

I. ANNEX

ISA Contract for Exploration – Public Information Template

	Type of resource: Manganese Nodules
	Name of Contractor: Federal Institute for Geosciences and Natural Resources (BGR)
	Contract Start: 19 July 2006
Sponsoring State: Germany	Contract End: 18 July 2021
	Location: Clarion-Clipperton Zone

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Introduction

The information contained in this ISA Contract for Exploration – Public Information Template is made available to the public in response to the request by the Council of the ISA to make contracts publicly available, subject to restrictions on confidential information, industrial secrets and proprietary data.

The content of the present template is in accordance with the Regulations on Prospecting and Exploration for [*Polymetallic Nodules in the Area*] [*ISBA/19/C/17*] (the “Regulations”).

1. Contract Information

Annex III of the Regulations.

Type of resource	Manganese Nodules
Name of Contractor	Federal Institute for Geosciences and Natural Resources (BGR)
Contract Start	19 July 2006
Contract End	18 July 2021
Location	Clarion-Clipperton Zone
Contract Area (km²)	77,230

2. Coordinates and Illustrative Chart of the Exploration Area

Schedule 1 of Annex III of the Regulations.

The exploration area is shown in red on the map below and located between

W1: western part of the contract area

Starting Point 1: N 13°30' / W 138°22'

E to 2: N 13°30' / W 137°32'

S to 3: N 12°30' / W 137°32'

W to 4: N 12°30' / W 137°50'

S to 5: N 11°38' / W 137°50'

W to 6: N 11°38' / W 138°22' return

N to Starting Point1: N 13°30' / W 138°22'

E1: eastern part of the contract area

Starting Point 1: N 13°26' / W 119°25'

E to 2: N 13°26' / W 118°00'

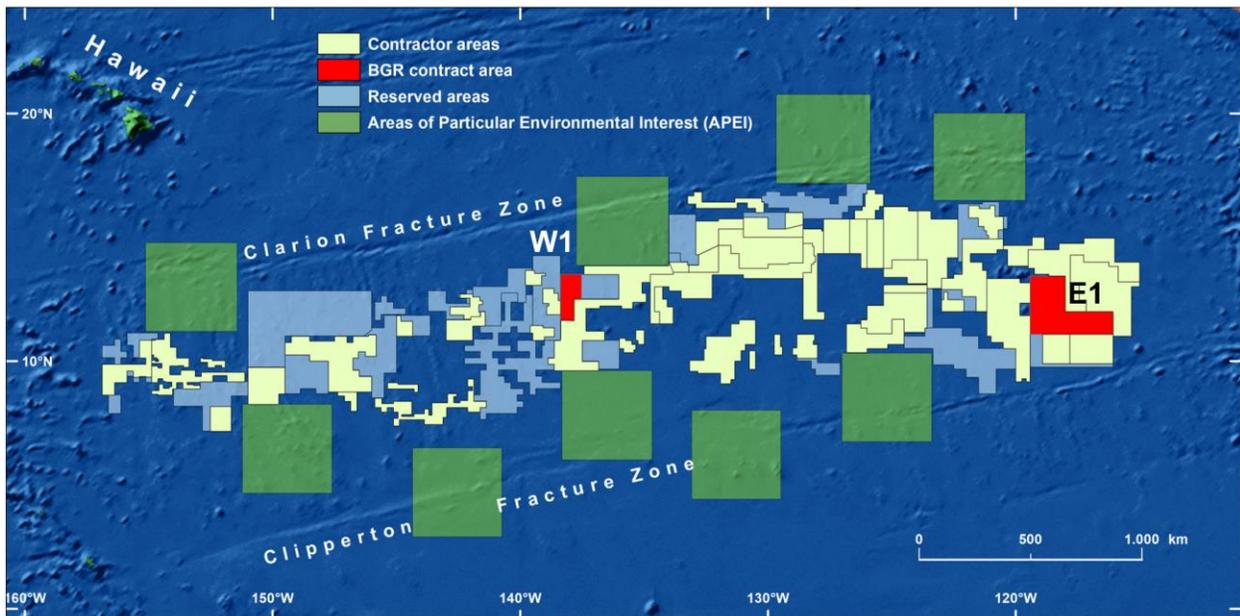
S to 3: N 12°00' / W 118°00'

E to 4: N 12°00' / W 116°04'

S to 5: N 11°05' / W 116°04'

W to 6: N 11°05' / W 119°25' return

N to Starting Point 1: N 13°26' / W 119°25'



3. Plan of work

Summary of Plan of Work for Exploration including the Programme of Activities for the first and/or the current 5-year period (Regulation 18).

