



CARMU Inspection Report 01/2023
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Acronyms

ABS	American Bureau of Shipping
ASM	Adaptive management system
AUV	Autonomous underwater vehicle
ADCP	Acoustic doppler current profilers
CARMU	Compliance assurance and regulatory management Unit
CCZ	Clarion Clipperton Zone
CSCT	Collector system component test
CTA	Collector test Area
DNV	Det Norske Veritas
DPR	Daily progress report
EIA	Environmental impact assessment
EIS	Environmental impact statement
EMMP	Environmental monitoring and mitigation plan
HSE	Health safety and environmental
ISA	International Seabed Authority
ISM	International Safety Management Code
ISO	International Organization for Standardization
ISPS	International Ship and Port Facilities Security Code
LARS	Launch and recovery system
LTC	Legal and Technical Commission
LR	Lloyds Register
MARPOL	The International Convention for Prevention of Pollution from Ships
MoC	Management of change
MRT	Magnetic rope testing
MV	Motor vessel
NDT	Non-destructive testing

NORI	Nauru Ocean Resources Inc.
OEMMR	Office of Environmental Management and Mineral Resources
PTW	Permit to work
ROV	Remotely operated vehicle
SIMOPS	Simultaneous operation
SMPEP	Shipboard Marine Pollution Emergency Plan
TF	Test field
TMC	The Metals Company Inc.
VSAT	Very small aperture terminal

I. Introduction and executive summary

1. Nauru Ocean Resources Inc. (NORI) holds a 15-year contract for exploration for polymetallic nodules in the eastern Clarion Clipperton Zone (CCZ), in the north Pacific Ocean. The contract was signed on 22 July 2011. NORI is registered in Nauru, which is also the Sponsoring State.
2. As part of its 2022-2026 programme of activities, NORI informed the Secretariat of the International Seabed Authority (ISA) of its intention to carry out a test of its polymetallic nodule collector system components in its contract area in the CCZ. The test campaign took place between 10 September and 15 November 2022.
3. The collector system components test (CSCT) was conducted in the NORI-D contract area in a designated 150 km² area within an 8 km² test field selected by NORI to be representative of the areas that would be subject to collection for the first version of the collector system, based on bathymetry, slope, water depth, nodule type, nodule distribution, and geoform classification.
4. A full description of the proposed CSCT is included in the environmental impact statement (EIS) submitted by NORI available at <https://metals.co/nori/>
5. The ISA Secretariat, through its Compliance and Assurance Regulatory Management Unit (CARMU) conducted a supervisory inspection of the CSCT campaign. The inspection started on 23 June 2022 and concluded on 20 January 2023. The inspection activities included a pre-inspection planning phase and three separate visits on board the two vessels involved in the campaign. Two of the visits were made before the offshore campaign started.
6. The inspection team visited the monitoring vessel *Island Pride* on 13 July 2022 and the subsea mining vessel *Hidden Gem* on 2 August 2022. One visit was made to the *Hidden Gem* after completion of the CSCT campaign on 18 November 2022. The three visits were conducted to inspect on board activities both in the planning and preparation phase of the CSCT and again after the completion of the campaign.
7. These visits were complemented by: (i) interviews with representatives of the Contractor and other experts participating in the CSCT campaign, including technical experts involved in the supervision of the test and overall management of the vessels' operations; (ii) review of operational plans and documents.
8. All costs incurred in carrying out the inspection were borne by NORI on the basis of actual cost recovery, with all invoices and supporting documents provided by the Secretariat.

II. Legal and policy context

9. Under article 162(2)(1) of the United Nations Convention on the Law of the Sea (UNCLOS), the Council shall exercise control over activities in the Area in accordance with article 153(4) of UNCLOS and the rules, regulations, and procedures of ISA. Under this article, ISA is required to exercise such control over activities in the Area as is necessary for the purpose of securing compliance with the relevant provisions of Part XI of UNCLOS and the annexes relating thereto, and the rules, regulations and procedures of ISA, and approved plans of work for exploration.¹

10. The plan of work for exploration is the fundamental document by which a Contractor sets out the objectives of its proposed exploration programme. Under the contract, the Contractor is required to submit an annual report to the Secretary-General within 90 days of the end of each calendar year covering its programme of activities in the exploration area (Standard Clause 10.1).

11. The programme of activities, including proposed minimum expenditures, may be modified by a contractor with the consent of ISA, insofar as any changes may be necessary and prudent in accordance with good mining industry practice, taking into account the market conditions for the constituent metals and other relevant global economic conditions.

12. It is the responsibility of the Contractor to comply with the terms of the contract. In so doing, it must also observe, as far as reasonably practicable, any recommendations for guidance that may be issued from time to time by the Legal and Technical Commission (LTC). It is also the responsibility of the Contractor to report promptly any incident arising from its activities which “have caused, are causing or pose a threat of serious harm to the marine environment” (Regulation 33 of the Regulations for Exploration for Polymetallic Nodules in the Area).²

13. The various organs of ISA have specific and clearly defined roles and responsibilities in relation to monitoring compliance with plans of work for exploration, which are derived from UNCLOS, the 1994 Agreement, the regulations, and the standard clauses for exploration contracts.

14. Monitoring of compliance with plans of work for exploration approved in the form of contracts is also one of the functions of ISA pursuant to section 1(5)(c) of the annex to the Agreement relating to the implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982 (1994 Agreement). Until recently, the primary monitoring mechanisms available to ISA were the annual reports submitted by Contractors pursuant to Standard Clause 10 of the standard clauses for exploration contracts, and the periodic reviews of the plans of work for exploration required under Standard Clause 4.4.

15. The responsibilities of the Secretary-General in relation to monitoring compliance with plans of work for exploration, which are derived from UNCLOS, the 1994 Agreement, the regulations, and the standard clauses for exploration contracts, include inspecting vessels and installations (Standard Clause 14.2), and providing relevant information to the Contractor and sponsoring State(s) arising from the inspection reports (Standard Clause 14.7).

¹ See ISBA/24/C/4.

² See ISBA/19/C/17.

16. The operational unit of the Secretariat that is responsible for the implementation of the Secretary-General's responsibilities with respect to monitoring and reporting on the activities of Contractors is the Compliance Assurance and Regulatory Management Unit (CARMU).³

17. In due time, the Council will be required to establish an appropriate inspection mechanism pursuant to article 162(2)(z) of UNCLOS. Although such an inspection mechanism does not exist at present, it is expected that the establishment thereof will be addressed in the context of the exploitation regulations.

III. Objective, scope, and methodology

3.1. Objective of the inspection

18. The inspection process was formally launched by the issue of a formal notification of inspection by the Secretary-General dated 23 June 2022 (attached as Annex 1).

19. The overall objective of the inspection was to verify that NORI had carried out its planned activities in compliance with regulatory requirements, contractual obligations and in line with the EIS and its associated EMP.

20. It is noted that the Legal and Technical Commission (LTC) reviewed the NORI EIS for completeness, accuracy and statistical reliability and recommended that the EIS, and the additional information subsequently provided by NORI, be incorporated into NORI's programme of activities under the contract. This was communicated to NORI in a letter from the Secretary-General on 5 September 2022 (attached as Annex 2).

21. The letter from the Secretary-General also included additional recommendations made by the LTC with regards to investigating the opportunity of introducing acoustic equipment to monitor midwater discharge plume, and to include eDNA sampling of water around the midwater discharge plume. It was also suggested that NORI review and determine the optimal allocation of sampling between strata and adding a further box cores and multicores to the benthic sampling programme. Finally, it was recommended that the contractor included a post-disturbance survey as part of the collector EMMP.

3.2 Scope of the inspection

22. The inspection activities comprised a review of NORI's Safety Management System, including plans, processes, procedures, and other relevant documents and separate in-port visits to NORI's monitoring vessel *Island Pride* and the subsea mining vessel *Hidden Gem*. The aim of these visits was to review both the scientific monitoring activities carried out as part of the CSCT and the actual deployment of the collector and riser systems from the *Hidden Gem*.

³ See ISBA/ST/SGB/2022/2.

23. The inspection scope for the visit on board *Island Pride* included review of company policies and management systems, vessel particulars, emergency preparedness procedures, technical and scientific collection procedures, monitoring equipment, and on-board operator competency. The inspectors also reviewed monitoring of system set-up and equipment operations, interviewed crew members, and reviewed available oceanographic documentation.

