay-barge proceeding forward.

The skidway will allow the sealine, fastened onboard by a sling system, to take a pre-definite configuration (S type launching) to limit stresses on the pipe during laying operations.

The barge trim, whose position will be continuously monitored by a radio-positioning system (satellite type) will be maintained by means of 8 ÷ 10 anchors and the lay barge will proceed gradually, according to the sealine sections launched, by means

of a winches central control system. As far as laying operations continue, anchors are weighted and dropped to another position with the help of tugs (1 or 2 tugs).

In order to avoid external corrosion phenomena, pipes will be protected by a corrosion-proof coating, whose characteristics will be defined during the basic engineering phase. Moreover, sealines will be protected against external corrosion (in case of damage / deterioration of the corrosion protection coating) by ring sacrificial anodes, installed at regular intervals along all the submerged section of the sealine.

To minimise the environmental impact, it is preferable to foresee the weighting of the pipeline laid on the sea-bed instead of burying it. Burying operation would cause:

- Increase in cloudiness in the area nearby the sealine route due to the mobilisation and suspension of particles;
- Burial of organisms living on the sea-bed caused by the removal of sediments during burying operations;
- Release, together with sediments suspension, of polluting substances in the water column above the sea bed.

Sealines will be weighted by reinforced concrete with iron mesh to guarantee the stability of the sealine against the currents caused by environmental phenomena (waves, winds, etc.) for a return period of 100 years.

Platforms risers will use the same piping of the submarine pipeline. These risers will be externally coated by means of a 20 mm polyurethane resin layer to guarantee the protection both against corrosion as well as against dynamic loads.

Rises will be fixed to the platform legs by means of metal clamps internally coated with neoprene to avoid interferences between the sealine and the platform cathodic protection systems. Electric insulation of the 2 systems (platform and sealine) will be ensured by the installation of apposite dielectric joints at the topside.

Flanged expansion loops will connect the sealine and the risers in order to maintain within allowable values the stresses values caused by temperature and pressure.

All submarine elbows and risers will have a bending radius equivalent to 5 diameters in order to allow the passage of intelligent pigs just after laying and during the sealine operating life.

The main characteristics of Annamaria A – Annamaria B sealine are summarised in the following table:

Table 2.14 - Sealine Annamaria A - Annamaria B - Piping 16" for gas transferring (1)

DN x Thickness [poll.] x [mm] (2)	Overall length [m]	Design pressure [barg]	Material ISO STD
16" x 12.7 - 14,3	5500	99	L 415

(1) Indicated data shall be considered as preliminary and shall be defined / confirmed during the detail engineering phase.

(2) Including 3 mm corrosion allowance
Single section average length equivalent to 12.1 m.

Rating 16" ND will be verified during the sealine design and will be optimised on the basis of the results obtained from the line expansion and variability analysis.

Concrete weighting coating (Gunite spraying) necessary to ensure the stability of the pipe on the sea-bed estimated in this phase, has a thickness of at least 40 - 60 mm and density 3044 Kg/m^3 .

Characteristics of cathode protection system: Aluminium – Zinc – Indium ring sacrificial anodes, 40 mm thick, 760 mm long and distanced 1 every 9 pipes have been assumed in this phase.

Cathode protection system is sized for the overall plant life: 30 years.

Annamaria A – Annamaria B sealine main characteristics are summarised in the following table:

Table 2.15 - Sealine Annamaria A – Ika A - Piping 16" for gas export (1)

DN x Thickness [poll.] x [mm] (2)	Overall length [m]	Design pressure [barg]	Material ISO STD
16" x 12.7-14,3	10500	99	L415

(1) Indicated data shall be considered as preliminary and shall be defined / confirmed during the detail engineering phase.

(2) Including 3 mm corrosion allowance
Single section average length equivalent to 12.1 m.

Rating 16" ND will be verified during the sealine design and will be optimised on the basis of the results obtained from the line expansion and variability analysis.

Concrete weighting coating (Gunite spraying) necessary to ensure the stability of the pipe on the sea-bed estimated in this phase, has a thickness of at least 40 - 60 mm and density 3044 Kg/m^3 .

Characteristics of cathode protection system: Aluminium – Zinc – Indium ring sacrificial anodes, 40 mm thick, 760 mm long and distanced 1 every 9 pipes have been assumed in this phase.

Cathode protection system is sized for the overall plant life: 30 years.

2.4.2 Sealines installation

Connecting sealines will be assembled offshore with the traditional method that is the lay-barge. This barge proceeds drawn by its anchors and progressively launches the sealine assembled onboard by pipes welding. During laying operations all welds are x-ray tested to ascertain the good execution. X-ray tests are made in an apposite room on the barge and the Company representative always certifies the result. Should there be any defect, welds are repaired or totally redone according to the procedures and technical requirements specified by the project.

Stresses on the sealine during the laying operation are checked by the manufacturer representatives, in the presence of Company supervisors always checking supports reactions, the tensile strength, and the length of the suspended span.

During laying operations, apposite instruments are used such as the buckle detector to check the pipe ovaling and the R.O.V. (remotely operated vehicle) to check the suspended span.

At the end of laying operations and after connections with the respective risers, pre-start-up operations are carried out, consisting in the sealine flooding, the internal cleaning, calibration and hydrostatic test. The line internal cleaning is made by flushing and launching the apposite pigs (cylinders complete of brushes and rubber gaskets).

Calibrations consists in launching along the sealine a “PIG” where is installed a calibrated plate, whose diameters is equivalent to 95% of the minimum internal diameter of the sealine (elbows, valves, flanges, etc.).

Hydrostatic test consists in flooding the sealine, increasing pressure up to the test value defined in the design phase, stabilising this pressure for 24 hours, maintaining the test pressure for additional 24 hours within the allowable data foreseen by the project specifications.

The following phase foresees the depressurisation, draining and gas introduction of the system.

Along the route of the new sealines, the competent authority will define a limit of territorial waters where anchorage and deep-sea fishing are forbidden.

2.4.3 Means used during sealines installation and laying

During the various laying phases of the sealine, along the selected route, several naval and/or underwater means will be used, and in particular:

- A supply vessel for ROV, the vehicle performing underwater surveys, during and after laying;
- The lay-barge, where the sealine is assembled;
- Ships assisting the lay-barge (laying spread), that is tugs, pipe carriers and vessels to transport personnel.

The selected barge for laying operations will be confirmed once defined the sealine installation engineering. For this document, a typical laying spread has been considered, used to lay sealines similar to this one.

2.4.4 Realisation time

Estimated times for the realisation of sealines are indicated here below:

- Engineering: by 2006;
- Procurement of materials: by 2007;
- Installation: by 2008.

As far as laying operations are concerned, the sequence and the relevant duration of activities are summarised in the following:

- Sealine Annamaria A – Ika A: approx. 20 days (about 10 km of sealines).

The described sequence is purely indicative and can be optimised once defined the sealine installation engineering and with reference to the other activities foreseen during the development of the field.

Generally speaking, in order to avoid interferences with the surrounding environment, during the sealine laying operations of Annamaria project, a speed of about 500m/day has been assumed, if compared to an advancement that can be assumed up to 1 km/day.

Moreover, for each sealine section it will be necessary to consider additional 30 days for the spool (including the stand-by).

On the basis of this program, the sealine laying will take place simultaneously with the two platforms drilling.

The foreseen life of the sealine is equivalent to 30 years.