Year 1 (starting 07/2006)

- Data extraction from archived files which BGR inherited from the Preussag AG (analogue seafloor photos, analogue echo-sounder readings)
- Preparation of proposal for BMBF-funded cruise to carry out (1) multibeam bathymetry and backscatter mapping with vessel-based swath sounding systems and side-scan sonar, (2) seafloor sampling and (3) investigation of benthic communities (taxonomy, composition of assemblages, biodiversity)
- Planned expenditure in total: 191,000 EUR

Year 2 (2007)

- Continuation of data extraction from archived Preussag AG files (evaluation of seafloor photos; determination of nodule abundance, analogue 3.5-kHz sub-bottom echo-sounder readings)
- Integration of data from the Preussag files and research cruises (sediment characteristics and sampling data, mapping data)
- Planned expenditure in total: 195,000 EUR

Year 3 (2008)

- Exploration cruise to the contract area (25 workdays, swath bathymetry, side-scan sonar, sediment sampling and biological baseline information)
- Data processing, compilation and evaluation (bathymetry, sediment and nodule samples)
- Planned expenditure in total: 1,595,000 EUR

Year 4 (2009)

- Analysis and interpretation of data and samples from 2008 cruise (bathymetry and backscatter, nodule chemistry and coverage, biology)
- Identification of prospective areas based on acoustic data and seafloor samples
- Planned expenditure in total: 588,000 EUR

Year 5 (2010)

- Development of a nodule distribution model
- Selection of prospective mining areas from the contract area
- Planned expenditure in total: 180,000 EUR

Year 6 (2011)

- Analysis and integration of samples and data obtained during cruises in 2008, 2009 and 2010 including:

- geochemical analysis (ICP-OES/MS, XRF) of major, minor, and trace elements of nodules
- mineralogical analysis of nodules (XRD, XANES)
- age dating of sediments and selected nodules using radiogenic isotopes
- investigation of environmental parameters such as pore water, organic carbon content of sediments, water column chemistry (salinity, temperature, redox potential)
- biological baseline data
- development of artificial neuronal networks software for automated analysis of HD seafloor photos
- analysis of seafloor photos to determine nodule coverage
- Implementation of a GIS-based data base and project for data handling
- Preparation of exploration cruise in 2012 including call for tender
- Preparation of proposal for BMBF-funded cruise to investigate potential hydrothermal influence on nodule formation
- Technical upgrade of BGR-owned video sledge (high-resolution photo/video, ADCP current meter, CTD, O₂ and chlorophyll sensors)
- Planned expenditure in total: 455,000 EUR

Year 7 (2012)

- Exploration cruise to the contract area with a focus on nodule samples, seafloor video mapping, a recording CTD and an ADCP for current measurements; side-scan sonar mapping; deployment of ADCP moorings; dredge hauls for nodule mass samples (ca. 25 workdays).
- Work in home labs: analysis of geological and biological samples, photo and side scan sonar data and CTD and ADCP data obtained during cruises from 2008 to 2011
- Lab experiment for metallurgical processing route
- Preparation of an exploration cruise in 2013
- Planned expenditure in total: 1,850,000 EUR

Year 8 (2013)

- Exploration cruise to the contract area with a focus on nodule samples, seafloor video mapping, a recording CTD and an ADCP for current measurements; side-scan sonar mapping; deployment of ADCP moorings; dredging of nodule mass samples (ca. 25 workdays).
- Work in home labs: continuation of analysis of geological and biological samples, photo and side scan sonar data and CTD and ADCP data obtained during cruises from 2008 to 2012
- Lab experiment for metallurgical processing route
- Extension of the GIS-based data base and project with new data and information
- Preparation of a cruise in 2014
- Planned expenditure in total: 1,655,000 EUR

Year 9 (2014)

- Geochemical analyses of Mn nodules from cruise in 2013 (300 samples; ICP-OES/MS; XRF)

- Analysis of extensive video (approx. 100 hours) and still photo data (approx. 30,000 pictures) gathered during the cruise in 2013 with specially developed software to obtain information on nodule coverage
- Analysis of high resolution bathymetric AUV data mapped during cruise in 2013. Development and adaptation of analytical software is necessary.
- Oceanographic data interpretation of near-bottom current data, simulation of sediment cloud distribution during nodule mining.
- Metallurgical experiments with Mn nodules to increase recovery of main metals (Cu, Ni, Co, Mn) and to investigate potential recovery of rare metals (Mo, Li, REE)
- Preparation of exploration cruise in 2015 to the western part of the contract area using a vessel-of opportunity. Focus of this cruise will be sampling of Mn nodules, extensive video mapping of nodule fields and mapping of geological structures using the BGR-own side-scan sonar in the western part of the contract area.
- Planned expenditure in total: 265,000 EUR

Year 10 (2015)

- Exploration cruise to the western part of the contract area with a focus on nodule sampling, video mapping of the seafloor, side-scan sonar mapping, installation of ADCP moorings for long-term measurement of near-bottom currents, dredging of nodule mass samples (ca. 25 workdays).
- Geochemical analysis of Mn nodules
- Video/photo interpretation (approx. 30.000 pictures) for nodule coverage
- Analysis of side-scan sonar data and development and adaptation of analytical software
- Environmental data interpretation including CTD and ADCP data and benthic biodiversity
- Continuation of metallurgical experiments with Mn nodules to increase recovery of main metals (Cu, Ni, Co, Mn) and to investigate potential recovery of rare metals (Mo, Li, REE)
- Planned expenditure in total: 1,720,000 EUR