24. The scope of the two visits on board the *Hidden Gem* included a review of the complete activity report for the CSCT, a presentation of data storage, nautical and technical reporting, reporting and proof of compliance with site selection, including track documentation, progress reports, visual checks of mining and monitoring tools, and dashboard reporting.

25. Interviews took place both with scientific staff and maritime vessel crew, as well as with representatives of NORI and Allseas, where Allseas is the operator of *Hidden Gem* and provides engineering and operational services to NORI under a strategic partnership agreement. Contemporaneous notes were made of these interviews by the Inspection Team and retained on file.

3.3 Methodology

26. The inspection was undertaken on the basis of a process developed by CARMU to ensure management of contractors' activities. Building on best industry practice from the oil and gas industry, this process follows the principles of ISO 19011 (Guidance for the Auditing of Management Systems). This enabled CARMU to organize the inspection on the basis of an internationally recognized standard.

27. The inspection team was led by CARMU and comprised different experts from the Secretariat, in particular from the Office of Environmental Management and Mineral Resources (OEMMR). The team's collective professional background includes oceanography, geology, mining technology, contract management, quality system audits, environmental analysis, and offshore vessels inspections.

28. One inspector visited the *Island Pride* on 13 July 2022. Two inspectors visited the *Hidden Gem* pre-cruise on 2 August 2022. Three inspectors visited the *Hidden Gem* again on 18 November 2022 on the vessel's return to port after the completion of the CSCT.

IV. Pre-inspection planning

29. Inspection planning started with a meeting between CARMU and NORI on 23 February 2022 to discuss the implementation of NORI's proposed mining collector test programme and the development of the environmental impact statement (EIS) and environmental monitoring plan (EMP). The Secretariat was further invited to attend an expert workshop in London organized by NORI as part of the planning process in preparation for the offshore test campaign.

30. This workshop which took place in April 2022 aimed at designing, with experts, the operational planning, timelines, scientific scope, monitoring activities, personnel resources, and planning activities for the CSCT campaign. The workshop provided an opportunity for the Secretariat to gather information and seek clarification from the Contractor on the specificities of the anticipated activities. The information collected added important value to the work of the Secretariat in preparation of the inspection by providing detailed knowledge of NORI's proposed timeline, scientific test scope, planned monitoring activities, and vessel logistics.

31. The ISA Inspection Team developed an Inspection Plan comprising different tools such as checklists, questionnaires and plans for interviews, on-site inspections, equipment demonstrations and document reviews. All reviewed documents are listed in section VII of this report. The Inspection Plan was reviewed with NORI to ensure clarity in the objectives, scope, and anticipated timelines of the inspection. NORI was asked to prepare relevant documentation and to make staff and crew available to meet with the Inspection Team upon arrival to the vessels.

32. An online planning meeting was conducted between ISA and NORI on 29 July 2022 to discuss the on-board visits to the *Hidden Gem* and to confirm dates suited to the vessel arrival in port for mobilization. NORI's Head of Offshore Campaigns assisted the inspection team with practical information about campaign progress, vessel sailing schedules, port access, and introduction to staff and crew.

4.1 Proposed variations

33. On 19 September 2022, NORI sent a letter to the Secretary-General to request two additions to the proposed programme of work for the CSCT.

34. The Secretary-General responded to NORI by letter dated 19 October 2022, informing that he could not approve the requested variations. The Secretary General is not vested with the mandate to approve any variations to the EIS or EMMP and that competency has neither been delegated to the Secretary-General (letter attached as Annex 3). Consequently, any variation to the documented system trials would need to undergo the same rigorous and transparent review process as previously undertaken by the LTC.

35. As a result, the proposed test trial programme remained as initially documented in the NORI's EMMP. The NORI CSTC EIS and EMMP were submitted and approved on the basis of conducting Collector test operations that would directly impact an area of seabed of 0.5km². The estimated area of impact was based on the Prototype Collector Vehicle (PCV) travelling approximately 82km. This distance was determined based on the activities required to achieve the objectives of testing the PCV and riser system and studying the environmental impacts of polymetallic nodule collection.

V. Report on vessel inspections

36. The following section details the activities carried out during the ship visits on 13 July, 2 August, and 18 November respectively. The sequence of vessel visits was planned based on sailing schedules and arrival in port for mobilization prior to the test campaign.

37. The pre-cruise vessel inspections (29 July and 2 August) included audits of proposed cruise activity and station plans, management systems, the monitoring of system set-up and equipment operations, crew interviews and review of available oceanographic documentation.

38. The post-cruise vessel inspection and information review (18 November) examined the complete activity report and cruise narrative, a presentation of data storage, nautical and technical reporting, reporting and proof of compliance with site selection, including track and station documentation, visual checks of mining and monitoring tools, and dashboard reporting.

5.1 Review of Safety Management System and Health and Safety

39. The Inspection Team noted that all activities, procedures, and processes on board the *Hidden Gem* were governed by the Allseas Integrated Management System (AIMS).

40. In accordance with the project Emergency Bridging Document no. 770001/EQ-916AD-000-Q-E-001, Rev.C, incidents and injuries shall immediately be notified to the Bridge. The Master will assess the situation and initiate control measures to prevent escalation. The Master decides if the Allseas Emergency Response Team shall be informed. The Master will inform the NORI Representative.

41. Weekly exercises and drills are conducted on both vessels to determine the readiness level of personnel for emergencies. Personnel on board both vessels were observed to be in the appropriate Personal Protective Equipment (PPE). PPEs are provided for personnel and are a requirement outside the accommodation area.

42. The inspection team was informed that two doctors were earmarked to be onboard the *Hidden Gem* for the collector system test campaign. This strategy was to ensure that when one doctor accompanies an injured or ill personnel to shore for treatment there will always be medical cover for the rest of the crew.

43. On the *Island Pride*, the Inspection Team reviewed the on-board management system which was based on the ISO 41000 family for facility management. Environmental issues on the *Island Pride* are managed in accordance with ISO 14001 and the requirements of the International Marine Contractors Association (IMCA).

44. The Inspection Team observed that the crew on both vessels were actively partaking in on-board risk assessment processes such as toolbox talk and pre-shift meetings with safety related information. A toolbox talk normally addresses one specific topic to a group of relevant persons. It addresses tools, positions, communications, and safety measures applicable.

45. Additionally, safety meetings are held weekly on both vessels to educate personnel on safety matters, incidents and lessons learnt from incidents on other vessels. Firefighting and lifesaving equipment were installed as required by industry requirements with trained personnel to use them during emergencies.

5.2 Maintenance system and permit-to-work

46. There was evidence of procedures in place for work order generation and the associated approval process. At the time of the inspection on the *Hidden Gem* there was an ongoing maintenance work order for the VSAT communication system. VSAT (very small aperture terminal) is a small-sized earth station used in the transmit/receive of data, voice, and video signals over a satellite communication network.

47. Verification of the maintenance management system indicated that maintenance of all critical components was up to date. A robust Permit-to-Work (PTW) system is in place on both vessels. Verification into the PTW system indicated that it was fit for purpose. Spares for all critical equipment are on board.

5.3 Simultaneous operations

48. The Contractor indicated that simultaneous operations (SIMOPS) were expected to occur due to the presence of three vessels in the area during the collector system test campaign: the *Hidden Gem*, the monitoring vessel *Island Pride*, and a support vessel providing supplies during the course of the offshore campaign.

49. SIMOPS had been assessed in the Project Health Safety and Environment Plan as a possible scenario for a major accident event. There was evidence of documented procedures to ensure safe simultaneous operations. The Inspection Team was informed that beacons have been installed on the seafloor prior to the test campaign to identify and signal the positions of deployed equipment.

5.4 Visit of the *Island Pride* (13 July 2022)

50. The first visit took place on board the *Island Pride*, a research vessel contracted by NORI for environmental monitoring activities in the NORI-D area in the CCZ. The visit took place in port in San Diego (USA) on 13 July 2022 from 10.00-18.00.

The *Island Pride* is a double hulled vessel with a diesel engine with space to accommodate 90 persons. 7 containers (labs), 3 containers (vessel), 6 autonomous underwater vehicles (AUVs), 2 remotely operated vehicles (ROVs), 1 CTD, 1 Boxcore, 3 Landers and more than 5 moorings was stored on the back deck of *Island Pride*.

The *Island Pride* uses the AIS navigation system. The AIS system is in place to indicate position of vessel and ship track at all times.