Year 11 (2016)

- Exploration cruise to the eastern part of the contract area with a focus on nodule sampling, video mapping of the seafloor and the acquisition of high-resolution multibeam mapping of seafloor topography within an area of high economic potential (PA-1), dredging of nodule mass samples, biodiversity and sediment sampling in the previously defined Preservation Reference Area, deployment of ADCP moorings for one year
- Geochemical analysis of Mn nodules
- Video/photo interpretation (approx. 30,000 pictures) for nodule coverage and megafauna
- Analysis of high-resolution multibeam bathymetry and backscatter data to identify natural and artificial obstacles for a nodule collector and to determine potential correlation between backscatter and nodule coverage.
- Environmental data interpretation of CTD and ADCP data
- Biodiversity studies including the phytoplankton community, the analysis of spatial and temporal similarities of the benthic fauna in the Impact and Preservation Reference Areas

- situated ca. 60 km apart, and the genetic connectivity and demography of predominant macrofaunal taxa.
- Compilation of oceanographic and climatologic data to characterise climate variability and the regional hydrodynamic structure of the upper water column based on data available in scientific literature and databases as well as BGR-owned oceanographic data
 - Continuation of metallurgical experiments with Mn nodules to increase recovery of main metals (Cu, Ni, Co, Mn) and to investigate potential recovery of rare metals (Mo, Li, REE)
 - Study on Ga, Ge, Sb contents in manganese nodules
 - Preparation of an exploration cruise in 2017
 - Planned expenditure in total: 3,850,000 EUR

Year 12 (2017)

- Exploration cruise to the eastern part of the contract area with a focus on nodule sampling, video mapping of the seafloor and the acquisition of high-resolution multibeam mapping of seafloor topography within an area of high economic potential (PA-1), dredging of nodule mass samples, biodiversity and sediment sampling in the previously defined Preservation Reference Area. Deployment of ADCP moorings for one year Deployment of sediment traps and current meters for the analysis of natural particle fluxes in the water column for a time period of several weeks
- Geochemical analysis of Mn nodules
- Video/photo interpretation for nodule coverage and megafauna
- Analysis of high-resolution multibeam bathymetry and backscatter data to identify natural and artificial obstacles for a nodule collector and to determine potential correlation between backscatter and nodule coverage.
- Interpretation of CTD and ADCP data
- Biodiversity studies including the phytoplankton community, the analysis of spatial and temporal similarities of the benthic fauna in the Impact and Preservation Reference Areas situated ca. 60 km apart, and the genetic connectivity and demography of predominant macrofaunal taxa. Focus will be on the analysis of spatial faunal communities of the PRA and the suitability of the PRA as protected area and source area for recolonisation of impacted areas.
- Continuation of metallurgical experiments with Mn nodules to increase recovery of main metals (Cu, Ni, Co, Mn) and to investigate potential recovery of rare metals (Mo, Li, REE)
- Development of a GIS-based database system to store, organise and process all geoscientific and biological data, photos, videos, reports, etc. that have been collected, developed and analysed during the exploration period.
- Determination of sinking velocities, flocculation potential, suspended particle matter size distributions, erosion and resuspension potential of CCZ sediments in order to deliver input parameters for a sediment-transport model for plume dispersion
- Planned expenditure in total: 4,100,000 EUR

Year 13 (2018)

- Biodiversity studies with a focus on the analysis of spatial faunal communities of the PRA and the suitability of the PRA to serve as protected area and source area for a recolonisation

of impacted areas. Comparison of biological data from distant regions to understand species ranges and dispersal on the scale of ocean basins.

- Video/photo interpretation for nodule coverage and megafauna
- Continuation of metallurgical experiments with Mn nodules to increase recovery of main metals (Cu, Ni, Co, Mn) and to investigate potential recovery of rare metals (Mo, Li, REE)
- Expansion of the GIS-based database and project with new data and information
- Preparation of an exploration cruise to the western area in 2019
- Planned expenditure in total: 800,000 EUR

Year 14 (2019)

- Exploration cruise to the western part of the BGR contract area with a focus on nodule sampling, video mapping of the seafloor and the acquisition of high-resolution multibeam mapping of seafloor topography, dredging of nodule mass samples, sampling for environmental and biodiversity studies. Deployment of ADCP moorings and sediment traps
- Geochemical analysis of Mn nodules
- Video/photo interpretation for nodule coverage and megafauna
- Analysis of high-resolution multibeam bathymetry and backscatter data
- Biodiversity studies on samples from the western BGR contract area with a focus on species ranges and dispersal on the scale of ocean basins, including comparison with the eastern area and other distant regions
- Continuation of metallurgical experiments with Mn nodules to increase recovery of main metals (Cu, Ni, Co, Mn) and to investigate potential recovery of rare metals (Mo, Li, REE)
- Development of a GIS-based database system to store, organise and process all geoscientific and biological data, photos, videos, reports, etc. that have been collected, developed and analysed during the exploration period.
- Lab experiments to determine sinking velocities and dispersion potential flocculation potential, suspended particle matter size distributions, erosion and resuspension potential of CCZ sediments to deliver the input parameters for a sediment-transport model for plume dispersion
- Planned expenditure in total: 3,380,000 EUR

Year 15 (2020/21)

- Compilation and cumulative assessment of all data regarding geology, nodule and resource potential, and environmental conditions in the entire BGR contract area in order to prepare reports on resource estimations, a mining concept and an Environmental Impact Assessment. In particular BGR will develop:
 - a model for the distribution of nodule coverage and metal grades as well as the inferred tonnages
 - studies on market trends and land-based mining developments
 - a mining concept
 - an evaluation of all environmental data for an Environmental Impact Assessment
- Planned expenditure in total: 1,650,000 EUR

Total cost estimates for entire exploration period of 15 yrs: 22,474,000 EUR

4. Programme of Activities and Exploration Expenditure

Section 4.1 of Annex IV of the Regulations and Schedule 2 of Annex III of the Regulations.

I. Agreed 5-year Programme of Activities

5-year Programme of Activities	First	Second	Third	Extension
General Objectives	Objective		Description	
	[List of the main objectives of the 5-year Programme of Activities]		[Description of the objective and related activities/factors/parameters]	
	Compilation and evaluation of archived data from the PREUSSAG Company		Additional data are extracted from archived Preussag AG files which BGR has inherited recently: analog seafloor photos of sampling sites: photos are compiled from the archive, digitised / scanned and subsequently evaluated in terms of nodule abundance and seafloor characteristics; photos can also be used to gather initial information on macrofauna; - Analog depth soundings: archive files are searched for analog information on depth soundings from ship tracks and sampling stations to improve the information base on bathymetry as acquired during exploration activities in the 1970ies and 1980ies	
	Submission of cruise proposal		Preparation and submission of a thematic proposal for a research cruise to the contract area; this proposal undergoes a review by the German Federal Ministry of Education and Research (BMBF) as third-party funding organisation	
	Compilation and evaluation of archived data from the PREUSSAG Company (continued)		Work continues on the archived data; evaluation of seafloor photos; determination of nodule abundance; cross-checking and calibration of data from seafloor sampling with results from interpretation of photos; re-	

		evaluation of data from all sources;
	Usage of additional archived survey data (II)	Extraction of further data from archived Preussag AG files and use for exploration of nodules
	Research cruise I	A cruise to the contract area will be carried out. Focus will be on acquisition of swath bathymetry, side-scan sonar data, sediment sampling and biological baseline
	Preparation of bathymetric maps	Following the cruise a compilation of bathymetric data will be commenced aiming at preparation of reliable bathymetric maps of the contract area
	Analysis and interpretation of data and samples from cruise I	Data on acoustic reflectivity of the seafloor (side-scan-sonar type information) will be extracted from digital acoustic data; digital data will have to be processed and interpreted; Analyses of biological data from the contract area will commence in year 3 and will continue in year 4
	Integration of existing and new data sets on nodule coverage	After completion of interpretation of acoustic reflectivity data of cruise I and compilation of facies maps all data (digital and archived data, and those derived from sampling) should be compared, and correlation be tested; more prospective areas in terms of nodule coverage should be selected
	Submission of cruise proposal II	Preparation and submission of a thematic proposal (no. 2) for a research cruise to the contract area; this proposal will have to undergo a review within Germany
	Development of a nodule distribution model	Correlation of bathymetric maps with those of sediment characteristics and nodule coverage; an integrative evaluation will come up with a general nodule distribution model for the contract area

	Selection of prospective mining areas from the contract area		Reasonably-sized areas will be defined based on all data types gathered so far which will be the focus for further detailed work	
General Objectives	First	Second	Third	Extension
	Objective		Description	
	Research cruise II		A second cruise to the contract area will be carried out. Focus will be on the acquisition of biological data, seafloor-photo profiles, sampling for calibration and ground truthing, and additional detailed high-resolution swath bathymetry.	
	Analyses and evaluation of cruise data and samples		Processing of data, analyses of samples of cruise II, interpretation of results will begin after the cruise in year 6 and continue in year 7	
	Studies on recent marine technological developments		As marine technology is undergoing changes due to computerisation (remote control, automatisisation, use of autonomous vehicles etc.), studies should focus on most recent marine technological developments which are of importance for the mining process	
	Studies on market trends / land-based mining developments		As work on nodule exploration evolves, studies on the evolution of land-based mine sites and market analyses focusing on intermediate trend development will be undertaken	
	Development of a mining concept		Once final data processing has been completed and evaluation of cruise and archive data is done a mining concept will be developed considering all relevant data including nodule coverage, grade, extend of mineable areas, water depths	
	Combined evaluation of all seafloor data for		In the light of a mining concept and considering results from	