Photo 1: *Island Pride* (source: Island Offshore)

51. In the context of the overall inspection exercise, this visit aimed at verifying that NORI planned and conducted activities in compliance with regulatory requirements and contractual obligations.

52. The approach adopted was to review relevant documentation in relation to NORI's activities, undertake verification on the vessel, conduct interviews and develop a draft inspection report with any relevant findings. A list of documents that were reviewed by the Inspection Team during the inspection can be found in section VII of this report.

53. The visit also provided the opportunity for the Inspection Team to look at the condition of the environmental monitoring vessel as well as to assess the condition of equipment and assets to be used in the conduct of environmental monitoring activities during the test campaign such as the integrity, launching and retrieval of environmental monitoring equipment, lifting equipment and lifting operations.

54. NORI had contracted the Danish Hydraulic Institute (DHI) to support test collector operations with regards to chemical and physical sensors, landers and moorings for oceanographic plume and acoustic monitoring. The Inspection Team was provided a presentation that detailed CSTC plans to apply acoustic sensors for bioacoustics measurements. This included a set of seabed acoustic doppler current profilers (ADCP) and hydrophones.

55. The presentation also addressed how additional survey sites had been added to both pre- and post-collector surveys based on the recommendations in the Secretary-General's letter dated 5 September 2022.

56. During the pre-collector operation phase, 3 benthic respirometers, 2 baited trap landers, and 3 time-lapse cameras were deployed to strengthen the benthic sampling programme.

57. DHI modelled both the benthic plume and the plume from the mid water discharge. The model predicted a Northwest benthic current, reflecting expected conditions in January. It was anticipated that the current would remain temporally constant, however, the direction could be highly variable from daily to seasonal scales.

58. The Inspection Team noted that no overall project documentation was made available to document in detail the completion of the total range of pre-collector operation activities. The Team suggested that a gap analysis could be provided to document how the CSCT activities were conducted against commitments in the EIS and EMMP and to better inform how aspects and objectives of environmental concern were achieved during the CSTC.

59. An observation to this effect is included in the present report.

5.5 Visits of the *Hidden Gem* (2 August and 18 November 2022)

60. The second and third ship visits took place on board the *Hidden Gem*, moored in Manzanillo (Mexico) on 2 August 2022 and 18 November 2022. Two separate visits were planned to allow the Inspection Team to visit the vessel both before the start of the CSTC and immediately after the vessel's return to port. Both on-board inspections started with an opening meeting with the vessel Master and company representatives from NORI and Allseas.

The vessel, ***Hidden Gem***, is a converted drillship, *Vitoria 10000*. It is a double hulled vessel which is 227m long, 42m deep and 19m wide. The vessel has dynamic positioning (DP3) with six (6) thrusters and six (6) engines (with redundancy for power generation) and track mapping capabilities. A blackout test had been conducted to verify the effectiveness of the emergency generator.

The *Hidden Gem* is the first vessel to be classed as a subsea mining vessel. The ship is registered under the Malta Ship Registry and classed by the American Bureau of Shipping (ABS). ISM, ISPS and MSC verification and certification are under Lloyds Register (LR). At the time of the inspection, an Interim Safety Management Certificate was in place. An inspector from Lloyds Register was on board to verify close out of outstanding actions in order to issue a permanent Safety Management Certificate.

The vessel specification including Flag States, IMO, Name and MMSI etc. documents were provided and shared. 129 persons were on board the vessel for the campaign.

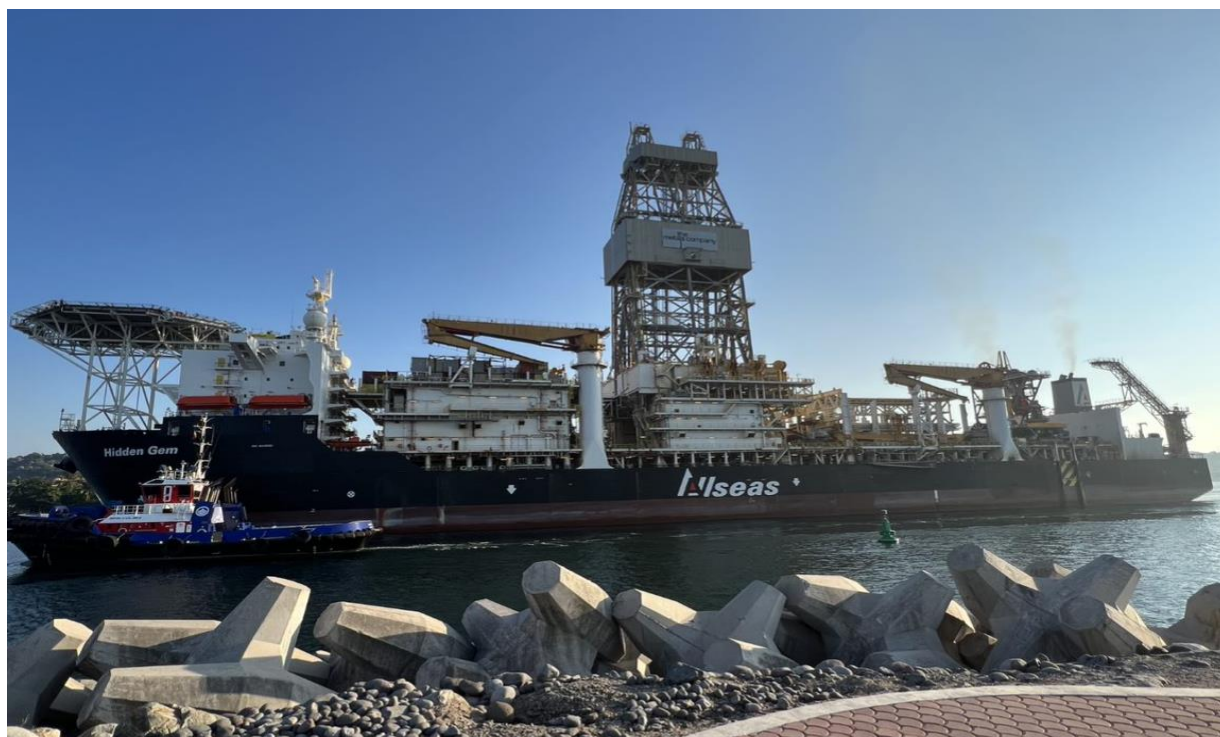


Photo 2: *Hidden Gem* (Source: NORI)

61. The first visit to the *Hidden Gem* (2 August) was limited to the pre-cruise status of the vessel and inspection of the test mining tool. The visit included review of vessel certificates, on board management systems, crew competency and equipment suitability. During the first visit on the *Hidden Gem*, the inspection team reviewed the Project HSE Plan and SIMOPS Plan and conducted a physical inspection of critical equipment to be used to conduct component system test mining activities. This included the nodule collector vehicle, ROVs and ROV launching equipment, risers, and the on-board sediment treatment systems.

62. The scope for the post-cruise visit was to follow up actual execution of the CSCT, in addition to inspect the performance of the collector and vessel operations during the campaign. The inspection team reviewed examples from daily activity reports, a presentation of data storage, nautical and technical reporting, collector track documentation, on board visual checks of mining and monitoring tools, and dashboard reporting.

63. The Inspection Team was also provided a PowerPoint presentation on board the Hidden Gem on 18 November 2022, which showed the collector vehicle track on the seabed and an introduction to the project's Daily Progress Reports. The reports included information about position, weather, CSTC activities, personnel, supply, and safety logs. It was signed off every day by vessel Master, Chief Engineer, and the NORI representative.

64. During the CSTC, NORI used an Adaptive Management System (AMS) which provided continuous real time operational data from monitoring devices on the collector vehicle, buoys, moorings, AUVs and ROVs.

65. This information included collector vehicle position and speed and was used to confirm that the vehicle position during the test campaign was in accordance with the original trial tracks from the EIS and EMMP.

66. The Inspection Team also inspected the operations room for the collector vehicle pilot to better understand how the manoeuvring of the vehicle, as well as live dashboard reporting, was conducted from the Hidden Gem.