	ecological impact assessment		working on the ecological baseline for the contract area, a study on the assessment of a possible ecological impact will be completed	
	Feasibility study		On the assumption that the at-sea exploration work will have been completed, an initial feasibility study would be outlined and commenced utilising the most recent data. If this preliminary feasibility assessment leads to positive conclusions, further conceptual and design work will be devoted to the mining process	
	Exploration cruise		An exploration cruise will be scheduled for the later part of this phase. The cruise will be undertaken for final sampling in accordance with the needs that may have come up with an appropriate mining concept which is based on the evaluation of all data (archived and newly acquired data)	
	Design of mining and recovery process		Design of the mining and recovery process will have to be completed towards the end of this phase. This includes all steps including economical assessment, legal and political developments, assessment of mining impact and recovery progress	
	Preparations for a pilot mining test		If technological concepts are favorable and the feasibility study is positive all necessary steps should be designed and organised to get prepared for a pilot mining test	
General Objectives	First	Second	Third	Extension
	Objective		Description	
	Exploration cruises		Three exploration cruises of 25-30 working days each to both parts of the BGR contract area are planned. The main focus is on high-	

		resolution seafloor topography mapping in areas of high economic value, the acquisition of nodule samples using a box corer and video mapping of the seafloor. Environmental studies include ADCP moorings for long-term measurement of near-bottom currents, sampling for environmental analyses (biodiversity, sediment parameters)
	Geochemical analyses of nodules	Analyses of nodule geochemistry and mineralogy for the determination of average metal contents and the crystal structure of nodules in order to develop a metallurgical processing route
	Photo analyses for nodule abundance	A combination of box corer and several kilometer-long photo transects provide data on Mn nodule abundance and coverage as the basis for resource assessment and modelling. Whereas box corer stations provide point information on nodule abundance, photo transects provide information on the variability of nodule coverage
	Evaluation of potential mining areas for nodule abundance	One of the main objectives of the manganese nodule exploration is the economic assessment of the deposit, which is mainly based on nodule abundances in box corer samples. BGR will investigate the amount of nodules per square meter and the topographic conditions in three areas of 4000 km ² size in total along with the environmental and biodiversity conditions
	Biodiversity studies	Biodiversity studies focus on the benthic faunal community (community structure, standing crops and geographic distribution and gene flow) sampled with a multicorer and an epibenthic sledge. Furthermore, the pelagic

		fauna and scavengers will be investigated. Faunal analyses integrate taxonomic, genetic (barcoding, metabarcoding) and distribution modelling approaches. Benthic community analyses are carried out through contractual work by the German Center for Marine Biodiversity Research (DZMB).
	Compilation and interpretation of oceanographic and climatologic data	Climate conditions such as the frequency of storms and hurricanes, seasonal fluctuations of wave height and direction, ocean currents strength and direction are important sources of information for the planning of exploration cruises and future mining activities. The compilation and analyses of climatologic and oceanographic data is based on BGR-owned data and data from publicly accessible databases
	Determination of sinking velocities, flocculation and resuspension potential of CCZ sediments	The sediments of the contract area are characterised through the analysis of their natural, dynamic behaviour under in-situ conditions based on laboratory studies [particle size distributions, settling velocities, concentration and turbulence-dependent flocculation potential (aggregation), erosion and resuspension potential]. These parameters are used as input values for numerical plume modelling exercises.
	Metallurgical experiment for the development of processing route	The focus of the metallurgical treatment of manganese nodules is the pyrometallurgical extraction of Ni, Cu and Co on the one hand, as well as the production of a saleable ferromanganese and/or silicomanganese product and a Ca-Si product on the other hand. This metallurgical concept is being developed with the aim of achieving "zero-waste" production,

		<p>including careful slag design so that the produced slags meet environmental and quality requirements, e.g. toxic metal concentrations must remain below pre-defined thresholds.</p>
	<p>Development of a GIS-based database system</p>	<p>As part of its exploration work, the BGR collects measurement, observation and analysis data on the order of 4-5 TB per year, especially during exploration cruises, in completely different formats.</p> <p>The BGR is therefore developing the MAREX data management system to manage its various exploration data and to carry out overall analyses of the geological, oceanographic and biological conditions. In order to enable a meaningful search in the future DMS, extensive metadata are also gathered and recorded.</p>