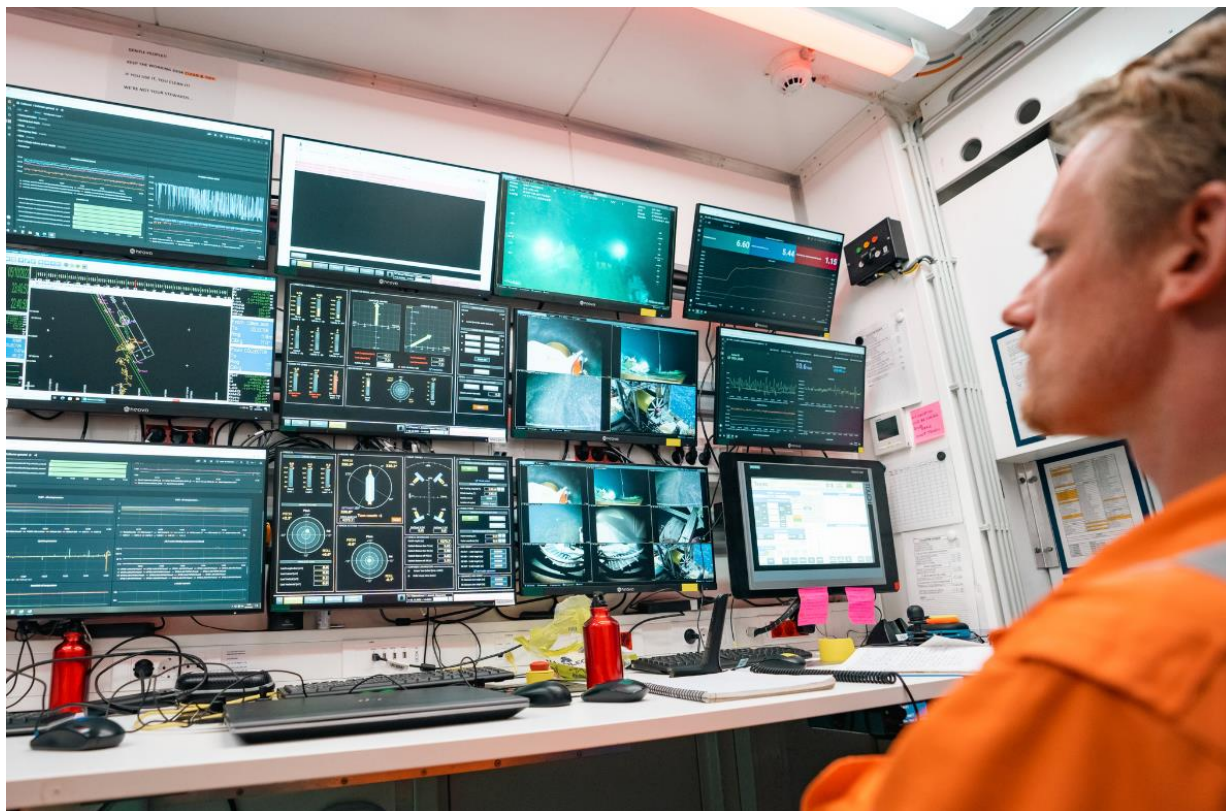


Photo 3: Pilot workstation for collector vehicle (source: NORI)

67. The Inspection Team also enquired about how NORI had addressed certain recommendations made by the LTC and contained in the letter from the Secretary-General to NORI on 5 September 2022, specifically with respect to investigating the type of acoustic equipment available for monitoring mid-water plume discharge, and the possibility to include eDNA sampling of water around the midwater discharge plume.

68. It was also suggested to NORI in the same letter that it reviewed its benthic survey design to determine the optimal allocation of sampling between strata and that it considered adding further boxcores and multicores to the sampling programme. NORI was also invited to consider adding a post disturbance monitoring campaign.

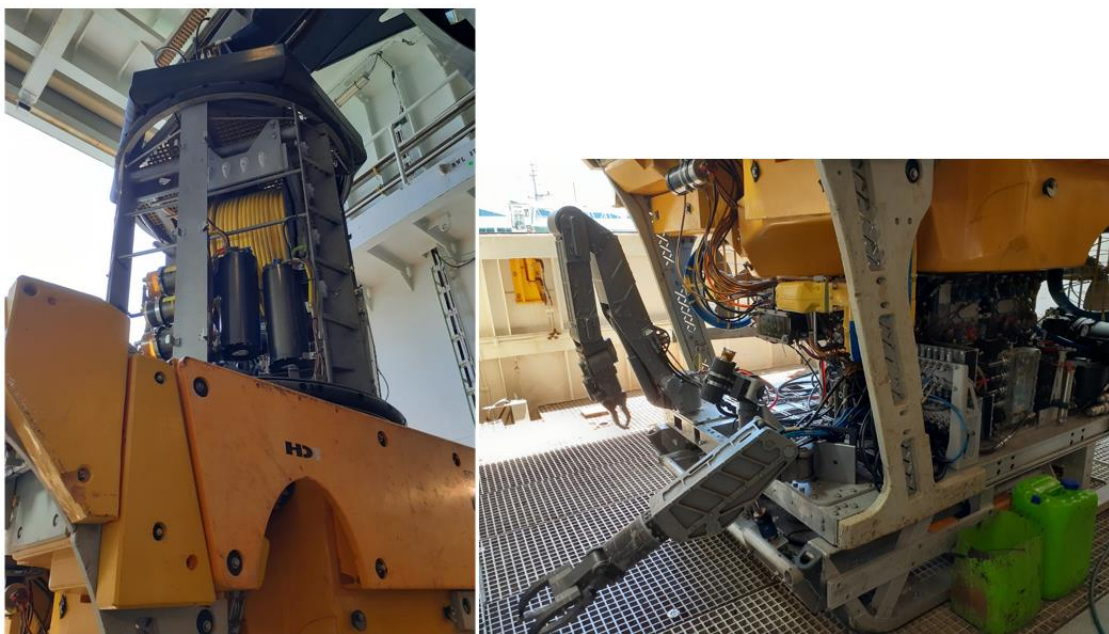
69. NORI did not have scientific personnel on board the *Hidden Gem* during the visit on 18 November to answer these questions from the Inspection Team. Written feedback was emailed to CARMU on 12 January 2023 demonstrating that NORI had taken the suggestions into account and that a full report on these activities will be included in the final report on the CSCT.

5.6 Inspection of CSCT equipment

a. ROVs and AUVs

70. Two ROVs were on-board the *Hidden Gem* for redundancy. Both ROVs have been tested and calibrated. Deployment strategy, umbilical management to prevent entanglement and emergency recovery have been developed and documented.

71. On the *Island Pride* there are six AUVs and two ROVs. It was observed that the Contractor had sufficient batteries and spare AUVs for continuing AUV observations, based on the scope of works included in the CSCT. It was also noted that those AUVs not in use were kept fully charged in case the AUV in operation needed to be replaced.



Photos 4 and 5: ROV on board the *Island Pride* (Source: ISA Secretariat)

b. Lifting equipment

72. The Inspection Team noted that all lifting equipment and accessories on the *Hidden Gem* had been inspected and certified by a third party in accordance with best industry practices. The Inspection Team identified four certified knuckle boom cranes onboard to support lifting operations.

73. The Collector is deployed by a launch and recovery system (LARS) designed with a heave compensation system when launching. The contractor indicated that the LARS could withstand about 6-7m heave for the stability of the collector during deployment. Lifting procedures are established and documented in the integrated management system for the control of lifting operations on both vessels. The LARS will launch the collector over the side of the vessel using the umbilical winch.

74. The ROVs had dedicated lifting equipment namely A-Frame and L-Frame. The rated safe working load capacity for the ROV winch is 15 ton. The vessel crew interviewed indicated that winch and load tests have been conducted together with integrity tests performed on cables.

75. Critical lifting operations require the development of a lifting plan which are approved and permitted before the lifting activity can be performed. Lifting activities are approved via a permit-to-work (PTW) system which is documented. Procedures of launch and recovery systems are reviewed annually.



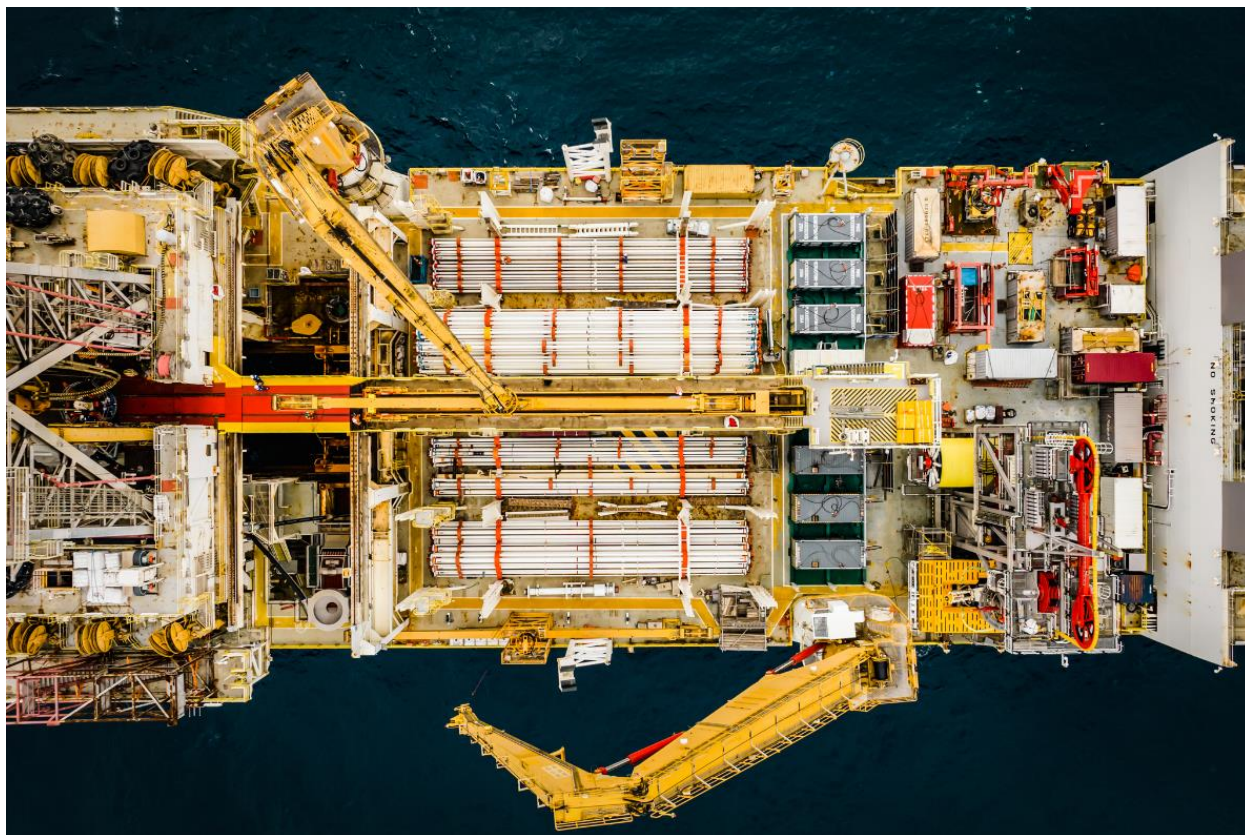
Photo 6: ROV in the A-frame (source: ISA Secretariat)

76. At the time of the inspection on 2 August, the compressors to support the airlift of the nodules through the riser system were not on board. These were later installed before sailing.

c. Collector system

77. The *Hidden Gem* has been equipped with a system to transport nodules from the collector vehicle to the vessel. Storage tanks on board was used to store the nodules, while the buffer tanks will be used to store sediment and water.

78. Risers will be attached to the collector via a flexible jumper hose. A biodegradable hydraulic oil (HPU) will be used for the hydraulic system associated with the riser tensioning and collector handling equipment.



Photos 7: Riser deck on the *Hidden Gem* (source: NORI)

79. It was noted that there was no redundancy for the subsea umbilical onboard. The subsea umbilical is a bundle of cables and conduits that transfer hydraulic and electric power from topsides to subsea. The lack of redundancy was justified by the fact that this was a pilot campaign, and it was not cost effective to have a spare umbilical on the campaign.

80. However, during actual mining, a spare umbilical will be available to reduce non-productive time (NPT). A destructive test (at 170 tons) had been carried out on the umbilical to assess its integrity.

81. During the first visit to the Hidden Gem on 2 August 2022, the inspection team was shown a video of the jumper hose connection to the riser base. The video visualized the riser operation the way it was planned to operate during the CSCT.



Photo 8: Riser assembly the *Hidden Gem* (source: NORI)

d. Nodule collector vehicle

82. The Inspection Team inspected the prototype nodule collector vehicle on board the *Hidden Gem* during the vessel visit on 2 August, and again on 18 November. During both visits, the vessel Master described the collector functions, including the control systems, and safety features. The nodule collector on the vessel was a prototype, 20% of the scale of the expected design.

83. A visual inspection of the collector was carried out by the Inspection Team to understand the various features of the vehicle. The Inspection Team was informed that the basis of design for the collector was to withstand sea states with maximum wave heights of three and a half meters (3.5m) for both collector and LARS. The Inspection Team was briefed on the design characteristics and operational details of the riser and collector system.



Photo 9: Nodule collector vehicle on the *Hidden Gem* (source: NORI)

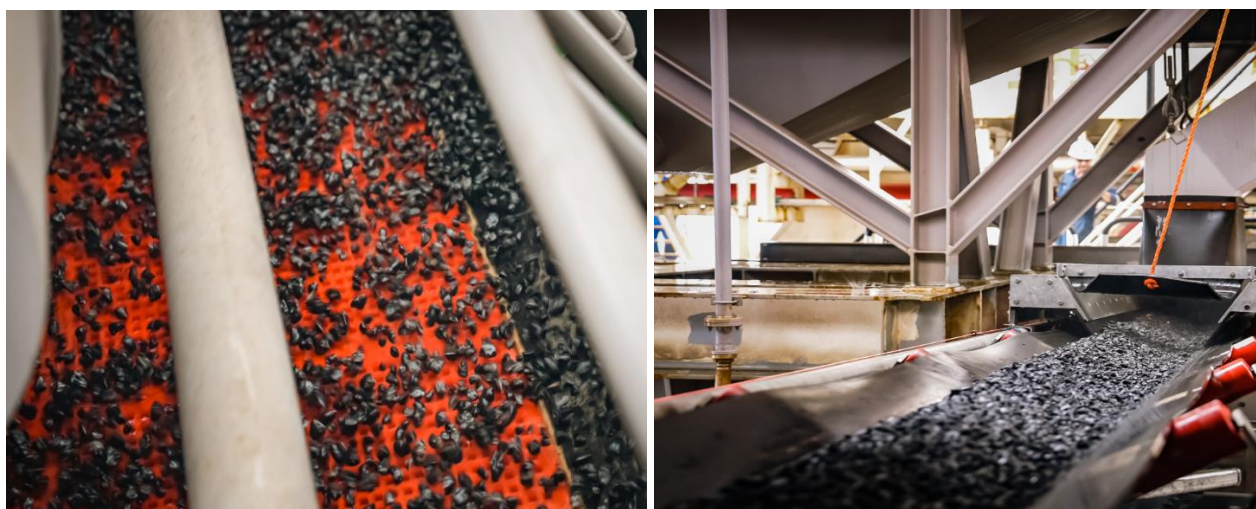


Photo 10 and 11: Shaker and conveyor belt (source: NORI)

e. Polymetallic nodules collected.

84. During the collector system campaign, 3,200 tons of nodules were collected. and stored in tanks below deck on the *Hidden Gem*. The quantity of 3,200 tons was verified by the vessel Master.

85. During the second ship visit of the *Hidden Gem* in November 2022, the Inspection Team was able to enter the storage tanks for a detailed inspection of the collected nodules, to inspect their degree of dryness, their size and sediment and potential faunal attachments. The team was accompanied by the vessel Master as well as NORI and Allseas representatives.

86. A safety briefing was provided before entering the storage facility to inform the Inspection Team about confined space entry and safety precautions for climbing down into the tank. A confined space permit to work was raised and in place. The vessel Safety Officer remained on the main deck, by the entrance to the tank, to maintain radio communication with those entering the tank the whole time the Inspection Team was below deck.

87. Description of collected nodules The collected nodules were found to be disc-shaped, with an average size of approximately 3cm across. They were dried, with remaining low level of moisture and with very little remaining sediment attached to them. This observation confirms the effectiveness of the separation process, both in the collector on the seabed, and on board in the cyclone and shaker.

88. The Inspection Team collected a limited quantity (2kg) of nodule samples of typical size, moisture, and shape during the inspection for further characterization.



Photos 12 and 13: Nodules in the storage tanks (source: ISA Secretariat)

VI. Report on overflow event on board the *Hidden Gem*

89. On 28 October 2022, CARMU was informed verbally that, on 12 October 2022 during the production ramp-up sequence on the *Hidden Gem*, a temporary overflow of water occurred. Due to the dynamic behaviour of the airlift riser when first switched on, there was a surge in the volume of water flow which exceeded the buffer capacity of the cyclone separator at the top of the riser. As a result, the cyclone experienced an overflow of water which contained sediment and fragments of nodules.