II. Results achieved during reported year [#]: [year]

Annual objectives and activities			
Year	No.	Agreed Objectives	Objective: Completed, Modified, Postponed or Replaced
2006	1	Compilation and evaluation of archived data from PREUSSAG	Completed Expenditure: 54,956 EUR
2006	2	Preparation and submission of cruise proposal	Completed Expenditure: 28,872 EUR
2006	3	Quality assurance in the geochemical analysis of manganese nodules (lab reference material)	Additional activity (not included in the original plan of work), started Expenditure: 20,160 EUR
2006	4	Assessment of spatial distribution nodule metal conc. in exploration area based on Preussag samples	Additional activity, completed Expenditure: 103,989 EUR
2007	1	Continued data extraction from Preussag archive and integration with data from previous research cruises	Completed Expenditure: 48,424 EUR
2007	2	Geochemical analyses of Mn nodules	Additional activity, completed Expenditure: 44,388 EUR
2007	3	Manganese nodule lab reference material	Additional activity, continued Expenditure: 63,338 EUR
2007	4	Preparation for cruise in 2008	Additional activity, completed Expenditure: 89,931 EUR
2007	5	Acquisition of sampling gear for exploration	Additional activity, completed Expenditure: 28,751 EUR
2008	1	Exploration cruise I to the eastern and western parts of the BGR contract area incl. multibeam data processing	Completed Expenditure: 2,116,777 EUR
2008	2	Training onboard and in home labs	Completed
2008	3	Preparation for cruise in 2009	Additional activity, completed Expenditure: 31,000 EUR
2008	4	Manganese nodule lab reference material	Additional activity completed Expenditure: 26,200 EUR
2009	1	Exploration cruise II to the eastern and western parts of the BGR contract area incl. multibeam data processing	Additional activity, completed Expenditure: 2,116,777 EUR
2009	2	Analysis of data and samples from 2008 cruise incl. identification of prospective areas	Completed Expenditure: 517,509 EUR
2009	3	Training (BGR lab)	Completed Expenditure: 16,300 EUR
2009	4	Preparation for cruise in 2009	Additional activity, completed Expenditure: 32,692 EUR

Annual objectives and activities			
Year	No.	Agreed Objectives	Objective: Completed, Modified, Postponed or Replaced
2010	1	Exploration cruise III to the eastern part of the BGR contract area	Additional activity, completed Expenditure: 1,923,652 EUR
2010	2	Acquisition of exploration equipment (side-scan sonar, video sledge, positioning system)	Additional activity, completed Expenditure: 1,397,367 EUR
2010	3	Concept of state-of-the-art nodule collector	Additional activity, completed Expenditure: 610,000 EUR
2010	4	Nodule geochemistry, processing of multibeam data, photo analyses	Additional activity, completed Expenditure: 350,000 EUR
2010	5	Development of nodule distribution model, selection of prosp. mining areas	Completed Expenditure: 403,371 EUR
2011	1	Analysis and integration of samples and data obtained in 2008, 2009 and 2010	Completed Expenditure: 1,992,565 EUR
2011	2	Implementation of a GIS-based data base system	Postponed to 2017 (start of development)
2011	3	Preparation of exploration cruise in 2012	Completed Expenditure: 106,200 EUR
2011	4	Preparation of proposal for BMBF-funded cruise	Completed
2011	5	Technical upgrade of video sledge and side-scan sonar	Completed Expenditure: 549,381 EUR
2011	6	Biological investigations on benthic fauna	Completed Expenditure: 197,400 EUR
2012	1	Exploration cruise IV: joint French-German cruise to both contract areas, focus on biodiversity research	Modified Expenditure: 1,313,729 EUR
2012	2	Geochemical analyses of nodules	Completed Expenditure: 422,099 EUR
2012	3	Evaluation of potential mining areas for nodule abundance (ArcGIS)	Completed Expenditure: 477,750 EUR
2012	4	Photo analyses for nodule abundance	Completed Expenditure: 473,120 EUR
2012	5	Selective leaching geochemistry	Additional activity, completed Expenditure: 396,870 EUR
2012	6	Metallurgical experiment for the development of processing route	Postponed to 2013 and subsequent years
2012	7	Acquisition/maintenance of survey and lab equipment	Additional activity, completed Expenditure: 126,615 EUR
2012	8	Biological investigations on benthic fauna	Completed Expenditure: 345,770 EUR
2012	9	Preparation of an exploration cruise in 2013	Completed Expenditure: 127,590 EUR