90. CARMU was initially informed that the event was classed as minor, based on an internal assessment against MARPOL requirements. It was the Contractor's assessment, in light of the estimated discharge volumes and contents, that the event had no potential to cause serious harm to the marine environment. Nevertheless, CARMU requested the Contractor to provide additional information and met with NORI representatives in Kingston on 3 November 2022.

91. A written report on the event was submitted to CARMU by NORI on 4 November 2022 (attached as Annex 4). In that report, the Contractor stated that the event was a temporary overflow of water with minor impact on the environment and that a more detailed report and analysis would be submitted to ISA as part of the final NORI Collector Test Campaign Report. NORI's estimate was that between 48-72 cubic metres of seawater with a sediment concentration of approximately 5kg per 100 litres went overboard.

92. A preliminary assessment by the Secretariat, based on the information provided, indicated no risk of serious harm to the marine environment from the event.

93. Notwithstanding, CARMU decided to include the event in the scope of the upcoming vessel visit on 18 November to obtain more information about the circumstances of the incident event and to verify that the full potential of the event was managed satisfactorily by on board operators, and that the mitigating measures had functioned as intended to prevent reoccurrence.

94. During the vessel visit, the Inspection Team was given a PowerPoint presentation of the event and the Contractor's evaluation of the potential effects on the marine environment (attached as Annex 5).

95. A verbal summary of the event was provided by the vessel Master at the site, including a description of the riser system and cyclone. The Inspection Team secured photographs of the site and relevant equipment.

96. The Contractor's estimate on 18 November 2022 was that between 48-72 cubic meters of seawater with a sediment concentration of approximately 5kg per 100 litres went overboard during the event, which occurred intermittently during a production test run over a period of 8 hours.



Photo 14: Event site with cyclone and shaker (source: NORI)



Photo 15: Event site with cyclone and shaker (source: ISA Secretariat)

97. NORI informed the Inspection Team verbally that they had observed the discharge visually at the time of the event and noted that the surface waters appearance returned to normal conditions after 60 minutes. They later confirmed same in an email to CARMU on 20 January 2023 and in a Discharge Memo provided to the Secretariat on 4 February 2023 (Discharge Memo attached as Annex 6)

98. Based on the presentation, the Inspection Team understood that the spill was minor and that the evaluations had been conducted in line with company processes as described in the EMMP.

99. The Inspection Team noted a lack of detail in the PowerPoint presentation about the event that indicated a reduced robustness in NORI's applied risk management process. Follow up questions revealed that NORI did not follow its own risk management procedure during the post-event assessment of the event and only conducted a verbal assessment on the site.

100. The absence of a structured process could have affected the accuracy of their estimates on the quantity of seawater going overboard, and the sediment concentration in the spilled sea water.

101. The observation into the reduced validity of the applied risk management process was communicated to the vessel Master and to NORI's Head of Offshore Campaigns during the close-out meeting on the Hidden Gem on 18 November 2022. An observation to this effect is included in the present report.

102. With regards to any possible residual impact on the marine environment resulting from the event, CARMU continues to evaluate evidence collected during and after the on-board visit as part of the ongoing process of information evaluation and documentary assessment. On 20 January 2023, CARMU requested NORI to provide additional information with regards to volume of overflow water, sediment particle concentration in the spilled seawater and estimated time for restoration to natural conditions. Further information was subsequently provided and is undergoing independent expert analysis.

103. The Secretary-General was informed on 25 January 2023 that the investigation into this event will continue, and a separate report will be provided in due course.

VII. Conclusions and recommendations

104. For the purposes of this inspection report, CARMU uses two categories of observations:
105. Non-compliance: observations where CARMU can document a failure or refusal to comply with a regulatory or contractual requirement.
106. Suggestions for improvement: observations where CARMU identifies a potential for improvement in order to fully meet ISA's expectations or where industry best practice could be applied, but where there is no non-compliance.
107. The Inspection Team did not identify any non-compliances related to the initial scope for the inspection. The ongoing investigation into the overflow event may result in additional observations by the Secretariat.
108. Two suggestions for improvement are made with a view to improving internal risk management processes and to demonstrate a visible completion of planned activities.

Suggestion for improvement 1

109. With reference to the overflow event on 12 October 2022, the Inspection Team considers that NORI's risk management lacked the expected robustness. Decision-making, incident management and execution were not rooted in a robust risk-based assessment, and Contractor personnel on board the *Hidden Gem* did not fully apply internally established risk management tools and procedures during the event. The use of procedures provides a road map to ensure compliance with regulatory requirements and provides a risk-based approach to help decision-making and reduce the risk of liability. It also provides documented evidence into the management of an incident.
110. Specifically, the inspection and subsequent follow up suggests that:
- (a) NORI did not identify seawater overflow as a major risk during the pre-cruise risk assessment. Consequently, this hazard was not included in their project risk register, and the project crew did not prepare or train to manage this risk.
 - (b) NORI did not follow its own risk management procedure and only conducted a verbal informal assessment on the vessel after the event. The on-board team did not conduct a properly documented assessment with relevant resources included in the assessment activity. Reference is made to the Project HSE Plan with Allseas document number: eq-916cm-100-c-c-002.
 - (c) The presentation provided to the Inspection Team on board the *Hidden Gem* on 18 November did not clearly demonstrate how a risk-based approach had been applied to manage the overflow event or how internal risk procedures and tools had been applied.
 - (d) Notwithstanding this, the on-site inspection and presentations by on-board staff describing the operational handling of the event demonstrated that operational management following the event was adequate and that implemented compensating measures functioned as intended to prevent reoccurrence of the overflow.

111. It is suggested that the Contractor review its incident reporting process to further demonstrate how a risk-based approach is applied in assessing and managing incidents and unplanned events.

Suggestion for improvement 2

112. Interviews and inspections of collector track documents and progress reports demonstrated that the CSCT was conducted in compliance with regulatory requirements and in line with contractual obligations.

113. Nevertheless, it is suggested that the Contractor develops a gap document to visualise how the CSCT activities were conducted against commitments in the EIS and EMP to better visualise how targets and objectives have been achieved. It is understood that NORI intends to provide such a document in the context of its full report on the CSCT.

Additional recommendation

114. In addition to the formal observations recorded above, it is recommended that NORI develop a lessons learned summary from the overflow spill to be made available to stakeholders. The lessons learned summary should address risks that needs to be assessed and mitigated in future campaign activities, including key lessons that were identified during the overflow event on the Hidden Gem. The document should also include a description of what worked well and what did not work well, as well as recommendations for future improvements.

VIII. References and resources

International Seabed Authority

- ISA Inspection Notice to NORI (Annex I)

Nauru Ocean Resources Inc.

- 20221108 Collector Tracks - FINAL PRELIMINARY Map
- Adaptive Management System (AMS) overview
- Adaptive Management System (AMS) example data
- Data Storage Flow Diagram
- Hazard and Operability Study: 104047-TMC-OI-HSE-PRO-HAZOP-02
- NORI-D COLLECTOR TEST EMMP_03052022_FINAL
- NORI-D Collector Test Monitoring Campaigns Overview 13072022

Allseas

- Allseas -Critical Equipment Identification
- Allseas -EAM - Asset List Critical Equipment (DWH) - Hidden Gem – 220727
- Allseas -EQ-916AD-000-Q-E-001 Emergency Bridging Document Rev C
- Allseas- Process Nonconformity
- Allseas-Project HSE Plan
- Health Safety and Environmental Plan: 104047-TMC-OI-HSE-PRO-HSEPLAN-02
- Health Safety and Environmental Plan: 104047-TMC-OI-HSE-PRO-HSEPLAN-B
- Hidden Gem Daily progress report 29 September 2022
- Hidden Gem project Minutes of Meeting 21 September 2022
- Hidden Gem Daily progress report on 10 October 2022
- Hidden Gem Daily progress report on 24 October 2022
- Hidden Gem Daily progress report on 26 October 2022

Island Pride

- Certificate of test and thorough examination- Examination of Lifting Appliances
- 0422_SAGAS_Statement_Fiber rope ISLAND PRIDE – Signed
- 1717.MRT. RE.001 - MRT Report 70mm Island Pride – Signed
- 1717.MRT. RE.002 - MRT Report 34mm Island Pride – Signed
- 2283 S0038227 54mm DynIce Warp Tereped
- INSPECTION REPORT ISLAND PRIDE 2021-004
- Sertifikat form 2 01-A-frame-21 rev1
- Deployment & Recovery of Baited Trap

- Launch & Recovery of Box Corer_27.06.2022
- Deployment & Recovery of Benthic Respirometer & Baited Camera Lander
- Mooring recovery and deployment operations
- Multi Corer Operations
- DNV_ISLAND PRIDE FINAL REPORT 7-14-22 OPTIMIZED
- Island Pride NDT Report CSA Winch
- Island Pride NDT Report Tuggers
- SME-10128-D-02 Rev.04_winch grillages
- SME-10128-D-10 Rev.00A
- DT3060EHLWR_SN1604 - DT MARINE MODEL 3060EHLWR ELECTRO-HYDRAULIC WINCH
- HD-P 8,000-S - Utility
- Heavy Duty Planetary -Ramsey-hd-p-8000-flyer
- Emergency Response Plan Island Pride: 104047-TMC-OI-HSE-PRO-ERPPRIDE-B
- MV Island Pride Equipment: 104047-TMC-OI-EQUIPMENT
- MINCS1_Audit and inspection procedure
- MINCS2_system description
- MOC_Management of change
- Risk Assessments: 2019-0027 AUV-FRC Recovery
- Risk Assessments: BFG101-RA-01(4) ROV Risk Assessments: BFG101-RA-02(0) BOX
- App B Procedures: BFG101-SOP-01(5) ROV NovaLog
- Shipboard marine pollution emergency plan: 785-150-002-A_SMPEP Manual

Annex 1: Inspection notification letter



23 June 2022

Nauru Ocean Resources Inc.
Att: Mr. Corey McLachlan

REGULATORY INSPECTION NOTIFICATION

The International Seabed Authority (ISA) hereby notifies Nauru Ocean Resources Inc. (NORI) of our intentions to conduct a regulatory inspection against the planned Q3 component tests.

The scope of the inspection will be to verify that NORI conduct planned activities in compliance with regulatory requirements and contractual obligations.


In order to cover the full operation, including test and monitoring activities, ISA Inspectors will go on board both the test vessel (Hidden Gem) and the monitoring vessel (Island Pride).

Vessel visits, pre-cruise, will include audits of activity plans and management systems, monitoring of system set-up and equipment operations, crew interviews and review of available oceanographic documentation.

Vessel visit and information review, post-cruise, will examine the complete activity report, a presentation of data storage, nautical and technical reporting, reporting and proof on compliance with site selection, including track documentation, visual checks of mining and monitoring tools, and dashboard reporting.

We will communicate a date for an onshore kick-off meeting to initiate the inspection and to further clarify scope, timeline, and ISA expectations prior to initiate any on board activities.

Sincerely,


Øystein Bruncell Larsen
Chief, CARMU

Annex 2: Letter to NORI on outcome of EIS review



The Secretary-General

5 September 2022

Ref: PMN/09.1/2011/NRU

Dear Mr Barron,

I refer to the revised environmental impact statement (EIS) for Nauru Ocean Resources Inc's (NORI) plans to conduct testing of a polymetallic nodule collector, in the NORI-D contract area of the eastern Clarion-Clipperton Zone, in the Central Pacific Ocean which I received in March 2022. I further refer to the related collector test environmental monitoring and management plan (EMMP) received on 1 May 2022 and the subsequent clarifications and additional information received to the feedback from the Legal and Technical Commission sent to NORI on 22 March 2022 and 15 July 2022 on the EIS and EMMP respectively.

The Commission reviewed the EIS for completeness, accuracy and statistical reliability and, for the purpose of the review, took into account, as a guide, the process for the review of environmental impact statements as set out in the revised *Recommendations for the guidance of contractors for the assessment of the possible environmental impacts arising from exploration for marine minerals in the Area* (ISBA/25/LTC/6/Rev.1 and Corr.1.).

Following its review, the Commission has recommended that the EIS, and the additional information subsequently provided by NORI, be incorporated into the programme of activities under the contract. The Commission further recommended that the contractor takes into account the following suggestions.

a) Midwater discharge Plume:

- To conduct investigation of the type of acoustic equipment available and whether it could be deployed from the vessels or remotely operated vehicles, and
- To include eDNA sampling of water around the midwater discharge plume.

Mr Gerard Barron
Director
Nauru Ocean Resources Inc.
c/o Peter Jacob
Private Mail Bag
Nibok District
Republic of Nauru
NRU68



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b) Benthic sampling:

- To add a further 5 box cores and 5 multicores (for both pre- and post-sampling) to the benthic sampling programme, and
- To review and determine the optimal allocation of sampling between strata.

c) Post-disturbance monitoring:

- To add another survey as part of the collector test EMMP (timing to be determined).

I wish to note that the Commission appreciated the willingness of NORI to investigate options to improve the effectiveness of its monitoring plan for the collector test.

Further, I wish to request that NORI reports, in the context of its annual report, on the way it has taken into account the above-noted suggestions from the Commission.

Finally, I wish NORI success in the tests and look forward to its sharing the outcomes of these activities.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Michael W. Lodge', is positioned above the printed name.

Michael W. Lodge

Annex 3: Environmental Impact Statement variations letter to NORI



Dear Mr. Barron,

Reference is made to your letter of 19 September 2022 as well as to the additional information provided in your subsequent letter and attachments of 6 October 2022 concerning Environmental Impact Statement Variations.

1. Background

In your letters of 19 September 2022 and 6 October 2022 you informed me of the intention of Nauru Ocean Resources Inc (NORI) to make variations to the collector test system trials as documented in the NORI-D Collector Test Study Environmental Impact Statement (EIS) and Collector Test Environmental Management and Monitoring Plan (EMMP) submitted to the Authority on 2 May 2022.

I have noted the comprehensive risk-based approach followed and supportive process description, as well as NORI's ongoing commitment to ensuring that the impacted test area does not exceed the 82km of track length and a total impacted area of 0.5km² as specified in the EIS and the EMMP.

I understand that this variation aims at testing the Prototype Collector Vehicle (PCV) in an area with a slope greater than 6°.

2. Legal basis

The Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area (ISBA/19/C/17) do not contain any regulation on variations of the Environmental Impact Statement.

Reference is made to the Recommendation for the guidance of contractors for the assessment of the possible environmental impacts arising from exploration for marine minerals in the Area (ISBA/25/LTC/6/Rev.2).

I refer you to section E concerning the process for reviewing the EIS.

Mr. Gerard Barron
Director
Nauru Ocean Resources Inc.
c/o Peter Jacob
Private Mail Bag
Nibok District
Republic of Nauru
NRU68



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3. Assessment

Based on the above and the material provided by NORI, the requested variations are considered material changes to the initial EIS. Therefore, I regret to inform you, that I cannot approve the requested variation, which has been submitted after detailed consideration of both the EIS and EMMP by the Legal and Technical Commission pursuant to its Recommendations for the guidance (ISBA/25/LTC/6/Rev.2).

The Secretary General is not vested with the mandate to approve any variations to the EIS or EMMP and that competency has neither been delegated to the Secretary-General.

Consequently, any variation to the documented system trials would need to undergo the same rigorous and transparent review process as previously has been undertaken by the Legal and Technical Commission regarding the previous environmental impact statement. Please see section E in the Recommendations for guidance (ISBA/25/LTC/6/Rev.2).

Yours sincerely,

A handwritten signature in black ink, appearing to read "Michael W. Lodge", is positioned above the printed name.

Michael W. Lodge

Annex 4: NORI Event report (water discharge letter)



4th November 2022

Oystein Larsen
International Seabed Authority
14 – 20 Port Royal Street
Kingston, Jamaica

Dear Oystein,

As requested, please find attached a brief overview of the temporary overflow of water.

On 12 October, 2022 during the production ramp-up sequence, a temporary overflow of water occurred. Due to the dynamic behavior of the airlift riser when first switched on, there was a surge in the volume of water flow which briefly exceeded the buffer capacity of the cyclone separator at the top of the riser. As a result, the cyclone experienced a minor overflow of water which contained some sediment and fragments of nodules. This occurred intermittently during a 7-8 hour test run, with the overflowing water landing on the deck of the vessel and eventually flowing overboard.