Annual objectives and activities			
Year	No.	Agreed Objectives	Objective: Completed, Modified, Postponed or Replaced
2013	1	Exploration cruise V to the eastern part of the BGR contract area	Completed Expenditure: 2,242,050EUR
2013	2	Geochemical analyses of nodules	Completed Expenditure: 1,055,692 EUR
2013	3	Evaluation of potential mining areas for nodule abundance (ArcGIS)	Completed Expenditure: 699,675 EUR
2013	4	Photo analyses for nodule abundance	Completed Expenditure: 546,917 EUR
2013	5	Acquisition/maintenance of survey and lab equipment	Additional activity, completed Expenditure: 156,024 EUR
2013	6	Biological investigations on benthic fauna	Additional activity, completed Expenditure: 391,639 EUR
2013	7	Metallurgical experiment for the development of processing route	Completed Expenditure: 83,549 EUR
2013	8	Extension of GIS-based data base and project with new data and information	Postponed to 2017 (start of development)
2013	9	Preparation of a cruise in 2014	Additional activity, completed Expenditure: 242,683 EUR
2014	1	Exploration cruise VI to the eastern and western parts of the BGR contract area	Additional activity, completed Expenditure: 2,292,096 EUR
2014	2	Geochemical analyses of nodules	Completed Expenditure: 718,479 EUR
2014	3	Evaluation of potential mining areas for nodule abundance (ArcGIS)	Completed Expenditure: 536,751 EUR
2014	4	Photo analyses for nodule abundance	Completed Expenditure: 479,339 EUR
2014	5	Acquisition/maintenance of survey and lab equipment	Additional activity, completed Expenditure: 53,474 EUR
2014	6	Biological investigations on benthic fauna	Completed Expenditure: 379,713 EUR
2014	7	Metallurgical experiment for the development of a processing route	Completed Expenditure: 102,500 EUR
2014	8	Training onboard and in BGR facilities	Completed Expenditure: 10,429 EUR
2014	9	Preparation of a cruise in 2015	Completed Expenditure: 169,715 EUR
2015	1	Exploration cruise VII to the eastern part of the BGR contract area	Modified Expenditure: 257,872 EUR
2015	2	Geochemical analyses of nodules	Completed Expenditure: 557,063 EUR
2015	3	Evaluation of potential mining areas for nodule abundance (ArcGIS)	Completed Expenditure: 367,680 EUR

Annual objectives and activities			
Year	No.	Agreed Objectives	Objective: Completed, Modified, Postponed or Replaced
2015	4	Photo analyses for nodule abundance	Completed Expenditure: 189,555 EUR
2015	5	Analysis of side-scan sonar data and development and adaptation of analytical software	Replaced by deep-towed multibeam mapping in 2016
2015	6	Acquisition/maintenance of survey and lab equipment	Additional activity, completed Expenditure: 273,813 EUR
2015	7	Biological investigations on benthic fauna	Completed Expenditure: 264,294 EUR
2015	8	Metallurgical experiment for the development of a processing route	Postponed to 2016
2015	9	Preparation of a cruise in 2016	Additional activity, completed Expenditure: 168,371 EUR
2016	1	Exploration cruise VII to the eastern part of the BGR contract area	Completed Expenditure: 2,631,338 EUR
2016	2	Geochemical analyses of nodules	Completed Expenditure: 416,035 EUR
2016	3	Study on Ga, Ge, Sb contents in manganese nodules	Postponed to 2017
2016	4	Evaluation of potential mining areas for nodule abundance (ArcGIS)	Completed Expenditure: 464,616 EUR
2016	5	Photo analyses for nodule abundance	Completed Expenditure: 232,259 EUR
2016	6	Acquisition/maintenance of survey and lab equipment	Additional activity, completed Expenditure: 444,259 EUR
2016	7	Biological investigations on benthic fauna	Completed Expenditure: 598,296 EUR
2016	8	Compilation and interpretation of oceanographic and climatologic data from climate databases and BGR-owned CTD and ADCP data	Completed Expenditure: 29,783 EUR
2016	9	Metallurgical experiment for the development of a processing route	Completed Expenditure: 241,297 EUR
2016	10	Preparation of a cruise in 2017	Postponed to 2017
2017	1	Exploration cruise VIII to the eastern part of the BGR contract area	Postponed to 2018
2017	2	Geochemical analyses of nodules	Completed Expenditure: 175,804 EUR
2017	3	Evaluation of potential mining areas for nodule abundance (ArcGIS)	Completed Expenditure: 153,051 EUR
2017	4	Analysis of high-resolution multibeam bathymetry and backscatter data	Completed in 2016