When safe to do so the test run was stopped. NORI and AllSeas conducted an assessment to determine if the minor overflow had the potential to cause serious harm to the marine environment. Based on the information provided on the estimated discharge volumes and contents, NORI and AllSeas concluded that this incident did not have the potential to cause serious harm and was, therefore, not a reportable incident. An assessment was conducted on how to prevent an overflow reoccurring on future runs. Based on this assessment, modifications were made to the cyclone. Testing was conducted and the implemented modifications to the cyclone separator proved effective. There have been no further overflows during subsequent test runs.

A more detailed report will be submitted to the ISA as part of the NORI Collector Test Campaign Report.

Sincerely,

Gerard Barron

Gerard Barron
NORI

C.C.
Francillia Akubor, Acting CEO, Nauru Seabed Authority

Annex 5: NORI presentation of overflow event 18 November 2022



Partial Discharge Overview

EVENT DESCRIPTION:

Overflowing water from the separator cyclone and subsequent unplanned partial discharge of entrained processing water from the vessel *Hidden Gem* to the sea surface.

WHEN:

During the execution of the Pilot Mining test (production ramp-up test STR1.2), on the 12th of October in the Nori D field.
Cause: unexpected dynamic behaviour of the airlift riser, the system experienced intermittent surges in the volume of the slurry flow. These surges exceeded the designed buffer capacity of the cyclone feeding the separator deck. As a result, the cyclone experienced intermittent overflows of processing water containing sediment and fragments of nodules.

FURTHER DETAILS OF EVENT:

The overflow was discharged onto the deck of the vessel and eventually over the side to the surface waters. This unplanned discharge did not contain any hazardous substances and was limited in volume (<5% of the total flow). The intermittent overflow was observed periodically for the duration of the 8-hour test run that was being conducted at the time. The volume of unplanned discharge to the surface waters was calculated to be 100-150 litres/min, containing ~5kg per 100liter (equating to the disposal of the residual sediment from 1-2 sampling box cores per hour).

During the operation Allseas was made aware by the representative of NORI that the approved Environmental Management and Monitoring Program (EMMP) did not allow for any discharge of processing water to the surface waters. Based on this information an intervention meeting was held, where it was decided that at the first safe and practicable opportunity – modifications would be made to the cyclone feeder, to prevent further unplanned overflow on subsequent tests.

CORRECTIVE ACTIONS:

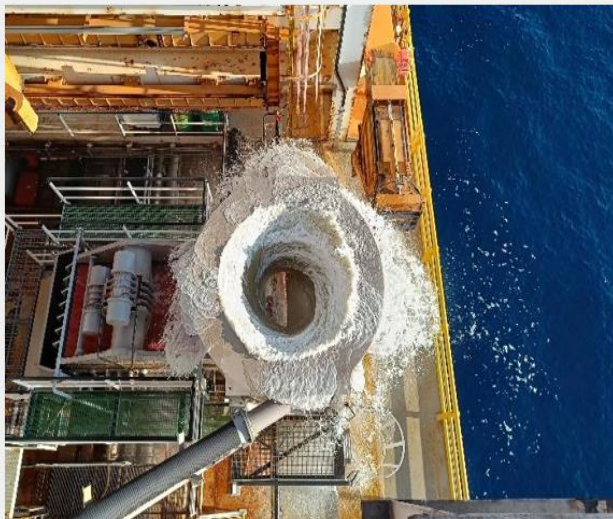
Mitigation measures were implemented to extend the height of the cyclone and construct an overflow bypass directly onto the separator deck. These measures successfully prevented any unanticipated overflows from the cyclone on subsequent test runs, and no further unplanned discharges occurred throughout the remaining collector test operations.

Images



Figure 1: Cyclone feeder in normal operations

Images



Cyclone feeder during overflow event – top view



Cyclone feeder during overflow event – side view

Images



Discharge over the side of the vessel



Discharge plume photograph taken from the derrick tower +100m from sea level

Annex 6: ISA Discharge Summary Memo



1.0 INTRODUCTION

This memorandum provides a summary of the event of overflowing water from the separator cyclone and subsequent unplanned partial discharge of entrained processing water from the vessel Hidden Gem during the execution of the Pilot Mining test on the 12th of October in the NORI D Contract Area. It also outlines the post event assessment process performed.

2.0 OVERVIEW OF THE EVENT

Due to the unexpected dynamic behaviour of the airlift riser during the execution of the production ramp-up test (STR1.2), the system experienced intermittent surges in the volume of the slurry flow. These surges exceeded the designed buffer capacity of the cyclone feeding the separator deck. As a result, the cyclone experienced intermittent overflows of processing water containing sediment and fragments of nodules.

The overflow was discharged onto the deck of the Hidden Gem and eventually over the side to the surface waters. (see Figure 2, 3 and 4). The intermittent overflow was observed periodically for the duration of the 8-hour test run that was being conducted at the time. Photographs were taken during and after the event to ensure a record of the overflow.

Once the team determined it was safe to do so, the test run was stopped. Immediately after the test was stopped an assessment was performed to determine how to prevent an overflow from reoccurring.

Based on this assessment, modifications were made to the cyclone. Testing was conducted and the implemented modifications to the cyclone proved effective.

An additional assessment was conducted to determine if the minor overflow had caused, was causing or posed a threat of serious harm to the marine environment. Details of this assessment are covered in the next section.

3.0 ASSESSMENT OF THE EVENT

Immediately after the event, information was gathered on the estimated volume and contents of the discharge.

The volume of unplanned discharge to the surface waters was calculated to be 100-150 litres/min, containing ~5kg per 100 liter of sediment. The estimated volumes were based on visual observations from the offshore personnel and based on volumes of sediment recovered during the production test.

Total estimated volume of discharge water = 48-72m³
Total estimated volume of sediment discharge = 2.4-3.6Te

The discharge was observed visually and it was noted that the surface waters appearance returned to normal conditions in less than one hour after the event.

After the event, and at our earliest opportunity, an assessment was performed to determine if the event caused, was causing or posed a threat of serious harm to the marine environment and any necessary reporting requirements pursuant to the rules, regulations and procedures of the Authority. The assessment of the event's impact was performed by offshore and onshore management teams from NORI, TMC, Allseas and DHI.

Several meetings were conducted on the 12th & 13th October.

NORI concluded that the event did not cause, was not causing and did not pose a threat of serious harm to the marine environment on the basis of the following facts:

- The volumes of discharged water and sediment were very small and significantly less than permitted as part of the NORI Collector Test EIS, which clearly demonstrated that, at the scale of a collector test, there was no threat of serious harm to the marine environment from the discharge. For reference the approximate sediment spills included in the Collector Test EIS is 259Te for the mid water discharge and 4015Te from the PCV at the seabed.
- The sediment and nodule fragments discharged are non-Hazardous and originated from the seabed.

As there was no threat of serious harm to the marine environment, NORI determined that formal reporting to the ISA pursuant to Regulation 33 of the Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area was not required. Although formal reporting was not required, in the interests of transparency, NORI chose to notify the ISA of the event and a commitment was made to provide a report of the event as part of NORI's annual report.

In addition to an assessment under applicable ISA rules, regulations and procedures, Allseas offshore and onshore management teams reviewed the event to determine the classification of the event against their internal procedures and policies (Allseas Safety Management System and HSE Plan (EQ-916AH-010-Q-E-001))¹. The conclusions of Allseas assessment was that the event was not a recordable environmental incident because the contents of the discharge were non-hazardous materials that originated from the seabed.

Allseas and NORI also verified that the discharge event did not contravene the International Convention for Prevention of Pollution from Ships (MARPOL) regulations. The review confirmed that the discharge event did not breach MARPOL regulations.

4.0 MITIGATION MEASURES

Following the assessment, mitigation measures were implemented to extend the height of the cyclone and construct an overflow bypass directly onto the separator deck. These measures successfully prevented any unanticipated overflows from the cyclone on subsequent test runs, and no further unplanned discharges occurred throughout the remaining collector test operations.

For reference, 6 photographs are added to visualise and clarify the issue and the remedial actions taken.

REFERENCE PHOTOGRAPHS



Figure 1: Cyclone feeder in normal operations

¹ The HSE plan was shared with the Secretariat as part of the Hidden Gem mobilization audit.



Figure 2: Cyclone feeder during overflow event – top view



Figure 3: Cyclone feeder during overflow event – side view



Figure 4: Discharge over the side of the vessel



Figure 5: Discharge photograph taken from the derrick tower +100m from sea level



Figure 6 : Modifications to the cyclone feeder – increased height and overflow bypass onto the separator deck.