Annual objectives and activities			
Year	No.	Agreed Objectives	Objective: Completed, Modified, Postponed or Replaced
2017	5	Acquisition/maintenance of survey and lab equipment	Additional activity, completed Expenditure: 353,534 EUR
2017	6	Biological investigations on benthic fauna	Completed Expenditure: 530,704 EUR
2017	7	Interpretation of CTD and ADCP data	Completed in 2016
2017	8	Development of a GIS-based database system	Completed Expenditure: 89,689 EUR
2017	9	Determination of sinking velocities, flocculation and resuspension potential of CCZ sediments	Completed Expenditure: 59,514 EUR
2017	10	Metallurgical experiment for the development of a processing route	Completed Expenditure: 220,193 EUR
2017	11	Co-organisation of the joint ISA/UBA/BGR international workshop on an environmental management strategy for the Area	Additional activity, completed Expenditure: 75,668 EUR
2017	12	Preparation of a cruise in 2018	Completed Expenditure: 123,878 EUR
2018	1	Exploration cruise VIII to the eastern part of the BGR contract area	Completed Expenditure: 3,292,699 EUR
2018	2	Geochemical analyses of nodules	Additional activity, completed Expenditure: 282,796 EUR
2018	3	Evaluation of potential mining areas, mineral resource assessment	Completed Expenditure: 115,371 EUR
2018	4	Development of a GIS-based database system	Completed Expenditure: 93,721 EUR
2018	5	Acquisition/maintenance of survey and lab equipment	Additional activity, completed Expenditure: 622,147 EUR
2018	6	Biological investigations on benthic fauna	Completed Expenditure: 178,734 EUR
2018	7	Determination of sinking velocities, flocculation and resuspension potential of CCZ sediments	Completed Expenditure: 68,104 EUR
2018	8	Environmental studies (oceanography, sediment geochemistry)	Additional activity, completed Expenditure: 67,463 EUR
2018	9	Environmental impact assessment for GSR collector test in BGR contract area	Additional activity, completed Expenditure: 62,045 EUR
2018	10	Metallurgical experiment for the development of a processing route	Completed Expenditure: 287,892 EUR
2018	11	Training onboard and in BGR facilities	Completed Expenditure: 51,780 EUR
2018	12	Preparation of a cruise in 2019	Completed

Annual objectives and activities			
Year	No.	Agreed Objectives	Objective: Completed, Modified, Postponed or Replaced
2019	1	Participation in JPIO monitoring cruise to the eastern part of the BGR contract area	Modified Expenditure: 111,298 EUR
2019	2	Geochemical analyses of nodules	Completed Expenditure: 282,796 EUR
2019	3	Photo analyses for nodule abundance	Completed Expenditure: 57,312 EUR
2019	4	Evaluation of potential mining areas, mineral resource assessment	Completed Expenditure: 115,371 EUR
2019	5	Development of a GIS-based database system	Completed Expenditure: 132,489 EUR
2019	6	Acquisition/maintenance of survey and lab equipment	Completed Expenditure: 479,952 EUR
2019	7	Biological investigations on benthic fauna	Completed Expenditure: 196,845 EUR
2019	8	Determination of sinking velocities, flocculation and resuspension potential of CCZ sediments	Completed in 2018
2019	9	Environmental studies (oceanography, sediment geochemistry)	Additional activity, completed Expenditure: 165,997 EUR
2019	10	Metallurgical experiment for the development of a processing route	Completed Expenditure: 417,312 EUR
2019	11	Preparation of a cruise in 2020	Additional activity, completed Expenditure: 35,490 EUR

5. Training Programme

Schedule 3 of Annex III of the Regulations.

I. Training Programme

Type of training	Onboard and home lab training	Onboard and home lab training	Onboard and home lab training
Institutions	BGR	BGR	BGR/DZMB
Duration	10 weeks	10 weeks	13 weeks
Scope	Onboard/home lab	Onboard/home lab	Onboard/home lab
Fields	[Description]		
Qualification required	[Description]		
Financing	BGR-own financing	BGR-own financing	BGR-own financing

II. Trainings conducted up to reported year [#]: [year]

Start year	End Year	Name of Trainee	Nationality	Gender	Type of Programme	Details	Duration
2008	2009	Yaya M. Djire	Mali	male	on-board and post-cruise training		6 weeks on-board training, 4 weeks post-cruise training
2008	2009	Suzan Mohamed El Gharapaw	Egypt	female	on-board and post-cruise training		6 weeks on-board training, 4 weeks post-cruise training
2008	2009	Heliarivonjy Rakotondramano	Madagascar	male	on-board and post-cruise training		6 weeks on-board training, 4 weeks post-cruise training
2008	2009	Nesha Nurse	Barbados	female	on-board and post-cruise training		6 weeks on-board training, 4 weeks post-cruise training
2014	2014	Khaled Sayed Sinoussy Mohamed	Egypt	male	on-board and post-cruise training		6 weeks on-board training, 4 weeks post-cruise training
2014	2014	Daniel Armando Perez-Calderon	Mexico	male	on-board and post-cruise training		6 weeks on-board training, 4 weeks post-cruise training

2018	2018	Christine Mae Edullantes	Philippines	female	on-board and post-cruise training		9 weeks on-board training, 4 weeks post-cruise training
2018	2018	Abner Nhgoongoloka	Namibia	male	on-board and post-cruise training		9 weeks on-board training, 4 weeks post-cruise training

III. Completed Trainings per Year

	Onboard and home lab training
Year 1 (2006)	
Year 2 (2007)	
Year 3 (2008)	4
Year 4 (2009)	
Year 5 (2010)	
Year 6 (2011)	
Year 7 (2012)	
Year 8 (2013)	
Year 9 (2014)	2
Year 10 (2015)	
Year 11 (2016)	
Year 12 (2017)	
Year 13 (2018)	2
Year 14 (2019)	
Year 15 (2020)	

6. Standard clauses

Annex IV of the Regulations.